Proceedings of the Southern Weed Science Society 74th Annual Meeting

Virtual Meeting

January 25-26, 2021

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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. A person may not serve as senior author for more than two articles in a given year.

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

Instructions to Authors

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

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

Typing Instructions-Format

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

2. Content:

Abstracts -	Title, Author(s), Organization(s) Location, the heading ABSTRACT, text of the Abstract, and Acknowledgments. Use double spacing before and after the heading, ABSTRACT.
Papers -	Title, Author(s), Organization(s), Location, Abstract, Introduction, Methods and Materials (Procedures), Results and Discussion, Literature Citations, Tables and/or Figures, Acknowledgements.

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

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

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

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

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

ABSTRACT

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

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

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

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

2021 AWARDS

Outstanding Young Weed Scientist - Academia

Muthukumar Bagavathianan

Dr. Muthukumar Bagavathiannan is an Associate Professor of Weed Science & Agronomy at the Department of Soil and Crop Sciences, Texas A&M University, College Station, TX. He received BSc (Agriculture) and MSc (Agronomy) at Tamil Nadu Agricultural University, Coimbatore, India; MSc in Plant Genetic Manipulation at the University of Nottingham, England; PhD in Weed Ecology at the University of Manitoba, Canada; and postdoctoral training at the University of Arkansas, USA. Dr. Bagavathiannan's research interests fall within the broader area of Weed Science and Agronomy, with particular emphasis on weed ecology and integrated management. The threat of herbicide resistance is immense in broad-acre systems, leading to loss of effective herbicide options, increased herbicide use, and unintended impacts on the broader environment. To this effect, the prime goal of his research program is to understand the evolutionary biology and dynamics of herbicide resistance in weed communities and develop integrated weed management (IWM) solutions for effectively tackling this challenge. Recently, his program has a substantial research focus on the application of digital tools in weed ecology and precision weed management. He takes an inter-disciplinary approach in tackling these challenges, by collaborating broadly at local, regional, national, and international levels. He leads or participates on a number of multi-state research projects focusing on integrated weed management.

Dr. Bagavathiannan has published over 75 peer-reviewed journal articles, 10 book chapters and several outreach bulletins. He has so far mentored 5 PhD students, 3 MS students, 4 postdoctoral researchers, 2 research assistants, 5 visiting scholars, 12 student interns, and 8 undergraduate researchers; and is currently mentoring 8 PhD students, 3 MS students, 1 postdoctoral researcher, 1 student intern, and 3 undergraduate researchers. He serves as an Associate Editor for Weed Science (WSSA) and Crop Science (CSSA) journals. Dr. Bagavathiannan was the recipient of the 2020 WSSA Outstanding Early Career Scientist Award, the 2019 Vice Chancellor's Outstanding Early Career Research Award, and the 2018 Dean's Outstanding Early Career Research Award from the College of Agriculture and Life Sciences, Texas A&M University.

Outstanding Young Weed Scientist - Industry
Matthew Wiggins

Matthew Wiggins serves as a Technical Service Manager with FMC covering Tennessee, Kentucky, North Alabama, and Southeast Missouri. His passion of agriculture started from being active in 4-H and FFA showing cattle and participating in many different development events. Matthew received a Bachelor of Science in Agriculture, with an emphasis in Agricultural Engineering Technology (2009) from Tennessee Technological University. Upon graduation, Matthew attended the University of Tennessee and received his M.S. (2012) in Plant Sciences and Ph.D. in Weed Science (2014), under the guidance of Dr. Larry Steckel. His Ph.D. research focused on herbicide-resistance management by integrating winter-annual cover crops and herbicide programs to control Palmer amaranth in corn, cotton, and soybean systems.

Matthew received several awards during his graduate school career from regional and national organizations. Most recently, he was recognized by FMC where he received the Ignite Award and the Tower Award in 2020. Additionally, he was recognized in 2017 by the Weed Science Society of America as an author for the Outstanding Paper Published in Weed Technology in 2016. Matthew continues to serve the Southern Weed Science Society and the Weed Science Society of America by volunteering to participate on various committees and supporting graduate student activities.

Previous Winners of the Outstanding Young Weed Scientist Award

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

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

Outstanding Graduate Student Award (MS)
Nick Hurdle

Nick is currently a PhD student at the University of Georgia under the direction of Dr. Timothy Grey. Nick received a B.S. in Crop and Soil Sciences from the University of Tennessee at Martin, followed by an M.S. in Crop and Soil Sciences with a focus on weed science from the University of Georgia. His primary research focuses on herbicide interactions with emerging peanut, herbicide tolerance in citrus orchards, and peanut storage regimes and their effect on germination and vigor. He will also focus on peanut seed treatments and their effect on early season growth. Prior to this, Nick worked on herbicide interactions with emerging peanut at the physiological level during his M.S. With no peanut experience prior to his time at UGA, Nick has developed a passion for weed control in peanut and assisting growers in weed management. In his time at UGA, Nick has participated in multiple student contests at the regional and national level with several 2nd and 3rd placings, and currently serves as the American Peanut Research and Education Society's President of the Graduate Student Organization. Nick has 4 publications ranging from herbicide tolerance in bermudagrass to physiological response of peanut to herbicide applications and direct applications of herbicide to peanut seed. Before attending UGA, Nick held an internship position overseeing the crop protection applications of research plots, maintaining grower showcase plots, and assisting in grower showcase days.

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

Outstanding Graduate Student Award (PhD)
Sam Rustom

Sam is a native of Greenwood, Mississippi, where he was first introduced to agriculture at a young age on a small family farm where his grandfather grew cotton, soybeans, and wheat. He worked for various farmers in the Mississippi Delta beginning at age 13 until he finished his B.S. in Environmental Science at Delta State University in 2014. Upon graduation Sam completed an internship with Monsanto at their former biotech research site in Leland, Mississippi working with corn, cotton, soybeans, and turfgrass. In 2015 Sam enrolled in graduate school at under the direction of Dr. Eric Webster. His M.S. project focused on quizalofop-p-ethyl mixture interactions with other herbicides in rice production. Sam remained at LSU to earn his Ph.D. under Dr. Webster focusing on florpyrauxifen-benzyl activity and use in Louisiana rice production systems. In 2019 Sam began working full-time as a Research Associate in Dr. Webster's program.

During his time at LSU, Sam has authored or co-authored seven peer-reviewed journal articles with five more lead author publications expected from his Ph.D. project. Additionally, he has authored or co-authored 66 abstracts from scientific presentations, 18 abstracts from international presentations and eight experiment station bulletins/research reports. Sam has been actively involved with teaching undergraduate and graduate curriculum, serving as Teaching Assistant for the Weed Biology and Ecology and Herbicide Physiology courses taught at LSU. He has also been involved with extension, presenting his work at LSU field days and local grower meetings. He finished his Ph.D. coursework with a 4.2 GPA.

Since 2015 Sam has been actively participating in the Southern Weed Science Society and served on the local arrangements committee, as a session chair, and as a moderator for the 2020 conference. He is also a member of the Weed Science Society of America, Rice Technical Working Group, and International Weed Science Societies. Sam has also competed in presentation competitions within these societies and was awarded first place for Ph.D. oral presentation at the 2019 Weed Science Society of America and 2020 Southern Weed Science Society annual conferences. He has also presented his research at several international conferences including the 2015 and 2017 Brazilian Irrigated Rice Congresses, as well as the 2017 and 2020 International Temperate Rice Conferences in Australia and Brazil, respectively. He has also competed at the SWSS Weed Contest every year since beginning graduate school, and his team placed third at the 2018 contest in Memphis. Sam plans to continue his involvement with the SWSS after graduation by serving on the local arrangements committee for the 2022 meeting in Austin, as well as continuing involvement with graduate student competitions and contests. Sam graduated in December 2020 and has recently began a career at FMC as the Technical Service Manager in Texas and New Mexico.

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

Fellow Award
David Jordan

David Jordan was raised on a small farm in eastern North Carolina and received BS and MS degrees from North Carolina State University and a PhD in Agronomy from the University of Arkansas (1993). David was a Post-Doctoral Associate at the University of Georgia (1993) and a faculty member at the Louisiana State University Agricultural Center (1993-1996). David is currently a Professor at North Carolina State University in the Department of Crop and Soil Sciences. David's first formal experiences with weed science were in Doug Worsham's weed science course and through an internship with DuPont under Louis Rodrigue. David's MS and PhD programs were directed by Alan York and Robert Frans, respectively. David focused on weed management in rice and soybean at LSU. David's focus in North Carolina has been peanut-based cropping systems in areas of agronomy, weed science, and IPM with both research and extension responsibilities. From 2007 to 2011, David provided assistance in weed science programs across several agronomic crops in North Carolina due to vacancies in key weed science positions. David has instructed courses in weed science, soil-crop management systems, IPM, and peanut production. David has directed statewide education programs associated with peanut management in North Carolina since 1996. David has served in elected, appointed, and volunteer positions in both WSSA and SWSS as well as other professional organizations and societies. David has made significant contributions in Sub-Saharan Africa since 2002 in areas of agronomy, weed science, IPM, and aflatoxin mitigation in peanut. David's work in the United States includes general weed management, pesticide compatibility, adjuvants, and management of herbicide-resistant weeds. David has led efforts to develop risk management tools for peanut in several countries. David has co-authored over three hundred peer-reviewed papers and has advised, co-advised or served on committees for over 90 graduate students. Since becoming a member of both the WSSA and SWSS in 1987, David has worked alongside many dedicated and talented people in academia and graduate education, industry, government and regulatory agencies, and NGOs as well as farmers and their advisors to address important issues related to managing weeds.

Fellow Award
Henry McLean

Henry McLean was raised in South Georgia in a farming family. He received his B.S. in Agronomy (1981) and MPPPM from the University of Georgia (1984) under Dr. Phil Banks. He began his career as a R&D Rep. for Sandoz responsible for Georgia, Florida, and Alabama. He returned to the University of Georgia and obtained a Ph.D. in Crop and Soil Science under Dr. John Wilcut (1998). In 1997, Henry accepted a position as the Novartis Midwest Research Station manager and 2001 relocated to the Syngenta site in Greensboro, NC in the role of Senior Data Analysis and Data Management Group Leader. In 2007, he accepted "best job in industry" as of Senior Field Scientist covering GA/AL and North Florida. Presently, he is a Senior Field Biology Expert (international appointment).

He attended his first "Southern" in 1984 and has rarely missed a meeting since. His development work has contributed to the development of herbicides including norflurazon, dimethenamid, S-metolachlor, trifloxysulfuron, butafenacil, bicyclopyrone, clodinafop, pinoxaden and fomesafen. He has also led several national teams within Syngenta including the Safety and Data Quality. Dr. McLean has authored or co-authored 41 publications, abstracts, or presentations pertaining to weed control and an additional 11 publications pertaining to fungicides and/or insecticides. He has always considered the SWSS as "home" and as the best professional society within or outside of Weed Science. He has served on numerous committees within WSSA and SWSS including: WSSA Herbicide Handbook, SWSS-Weed Scientist of the Year, Distinguished Service Award, and Outstanding Young Weed Scientist (Chair) and Local Arrangements. In addition, he has judged presentations at SWSS for 10+ consecutive years.

While Weed Science has been a primary interest, industry positions often demand involvement in other disciplines. Henry has been instrumental in the development and commercialization of four fungicides including: cyproconazole, solatenol, oxathiapiprolin, and adepidyn. While being given the opportunity to do things and go to more places than he ever imaged, it has only been possible with the support and understanding of his wife and partner Susan of 41 years and his two wonderful children Justin and Katelyn.

Previous Winners of the Distinguished Service Award
(Renamed Fellow Award in 2015)

Year	Name	University/Company
1976	Don E. Davis	Auburn University
1976	V. Shorty Searcy	Ciba-Geigy
1977	Allen F. Wiese	Texas Agric. Expt. Station
1977	Russel F. Richards	Ciba-Geigy
1978	Robert E. Frans	University of Arkansas
1978	George H. Sistrunck	Valley Chemical Company
1979	Ellis W. Hauser	USDA, ARS Georgia
1979	John E. Gallagher	Union Carbide
1980	Gale A. Buchanan	Auburn University
1980	W. G. Westmoreland	Ciba-Geigy
1981	Paul W. Santelmann	Oklahoma State University
1981	Turney Hernandez	E.I. DuPont
1982	Morris G. Merkle	Texas A & M University
1982	Cleston G. Parris	Tennessee Farmers COOP
1983	A Doug Worsham	North Carolina State University
1983	Charles E. Moore	Elanco
1984	John B. Baker	Louisiana State University
1984	Homer LeBaron	Ciba-Geigy
1985	James F. Miller	University of Georgia
1985	Arlyn W. Evans	E.I. DuPont
1986	Chester G. McWhorter	USDA, ARS Stoneville
1986	Bryan Truelove	Auburn University
1987	W. Sheron McIntire	Uniroyal Chemical Company
1987	no nomination	--
1988	Howard A.L. Greer	Oklahoma State University
1988	Raymond B. Cooper	Elanco
1989	Gene D. Wills	Mississippi State University
1989	Claude W. Derting	Monsanto
1990	Ronald E. Talbert	University of Arkansas
1990	Thomas R. Dill	Ciba-Geigy
1991	Jerome B. Weber	North Carolina State University
1991	Larry B. Gillham	E.I. DuPont
1992	R. Larry Rogers	Louisiana State University
1992	Henry A. Collins	Ciba-Geigy
1993	C. Dennis Elmore	USDA, ARS Stoneville
1993	James R. Bone	Griffin Corporation
1994	Lawrence R. Oliver	University of Arkansas
1994	no nomination	--
1995	James M. Chandler	Texas A & M University
1995	James L. Barrentine	DowElanco
1996	Roy J. Smith, Jr.	USDA, ARS Stuttgart
1996	David J. Prochaska	R & D Sprayers
1997	Harold D. Coble	North Carolina State University

1997	Aithel McMahon	McMahon Bioconsulting, Inc.
1998	Stephen O. Duke	USDA, ARS Stoneville
1998	Phillip A. Banks	Marathon-Agri/Consulting
1999	Thomas J. Monaco	North Carolina State University
1999	Laura L. Whatley	American Cyanamid Company
2000	William W. Witt	University of Kentucky
2000	Tom N. Hunt	American Cyanamid Company
2001	Robert M. Hayes	University of Tennessee
2001	Randall L. Ratliff	Syngenta Crop Protection
2002	Alan C. York	North Carolina State University
2002	Bobby Watkins	BASF Corporation
2003	James L. Griffin	Louisiana State University
2003	Susan K. Rick	E.I. DuPont
2004	Don S. Murray	Oklahoma State University
2004	Michael S. DeFelice	Pioneer Hi-Bred
2005	Joe E. Street	Mississippi State University
2005	Harold Ray Smith	Biological Research Service
2006	Charles T. Bryson	USDA, ARS, Stoneville
2006	no nomination	--
2007	Barry J. Brecke	University of Florida
2007	David Black	Syngenta Crop Protection
2008	Thomas C. Mueller	University of Tennessee
2008	Gregory Stapleton	BASF Corporation
2009	Tim R. Murphy	University of Georgia
2009	Bradford W. Minton	Syngenta Crop Protection
2010	no nomination	--
2010	Jacquelyn "Jackie" Driver	Syngenta Crop Protection
2011	no nomination	--
2011	no nomination	--
2012	Robert Nichols	Cotton Incorporated
2012	David Shaw	Mississippi State University
2013	Renee Keese	BASF Company
2013	Donn Shilling	University of Georgia
2014	Tom Holt	BASF Company
2014	Dan Reynolds	Mississippi State Univ.
2015	Bobby Walls	FMC Corporation
2015	John Harden	BASF Corporation
2016	No award	--
2017	James Holloway	Syngenta Crop Protection
2018	Scott Senseman	University of Tennessee
2018	Jerry Wells	Syngenta Crop Protection
2019	John Byrd	Mississippi State University
2020	Greg MacDonald	University of Florida
2020	Cletus Youmans	BASF Corporation

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

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

Excellence in Regulatory Stewardship Award
Larry Steckel

Larry Steckel was raised on a small family farm near Carrollton, Illinois. He received his B.S. in agronomy in 1987 from Western Illinois University and his M.S. in Weed Science from the University of Missouri in 1989. Larry then went on to work for Pioneer Hi Bred Int'l. where he worked for 10 years as an Agronomist. He left Pioneer to pursue a Ph.D. in the spring of 2000 and received his doctorate in 2003 from the University of Illinois. Larry joined the Department of Plant Sciences at the University of Tennessee in 2003 where he holds a weed science extension (75%) and research (25%) appointment.

Dr. Steckel's extension/education efforts have been recognized formally several times with awards including the Cavender award for outstanding extension publication from the UT Institute of Agriculture, Excellence in Extension Award from Gamma Sigma Delta, the Weed Science Society of America Extension award, the Association of Southern Region Extension Directors Runner-up Excellence in Extension Award and most recently the Outstanding Educator Award from the SWSS.

Dr. Steckel maintains an extensive applied research program that has focused on the biology and management of troublesome weeds which has recently been Palmer amaranth, junglerice and horseweed. These weeds cause Tennessee growers the most management challenges and is where the majority of his program efforts are directed. His research has been recognized by the National Conservation System Cotton and Rice Conference with the Conservation System Cotton Researcher of the Year award, the University of Tennessee Ag Research Impact award and he has received the Award of Excellence – Outstanding Paper award in 2017 and 2018 for manuscripts in Weed Technology as well as the Superior Paper Award for a manuscript in the American Society of Agriculture and Biological Engineers in 2018.

Dr. Steckel has been one of the leaders in the State of Tennessee's dicamba training which is taken annually by over 4,000 applicators. Dr. Steckel was also part of a team that put together Tennessee's pesticide applicator recertification effort most notably with education focused on glyphosate stewardship. He works closely with the Tennessee Department of Agriculture advising them on pest management issues as well as mentoring some of their field inspectors. He also provides data and insight to the Environmental Protection Agency as they evaluate herbicide registrations.

Previous Winners of the Outstanding Educator Award

Year	Name	University
1998	David R. Shaw	Mississippi State University
1999	Ronald E. Talbert	University of Arkansas
2000	Lawrence R. Oliver	University of Arkansas
2001	James L. Griffin	Louisiana State University
2002	Thomas F. Peeper	Oklahoma State University
2003	Daniel B. Reynolds	Mississippi State University
2004	William Vencill	University of Georgia
2005	John W. Wilcut	North Carolina State
2006	Don S. Murray	Oklahoma State University
2007	Thomas C. Mueller	University of Tennessee
2008	James M. Chandler	Texas A&M University
2009	William W. Witt	University of Kentucky
2010	Peter Dotray	Texas Tech. University
2011	Eric Prostko	University of Georgia
2012	Gregory Mac Donald	University of Florida
2013	Tim Grey	University of Georgia
2014	Scott Senseman	University of Tennessee
2015	Nilda Roma-Burgos	University of Arkansas
2016	Katie Jennings	North Carolina State
2017	Jason Norsworthy	Univesity of Arkansas
2018	Stanley Culpepper	University of Georgia
2019	Larry Steckel	University of Tennessee
2020	Stephen Enloe	University of Florida

Past Presidents of the Southern Weed Science Society

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

Dedication of the Proceedings of the SWSS

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

List of SWSS Committee Members
January 31, 2021 - January 31, 2022

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

100. SOUTHERN WEED SCIENCE SOCIETY OFFICERS AND EXECUTIVE BOARD

100a. OFFICERS

President	Clete Youmans	2021-2022
President Elect	Darrin Dodd	2021-2022
Vice-President	Eric Castner	2021-2022
Secretary-Treasurer	Hunter Perry	2021-2022
Editor	Paul Tseng	2021-2022
Immediate Past President	Eric Webster	2021-2022

100b. ADDITIONAL EXECUTIVE BOARD MEMBERS

Member-at-Large - Academia	Shawn Askew	2020-2022
Member-at-Large - Industry	Kelly Backscheider	2020-2022
Member-at-Large - Academia	Tom Barber	2021-2023
Member-at-Large- Industry	Andy Kendig	2021-2023
Representative to WSSA	John Byrd	2020-2023

100c. EX-OFFICIO BOARD MEMBERS

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

101. SWSS ENDOWMENT FOUNDATION

101a. BOARD OF TRUSTEES - ELECTED

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

101b. BOARD OF TRUSTEES - EX-OFFICIO

Hunter Perry	Past President of Endowment Foundation Board of Trustees
Kelley Mazur	SWSS Business Manager

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

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

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

102a. SWSS Fellow Award Subcommittee

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

102b. Outstanding Educator Award Subcommittee

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

102c. Outstanding Young Weed Scientist Award Subcommittee

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

102d. Outstanding Graduate Student Award Subcommittee

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

102e. Excellence in Regulatory Stewardship Award Subcommittee

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

103. COMPUTER APPLICATION COMMITTEE

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

104. CONSTITUTION AND OPERATING PROCEDURES COMMITTEE (STANDING)

W. Carroll Johnson *	2022-2024

105. FINANCE COMMITTEE (STANDING) - Shall consist of the Vice President as Chair and President-Elect, Secretary-Treasurer, Chair of Sustaining Membership Committee, and others as the President so chooses, with the Editor serving as ex-officio member.

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

106. GRADUATE STUDENT ORGANIZATION

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

107. WEED RESISTANCE AND TECHNOLOGY STEWARDSHIP (STANDING)

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

Louisiana	D. Stephenson		Virginia	M. Flessner*
Missouri	J. Heiser		Puerto Rico	W. Robles
			Grad. Student Representative	P. Carvalho

108. HISTORICAL COMMITTEE (STANDING)

Andy Kendig*	2022
John Byrd	2023
Tom Mueller	2024

109. LEGISLATIVE AND REGULATORY COMMITTEE (STANDING)

Todd Baughman*	Chair & Member-at-Large - Academia	2020-2023
Lee Van Wychen	(ad hoc) WSSA Science Policy Executive Director	2021-2022
Janice McFarland	(ad hoc) Chair of the WSSA Science Policy Committee	2020-2021
Greg Kruger	(ad hoc), EPA liaison	2020-2021
Shawn Askew	Member-at-Large - Academia	2020-2023
Kelly Backscheider	Member-at-Large - Industry	2020-2023
	Member-at-Large - Academia	2022-2024
	Member-at-Large - Industry	2022-2024

110. LOCAL ARRANGEMENTS COMMITTEE - (STANDING)

Luke Etheridge*	2022	Austin, TX (SW)
TBD (LSU prof.)	2023	Baton Rouge, LA (SE)
Em L Etheredge	2024	San Antonio, TX (SW)

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

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

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

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

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

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

Eric Webster*	2022

114. PROGRAM COMMITTEE – 2021 MEETING (STANDING)

Darrin Dodd	2022
Eric Castner	2023

115. RESEARCH COMMITTEE (STANDING)

Darrin Dodds*	2022			
Alabama	S. Li		North Carolina	W. Everman
Arkansas	N. Burgos		Oklahoma	T. Baughman
Florida	P. Dittmar		Puerto Rico	W. Robles
Georgia	E. Prostko		South Carolina	M. Marshall
Kentucky	T. Leglieter		Tennessee	L. Steckel
Louisiana	D. Miller		Texas	P. Dotray
Mississippi	J. Byrd		Virginia	S. Askew
Missouri	K. Bradley			

116. RESOLUTIONS AND NECROLOGY COMMITTEE (STANDING)

David Black*	2022	Michael Flessner	2023	Ryan Edwards	2024

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

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

Mississippi	D. Reynolds		Puerto Rico	W. Robles
Ad Hoc - Current	B. Kirksey		Ad Hoc - Previous	Cheryl Dunne

118. STUDENT PROGRAM COMMITTEE (STANDING)

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

119. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

Andy Kendig	2022	Luke Etheridge	2023		2024
Kelly Backscheider	2022	Chris Meyer	2023		2024

120. CONTINUING EDUCATION UNITS COMMITTEE (SPECIAL)

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

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

Board of Directors Meeting Minutes

Wednesday, January 20th, 2021
Virtual Meeting (Zoom)
9:00 am - 12:00 pm (Central Time)

Call to order

Eric called to order at 9:03 am. Clete motions to approve agenda and James seconded. Motion passes

Program Update

Good help provided by program committee to pull off virtual program. Four speakers in the general session. Four trainings held already with two student trainings on 1/20-1/21. Award presenter training following student training. Access to the website and program can be done in two ways (open to everyone). Virtual site is live (David Krueger). Enter through the "members only" portal since a private meeting, click 2021 virtual meeting, and navigate individual talks from there. 61 virtual talks planned for Monday – (33 PhD, 28 MS). Program is setup so no overlap of students which is very convenient for professors who want to see all.

Business Manager Update

246 attendees planned as of 1/20/2021. At this rate participation may eclipse the last two years. Please see business manager report for full details.

Review Committee Reports

Additions made to Graduate Contest Report by Pete Eure regarding judges, scoring, methods of reporting scores, etc.

Finance Committee overview – Darrin Dodds. SWSS profited in 2020. Area of concern is attendance and slow downward trend. Close attention needs to be paid to finances and think strategically and how to manage financial resources (long-term planning). Darrin posed question regarding CDs and stagnant nature. Eric mentioned several years ago having the discussion about doing something else with CDs, but there was some pushback.

Science Policy – Lee Van Wychen. Two main topics: **1.** Not in the report. Data exists from USDA that 50% of dicamba applied in cotton are applied illegally (USDA survey economic resource service). Based on 2018 and 2019, roughly 50% of generic products went down on cotton. For soybean it was approximately 15%. Important for SWSS to get message out and cut off before information is picked up by someone outside of the community who is looking to do damage. **2.** On a positive note, a weed scientist (Steven Young) is national program leader (ARS). Lee makes it priority to work with Steven and provide as much stakeholder support as

possible since pool of entomologists is so large. EPA is going through modeling with atrazine and others to determine how many endangered species will be impacted by herbicides. Troubles with modeling. The ball is in EPAs court, but then it will get kicked over to the National Marine Service and Wildlife and Fisheries.

Proceedings – Paul. Proceeding draft has been sent to Kelley. Kelley confirmed it's posted on the proceedings page.

Sustaining Membership (Jacob Reed) – Good contributions approx. $34,800 for 2020. Still waiting on checks from Adama and Bayer.

Constitution (Carroll Johnson) – A few items need to be corrected in 2021/2022 in constitution and by-laws. Virtual conference will lead to postponing these items. This summer discussion needs to be had around social media, change newsletter editor to 'Director of Communications' or something similar. GSO needs to request changes, bring to the BOD, vote is made and changes are completed.

Resistance and Technology Stewardship (Connor Ferguson) – Good feedback from states on current resistance issues (nothing much new to speak of).

GSO MOP Change Discussion

No social chair in the MOP, but there isn't, so GSO wants to add responsibilities such as social media, getting out newsletter info and letting universities share information related to their respective programs. The entire GSO wasn't involved in discussion, but rather just the officers. Lawson asks Carroll's input. Carroll requests tackling situation as an entire GSO organization (not just officers) between now and the summer board meeting. Offers elected through online voting poll.

Todd makes motion to accept committee reports, Shawn seconded. Reports approved.

Old Business

Eric acknowledges new board members.

Discussion around graduate student awards and how they were set up. Years ago, when you nominated an Outstanding Graduate Student, five letters were required and one needed to be outside of the school. As a new MS student, they may be at a disadvanatage. Ultimately, a MS winner would also have a leg up on the PhD award. There is still some concern around this issue.

New Business

Hunter mentioned the Endowment Enrichment Scholarship and the Weed Contest and how to proceed with Covid factor. Discussion is tabled for a later meeting.

Paul asked about layout of meetings and Clete gave a breakdown of how to enter separate sessions.

Darrin acknowledged Eric and the challenges associated with serving as society President during these difficult/challenging times.

Todd motioned to adjourn and Eric Castner seconded. Motion passed.

Adjourn

SWSS Board of Directors Meeting

Wednesday, January 27th, 2021
Virtual Meeting (Zoom)
9:00 am - 12:00 pm (Central Time)

Attendees: Hunter Perry, Kelley Mazur, Clete Youmans, Jacob Reed, Matt Goddard, Carroll Johnson, Lee Van Wychen, Tom Barber, John Peppers, Tommy Butts, Bruce Kirksey, Paul, John Byrd, Kelly Backscheider, Sandeep Rana, Eric Castner, Darrin Dodds, Eric Webster, Connor Ferguson, Andy Kendig, Drew Ellis

Call to order – Clete Youmans @ 9:03 am

Agenda review

Introduction of new board members (Tom Barber, Andy Kendig, John Peppers)

Eric Castner moves to Vice President

Feedback/Input on the 2021 Virtual Meeting

Carroll – felt like meeting went very well. More concentration on talks and posters because less side conversations outside the rooms, etc. Was very pleased with some of the Tuesday speakers.

Clete – breaks down numbers of attendees. After approximately 9:30 over 100 viewers. Remained fairly high in PhD section with over 60 attendees at the end of the PhD paper sections. On Tuesday, numbers went above 130 most of the day. The meeting was not recorded due to potential legal issues.

Paul – Did the judges interact with students? No

Hunter and Tom – provided good feedback on judging efforts. Commended team on execution. The spreadsheet was very convenient. Tommy has all intentions of using the spreadsheet again in the future. Kelly indicated internet access is subpar at some facilities, so we should be cautious in the future.

Tommy Butts - Judges were tough to come by, but Tommy and Pete were able to handle capacity. A could have been attributed simply to the virtual layout.

John Byrd – expressed a little concern that some students may not have tuned into the general session on Tuesday. Numbers were good, but viewership is unknown since you can log into the meeting and walk away from your computer.

Sandeep Rana – Curious if any feedback from students on not being able to present both poster and paper? Missed opportunities. Recommended if at all possible recording the meeting.

Lee Van Wychen – missed comment due to audio.

Eric Castner – The meeting was fantastic. If we have this next year, do we expand a day to bring in more industry and university (non-student) talks/presentations? Agrees we did what we needed to do and it was very successful. Potentially build on this next year if we aren't able to meet in Austin.

Business Update – Kelley

276 registrants total (6 less than 2020; 10 more than Oklahoma City). 154 regular members, 122 students (largest number of students to participate since 2015).

Meeting income at approximately $68K with credit card expenses removed. We are able to cover bill from Knoxville + Zoom expenses (approximately $28K). Currently David hasn't sent a bill from Apex.

$39,599.03 in net income from meeting.

John Byrd asks about NCWSS income from their meeting. They cut registration costs and incurred $60K of costs. They had some "extras" on their meeting, but hard to say if it was worth the cost.

Lee – no incurred costs on hotel and will return to same location as planned next year. He didn't think their platform was worth $60K, but it felt more like a regular meeting.

Sandeep – they had interactive activities that also generated value for the society. Need to talk to Karen Schmidt (spelling??) about what they did and potentially leverage some of their ideas if we have to go virtual in 2022.

Graduate Student Organization Discussion (John Peppers)

Concern among students who couldn't do both poster and paper. Acknowledges the challenging times and meeting, but hopefully moving forward this can change.

A social chair is being added to the GSO. It couldn't be voted on, so they couldn't fully approve the changes. A new vice president and new officers were elected.

Carroll – John and he will work together and through MOP to formalize (at the summer meeting). Will be worked on between now and then.

Discussion around voting on Zoom. This will be worked on in the near future to correct for future meetings.

Weed Contest - Drew Ellis

Corteva is committed to host. Decision was made to postpone/cancel the contest in 2020 due to Covid-19.

In 2021, Corteva has offered the same level of support as 2020. Hopefully things will improve going forward that can lead to hosting in 2021. We should work with society leadership to develop a plan to instill measures of caution that will make the contest safer and ultimately have the contest.

Plan would be to start the contest on Tuesday. Folks travel in on Monday for judge review and walkthrough. If it happens, it would be scheduled for August 3rd.

Drew and Hunter to discuss talking to Corteva leadership about a safety plan

Newsletter editor – Carroll/Clete/Tommy

New editor to replace Susan Scott. Carrol Johnson – ideas being kicked around to expand duties as 'Director of Communications'. Would expand to social media accounts. Tommy would have to agree to these duties as well. Tommy is fine with it. Plans to role his wife in to help with creativity and he would handle the technical end. Tommy would be a board member as newsletter editor/director of communications.

Carroll makes motion for Tommy Butts to be Newsletter editor. Tom Barber seconds. No 'no' votes from board. Motion passes. Tommy is elected new editor.

Apex Proposal - Kelley

David states the SWSS website and database was developed in 2013. The underlying framework is obsolete and it cannot be built upon or changed. It would have to be broken down and changed. It is also being proposed for the other societies (they run similarly). WSSA is the exception. It should be done sooner rather than later. Cost doesn't include any annual/monthly fees. Research has been done on items included in the proposal. One-time fee of $7,500 to Apex for development. Maintenance cost of $1K per quarter. The costs do not include specific fees and this can vary depending on what we want/need as a society. Kelley and David could potentially leverage all societies to get discounts. In 2013, a one-time fee of $5K was made with no database cost. We don't want to purchase a database without knowing what it's like and how it works. Recommended putting together a working group that can make a formal request to the board. Do we want to move forward?

John Byrd makes motion to create a working group/subcommittee to work with David and Kelley to research the new platform with the end goal of creating a revised system for SWSS. Carroll seconded. Motion passes

Andy asks if we could form a subcommittee across societies. Kelley will be the liaison between groups to insure we work together. Proposal by next board meeting would be good.

Summer board meeting dates – Clete

Do not need to meet in August for summer board meeting (weed contest). Carroll asks about meeting at the site of the next meeting. Discussion about timing will be had at a later date. An earlier meeting needs to take place prior to the summer board meeting (roughly April).

Endowment Enrichment Scholarship - Hunter

Carroll recommends putting discussion in the Endowment's hands to vote on how to handle the number of Endowment Enrichment Scholarships. Look at finances and see what we can afford for this year. A recommendation of students writing a thank you letter to GDM , the Endowment or others for their generous donations. General discussion around the expenses Endowment has had to shoulder over the years and to be cautious about how many awards to hand out----award what makes sense.

Carrol makes motion to adjourn. Not sure who seconded

SWSS Committee Reports (as of 1/19/21)

Compiled by: Hunter Perry – Secretary-Treasurer

Committee Reports Included:

Resolutions and Necrology

2021 Program

Weed Resistance and Technology Stewardship

Science Policy

Awards

Student Program Committee

Continuing Education (Education Units)

Sustaining Membership

Site Selection

Nominating

Endowment Foundation

Southern Weed Contest

Graduate Student Organization

Constitution and Operating Procedures

Business Manager Report

Legislative and Regulatory

Long-range Planning

Newsletter

Missing Committee Reports:

2022 Program

Computer Application

Finance (will be discussed at the business meeting)

Historical

Research Committee

2021 Necrologies and Resolutions (condensed version for business meeting)

There are a several individuals that have passed away within the last year that should be recognized at this time.

Mr. Cleston Granville Parris; Cleston was born on September 8th, 1928 in Byrdstown, Tennessee. He received his BS in Agriculture from Tennessee Tech University followed by a MS in Agronomy from the University of Florida. He was employed by the Association of American Railways as their chemical specialist in controlling weeds on the right of way of the railroads. In 1960 he was employed by Tennessee Farmers' Cooperative as manager of the Agricultural Chemical Department, later becoming manager of the Advertising Department and TFC's advertising, public relations, and communications programs. Cleston was also an army veteran of the Korean War. Cleston was a long-standing active member of the SWSS and WSSA, serving as president of the SWSS in 1978 – 1979. Cleston was recognized by receiving the Distinguished Service Award from the SWSS in 1982.

Dr. Rex Weldon Millhollon; Rex was born on May 1st, 1931 in Scurry County, Texas. He earned a BS in Agriculture from Texas A&M University. He earned another BS in Plant Science, followed by a Ph.D. from the University of Arizona. Dr. Millhollon began his professional career in Virginia before eventually settling in Houma, Louisiana as a Research Agronomist with the Unites States Department of Agriculture. He worked for 40 years at the USDA Sugar Cane Field Laboratory in Houma, Louisiana. Rex was an internationally respected USDA research agronomist, military veteran and native Texan.

Dr. Morris G. Merkle; Morris was born on July 23rd, 1934 in Lincoln, Alabama and was raised on the family farm in Talladega County. He received his BS in Agricultural Science in 1955 and MS in Agronomy-Weed Science in 1959 from Auburn University. From January 1956 to January 1958 he was in Germany with the 868th Field Artillery Battalion unit as a first lieutenant. He received his Ph.D. in Agronomy-Weed Science in 1963 from Cornell University. Dr. Merkle began his professional career with the USDA-ARS in 1963. In 1966 he transferred to the Department of Soil and Crop Sciences at Texas A&M University. During his teaching career he taught 1,166 undergraduates and was the major professor for 84 M.S. and 53 Ph.D. students.

Dr. Merkle was a long-standing active member of the SWSS and WSSA, serving as president of the SWSS in 1979 – 1980, and later recognized with the Fellow / Distinguished Service Award from the SWSS in 1982. Dr. Merkle was a member of Operation Ranchland that developed vegetation control strategies for the U.S. Military during the Vietnam War.

Dr. Walter "Walt" Arthur Skroch; A native of Arcadia, Wisconsin, Walt received his BS from the University of Wisconsin – River Falls and his MS and Ph.D. from the University of Wisconsin – Madison. Dr. Skroch joined the faculty at North Carolina State University in 1964 and served there until his retirement in 1994. Dr. Skroch advised 16 MS and Ph.D. students and innumerable Extension educators. He was a Fellow of the WSSA and an active member of the SWSS. Dr. Skroch was a founding member and past president of the Weed Science Society of North Carolina and was later honored with the Distinguished Service award from the society. In 2015, Walt was inducted into the Western NC Agricultural Hall of Fame.

Dr. Stacey Alan Bruff; Stacey was born on November 9th, 1962, in Columbia, SC. He received his BS degree in Agriculture from University of Tennessee at Martin. In 1991 he then received his MS in Weed Science from Mississippi State University followed by a PhD in Weed Science from Louisiana State University in 1994. Dr. Bruff began his professional career as a Field Development Representative for FMC Agricultural Solutions in the mid-south. He most recently served as a divisional seed manager for Nutrien Ag Solutions in Union City, Tennessee.

Dr. Robert Loring Nichols; Bob was born in rural Sussex County, New Jersey. He graduated high school from Blair Academy in Blairstown, New Jersey in 1964 followed by Yale College in 1968 with a concentration in Economics and Political Science. He planned to attend law school but went to war instead. Bob joined the Army Security Agency, volunteered for, and served three consecutive combat tours in Vietnam – one in the Central Highlands, and two in defense of the Cambodian border. He was a Vietnamese language interpreter for a tactical intelligence organization.

Bob returned to the United States in 1972, lived in the Mt. Washington Valley of New Hampshire and worked as a carpenter. With the G.I. bill Bob attended the Univ. of Connecticut College of Agriculture at Storrs. He earned a MS in 1977 followed by a Ph. D. in Agronomy in 1980. For the next 12 years Dr. Nichols worked for USDA-ARS as the Southern Regional Forage Agronomist with a co-appointment with the Univ. of Georgia; for PPG Industries as a field development specialist; for F. Hoffman LaRoche coordinating field research in the Western U.S., and headed the marketing of research services for Agri-Growth Research and managed four research farms in Illinois, Iowa, Minnesota, and Nebraska.

In 1992, Dr. Nichols joined Cotton Incorporated and served for 28 years as Director, then Senior Director of Agricultural and Environmental Research. Dr. Nichols was long standing and active member of the SWSS and the WSSA. He chaired the SWSS's Herbicide Resistant Plants Committee and its Science Policy Committee. In 2012 Dr. Nichols was recognized by the SWSS with its Fellow / Distinguished Service Award and its Regulatory Stewardship Award. He was a longtime member of the WSSA's Science Policy Committee and strong advocate for action, ethics, and scientific excellence.

Dr. Dave Weaver; Dave was born on July 24th, 1939 in Hamlin, Texas. He earned his BS and MS degrees from Texas Tech University followed by a Ph.D. in Agronomy from Texas A&M University in 1971. Dr. Weaver spend his career with the Texas Agricultural Extension Service in College Station, serving as the Associate Department Head at the time of his retirement in 1995. He was awarded both the Outstanding Extension Award and Soil and Crop Sciences Award.

Dr. Robert "Bob" Frans; Bob was born on April 19th, 1927 in Louisville, NE. He grew up in small towns in Eastern Nebraska graduating high school in Belden, NE. Bob served in the U.S. Army for 2 years and was training to drive tanks when the war in Europe ended. Bob went on to further his education at the University of Nebraska where he earned his BS in Agriculture in 1950 followed by a MS in Farm Crops from Rutgers University in 1953. He then attended Iowa State University where he received his Ph.D. in Botany-Plant Physiology in 1955.

Dr. Frans came to the University of Arkansas in 1955 as an Assistant Professor of Agronomy. He retired forty years later as Emeritus Distinguished Professor of Agronomy in the Department of Crops, Soil and Environmental Sciences. He was also involved with the Bolivian chapter of Partners of the Americas. Dr. Frans was a long-standing active member of the Southern Weed Science Society and Weed Science Society of America. Dr. Frans served as president of the SWSS in 1964 – 1965, and later recognized by the SWSS by receiving the Distinguished Service Award in 1978 followed by Weed Scientist of the year in 1987.

At this time, I'd like to ask that you please bow your heads with me and take a moment of silence in recognition for those mentioned.

That concludes the report from the Resolutions and Necrology Committee.

SWSS Program Committee Report (prior to the 74th Annual Meeting) – Clete Youmans

The SWSS 74th Annual Meeting Program committee, chaired by Clete Youmans, includes: Dr. Gary Schwarzlose, Dr. Jim Brosnan, Dr. Eric Castner, Ms. Kelley Mazur, Dr. Pete Eure, and Mr. Lawson Priess. Since this is a virtual meeting, a tremendous effort went into the training of moderators and those moderators attended at least five training classes. The moderators worked and are working many hours to support a successful SWSS meeting and include: Dr. Tim Adcock, Dr. Larry Steckel, Dr. Greg Stapleton, Dr. Nilda Burgos, and Dr. Jacob Reed.

Although not a program committee member, Mr. David Kreuger (Apex WebStudio) developed the SWSS Title and Abstract submission website, as well as the first SWSS website for conducting Zoom webinars during the SWSS meeting, these include: The 1) MS and PhD Virtual Talk link, the 2) Poster Session link, and the 3) Tuesday's guest speakers, business mtg., and awards link.

Guest Speakers were invited to speak on Tuesday Jan. 26, 2021 about their careers, which would tie into the SWSS theme of "Moving Obstacles". These speakers will include: Dr. Bob Scott (Director of the Arkansas Ext. Service and Sr. Assoc. VP of Agriculture in AR), Dr. David Bridges (Pres. of ABAC, Tifton, GA), Dr. Steve Powles (Univ. of W. Aust. Emeritus Prof.), and Mrs. Emily Unglesbee (DTN / Progressive Farmer Reporter), whose presentation will lean more towards interviews with a reporter. Senator John Boozman (Rep., leading minority leader of the U.S. Senate Comm. on Agric.) agreed to speak but recently indicated he could not.

There were two Zoom meetings to discuss training and Web ideas. There have been four Zoom webinars to train moderators, there will be two Student Virtual Talk training webinars, one Awards Chair training webinar, and the Annual Meeting webinar's (Posters link webinar, MS and PhD virtual talk link webinar, and the Tuesday guest speaker / Bus. Mtg. / Awards webinar). Moderator "cheat sheets" and Student training aids were developed to assist most people participating in a webinar.

The program committee completed the 74th SWSS Annual Meeting Program, which can be viewed by members and non-members at the "SWSS.WS" web site / single click Annual Meeting, and single click "View the 74th Annual Virtual Meeting Program Here". This program (there are actually two) is sorted primarily by Sections, within each section the program is sorted by Non-contest or MS contest or PhD contest. There are currently 61 Virtual Talks (33 PhD and 28 MS), all being in the student contest, plus 100 Posters. Weed Mgt. in Agronomic Crops is the largest Section with 54 Posters (12 PhD and 14 MS contest posters, plus 28 Non-contest posters).

On Jan. 19, 2021 SWSS members could enter the 2021 Virtual Meeting site for the first time (see directions below). Between Jan. 19 and Jan. 24 only the Posters are activated, this helps assist in early judging. Posters will be removed from the website Jan. 29, 2021. On Jan. 25, 2021 the Virtual Talk Student Contest webinar is activated. On Jan. 26, 2021 the General Session, Business Mtg., and Awards webinar is activated. To enter any Virtual Posters or Webinar (Jan. 19-29) of the SWSS Annual Meeting go to: 1) swss.ws website, 2) click "Members-Only: and enter your username and password, then 3) on the left sidebar, click "**Enter the 2021-Virtual Meeting**". From this location you can click on posters to view or be an attendee during a virtual webinar (as an attendee, no one will hear you or see your screen unless the Co-host moves you to panelist level).

Thanks, Clete Youmans, SWSS 2021 Program Chair

SWSS Herbicide Resistance and Technology Stewardship Committee Report – Connor Ferguson

Meeting Held Via WebEx

Thursday January 14, 2021 from 1:00-3:00pm

Meeting called to order at 1:05 pm CST

Attending were:

Connor Ferguson – Mississippi

Steve Li – Alabama

Michael Flessner – Virginia

JD Green – Kentucky

Pamela Carvalho – Graduate Student Rep (Arkansas)

Michael Flessner was elected Chair for 2021-2022 and Steve Li as Vice Chair to be chair of the committee in 2022-2023

Meeting Adjourned at 2:05pm CST

Report Compiled by

Connor Ferguson, Chair (Mississippi State University)

Alabama State Report

No report submitted.

Arkansas State Report – Jason Norsworthy

There are no new cases of resistance to report in Arkansas for 2020. There are several weeds that are currently under investigation at this time, but again we are not ready to officially announce any new cases.

Florida State Report

No report submitted.

Georgia State Report – Eric Prostko

PPO-resistance in Palmer amaranth has been confirmed by Stanley Culpepper.

Kentucky State Report – JD Green

No new herbicide resistant weeds confirmed during 2020. The primary and wide-spread glyphosate-resistant weeds in Kentucky impacting grain crop production include horseweed (i.e. marestail), waterhemp, and Palmer amaranth. Biotypes of these species are also resistant to ALS

type herbicides and we have isolated populations of PPO resistant waterhemp and Palmer. There are a few cases of glyphosate resistant common ragweed, giant ragweed, and annual ryegrass. Dr. Travis Legleiter is currently screening annual ryegrass populations to determine the extent of glyphosate-resistance, as well as, resistance of annual ryegrass to other herbicide site of action groups.

Fewer dicamba off-target complaints were reported during 2020 season on sensitive soybean. Cases of off-target movement to tobacco, home landscapes, and other sensitive crops continues to be a concern.

Louisiana State Report – Daniel Stephenson

Louisiana does not have any new herbicide resistant species to report for 2020. We currently have clethodim failures when applied to populations of Italian ryegrass in the spring. This issue is currently being investigated.

Starting at the 2022 SWSS meeting, Dr. Lauren Lazaro will replace me as the Louisiana representative on this committee. Thanks and have a great day.

Mississippi State Report

Jason Bond –

No new cases of resistance that I'm aware of.

Are we managing dicamba well? The Bureau of Plant Industries logged very few cases involving dicamba in 2020. I was not asked to look at any of those or cases not reported to the Bureau.

John Byrd –

I've communicated with the Organic Arsenical Task Force on many occasions. We continue to be told that once the review of arsenic levels in soils and new tolerances are established, the concern over MSMA use in turf will disappear. That said the review was supposed to be completed 3 or 4 years ago, so the Task Force legal team may be blowing smoke?

I think herbicide resistance awareness has improved as it seems any case of a control failure, resistance is the first thought among landowners. I think Roundup performance has been extremely forgiving in terms of weed size as well as environmental conditions, therefore many have forgotten that other postemergence herbicides perform at optimum on small (ideally <2 inch tall) weeds growing rapidly under optimum environmental conditions. Growers have become accustomed to Roundup flexibility and expect that from all other herbicides.

I received more complaints of herbicide damaged gardens and landscapes last year than my entire 30 year career. That may have absolutely nothing to do with "hormone" crop technology, but then, again, it may.

Jay McCurdy -

Along with our colleagues in the ResistPoa SCRI, we have developed some online curriculum and support tools: http://resistpoa.org/tools/slide-sets/poa-annua/

The Site of Action poster is currently on round two of revisions and should be published as an official MSU Extension publication this year: http://resistpoa.org/wp-content/uploads/2020/02/Resist-Poa-SOA-Herbicide-Poster-20x39-flush.pdf

Putative screens have identified at least 54 populations resistant to 1 or more sites of action in Mississippi (we tested 168). Conservatively, about half of those 54 are now confirmed with rate response screens and/or genetic analysis. We have a hand full of populations with resistance to at least three sites of action. The mechanisms are mixed – sometimes target site, sometimes non-target site.

The putative screens of those 54 putatively resistant populations break down into the following:

- 30 to prodiamine
- 25 to simazine
- 12 to pronamide applied postemergence foliar
- 9 to ALS inhibiting sulfonylurea herbicides (foramsulfuron or trifloxysulfuron were used in our screens)
- 1 to glyphosate

The new EPA guidelines on triazines is potentially problematic. We've managed to keep 0.65 lb simazine for single application use, if I'm not mistaken. That's only enough to control annual bluegrass when combined with other active ingredients (and that's assuming the annual bluegrass isn't resistant to simazine or the other active ingredient – most likely an ALS inhibitor).

We are also in the early stages of characterizing what we believe is a quinclorac resistant smooth crabgrass population. The restrictions on MSMA use has driven many practitioners, especially in home lawns, towards quinclorac application to control crabgrass. Quinclorac resistance has only been reported in Digitaria species a handful of times.

Missouri State Report – Jim Heiser

We continue to sample and screen populations of Palmer amaranth from the southeast Missouri counties of Ripley, Butler, Stoddard, Scott, New Madrid, Mississippi, Pemiscot and Dunklin for resistance to dicamba and glufosinate. Seed from these populations are sent to Dr. Burgos at the University of Arkansas to compare results of screening efforts as well as for determination of mechanism of resistance. In the past two years, we have seen low levels of tolerance to both glufosinate and dicamba, but results have not been consistent. We plan to continue working with Dr. Burgos on this project and will be submitting 60 populations (58 Palmer, 2 Waterhemp) for screening from seed collected in the fall of 2020. Prior years' results should be attainable through Dr. Burgos' report.

In addition to palmer amaranth, we also screen barnyard grass and red rice populations suspected of resistance to one or multiple modes of action used in rice production. In 2019, seven populations of barnyard grass were sent to us by consultants and screened for Cyhalofop, quinclorac and imazethapyr tolerance. All populations had between 13 and 73% survival to cyhalofop at 14 days after application. When a second application was made, survival was reduced to 7 to 47%, with one population having no decrease in survivability following the second application. Tolerance to quinclorac was found to be between 40 and 97% survivability following one application. A second application reduced the number of survivors in all populations but survivability was still greater than 25%. Two populations of barnyard grass had very low levels of survivors at 14 days following one application (0 and 3%) of imazethapyr. The other populations however had 27-80% survivors with reductions to 17-63% survivors following a second application.

Several other barnyard grass populations were screened only for tolerance to imazethapyr. Of these four, two showed no control following two applications. In addition, one population of Red Rice from the same field as one of the high tolerance barnyard grass populations showed no control from two applications of imazethapyr. Area consultants submitted 14 barnyard grass, 2 amazon sprangletop and 2 yellow nutsedge accessions for tolerance/resistance screening for multiple herbicides.

North Carolina State Report

No report submitted.

Oklahoma State Report

No report submitted.

South Carolina State Report – Matt Cutulle

In row crops we have confirmed in the greenhouse glyphosate-resistant Italian Ryegrass. Plenty of glyphosate, ALS, and PS2 resistant Palmer amaranth, likely PPO resistance as well. Samples was collected from a burndown failure in corn (Marion County) in 2019. Plenty of glyphosate, ALS, and PS2 resistant Palmer amaranth, likely PPO resistance as well. In vegetables we have suspected group clethodim resistant goosegrass in cucurbit crops as well suspected halosulfuron resistant yellow nutsedge.

In turf:

Weed Species	**Relevant Herbicide Resistance**
Annual bluegrass	simazine/atrazine, paraquat, diquat pendimethalin, prodiamine, dithiopyr, glyphosate, trifloxysulfuron, foramsulfuron, pronamide
Goosegrass	diclofop, pendimethalin, prodiamine, trifluralin, dithiopyr, metribuzin, glyphosate, oxadiazon
Crabgrass	Acclaim Extra, quinclorac
Ryegrass	Illoxan, ALS inhibitors, glyphosate, mitotic inhibitors
Spotted Spurge	ALS inhibitors
Sedges	halosulfuron, trifloxysulfuron
Buckhorn plantain	2,4-D, glyphosate
Barnyardgrass	Various ALS & ACCase inhibitors, quinclorac
Johnsongrass	sethoxydim, fluazifop, glyphosate, imazapic, foramsulfuron, mitotic inhibitors
dayflower, horseweed	glyphosate

Tennessee State Report

No report submitted.

Texas State Report – Pete Dotray

1. Confirmed glyphosate-resistant Palmer amaranth and waterhemp. In west Texas, likely every farm has glyphosate resistant Palmer amaranth at some level.

2. Greenhouse trials comparing some Tennessee populations from Dr. Steckel to local Palmer amaranth populations suggest our populations are still susceptible to dicamba and 2,4-D. Lack of control can be attributed to several factors, but weed size is likely the

main cause for less than acceptable control. We collected seed last fall from several locations and will continue to evaluate.

3. Kochia weed seed collections were made in fall 2019 because of suspected dicamba and glyphosate resistance. Greenhouse studies are being conducted in Kansas along with K-State and OK-State. We have made additional collections from plants that seem to be exhibiting elevated tolerance to dicamba and glyphosate. Greenhouse trials will be conducted this spring

4. Muthu and Josh demonstrated 16-fold resistance in false ragweed to paraquat, atrazine, and glyphosate

5. Lots of grower concern regarding glyphosate tolerance in Johnsongrass. This concern needs further testing

Virginia State Report – Michael Flessner

1. **Are there any new and confirmed or suspected cases of herbicide resistant weed species (if so, what species and to what herbicides)**

Confirmed cases prior to 2021 (from weedscience.org)

Year	Species	MOAs
1976	*Amaranthus hybridus*	Photosystem II inhibitors (C1/5)
1979	*Chenopodium album*	Photosystem II inhibitors (C1/5)
1993	*Lolium perenne* ssp. *multiflorum*	ACCase inhibitors (A/1)
1993	*Amaranthus retroflexus*	Photosystem II inhibitors (C1/5)
1994	*Amaranthus hybridus*	ALS inhibitors (B/2)
1995	*Sorghum halepense*	ACCase inhibitors (A/1)
2001	*Poa annua*	Photosystem II inhibitors (C1/5)
2003	*Sorghum bicolor*	ALS inhibitors (B/2)

2005	*Conyza canadensis*	EPSP synthase inhibitors (G/9)
2008	*Stellaria media*	ALS inhibitors (B/2)
2011	*Amaranthus palmeri*	EPSP synthase inhibitors (G/9)
2015	*Eleusine indica*	PPO inhibitors (E/14)

Suspected cases

Year	Suspected cases	Groups
before 2014	*Conyza canadensis*	2 + 9
before 2014	*Amaranthus palmeri*	2 + 9
before 2014	*Ambrosia artemisiifolia*	2 + 9
2019	*Ambrosia artemisiifolia*	2 + 9 + 14
before 2017	*Lolium perenne* ssp. *multiflorum*	2
before 2017	*Lolium perenne* ssp. *multiflorum*	1 + 2
2018	*Amaranthus tuberculatus*	2 + 9

2. How has Virginia stewarded new technologies (auxin-resistant crops, Inzen sorghum, etc.)

Auxin-resistant crops: No additional restrictions beyond EPA/Federally approved label. Registrants conducted training. Extension programming emphasized need and importance of stewardship. In 2020, I estimate that 60 to 80% of both soybean and cotton acreage had either the Enlist or Xtend/Xtendflex trait and of that, about half of those acres received an auxin herbicide. Off-target movement has occurred but has not been a major issue.

Inzen Sorghum: I'm not aware of any Inzen sorghum in Virginia but have gotten questions about it from farmers considering planting it. Likely very limited acres.

a. Is there any concern for long-term viability of newly released technologies in Virginia?

Auxin-resistant traits: Not too concerned at the state level, but very concerned at the national level primarily due to: 1) negative public perception or ag fueled by dicamba off-target movement, 2) resistance development in other states, and 3) the so-called "extorsion" beans or "defensive planting", but also other issues surrounding these traits

Inzen Sorghum: transfer of the trait via pollen to Johnsongrass resulting in ALS resistant (group 2) Johnsongrass. Due to limited acreage at this time, this is not a major concern.

3. What, if any comments, do you have regarding the potential loss of certain herbicides in the new administration? How would you manage without paraquat in peanut (if label is revoked) and other type situations that could arise in the next 12 months?

No comments at this time, beyond that I appreciate and respect the process, expertise, and role of the EPA.

Executive Director of Science Policy Report - Lee Van Wychen

SWSS Annual Meeting 2021

Yellow Highlight = input/feedback appreciated.

Leadership Changes in Congress and Federal Agencies

- The House Ag Committee will have a new chair and ranking member. Since the Chair and Ranking Member hire all the committee staff, this will likely mean a major turnover in committee staff expertise. The new chair is **David Scott-D-GA**. The new ranking member is Glen "GT" Thompson-R-PA.
- The new chair of the Senate Ag Committee will be Debbie Stabenow-D-MI, who was the ranking member. The new ranking member will be **John Boozman-R-AR.**
- The new ranking member of the House Natural Resources Committee is **Bruce Westerman-R-AR.** The chair will remain as Rep. Raul Grijalva-D-AZ.
- The "new" Secretary of Ag nominee is Tom Vilsack who served eight years as the Secretary of Ag in the Obama administration. On Dec. 22, the Trump administration named **Dr. Carrie Castille from LSU** as the new, permanent director of USDA-NIFA. This is a 6-yr appointment that does not require Senate confirmation.
- The Secretary of Interior nominee is Rep. Deb Haaland-D-NM.
- The EPA Administrator nominee is Michael Regan, Secretary of the NC Department of Environmental Quality.

WSSA- EPA Liaison & NIFA Fellow

The WSSA Board approved updates on the MOP's for both liaison positions.

- Greg Kruger will be stepping down from the EPA Liaison role in 2021 and will be helping mentor the new liaison. Candidates should apply by Feb. 1, 2021. Please direct prospective applicants to WSSA President Bill Curran and myself.
- Our WSSA NIFA-Fellow, Jim Kells, has had limited opportunities to interact with NIFA staff because of NIFA's move to Kansas City in 2019 and covid in 2020. Jim will be renewing his role for three years.
- **Free WSSA Webinar on Federal Career Opportunities for Weed Scientists**. Thursday, January 28, 2021 at 3:00 pm E.S.T. Register here.

Weed Science/Aquatic Plant Management "Virtual" Congressional Visits:

Held 22 visits with staffers in GA, IA, IN, LA, MN, MT, NC, PA, UT & VA. Top issues:

- Oppose H.R. 7940 and S. 4406, the "anti-FIFRA" legislation introduced by Rep. Neguse-D-CO and Sen. Udall-D-NM. We also joined 300+ societies in a letter to every member of Congress and also issued a separate press release.
    - Success. None of Congressional offices we spoke with supported this legislation.
- Support USDA IR-4 funding at President's request of $17 million for FY 2021.
    - Unfortunately, the final appropriation for IR-4 remained at $12 million for FY 2021, which has been its funding level for the past decade.
- Glyphosate is safe. IARC decision is flawed.
    - Success. All of the Congressional offices supported our discussion of this issue.
- Support funding for the U.S. Army Corp of Engineers Aquatic Plant Control (APC) research program at the Senate level of $7 million for FY 2021.
    - Success. This program, which is critical to research in the Aquatic Plant Management Society (APMS), was almost eliminated a decade ago and only funded at $4 million in FY 2017 and $6 million last year.
- Support the Senate's version (S. 3591) of the 2020 Water Resources Development Act (WRDA), which includes $25 million for a Harmful Algal Bloom (HAB) demonstration program and funding for various invasive species pilot programs that the House version (HR 7575) does not contain.
    - Major success. Everything we asked for happened. The Army Corp's $25 million HAB demonstration program will have focus areas in the Great Lakes, the tidal and inland waters of NJ, the coastal and tidal waters of LA, the waterways of the counties that comprise the Sacramento-San Joaquin Delta, CA, the Allegheny Reservoir Watershed in NY, and Lake Okeechobee, FL.

FY 2021 Appropriations Signed into Law on Dec. 27, 2020

Key USDA research programs for weed science either received increases in funding compared to FY 2020 or remained the same as FY 2020. There is also great news for SWSS states with new money for cogongrass control, which is a federally listed noxious weed.

USDA Program	**FY19 Final**	**FY20 Final**		**FY21 President**	**FY21 House**	**FY21 Senate**	**FY21 Final**
	----------Millions ----------						
ARS	$1,303	$1,414		$1,368	$1,452	$1,510	**$1,492**
NIFA	$1,471	$1,527		$1,591	$1,574	$1,539	**$1,570**
AFRI Competitive Grants	$415	$425		$600	$435	$435	**$435**
Hatch Act (Exp. stations)	$259	$259		$243	$259	$259	**$259**
Smith Lever (Extension)	$315	$315		$299	$315	$315	**$315**
IR-4 Program	$12	$12		$17	$15	$12	**$12**
Crop Protection and Pest Management (CPPM)	$20	$20		$20	$20	$20	**$20**
Note- The final FY 2021 appropriations language provides **$3 million** to USDA-APHIS to partner with state departments of agriculture and forestry commissions in states considered to be the epicenter of **cogongrass** infestations to assist with its control and treatment.							

USDA-ARS: The Crop Protection and Quarantine program (NP 304) has hired a **new National Program Leader (NPL) for weed science: Dr. Steve Young**. He is a weed scientist who was most recently at Utah State University and prior to that served as the Director of the Northeastern IPM Center at Cornell.

Weed Genomics Conference: A USDA-NIFA proposal from weed scientists for $25K of funding for a Weed Genomics conference has been approved. Tentative conference date is Sep. 22-24, 2021 in Kansas City.

Genetic Mapping of Weeds Fact Sheet: The WSSA Public Awareness Committee, chaired by Carroll Moseley, has worked hard to publish this fact sheet and an accompanying press release that explores the status of weed genomics, what weed scientists are learning, and the potential impact on future weed control.

USDA Ag Innovation Agenda comments: We submitted comments based on WSSA's 2018 Research Priorities, but adjusted them to fit the requested format.

EPA Proposed Interim Decision for Paraquat

- Given the value of paraquat as a unique weed management tool and the updated human health mitigation measures, WSSA is **opposed** to the following two application restrictions proposed by EPA:
    - prohibition of all aerial applications of paraquat except for cotton desiccation;
    - prohibition of all paraquat applications using mechanically pressurized handguns and backpack sprayers.
- Those application restrictions would eliminate many unique weed management options and put undue pressure on other broad-spectrum burndown treatments.
- We submitted comments on Jan. 11, 2021.

EPA Draft Biological Evaluations (BEs) for Triazines. Comments due Feb. 19, 2021

This is the second group of pesticides, and the first herbicides, where the agency used its March 2020 Revised Method for National Level Listed Species Biological Evaluations of Conventional Pesticides to assess potential impacts that these herbicides may have on threatened and endangered species and their critical habitats.

- The BEs make effects determinations for 1,795 listed species and 792 designated critical habitats when these pesticides are used according to product labels. This includes no effect, not likely to adversely affect, and likely to adversely affect determinations.
- EPA estimated that atrazine is likely to adversely affect 54 percent of all species and 40 percent of critical habitats.

EPA Draft Biological Evaluations (BEs) for Glyphosate. Comments due Mar. 13, 2021

- Same situation as the triazine BEs above. Lots of unknowns with the models and assumptions.
- EPA estimated that glyphosate is likely to adversely affect 93% of endangered species and 96% of critical habitat.

- One suggestion is to focus on the benefit of herbicides in controlling weeds to help reestablish endangered species habitat. A good example is the work by Rod Lym in North Dakota on controlling leafy spurge that helped reestablish critical habitat for the endangered western prairie fringed orchid.
- However, most of our comments probably need to focus on the assumptions and models EPA used to estimate these BEs to help refine the conclusions about risk.

EPA's Final Application Exclusion Zone (AEZ) Requirements:

The National and Regional Weed Science Societies submitted comments on EPA's proposed Application Exclusion Zone (AEZ) requirements and we are pleased to see EPA adopted most of those revisions. The AEZ is the area surrounding pesticide application equipment that exists during outdoor pesticide applications. Below are some of the improvements made:

- AEZ requirements only apply within the boundaries of the agricultural establishment, removing off-farm responsibilities that were difficult for state regulators to enforce.
- Immediate family members of farm owners are now exempted from all aspects of the AEZ requirements. Farm owners and their family are now able to shelter in place inside closed buildings, giving them flexibility to decide whether to stay on-site.
- New clarifying language has been added so that applications that are suspended due to individuals entering an AEZ may be resumed after those individuals have left the AEZ.
- Simplified criteria to determine whether applications are subject to the 25- or 100-foot AEZ.

Comments on Interior's Draft Invasive Species Plan: The National and Regional Weed Science Societies submitted comments on the Department of the Interior's efforts to develop a comprehensive Invasive Species Strategic Plan. Invasive weeds in terrestrial and aquatic ecosystems are estimated to cost nearly $30 billion per year.

2021 National Invasive Species Awareness Week (NISAW):

Working with Belle Bergner, Executive Director for the North American Invasive Species Management Association (NAISMA), to help coordinate NISAW activities.

- A policy-focused webinar series is being scheduled for February 22-26, 2021.
- A traditional NISAW with "in the field" awareness events at state and local levels is being discussed for May/June 2021.
- Any input on invasive weed policies and funding is welcome.

2020 Survey Results of Common and Troublesome Weeds Now Available

The 2020 survey results for weeds in grass crops, pastures & turf are posted at http://wssa.net/wssa/weed/surveys/.

- Weeds barely mentioned in 2017 that increased in 2020 include medusahead, ventenata, dogfennel, Scotch thistle, vaseygrass, Lehmann lovegrass, milkweed spp., and *Lepidium spp*.

- Submitted a SWSS poster with the survey results specific to the SWSS region.
- **The top three most common weeds among all grass crops in the SWSS region** were 1) *Digitaria spp*.; 2) Italian ryegrass; and 3) *Ipomoea spp*. and the most troublesome weeds were: 1) Italian ryegrass; 2) Palmer amaranth; and 3) *Ipomoea spp*.

Weed Science Policy Fellows

The 2020 Science Policy Fellows are **Camp Hand** at the University of Georgia (advisor: Stanley Culpepper) and **Vasiliy Lakoba** at Virginia Tech (advisor: Jacob Barney). Instead of trips to Washington DC for meetings and networking, everything has been virtual. Both of them will be finishing their Ph.D. programs in spring 2021.

Awards Committee report - James Holloway – Chair

We had nominations in every category with winners in all but one. We will have 2 carry overs in the SWSS Fellow award, 1 in the Outstanding Educator award and 1 in the Outstanding Young Weed Scientist-Industry award for the 2022 award nominations.

Carry over packets will be sent to President Eric Webster and Kelley Mazur for inclusion into the 2022 awards process.

The SWSS 2021 awards summary follows:

SWSS Award Summary - 2021
Chair _ James Holloway

Award	Nominator	Nominee	Result
SWSS Fellow	Alan York	David Jordan	Winner
Brad Minton - Chair			
	David Shaw	Andy Ezell	Not awarded
			Carry over to 2022
	Tim Grey	Henry McClain	Winner
	229-886-6573		
	Melissa Siebert	Bo Braxton	Not Awarded
	662-347-8583		Carry over to 2022
Oustanding Educator	James Holloway		Not awarded
Peter Dotray - Chair		Jason Bond	Carry over to 2022
Oustanding Young Weed Scientist - Industry		Matthew Wiggins	Winner
Hunter Perry - Chair			
Oustanding Young Weed Scientist - Academia		Muthu Bagavathiannan	Winner
Hunter Perry - Chair		Michael Flessner	Carry over to 2022
Graduate Student - MS	Muthu Bagavathiannan	Cynthia Sias	
Nicholas Basinger - Chair	Tim Grey	Nick Hurdle	Winner
	Jason Norsworthy	Mason Castner	
	Michael Flessner	Eric Scruggs	
Graduate Student - PhD	Muthu Bagavathiannan	Seth Abugho	
Nicholas Basinger - Chair	Stanley Culpepper	Camp Hand	
	Shawn Askew	Jordan Craft	
	Muthu Bagavathiannan	Aniruddha Maity	
	Eric Webster	Sam Rustom	Winner
	Tim Grey	Kayla Eason	
	David Monks	Stephen Smith	
	David Monks	Levi Moore	
Excellence in Regulatory	James Holloway	Larry Steckel	Winner
Cherilyn Moore - Chair			

SWSS Award
Winners

Award		Nominator		Nominee	Result
SWSS Fellow		Alan York		David Jordan	Winner
Brad Minton - Chair					
		Tim Grey		Henry McClain	Winner

Oustanding Young Weed Scientist - Industry				Matthew Wiggins	Winner
Oustanding Young Weed Scientist - Academia				Muthu Bagavathiannan	Winner
Hunter Perry - Chair					

Graduate Student - MS		Tim Grey		Nick Hurdle	Winner
Nicholas Basinger - Chair					

Graduate Student - PhD		Eric Webster		Sam Rustom	Winner
Nicholas Basinger - Chair					

Excellence in Regulatory		James Holloway		Larry Steckel	Winner
Cherilyn Moore - Chair					

Graduate Student Program Committee Report for 2021 – Pete Eure

Meeting Date: January 8, 2021

Attendees: Tommy Butts, Matt Wiggins, Kelley Mazur, Drew Ellis, and Hunter Perry

ITEMS OF BUSINESS:

1. **Student Contest Participation:**

Year	Poster Contest Participants			Oral Paper Contest Participants			Total Participants
	MS	PhD	Total	MS	PhD	Total	
2021	22	24	46	28	34	62	108
2020	13	9	22	29	26	55	77
2019	15	15	30	26	17	43	73

2. **Virtual Student Contest Overview**
   a. The virtual student contest will enable live presentations from students.
   b. Attendees and judges may pose questions to presenters using the "Q&A" function in Zoom.
   c. A host, moderator and, co-moderator will manage presentation transitions, introductions, Q&A, and time.
   d. In the event a student loses internet connectivity for an extended period, a student should be given the opportunity to present later (i.e. at the end of the day). Guidance and support from the Board will be needed in the event this occurs.
   e. Committee concurs that only material on the poster (48"x48") should be judged. Links or linked material should not be judged as part of the contest poster.
3. **Virtual Score Recording**
   a. A Google Spreadsheet for each section will be provided to allow judges to record scores, rankings, and comments. This spreadsheet is designed to "auto sum" scores for each judge.
      i. Access to the spreadsheet will be 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. If a judge does not wish to enter information into the online spreadsheet, they will need to submit their scores, ranking, and comments to the committee via email.
4. **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 word document of the score sheet to easily record scores and comments
    iii. A link to a Google Document to record final scores, ranking, and comments for the section.
b. Committee member (Eure, Butts, Wiggins) contact information will be shared with judges to address questions prior to, during, or after the contest.

5. Communication of Contest Results

a. Awards will be announced as part of the general session held on Tuesday, January 26th (Virtual Room 1).
b. Following the meeting an email will be sent to each contest participant, including:
    i. Scores and ranking from judges
    ii. Any comments provided by judges
c. This will take a few days to complete

6. Committee Succession Plan

a. Tommy Butts will be the committee chair in 2021.
b. Mathew Wiggins will assist and follow as the chair in 2022.
c. The committee recommends Pratap Devkota (pdevkota@ufl.edu) for the graduate student program committee and 2023 chair.

Continuing Education Units Committee Report – Bruce Kirksey

We did not meet. Chair is working with each state representative on obtaining documentation for virtual meeting credits.

Submitted by

Bruce Kirksey

2021 Sustaining Membership Committee Report – Jacob Reed

Receipts for the 2020 SWSS Sustaining Membership Fund total $24,300.00 as of January 11, 2021. Bayer has issued a check in the amount of $9,500.00 which has not been received yet. ADAMA has also communicated intent to contribute $500 which has not yet been received. Total receipts for 2020 are expected to be **$34,300.00**.

Bayer stated that they would make up some of the contributions lost from the consolidation of Bayer and Monsanto. We are extremely grateful for their generosity and for Gary Schwarzlose's hard work in this matter.

The Committee approved recommendations for additional committee members and a committee chair to be requested after the 2021 meeting.

2020 Committee:

Jacob Reed - chair

Bob Scott

Andy Kendig

Kelly Backschieder

Luke Etheredge

Chris Meyer

120. SUSTAINING MEMBERSHIP COMMITTEE (STANDING)

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

2020 Meeting Site Selection Committee Report – James Holloway

The 2020 Meeting site selection Committee held its annual meeting at the 2020 SWSS annual meeting in Biloxi, MS. Minutes follow:

Meeting Site Selection Committee

1/27/2020

9-10 AM Azalea A

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

Absent: Andrew Price, Kelley Mazur

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

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

Suggested dates: Jan 23-26

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

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

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

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

The 2023 Site Selection Committee recommended 3 location for the SWSS Executive Board to review. These included Memphis, TN, Little Rock, AR and Baton Rouge, LA.

Following discussion and voting at the 2020 summer board meeting, the Executive Board choose Baton Rouge, LA for the 2023 SWSS annual meeting.

Respectively submitted,

James C. Holloway, Jr.

Past President - SWSS

01-06-2021

2021 Nominating Committee Report – James Holloway

The following individuals were nominated for various seats on the SWSS Board.

VP – Industry

Eric Castner

Jacob Reed

Member at Large – Industry

Andy Kendig

Bruce Kirksey

Member at Large – Academia

Tom Barber

Jim Brosnan

Endowment

Sandeep Rana

Adam Hixson

Following are the election results:

VP – Industry - Eric Castner

Member at Large – Industry - Andy Kendig

Member at Large – Academia - Tom Barber

Endowment - Sandeep Rana

Respectively submitted,

James C. Holloway, Jr.

Past President – SWSS

1-6-2021

Weed Contest Committee Report – Drew Ellis (updated 2020 report…no contest held in 2020)

Opening remarks:

Announced Drew Ellis as Chair.

Announcement of location and date for 2020 Weed Contest. Corteva agriscience will host in Stoneville, MS on **August 3rd, 2020**.

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

Review of proposed rules and possible changes.

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

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

Comments from the society members in attendance included the following:

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

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

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

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

Comments from attendees:

- Pictures should not be more than 3 to 5 in total number.
- Only can be of plants and not seeds.
- Proper attention by host to show good quality pictures and multiple inset pictures of key identifying structures (ex. grasses and ligules/stem shape/etc or ocrea for polygonum spp)
- A comment was made that this is not truly meeting the intent of weed identification training.

- A couple of comments that this is a very valid method for students to become comfortable with as many weed scientist answer such daily in their career.

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

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

- No objection was given to this addition/change.

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

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

Unknown Herbicide (Symptomology Plots)

Changes shown highlighted.

Potential Herbicide Families and Herbicides	
Amide	**Isoxazoline**
Sulfonanilide	**Phenoxy**
Benzoic acid	**N-Phenylphthalimide**
Bipyridylium	**Phosphinic acid**

Chloroacetamide	**Pyrimidinedione**
Arloxyphenoxypropionate	**Arylpicolinate**
Dinitroaniline 7. pendimethalin (1.0 lb ai/A PRE)	**Substituted urea** 18. diuron (0.5 lb ai/A POST) + COC
Diphenylether 8. fomesafen (0.25 lb ai/A POST) + COC	**Sulfonylurea** 20. chlorimuron (0.0156 lb ai/A POST) + NIS
Glycine 9. glyphosate (0.77 lb ae/A POST) + NIS	**Triazine** 22. atrazine (1.5 lb ai/A PRE)
Imidazolinone	**Triazolinones**
Isoxazolidinone	**Triketone**

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

No further business, adjourned.

SWSS Endowment Board Committee Report - Gary Schwarzlose, Secretary

Virtual (Zoom) Meeting held January 14, 2021 at 10:00 am CST

Attending – Hunter Perry, Gary Schwarzlose, Kelley Mazur, Greg MacDonald, Jason Bond, Michael Lovelace, Donnie Miller, and Sandeep Rana. Not attending due to schedule conflict – Hannah Wright. Introductions were made.

Attachments – Agenda, Committee list, and Balance Sheet

Kelley Mazur gave a business update. Total Assets as of January 13 was $406, 187. This amount is comprised of a checking account, an RBC account and 4 CDs on 4-year rotating renewals. Kelley reminded the Board that the CDs investments should be reviewed as they are currently on a "conservative" trend and if the Board wanted, those funds could be invested in a "more aggressive" fund line-up. The Request for Endowment Funds went out last week and additional funds will be received. Because of the move to a Virtual Meeting there will not be a fund-raising activity. Discussions were held on what was planned for 2021 and what activity might be available in 2022. Motion to approve the financials was made by Donnie Miller and seconded by Greg MacDonald. Motion Passed.

Endowment Enrichment Scholarship discussion led by Hunter. Hunter has been updating the Endowment Enrichment Scholarship file with information for 2021. There were 3 winners in 2019. Unfortunately, there were no scholarship winners in 2020 due to the pandemic. Sponsors are being contacted to see if they are still willing to participate. An email will be sent to SWSS members asking for additional hosts. We will move forward as if we will be able to offer these scholarships but due to the COVID-19 situation the Board decided that a "go / no go date" of April 1 will be used to determine if we move forward. Motion to approve these actions was made by Greg MacDonald and seconded by Michael Lovelace. Motion Passed.

Discussion was held on nominations from Academia for Endowment Board Member 2021 – 2022. Several names were suggested and a motion to recommend the nominations of Michael Flessner (VT) and Lauren Lozano (LSU) to the SWSS Board was made by Jason Bond and seconded by Greg MacDonald. Motion Passed. Next year (2022-23) nominations will come from Industry.

New Business – Kelley requested that the SWSS Endowment Board move to an online version of QuickBooks. Currently we are using the Desktop version and that product is nearing end of life and will not be supported. Cost to be incurred is $41.95 / month. Motion to move to QuickBooks online was made by Greg MacDonald and seconded by Donnie Miller. Motion Passed.

Discussion was held regarding holding some type of event for the attendees during the SWSS Weed Contest. Further discussion is needed, and No action was taken.

New member, Sandeep Rana, will be joining the Board and Past President, Donnie Miller, will be leaving the Board following the conclusion of the 2021 SWSS meeting.

Hunter Perry made motion to adjourn and seconded by Greg MacDonald. Motion Passed.

Constitution and Operating Procedures Committee – Carroll Johnson

Report: There are no substantial changes made during 2020 to the SWSS Manual of Operating Procedures, Constitution, and By Laws. Slight editorial changes were made in 2020 in the Manual of Operating Procedures and these changes are reflected in the present document accessible by the membership.

There were a few minor items that need to be changed to both the Constitution and By Laws, but these changes will be processed and voted by the SWSS membership at the 2022 in-person conference. This course of action was deferred to 2022 due to the virtual 2021 conference and there is not a mechanism in place for the membership to conveniently vote on changes to either the Constitution or By Laws. Since these changes are minor, almost trivial, deferring to 2022 will not affect SWSS operations.

For 2021 and 2022, it is anticipated that the SWSS Newsletter Editor responsibilities might be expanded to include additional duties related to social media oversight. This is still in the discussion stage. If this proposed change is further clarified and approved by the SWSS Board, the Manual of Operating Procedures, Constitution, and By Laws will be changed according to established protocols.

Respectively Submitted;

W. Carroll Johnson, III

Committee Chair.

Business Manager Report – Kelley Mazur

Office or Committee Name: Business Manager

Officer or Chairperson Name: Kelley Mazur

Date of Preparation: 1/19/2021

Annual Meeting:

Pre-registration as of January 19, 2020 at 9:01AM MST is 244 which includes 116 Students and 128 Regular Members vs pre-registration of 2020 at 249 (92 Students, 157 Regular Members, 0 Spouse Registrations). Registration rate remained $350 for Regular Members and $150 for Students totaling $58,646.40 with Paypal processing fees removed. Majority of the expenses listed were the cancellation fee with Hilton Knoxville at $27,904.50 and Zoom subscription fees. Maple Hall was contracted to host the Grad Student Mixer but voided the deposit with their cancelation.

Below is a summary of past meeting registration:

	Virtual	*Biloxi*	*Oklahoma City*	*Atlanta*	*Birmingham*	*San Juan Joint*	*Savannah*
	2021	*2020*	*2019*	*2018*	*2017*	*2016*	*2015*
Members	128	157	169	246	224	652	270
Students	116	92	97	95	98	72	98
Total	244	249	237	341	322	724	362
Final	TBD	282	266	376	420	724	362

Financial Reports w/ Clete Youmans:

SWSS Assets total $295,186.58 broken out in the following (also listed on the attached Balance Sheet). Keep in mind that the SWSS FY does not abide by the pay schedule of Sustaining Members which has collected $24,800.

- AHB Checking $46,422.69
- AHB MM $9,883.73
- RBC Brokerage $154,045.50
- CD 1 $21,271.29
- CD 2 $21,135.20
- CD 3 $21,145.94
- CD 4 $21,282.23
-

Old Business:

APEX has provided a quote for a new databse and website face lift. Please review for consideration.

Respectfully submitted by Kelley Mazur, SWSS Business Manager

Legislative and Regulatory – Todd Baughman

January 19, 2021

Committee Name: SWSS Legislative and Regulatory Committee

Report: The SWSS Legislative and Regulatory Committee chose not to meet in 2021. The chair participated in WSSA Science Policy Committee meetings throughout the 2020-2021 year.

Dr. Lee Van Wychen Executive Director of Science Policy for the National and Regional Weed Science Societies will present the minutes of those meetings to the SWSS membership.

Submitted by: Todd Baughman, Committee Chair.

Long Range Planning Committee

Report: No report or nothing to report

Submitted by: ___Bob Scott_____, Committee Chair.

Newsletter Committee

Report: Committee did not meet. This committee has been inactive for the past 5-6 years. The current newsletter editors are stepping down after 10 years of service in this role (Bob and Susan Scott). The President, President-elect and business manager have been made aware. The current editor made a recommendation for a replacement and continued need for a newsletter statement to the president elect.

Submitted by: ___Bob Scott_____, Committee Chair.

Finance Committee Report – Darrin Dodds

The Southern Weed Science Society posted a gross income of $71,199.83 from June – December 2020 against gross expenses of $62,811.66 during the same time period. Net income over this time equates to $8,388.17

Total assets for the SWSS total $287,269.10. Assets are divided amongst a number of accounts including a checking account, four certificates of deposit, a money market account, and an account with RBC. The AHB checking account had a balance of $33,009.46 as of December 31, 2020 and posted a net gain of $8,109.81. The RBC account has a balance of $154,045.50

posting a net gain of $1,364.23. The money market account has a balance of $9,883.76 and posted a net gain of $0.42. Balances allocated to certificates of deposit appear to be static containing the following amounts: CD # 1 - $21,271.29; CD # 2 - $21,135,20; CD # 3 - $21,145.94; CD # 4 - $21,282.23. An additional $576.77 is housed in PayPal Bank; $4,000 is in accounts receivable, and $918.98 is in undeposited funds.

Given the global pandemic, the financial position of SWSS appears strong. However, caution is warranted against continually declining annual meeting attendance and subsequent revenue. A strategic plan outlining possible courses of action in the event of continually declining annual meeting attendance and revenue may be warranted to ensure future financial stability of the SWSS.

Proceedings Editor Report

Report by: Paul Tseng

Proceedings Editor's Report of the 2020 Meeting

The 2020 meeting was held at The Beau Rivage Resort and Casino Biloxi, MS during January 27-30, 2020. The 2020 Proceedings of the Southern Weed Science Society contained 362 pages, including 252 abstracts. By comparison, 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 252 titles (123 posters and 129 oral presentations) were submitted.

The Proceedings contained the Presidential Address, list of committees and their members, Executive Board minutes from the January and summer board meetings, committee reports (including reports from: Program Chair, Editor, Business Manager, Legislative & Regulatory Committee, Director of Science Policy, Graduate Student Contest, Weed Resistance & Technology Stewardship, Endowment, Nominating, Site Selection, Manual of Operations Procedures, and Necrology), award winners, as well as abstracts. The Proceedings were complete and uploaded to the SWSS website in December 2020.

Graduate Student Report

Report by: Cynthia Sias

In August of 2020, the GSO officers met to discuss how the virtual meeting setting may impact the normal operations of the GSO. Conversation about electing new officers in a virtual setting was discussed as well as amending the MOPs to include roles for the SWSS GSO Social Chair.

SWSS Student Graduate Organization

Student Officer Meeting 8/04/2020

Held over Zoom 4pm Central Time

Meeting Minutes:

Recorded by Cynthia Sias-SWSS GSO Secretary

Meeting start time 4 pm

Virtual assistance committee for 2021 SWSS Virtual Meeting- asking for volunteers to help older folks navigate the web for conferences. Everyone on GSO group has offered to be available and help.

Discussion on nominations for GSO

Proposition to send out an email for student nominations beforehand

Those who get nominated then send in a video regarding why they would be a good for the position. Display videos to then have a voting platform such as doodle poll. Potential personal written statements if videos don't work.

Might have to send out guidelines on what to include with the nomination such as including pictures, bio, etc.

We will continue to brainstorm on elections and how to be creative with this due to the current virtual situation.

Ideas for future meetings

The SWSS Executive board suggested getting rid of the golf tournament since enrollment has not been high previously to instead play putt-putt, laser tag or bowling – agreement and support for this- more people might be more interested in this

Potentially also combining the mixer with this activity whether it's putt-putt or bowling etc.

Panel discussion at the luncheon instead of a single speaker

Implementing a social chair in the future and creating twitter and Instagram accounts for SWSS SGO.

Social chair creating a schedule for each university to send the chair pictures, captions, tweets that can be posted to highlight the university. Good outlet for news b/c newsletters aren't reaching folks.

University representatives would have opportunity to get involved this way by being the responsible party to send in twitter and Instagram captions, pictures, etc. to add to the social media pages.

Motion by Lawson:

Include a section 6 in the SWSS SGO constitution and have social chair duties drafted into our constitution

University representatives will be responsible for sending content to the social chair to add to social media pages

Hannah: Second

Motion is passed

Lawson's changes will be revised and added to the constitution to have the social chair position included- pending SWSS Executive Board approval

Jake will make Instagram and twitter page

All orders of business have now been discussed and revised.

Meeting adjourned 5:33 pm.

WSSA Representative Report
Report by: John Byrd

2020/2021 WSSA Board of Directors

President:	Curran, William (2021)	williamscurran@gmail.com
President-Elect:	Dille, Anita (2021)	dieleman@k-state.edu
Vice-President:	Culpepper, Stanley (2021)	stanley@uga.edu
Past-President:	Steckel, Larry (2021)	lsteckel@utk.edu
Secretary:	Dodds, Darrin (2021)	dmd76@msstate.edu
Treasurer:	Banks, Phil (2021)	marathonag@zianet.com
Director of Publications:	Willenborg, Chris (2023)	chris.willenborg@usask.ca
Chair, Constitution and Operating Procedures:	Lindquist, John (2023)	jlindquist1@unl.edu
Member-at-Large (4-year term)	Refsell, Dawn (2022)	Dawn.Refsell@valent.com
Member-at-Large: (4-year term)	Sosnoski, Lynn (2024)	lms438@cornell.edu
Graduate Student Member:	Greene, Wykle (2021)	wykle@vt.edu
Executive Director of Science Policy:	Van Wychen, Lee (Ex-off and non-voting)	Lee.VanWychen@wssa.net

Conference members:		
Aquatic Plant Management Society:	Richardson, Rob (2022) **	rob_richardson@ncsu.edu
Canadian Weed Science Society:	Tardif, Francois (2021) **	ftardif@uoguelph.ca
North Central Weed Science Society:	Elmore, Greg (2021) **	greg.elmore@bayer.com
Northeastern Weed Science Society:	Chandran, Rakesh (2023) **	RSChandran@mail.wvu.edu
Southern Weed Science Society:	Byrd, John (2022) **	JByrd@pss.msstate.edu
Western Society of Weed Science:	Schraer, Marty (2021) **	marty.schraer@syngenta.com
Executive Secretary (ex-off and non-voting):	Gustafson, Eric	eric@imigroup.org
Interactive Management, Inc Staff		
Vice-President and CEO:	Leeper, Gary	gary@imigroup.org
Meeting Manager:	Gustafson, Eric	eric@imigroup.org

The first WSSA virtual annual meeting will be February 15-19, 2021 hosted by Country Brands. Registration is $350. The program will open with a presentation by The Peterson Brothers (Peterson Farm Brothers) followed by the Awards program. A new HRAC Award will be presented the first time in 2021 for Herbicide Resistance Awareness. The Award will focus on team, rather than individual accomplishments.

The meeting format will be prerecorded uploaded 12-minute oral presentations (104 titles submitted) with 3 minutes of live question and answer and 50 poster titles submitted. Again, this

year will be a 3-minute oral research presentation (45 titles submitted) for both M.S. and Ph.D. graduate students as well as poster (71 titles submitted) competitions. Students are eligible to win 1st place only once per degree program per delivery format.

Symposia organized and approved for the 2021 meeting: Advances in Sensor- Based Weed Management; Beyond the Boom, Benefits of Weed and Brush Management in Grasslands; Optimizing Aquatic Weed Management; PPO Inhibiting Herbicides History, Overview and Plan of Action; Sustainable Weed Management-What is it and What are We Doing? A sixth symposium title on Federal Career Opportunities for Weed Scientists was rerouted into a virtual workshop planned for January 28, 2021.

Tuesday, February 16 the format will be concurrent sessions from 9-10:30, 11-12:30 and 3-4:30 (all Central Time) with breaks between and a virtual Networking Lounge and the ability to connect and chat.

Due to COVID, there has been little in person face to face interaction for NIFA, EPA, or CAST representatives. Terms of NIFA and EPA liaisons is 3 years with 1 year for transition to the new liaison. Both NIFA and EPA liaisons will be refilled in 2021. Travis Gannon has agreed to start the revisions of the Herbicide Handbook, which will be electronic format, rather than printed.

President Curran assembled a Strategic Planning Committee chaired by Dawn Refsell with Greg Elmore, Janis McFarland, Rakesh Chandran, Eric Gustafson, John Byrd, Larry Steckel and Stanley Culpepper with the focus of how WSSA can improve service to members, affiliated organizations, and others. A website redesign is also being discussed.

WSSA will meet February 21-24, 2022 in Vancouver, Canada with Canadian Weed Science Society; the 2023 WSSA annual meeting will be January 30-February 2 in Arlington, VA with the Northeastern Weed Science Society; details to host the 2024 meeting with SWSS in Austin, TX are being negotiated.

Necrologies and Resolutions
Report by: David Black

2021 Necrologies and Resolutions

Eight necrology reports were submitted, Mr. Cleston Granville Parris, Dr. Rex Weldon Millhollon, Dr. Walter Arthur Skroch, Dr. Morris G. Merkle, Dr. Stacey Allen Bruff, Dr. Robert Loring Nichols, Dave Weaver, and Dr. Robert E. Frans.

Mr. Cleston Granville Parris, 91, died on March 2nd, 2020. Cleston was born on September 8, 1928 in Byrdstown, Tennessee.

Mr. Parris was an army veteran of the Korean War. He received his Bachelor of Science degree in Agriculture from Tennessee Tech University followed by a Master of Science degree in Agronomy from the University of Florida. He was employed by the Association of American Railways as their chemical specialist in controlling weeds on the right of way of the railroads. In 1960 he was employed by Tennessee Farmers' Cooperative as manager of the Agricultural Chemical Department, later becoming manager of the Advertising Department and TFC's advertising, public relations, and communications programs.

Cleston was a long-standing active member of the Southern Weed Science Society and Weed Science Society of America, serving as president of the SWSS in 1978 – 1979, and later recognized by receiving the Distinguished Service Award from the society in 1982. During his career he also served as president of TACA and the Advertising Council of Cooperatives International.

Cleston was survived by his wife Helen Beeler Parris; daughter, Jeanne Knight (Bill); two grandchildren; one great grandchild; brother, Clyde Parris (Mildred); several nieces, nephew, several great nieces and nephew, and great great nieces and nephew.

WHEREAS Mr. Parris served with distinction at Tennessee Farmers' Cooperative and,

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

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

Dr. Rex Weldon Millhollon, 89, died on May 3rd, 2020. Rex was born on May 1st, 1931 in Scurry County, Texas. He earned a Bachelor of Science degree in Agriculture from Texas A&M University. He earned another Bachelor of Science degree in Plant Science, followed by a Ph.D.

from the University of Arizona. In 1952 he married Paula Milo Creekmore and began their 67 years of marriage.

Dr. Millhollon began his career in Virginia before eventually settling in Houma, Louisiana as a Research Agronomist with the Unites States Department of Agriculture. He worked for 40 years at the USDA Sugar Cane Field Laboratory in Houma, Louisiana. Rex was an internationally respected USDA research agronomist, military veteran and native Texan.

Rex is survived by his wife, Paula; their children: Dr. Eddie Millhollon (wife Penny); Dr. Brian Millhollon (wife Catherine); Brenna Millhollon Barthel (husband Bobby) and Scott Millhollon; 6 grandchildren; and two great grandchildren.

WHEREAS Dr. Millhollon served with distinction at Unites States Department of Agriculture and,

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

Dr. Morris G. Merkle, 85, died on May 17th, 2020. Morris was born on July 23rd, 1934 in Lincoln, Alabama and was raised on the family farm in Talladega County. He was the fifth of six surviving siblings. He received the Bachelor of Science degree in Agricultural Science in 1955 and Master of Science degree in Agronomy-Weed Science in 1959 from Auburn University. From January 1956 to January 1958 he was in Germany with the 868th Field Artillery Battalion unit as a first lieutenant. He received his Ph.D. degree in Agronomy-Weed Science in 1963 from Cornell University under Dr. Stanford Fertig. A fellow student said Morris took every chemistry course at Cornell with all A's. He stated that Morris was at a level by himself above all other students. Extracurricular activity was baseball where he was a proud rebel in Yankee land. He considered making a run for the minor league, but a more financially stable career prevailed. He also found the love of his life Jean.

As a graduate student at Cornell University Morris spent 6 months in Midland, Michigan with Dow Chemical learning how to run a new analytical instrument called a gas chromatograph. With that knowledge he was hired in 1963 by Dayton Klingman with USDA-ARS as part of a five-member research unit at Texas A&M University to study and develop control programs for mesquite and huisache. Based on a very strong desire to teach students he transferred in 1966 to the Department of Soil and Crop Sciences at Texas A&M University. He taught his first two semester long weed science courses in 1967. During his teaching career he taught 1166 undergraduates and was the major professor for 84 M.S. and 53 Ph.D. students. He kept a

personal list of the first and last name of every student he taught. His students are considered leaders throughout the world.

Dr. Merkle was a long-standing active member of the Southern Weed Science Society and Weed Science Society of America, serving as president of the SWSS in 1979 – 1980, and later recognized by receiving the Fellow / Distinguished Service Award from the SWSS in 1982. He received all the teaching awards provided by both the SWSS and WSSA as well as Texas A&M University. Based on his vast knowledge he was a member of Operation Ranchland that developed vegetation control strategies for the U.S. Military during the Vietnam War.

Dr. Merkle is survived by his wife of 57 ½ years, Jean Carol; children, Charles Donald, George Ashley and Page Marie; grandchildren, Lance Andrew, Christopher Ryan, and Nicholas Kyle.

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

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

Dr. Walter "Walt" Arthur Skroch, 82, died June 13th, 2020. A native of Arcadia, Wisconsin, Walt received his bachelor's degree from the University of Wisconsin – River Falls and his Master of Science and Ph.D. from the University of Wisconsin – Madison.

Dr. Skroch joined the faculty at North Carolina State University in 1964 and served there until his retirement in 1994. During his 30-year career as professor of Horticultural Science in the NCSU College of Agriculture and Life Sciences, Walt developed many award- winning and beneficial programs that were very impactful both locally and nationally. In particular, his work in the Christmas tree industry in western North Carolina saved tons of soil from eroding, and the program established by Dr. Skroch is standard practice in the North Carolina industry today.

Dr. Skroch advised 16 MS and Ph.D. students and innumerable Extension educators. He was a Fellow of the Weed Science Society of America, founding member and past president of the Weed Science Society of North Carolina (WSSNC), and an active member of the SWSS. He received numerous awards including the Outstanding Extension Educator award from the American Society of Horticultural Science, Outstanding Extension Worker from NC State, the Porter Henegar Award from the Southern Nurserymen's Association, and Distinguished Service award from the WSSNC. In 2015, Walt was inducted into the Western NC Agricultural Hall of Fame.

Walt is survived by his wife, Carol Pendergraft Skroch; three daughters, Denise (Kirk) of Apex, Joan (Darren) of Raleigh, and Tammy (Robbie) of Laurel Springs; two sons, Tim (Sharon) of Garner, and Terry (Leigh) of Garner. Walt is also survived by nine grandchildren, and one great-grandchild. He is also survived by one brother, Mark, and two sisters, Pat and Barb as well as several nieces and nephews. Walt was preceded in death by three brothers, Harold, Al and Don, and one sister, Virginia.

WHEREAS Dr. Skroch served with distinction at North Carolina State University and,

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

Dr. Stacey Alan Bruff, 57, died September 23rd, 2020. Stacey was born on November 9th, 1962, in Columbia, SC. He received his Bachelor of Science degree in Agriculture from University of Tennessee at Martin. In 1991 he received his Master of Science in Weed Science from Mississippi State University followed by a PhD in Weed Science from Louisiana State University in 1994. He was an alumni of Alpha Gamma Rho fraternity.

Upon completion of his PhD, Dr. Bruff became Field Development Representative for FMC Agricultural Solutions in the mid-south. He most recently served as a divisional seed manager for Nutrien Ag Solutions in Union City, Tennessee.

Stacey is survived by his wife Sherri; a daughter Adeline Cook (Kyle); a son, Colton Bruff of Jonesboro, AR; two brothers Tracy Bruff (Jennifer) and Gordon Bruff (Amanda) both of Union City, TN; two nieces; and two nephews.

WHEREAS Dr. Bruff served with distinction at Nutrien Ag Solutions and,

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

Dr. Robert Loring Nichols, 74, died on October 8th, 2020. Bob was born in rural Sussex County, New Jersey. He graduated high school from Blair Academy in Blairstown, New Jersey in 1964 followed by Yale College in 1968 with a concentration in Economics and Political Science. He planned to attend law school but went to war instead.

Bob joined the Army Security Agency, volunteered for, and served three consecutive combat tours in Vietnam – one in the Central Highlands, and two in defense of the Cambodian border. He was a Vietnamese language interpreter for a tactical intelligence organization. He held security clearances above Top Secret and was prohibited from travelling to any communist country for the rest of his life.

Bob returned to the United States in 1972, lived in the Mt. Washington Valley of New Hampshire, worked as a carpenter, and read the words of Jonathan Swift, "If a man can make two ears of corn grow where before there was only one, he will have done more for mankind than the whole race of politicians". Bob resolved to study plants. With the G.I. bill, a tuition wavier from the state of Connecticut, and the assistance of the faculty of the Univ. of Connecticut College of Agriculture at Storrs, he achieved a Master of Science and Ph. D. in agronomy in 1977 and 1980, respectively. His dissertation was on the use of glyphosate for planting without tillage.

Dr. Nichols worked for USDA-ARS as the Southern Regional Forage Agronomist with a co-appointment with the Univ. of Georgia; for PPG Industries as a field development specialist and launched the soybean herbicide, lactofen; for F. Hoffman LaRoche coordinating field research in the Western U.S., managing a field station in Florida, and developing insect managing technologies in the Western Hemisphere. He headed the marketing of research services for Agri-Growth Research and managed four research farms in Illinois, Iowa, Minnesota, and Nebraska.

In 1992, Dr. Nichols joined Cotton Incorporated and served for 28 years as Director, then Senior Director of Agricultural and Environmental Research. He had no requirement to publish after 1984, but authored over 190 publications in agronomy, biochemistry, entomology, genetics, nematology, plant pathology, and weed science.

Dr. Nichols considered his key expertise to be weed management and herbicide chemistry. He was long standing and active member of the Southern Weed Science Society and the Weed Science Society of America. He chaired the SWSS's Herbicide Resistant Plants Committee and its Science Policy Committee. In 2012 Dr. Nichols was recognized by the SWSS with its Fellow / Distinguished Service Award and its Regulatory Stewardship Award. He was a longtime member of the WSSA's Science Policy Committee and strong advocate for action, ethics, and scientific excellence.

Bob Nichols is survived by his loving wife, Carol Lee Nichols; five children; and five grandchildren.

WHEREAS Dr. Nichols served with distinction at Cotton Incorporated and,

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

Dr. Dave Weaver, 81, died on November 22nd, 2020. Dave was born on July 24th, 1939 in Hamlin, Texas. He earned a Bachelor's and Master's degrees from Texas Tech University followed by a Ph.D. in Agronomy from Texas A&M University in 1971. He married his wife of 46 years, Mary Ann, on June 2nd, 1961 in Lubbock.

Dr. Weaver spend his career with the Texas Agricultural Extension Service in College Station, serving as the Associate Department Head at the time of his retirement in 1995. He was awarded both the Outstanding Extension Award and Soil and Crop Sciences Award.

Dave was preceded in death by his wife, Mary Ann, in 2007. He is survived by his children; Chad Weaver, Linda Weaver Gleason; a brother Guy Weaver: a sister-in-law, Judy Kay Cowan; and 2 grandchildren.

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

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

Dr. Robert E. Frans, 93, passed away on January 11th, 2021. Bob was born on April 19th, 1927 in Louisville, NE. He grew up in small towns in Eastern Nebraska as his father was a station agent primarily for the Chicago, Burlington and Quincy Railroad. The family landed in Belden, NE, where Bob graduation from high school. Bob served in the U.S. Army for 2 years and was training to drive tanks when the war in Europe ended. After his honorable discharge he went on to further his education at the University of Nebraska where he earned his Bachelor of Science degree in Agriculture in 1950 followed by a Master of Science degree in Farm Crops from Rutgers University in 1953. He then attended Iowa State University where he received his Ph.D. in Botany-Plant Physiology in 1955.

Dr. Frans came to the University of Arkansas in 1955 and started out as an Assistant Professor of Agronomy. He was a highly effective researcher, teacher and spokesman for agriculture and weed science, not only in Arkansas, but also in international agriculture. In addition to professional and civic awards, he published many scientific articles for professional journals and university publications. He retired forty years later as Emeritus Distinguished Professor of Agronomy in the Department of Crops, Soil and Environmental Sciences. During his career Bob was invited to attend and speak at many international conferences and so was able to "travel the world". He became passionately involved with the Bolivian chapter of Partners of the Americas. Bob was a man of faith and the First Presbyterian Church of Fayetteville was an integral part of his life, especially his 52-year membership in the Chancel Choir.

Dr. Frans was a long-standing active member of the Southern Weed Science Society and Weed Science Society of America. Dr. Frans served as president of the SWSS in 1964 – 1965, and later recognized by the SWSS by receiving the Distinguished Service Award in 1978 and Weed Scientist of the Year in 1987. Dr. Frans held many positions of responsibility in organizations related to his field and received countless honors, awards and recognitions for the service he gave to the study of weed science.

Dr. Frans was preceded in death by his wife Maria Theresa Villanueva. He is survived by two daughters from his first marriage to Marilee Nebelsick, Catherine Hall (Ben), Cyndy Binder (Allen); three daughters from his marriage to Maria Theresa Villanueva, Veronica Croskrey (Nathan), Cecelia Callaway (Mike), and Isabel Pitts (Donnie). He is also survived by twenty-two grandchildren; and 17 great-grandchildren.

WHEREAS Dr. Frans served with distinction at the University of Arkansas and,

WHEREAS Dr. Frans 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. Robert “Bob” Frans, and by copy of this resolution, we express to his family our sincere sympathy and appreciation for his contributions.

2021 MEETING ABSTRACT

Goosegrass (*Eleusine indica*) Control and Warm-Season Turfgrass Tolerance to Combinations of Topramezone and Speedzone® EW Herbicide. JM Peppers*, S Askew, J Brewer; Virginia Tech, Blacksburg, VA (1)

Topramezone effectively controls goosegrass (*Eleusine indica* L. Gaertn.), but warm-season turfgrass suffers severe bleaching injury when topramezone is applied even at low rates. Admixtures with topramezone to mitigate warm-season turfgrass injury have drawn research attention recently due to the limited options for postemergence goosegrass control. It is hypothesized that Speedzone EW (2,4-D, MCPP, dicamba, and carfentrazone) can reduce topramezone-associated bleaching in warm-season turfgrass while maintaining goosegrass control. Three field studies were conducted in the summer of 2020 in Blacksburg, VA to evaluate goosegrass control and 'Latitude 36' bermudagrass (*Cynodon dactylon* L.) and 'Zeon' zoysiagrass (*Zoysia matrella* L.) tolerance to combinations of topramezone and Speedzone EW. These studies consisted of eight treatments and a nontreated control. These treatments include Speedzone EW (1010 g ha^{-1}) alone applied twice, topramezone (12.3 g ai ha^{-1}) alone applied with MSO (0.5% v/v) and topramezone applied at 6.15 and 12.3 g ai ha^{-1} plus Speedzone EW applied at 505, 758, and 1010 g ai ha^{-1}. Each week, goosegrass control and bleaching as well as turfgrass injury and bleaching were visually evaluated on a 0-100% scale. Topramezone (12.3 g ai ha^{-1}) alone controlled goosegrass 91% at 4 weeks after treatment (WAT) while Speedzone EW controlled goosegrass not more than 34% at 8 weeks after the initial treatment (WAIT) following two treatments. Every combination of topramezone and Speedzone EW controlled goosegrass between 84-89% at 4 WAT with the exception of topramezone (12.3 g ai ha^{-1}) plus Speedzone EW (1010 g ai ha^{-1}) which controlled goosegrass 97%. The addition of Speedzone EW to topramezone reduced the foliar bleaching on goosegrass to no more than 8%. Topramezone (12.3 g ai ha^{-1}) applied alone was the most injurious treatment to bermudagrass. The addition of Speedzone EW to topramezone reduced foliar bleaching at all Speedzone EW rates. Speedzone EW alone was injurious to bermudagrass and while the addition of Speedzone EW to topramezone reduced the bleaching injury, general bermudagrass necrosis was also observed with these treatments. The duration of injury when topramezone was applied alone and in combination with Speedzone EW was similar, with the exception of the lower rate of topramezone (6.15 g ai ha^{-1}) plus the lowest rate of Speedzone EW (505 g ai ha^{-1}). This treatment recovered more quickly than the other treatments and was also less injurious. Topramezone (12.3 g ai ha^{-1}) alone injured bermudagrass more than any other treatment in this study. While foliar bleaching decreased as Speedzone EW rate increased, bermudagrass injury also increased as Speedzone EW rates increased. Speedzone EW injured zoysiagrass less than it injured bermudagrass. Overall trends in zoysiagrass response to the addition of Speedzone EW to topramezone were similar to bermudagrass response, but the maximum injury, injury duration, and foliar bleaching were lower on zoysiagrass compared to bermudagrass when Speedzone EW was included in the treatment. The addition of Speedzone EW to topramezone reduced foliar bleaching from 65% to <10%. From these studies, we can conclude that the addition of Speedzone EW to topramezone can significantly reduce foliar bleaching of goosegrass and warm-season turf species while also maintaining goosegrass control. Speedzone EW is more injurious to bermudagrass than zoysiagrass and combinations of Speedzone EW and topramezone were less injurious to zoysiagrass than bermudagrass.

Competitive and Allelopathic Effects of Tall Fescue on Annual Grassy Weeds. D Koo*, CG Goncalves, S Askew; Virginia Tech, Blacksburg, VA (2)

Studies have shown that mowing tall fescue at or near four inches will decrease weed populations compared to lower mowing heights. Some researchers have speculated that allelopathy could be involved with competitive displacement of weeds by tall fescue. Greenhouse and growth chamber trials were conducted at Virginia Tech's Glade Road Research Facility in Blacksburg, VA, to 1) examine the impact of three tall fescue mowing heights on annual bluegrass (Poa annua) seedling establishment, 2) determine whether soil leachate collected from tall fescue affect seed germination of annual bluegrass, crabgrass (Digitaria sanguinalis), and goosegrass (Eleusine indica). and 3) evaluate the effect of aqueous leaf extracts of tall fescue on germination and growth of annual bluegrass, crabgrass, and goosegrass. Mowing-height treatments included turf-type tall fescue established from sod maintained at 3.81, 7.62, and 11.43 cm mowing heights, and a soil-only control to determine emergence of annual bluegrass without competition from turfgrass. Soil leachate treatments included 36-inch lysimeters of routinely-fertilized native silt-loam soil containing 'Kentucky 31' tall fescue (Festuca arundinacea Schreb.), turf-type tall fescue (cv. Falcon), and soil only and a comparison lysimeter that was nonfertilized soil only. The lysimeters were watered daily with 1 quart of solution comprised of collected leachate supplemented with tap water. After 1 month, leachate was used to hydrate seed germination paper along with a distilled water control. Leaf extract treatments included aqueous leaf extracts of 'Kentucky 31' tall fescue, turf-type tall fescue, and distilled water control. Preliminary results suggest that all tall fescue mowing heights equivalently reduced annual bluegrass germination 12 to 30% at 21 DAT. At 42 DAT, tall fescue at any mowing height had eliminated annual bluegrass seedlings. Soil leachate did not inhibit germination or seedling growth of annual grassy weeds regardless of tall fescue cultivar, soil only, or fertility treatment. Leaf extracts did not affect crabgrass and goosegrass germination and had temperature-dependent effects on annual bluegrass. Leaf extracts from tall fescue grown in cold temperature (day/night 4.4/-1.1?) reduced annual bluegrass germination 35% compared to control, but the tall fescue grown in warm temperature (day/night 32.2/26.7? reduced germination of annual bluegrass 10%.

Fraise Mowing: Mechanical Control of Annual Bluegrass in Bermudagrass Turf. DE Carroll*[1], J Brosnan[2], B Unruh[3], C McKeithen[3], P Boeri[3]; [1]University of Tennessee, Knoxville, TN, [2]Univeristy of Tennessee, Knoxville, TN, [3]University of Florida, Jay, FL (3)

Fraise mowing is a cultivation practice that removes turfgrass verdure, thatch, organic matter, and soil that can be used as a non-chemical means of controlling annual bluegrass (*Poa annua* L.). Research assessing annual bluegrass control via fraise mowing has been conducted in stands of zoysiagrass (*Zoysia japonica* Steud.) and perennial ryegrass (*Lolium perenne* L.) but has not yet been explored in bermudagrass (*Cynodon* spp.). A field experiment was conducted in Knoxville, TN and Jay, FL in 2019 and repeated in 2020 to assess bermudagrass regrowth and annual bluegrass control following fraise mowing. Turfgrass was common bermudagrass (*Cynodon dactylon*, cv. 'Vamont') maintained at a 3.2 cm height of cut in Tennessee and 'TifSport' hybrid bermudagrass (*C. dactylon* x *C. transvaalensis* Burtt Davy) maintained as a golf course fairway at a 1.3 cm height of cut in Florida. In both locations, fraise mowing was conducted in mid-June each year at depths of 1.5 and 3.0 cm. A non-fraise mowed control was included for comparison. The experiment was arranged as a randomized complete block design with four replications of plots (6 x 2.4 m). Bermudagrass cover was rated visually and quantified using digital image analysis every two weeks following fraise mowing. Annual bluegrass cover was quantified monthly the spring following fraise mowing by assessing the number of plants present within a grid and converting values to percentages. In Tennessee, bermudagrass recovered faster when fraise-mowed to 1.5 cm rather than at 3.0 cm. Turfgrass fully recovered 116 days after treatment (DAT) when fraise mowed to 1.5 cm; comparatively, the 3.0 cm fraise mowing did not recover by the end of the study. Bermudagrass recovery occurred much quicker in Florida with the 1.5 cm treatment fully recovering 85 DAT and the 3.0 cm treatment completely recovering 156 DAT. In both Tennessee and Florida, fraise-mowing effectively controlled annual bluegrass. In plots that were not fraise mowed, annual bluegrass cover ranged from 33 to 62% (Tennessee) and 26 to 65% (Florida) the spring following fraise mowing. Comparatively, annual bluegrass cover in Tennessee ranged from <1% to 4% in plots subjected to fraise-mowing: a response equating to a 94 to 97% reduction. In Florida, annual bluegrass cover ranged from 5 to 22%, equating to a 61 to 86% reduction. In both locations, there were no differences in annual bluegrass cover between the 1.5 and 3.0 cm treatments. These results suggest fraise mowing can be an effective, non-herbicidal method of reducing annual bluegrass populations in bermudagrass, which may be useful for those struggling with herbicide-resistant biotypes.

Goosegrass Control in 'TifWay' Bermudagrass. LB McCarty[1], FH Yelverton[2], T Gannon[3], A Gore*[1], T Stoudemayer[1]; [1]Clemson University, Clemson, SC, [2]Affiliation Not Specified, Raleigh, NC, [3]North Carolina State University, Raleigh, NC (4)

Goosegrass (*Eleusine indica* L.) is a problematic warm-season weed in turf situations due, in part, to its ability for late-season growth and seed production, plus decreasing control options in hybrid bermudagrass (*Cynodon dactylon* (L.) Pers. X *C. transvaalensis* Burt-Davy). In this study, mature goosegrass was treated with individual products and combinations of Sencor (metribuzin), Pylex (topramezone), Tribute Total (foramsulfuron + halosulfuron + thiencarbazone-methyl), Dismiss South (sulfentrazone + imazethapyr), and Speedzone (carfentrazone + 2,4-D + mecoprop + dicamba) with and without immediate 0.64 cm (0.25 in) irrigation following treatments. Visual turf quality (1 to 9, 9=best) and goosegrass control (%) were measured over the following 42 days. Sencor (0.29 L/ha) + Pylex (18.3 mL/ha) + irrigation, Sencor (0.29 L/ha) + Pylex (18.3 mL/ha) + Tribute Total (224.2 g/ha) + irrigation, Sencor (0.29 L/ha) + Pylex (18.3 mL/ha), Pylex (18.3 mL/ha) + Speedzone (9.4 L/ha), and Sencor (0.29 L/ha) + Pylex (18.3 mL/ha) + Tribute Total (224.2 g/ha) provided greater than 75% control at 42 days after initial (DAIT) treatment. In terms of acceptable (>7) turf quality at 42 DAIT, all treatments except for Sencor (0.29 L/ha) + Pylex (18.27 mL/ha) + irrigation provided this. In conclusion, this study identifies additional goosegrass control options for bermudagrass turf managers, especially those experiencing herbicide resistant issues.

Exploring Natural Alternatives for Annual Bluegrass Control. JW Taylor*, LB McCarty; Clemson University, Clemson, SC (5)

Recently, with the development of widespread resistance of annual bluegrass (aka, Poa) to a number of herbicidal modes-of-action and concerns about using certain synthetic products, demand for “natural” or “organic” control of this and other weeds has skyrocketed. Most of these products are either salt- or acid-based. Salts typically cause severe desiccation to treated plants while acid-based products typically disrupt/degrade cuticles, thus, allowing cellular content leakage. With this in mind, a field study was conducted at Clemson University to identify and evaluate the effectiveness to control annual bluegrass and turfgrass tolerance with nontraditional products.Treatments were applied to a s TifEagle bermudagrass (*Cynodon dactylon* x *C. traansvalensis*) putting green due to its sufficient natural infestation of annual bluegrass. This study included 12 different treatments consisting of common household compounds. Products and rates screened included: baking soda + Dawn dishwashing soap (269 kg/ha), white vinegar + lemon juice + Dawn (234 L/ha), Suppress herbicide (35 L/ha), superphosphate + Dawn (122 kg/ha), clove oil + Dawn (28 L/ha), Weed Zap (28 L/ha), Avenger Weed Killer (83 L/ha), Fiesta Turf Weed Killer (22 L/ha), Ecologic Weed & Grass Killer (28 L/ha), Alcohol + Dawn (31 L/ha), and Pool Time Algicide (0.5% v/v). All products were applied with a CO_2-pressurized backpack sprayer at 561 L/ha (60 GPA).Treatments were applied when the majority of consumer calls occur, in late winter during spring “greenup” as this is when the weed is most noticeably, as it starts to flower. Spring green-up is also the most sensitive time bermudagrass experiences during the year to applied products. Treatments were assessed visually for annual bluegrass control (%) and turf phytotoxicity (1 to 9 where 9=best turf). Annual bluegrass control from treatments was mostly non-selective and visually similar to the burndown observed following use of a non-selective herbicide such as glyphosate. However, few treatments provided significant control and results were short-lived as annual bluegrass recovery typically began approximately two weeks after treatment applications. None of the products tested appear to be nearly as effective as or suitable alternatives for synthetic herbicides used for control. These products also behaved as non-selective with some causing turf phytotoxicity that lasted one to two weeks after application. Therefore, applying such products may potentially damage (albeit, temporarily) the desired turf in treated areas as well.Additional research is needed to further evaluate these products for turf safety. Future research may also investigate application timing and rate for optimal control and possibly evaluating additional products as they become available.

Cantaloupe Transplant Response to *S*-Metolachlor, Acetochlor, Pyroxasulfone, and Pendimethalin. HE Wright*, TM Randell, LC Hand, JS Vance, A Culpepper; University of Georgia, Tifton, GA (6)

Cantaloupes (*Cucumis melo* L.) are a high value vegetable crop, contributing over $13 million to the Georgia Farm Gate. Production is dynamic, including transplanting into bareground fields or into fields having mulched bed configurations of 45 cm wide and 3 cm tall (small-bed mulch) or 58 cm wide and 20 cm tall (large-bed mulch). Weed control is challenging in each system because herbicides and tillage are often limited. Few herbicides, especially residual herbicides, exist in cantaloupe because of production complexities and because there is a lack of understanding of how herbicides interact with plastic mulch in these systems. In each production system, cantaloupe tolerance to *S*-metolachlor (803 and 1,606 g ai ha^{-1}), acetochlor (421, 842, and 1,263 g ai ha^{-1}), pyroxasulfone (44.7, 89.6, and 134 g ai ha^{-1}), and pendimethalin (533, 1,066, and 1,599 g ai ha^{-1}) were evaluated during 2020. Herbicides were applied and followed by irrigation before transplanting in small-bed and bareground systems and applied topically within a week of planting in the large-bed system. Crop injury, biomass, vine growth, fruit production and fruit weight were measured; cantaloupe were harvested 13-14 times. *In large-bed production*, topical applications of pyroxasulfone at all rates and the highest rate of *S*-metolachlor and acetochlor injured plants up to 35-55%; the lowest level of visual injury was noted with pendimethalin at all rates and acetochlor at 421 and 842 g ha^{-1} (0-20%). Biomass production and vine growth were influenced the least by the two lowest rates of pendimethalin and the lowest rate of acetochlor. All treatments reduced early-season (harvests 1-3) yield except acetochlor at 421 g ha^{-1}; cantaloupe was resilient with treatments not influencing season-long yields. *In the small-bed system*, acetochlor at 421 g ha^{-1} and pendimethalin at 533 and 1,066 g ha^{-1} injured melons 5 to 13% while other treatments were more injurious (24-49%); pyroxasulfone was the most damaging herbicide option. Biomass and vine lengths were not influenced by the lowest rate of pendimethalin or acetochlor (92-104% of the control). *S*-metolachlor, pyroxasulfone, and the two highest pendimethalin rates reduced early-season yield while no treatment influenced season total fruit counts or weights. Applying herbicides prior to transplanting into *bareground* noted a maximum injury of 63-79% with pyroxasulfone at 89.6 and 134 g ha^{-1} and *S*-metolachlor at 1,606 g ha^{-1}. The lowest rate of acetochlor and pendimethalin injured melons the least (6-23%) and did not influence biomass or vine length growth. Early-season fruit numbers and weights were reduced at least 46 and 54%, respectively, by all treatments except the lowest rate of acetochlor. For the season, fruit numbers and weights were reduced 24-64% by all rates of S-metolachlor and pyroxasulfone. Results indicate cantaloupe were not tolerant to pyroxasulfone or *S*-metolachlor regardless of production system or rate applied. Pendimethalin, at low rates, lacked visual injury or growth reduction concerns but delayed crop maturity. Acetochlor at rates of 421 g ha^{-1}, or less, is likely the only treatment with the potential for future labeling across production systems for cantaloupe.

Residual Activity from Glyphosate and Glufosinate Applied Preplant Damage Vegetables Produced on Plastic Mulch. TM Randell*[1], LC Hand[1], HE Wright[2], A Culpepper[1]; [1]University of Georgia, Tifton, GA, [2]University of Georgia, Athens, GA (7)

Georgia vegetable growers often utilize the same raised beds covered with plastic mulch for 3 to 5 cropping cycles, extending over an 18-month period. Glyphosate and glufosinate are tools that could assist in removing weeds between crops, facilitating a weed-free planting window for the next crop. To avoid crop contact through foliar splashing from the surface of the mulch, these herbicides can be washed from the mulch with rainfall or overhead irrigation. Potential damage from residual activity through herbicide concentration in old planting holes, or in areas where natural degradation of the plastic has occurred is unknown. Six weed-free plastic mulch studies, conducted during 2019 and 2020, determined tomato, cucumber, and squash response to glyphosate and glufosinate when transplants were placed 1) into newly punched plant holes, avoiding contact with treated soil (new hole), 2) into an existing plant hole, contacting soil exposed to herbicides (old hole), and 3) into a newly punched plant hole, shifted 15 cm from an old plant hole exposed to herbicide (adjacent hole). Within each planting arrangement study, treatments replicated four times included four application rates of glyphosate (0, 1.54, 3.08, and 6.17 kg ai ha^{-1}) and glufosinate (0, 0.66, 1.31 and 2.62 kg ai ha^{-1}) arranged in a randomized complete block design. Following application but prior to transplanting, overhead irrigation was implemented to wash the herbicide from the mulch surface, following label recommendations. Visual injury, biomass, crop growth and yield were measured; tomato, cucumber, and squash were harvested 13-16, 15, and 30 times, respectively. *Glyphosate.* Crop injury was less than 4% from all treatments when plants were placed into new holes or adjacent to old holes; no impact on crop growth, biomass, fruit number or fruit weights were recorded. In contrast, tomato, cucumber, and squash injury ranged from 23-40%, biomass reductions ranged from 41-65%, and fruit weight loss ranged from 9-36% with glyphosate at 6.17 kg ai ha^{-1}, when compared to the control. Lower rates of glyphosate caused 4-12% visual injury without influencing growth or yield. *Glufosinate*. Crop injury was less than 8% from all treatments when plants were placed into new holes or adjacent to old holes; no impact on crop growth, biomass, fruit number or fruit weights were recorded. Tomato plants placed in old holes were not injured regardless of rate. In contrast, cucumber and squash injury ranged from 35-76%, biomass reductions ranged from 44-88%, and fruit weight loss ranged from 25-70% with glufosinate at 1.31 and 2.62 kg ai ha^{-1}, when compared to the control. Lower rates of glufosinate caused 8-10% visual injury without influencing growth or yield. Results suggest that tomato, cucumber, and squash can be safely planted into plastic mulch treated with glyphosate or glufosinate, if the mulch is washed after herbicide application, and transplants are placed at least 15 cm from old holes or tears in the mulch. Transplants placed in areas where the herbicide has contacted the soil may be damaged, depending on herbicide rate and the crop planted.

Screening Broad-spectrum Herbicides to Identify Lettuce Lines with Tolerance. S Vemula*[1], D Odero[2], GV Sandoya[3], R Kanissery[4], G MacDonald[3], HS Sandhu[3]; [1]University of Florida, Agronomy Department, Gainesville, FL, [2]University of Florida, Belle Glade, FL, [3]University of Florida, Gainesville, FL, [4]University of Florida - IFAS, Immokalee, FL (8)

Production of leafy vegetables such as lettuce (*Lactuca sativa* L.) on organic soils in the Everglades Agricultural Area in south Florida is hindered by lack of effective weed management programs, particularly chemical control due to limited number of herbicides available for control of problematic weeds. Since the discovery and development of new herbicides for small acreage crops such as leafy vegetables is limited, utility of existing herbicides with broad-spectrum weed control to develop varieties through enhanced non-transgenic genetic resistance using chemical mutagenesis and conventional breeding is important. A preliminary study was conducted to screen broad-spectrum postemergence and premergence herbicides on commercial lettuce cultivars at the Everglades Research and Education Center (EREC) in Belle Glade, FL. A total of 32 postemergence herbicides (7 modes of action) were used to screen 25 commercial lettuce cultivars planted in trays, with 3 replications per tray, in an outside environment. An untreated control was included for comparison. The herbicides were applied 38 days after emergence. Plants were visually rated as dead or alive at 7 and 14 days after treatment. The experiment was repeated using herbicides (flumetsulam, imazamox, imazapic, rimsulfuron, and atrazine) that the cultivars had shown tolerance and rated in a similar manner. For the preemergence herbicides, a total of 20 herbicides (8 modes of action) were used to screen the same commercial lettuce cultivars. An untreated control was included for comparison. Thirty seeds of each variety were placed in a petri dish lined with moist filter paper. The herbicides were applied over-the-top of the Petri dishes. At 7 days after treatment, germination percentage was taken and at 14 days after treatment, root and shoot length were recorded. The commercial lettuce varieties showed tolerance to preemergence herbicides metribuzin, hexazinone, and pronamide. The postemergence and preemergence herbicides that commercial lettuce cultivars showed tolerance are being used to screen 98 breeding lines (developed at the University of Florida), 13 commercial cultivars, 3 University of Florida (UF) mapping population, 20 parents of mapping populations, 8 USDA-Pullman lines, and 42 wild types. Any of the aforementioned lines that show herbicide tolerance will be subjected to chemical mutagenesis to help isolate herbicide resistant mutants that will be used in the future for lettuce breeding programs to develop cultivars with herbicide tolerance to enable efficacious weed control in the crop.

Evaluating Electrical and Mechanical Methods for Palmer Amaranth (*Amaranthus palmeri*) Control. LD Moore*, KM Jennings, D Monks, MD Boyette, DL Jordan, RG Leon; North Carolina State University, Raleigh, NC (10)

Using electricity to selectively control weeds taller than the crop canopy has recently sparked interest in many conventional and organic growers as an alternative to hand weed removal. In addition, machinery to mechanically remove tall weeds from crops are available. However, little research has compared these weed control strategies or evaluated application timings that will result in optimal weed control and crop yield and quality. Palmer amaranth (*Amaranthus palmeri*) is a problematic weed in the United States and can reach heights over 2 m tall, whereas both peanut and sweetpotato grow less than 0.5 m in height. Thus, field studies were conducted to determine recommendations for electrical and mechanical Palmer amaranth control in peanut and sweetpotato. Treatments were arranged in a three by four factorial of electrical (The Weed Zapper), mechanical (Bourquin Organic Weed Puller / Roguing Machine), or hand removal applied when Palmer amaranth were less than 0.3, 0.6, 0.9, or 1.2 m in height. In addition, a nontreated check was included for comparison. All treatments resulted in at least 78% Palmer amaranth control 8 wk after planting (WAP). Palmer amaranth control from electrical treatments were similar to the hand removal treatments when applied before weeds were 0.6 m in height. All electrical and mechanical treatments yielded less than early (Palmer amaranth less than 0.3 m in height) hand removal. Electrical and mechanical weed control can be effective alternatives to hand Palmer amaranth removal but should be incorporated into management systems rather than utilized as the primary weed management strategy.

Impact of Mechanical Tuber Removal Integration with Cover Crop or Glyphosate During the Summer Fallow for Nutsedge Control Over a 2-Year Period. RS Randhawa*, PJ Dittmar; University of Florida, Gainesville, FL (11)

Nutsedge (*Cyperus* spp.) is the most troublesome weed in plasticulture vegetable production. Poor nutsedge control from a single weed control method has required growers to adopt integrated weed management (IWM) strategies using a mix of mechanical, chemical, and cultural techniques for nutsedge control. The study objectives were to evaluate immediate and next year's nutsedge control from summer fallow weed management programs that include mechanical tuber removal, herbicides, and cover crops. A two-year field study was conducted during 2019 and 2020 at Citra, FL. Mechanical tuber removal (MTR) was completed with a peanut digger; the cover crop (CC) was cowpea (*Vigna unguiculata* L. at 67 kg ha^{-1}) and glyphosate @ 1155.5 g ae ha^{-1}. The study consisted of seven treatments and a non-treated check arranged in a randomized complete block design with four replications for each treatment. During 2019, the treatments included MTR or GLY once (fb) CC, MTR twice followed by CC or GLY; 2 applications of GLY fb CC, MTR fb GLY fb CC, GLY fb MTR fb CC and the non-treated check. The two MTR/GLY applications were made four weeks apart, whereas CC planting was done two weeks after the latest MTR or GLY application. In 2020, CC was planted across all the plots. Bell pepper (*Capsicum annum* L.) were transplanted two weeks after CC termination for both years. For data collection in both years, the nutsedge density was counted at two-week intervals through the beginning of the fallow period until the bell pepper harvest for both years. Also, tuber count and nutsedge biomass data were taken at cover crop termination and at bell pepper harvest. Finally, bell pepper fruit count and yield data were taken at pepper harvest. At the end of the fallow period 2019, all IWM treatments had lower nutsedge density (1-28 plants 0.5 m^{-2}) compared to 115 plants 0.5 m^{-2} for NT. Similarly, at the end of the fallow period 2020, all IWM treatments had less than eight plants relative to 54 plants 0.5 m^{-2} for NT. In the bell pepper 2019, MTR fb MTR fb GLY had significantly lower nutsedge density (10 plants 0.5 m^{-2}) compared to other treatments, which had a nutsedge density ranging between 20 to 31 plants 0.5 m^{-2}. However, during 2020, all treatments resulted in significantly lower nutsedge density compared to the NT. All IWM treatments had nutsedge density between 9 to 13 compared to 66 plants 0.5 m^{-2} for NT. The results showed that all treatments resulted in less than six tubers at the end of the fallow period during both years compared to 42 and 27 tubers for NT in 2019 and 2020, respectively. Similarly, at bell pepper harvest, all treatments had less than eight tubers compared to 31 for NT during both years. During 2019, treatments had a significant impact on pepper yield and fruit count. It was found that all treatments had a higher yield than NT except GLY-CC. All treatments had 29139 to 32069 kg ha^{-1} pepper yield compared to 22696 kg ha^{-1} for NT. Similarly, NT had the least fruit count, while other treatments had similar fruit count. No treatment differences were detected for yield and fruit count during 2020. In conclusion, integrating MTR with GLY and CC resulted in effective nutsedge control at the end of the first year. The nutsedge control duration can be extended by growing cover crops during the fallow period in the following year. If left unchecked, the nutsedge grows rapidly and produces numerous underground tubers during the summer fallow resulting in increased nutsedge competition during fall cash crop.

Effect of Florpyrauxifen-benzyl on the Establishment of Cool-season Grasses and Legumes. WC Greene*, ML Flessner; Virginia Tech, Blacksburg, VA (12)

Competition from weeds is one of the greatest factors affecting forage establishment. Because of the slow growth of forages from seed, weeds are often able to outcompete forage seedlings, leading to stand reduction or in severe cases, stand failure. Three separate studies were conducted in Blacksburg in 2019 and 2020 to determine the effect of new herbicide combinations, florpyrauxifen-benzyl + 2,4-D (ProClova), and florpyrauxifen-benzyl + aminopyralid (DuraCor) on tall fescue, orchardgrass and white clover establishment. Herbicides were applied: two weeks prior to grass seeding, at seeding, and postemergence for the forage grass establishment trial. Herbicide treatments consisted of 1) ProClova, (2) GrazonNext (2,4-D + aminopyralid), (3) metsulfuron, (4) Pasuturegard (fluroxypyr + triclopyr), (5) DuraCor at 12 fl. oz./acre, and (6) DuraCor at 16 fl. oz/acre. Above-ground biomass was taken midseason and at the end of season. In addition, two studies were conducted in order to determine the effect of the herbicides on white clover established by drilling and frost-seeding. All herbicides were applied: the fall prior to planting, and florpyrauxifen-benzyl containing treatments were also applied at seeding and postemergence in the spring. Herbicide treatments consisted of: 1) 2,4-D + dicamba, (2) 2,4-D , (3) GrazonNext, (4) Duracor at 16 fl. oz./acre, and (5) ProClova. Above-ground biomass was taken at the end of the establishment period. A randomized complete block design with four replications was used for all studies. All data were subject to ANOVA and subsequent means separation were performed using Tukey's HSD (a=0.05). Florpyrauxifen-benzyl containing treatments did not negatively affect forage grass biomass regardless of application timing. Fall-applied herbicides had no effect on the establishment of drilled white clover. However, spring applied ProClova significantly reduced white clover biomass. DuraCor applied at seeding and postemergence completely eliminated drilled white clover. Fall-applied DuraCor significantly reduced frost-seeded clover biomass the following year. Proclova did not reduce biomass when applied at seeding, but did reduce biomass when applied postemergence. DuraCor applied at seeding and postemergence completely eliminated frost-seeded white clover. This research suggests that florpyrauxifen-benzyl containing herbicides can be used safely for tall fescue and orchardgrass establishment. The use of florpyrauxifen-benzyl containing herbicides during white clover establishment will depend upon the application timing as well as the seeding method.

Determining the Sphere of Influence of Spiny Amaranth (*Amaranthus spinosus*) on Forage Yield Losses in Bermudagrass (*Cynodon dactylon*) Pastures in Georgia: Weed Competition and Livestock Avoidance. T Denman*, N Basinger, J Hale; University of Georgia, Athens, GA (13)

Weeds can be detrimental on forages through competition for nutrients and light, and can influence grazing as livestock deliberately avoid biomass surrounding them, leaving valuable forage untouched. The purpose of this study is to: 1.) Determine the competition of spiny amaranth (*Amaranthus spinosus L.*) on bermudagrass (*Cynodon dactylon (L.)Pers.*) yield and 2.) Evaluate bermudagrass yield loss due to livestock avoidance of forage surrounding spiny amaranth. Four spiny amaranth plant densities were evaluated (0, 1, 2, and 4 plants per 0.09 m^2) at two harvest timings (early-season and late-season) in two traditional bermudagrass practices (hayfield and pasture). Spiny amaranth densities were established centrally within the plot and biomass measurements were obtained at four distances (0.31, 0.61, 0.91, and 1.22 m) away from the center at the designated harvest timing. Results indicate in the pasture study, weed pressures 0, 1, and 2 had greater (p = 0.0065, ? = 0.05) bermudagrass biomass than that of a density of 4 plants in the early season harvest with no significant differences in spiny amaranth biomass. Late-season harvest spiny amaranth biomass was significantly greater (p = 0.022, ? = 0.05) at 2 and 4 plants per 0.09m^2 and no significant differences observed in bermudagrass biomass. Cattle tended to graze spiny amaranth plants in the early season, which could have affected the growth habit of the plants later in the season. In the hayfield study, there were no significant differences in spiny amaranth biomass between harvests or weed pressure treatments. This indicates that at these plant densities on a well-maintained hayfield, spiny amaranth may have limited impact on bermudagrass growth. Minor significance observed in bermudagrass biomass in the early season harvest (P = 0.022, ? = 0.05) could have been due to bermudagrass stand variability.

Using Unmanned Aerial Systems for Estimating Biomass of Smutgrass (*Sporobolus indicus*) and Management Interventions. ZS Howard*[1], BB Sapkota[2], C Yang[3], MV Bagavathiannan[2], SA Nolte[4]; [1]Texas A&M, College Station, TX, [2]Texas A&M University, College Station, TX, [3]United Station Department of Agriculture - Agricultural Research Station, College Station, TX, [4]Texas A&M AgriLife Extension, College Station, TX (14)

Smutgrass (*Sporobolus indicus)* present in pastures can significantly impact forage quantity and quality, and current herbicide management strategies are either costly or detrimental to the desired forages. Remote sensing based site-specific weed management (SSWM) can not only lead to effective utilization of herbicides, but also foster ecological and economic savings. In this study, multispectral imageries were analyzed using advanced algorithms to produce mature smutgrass distribution maps, that could be further subjected to SSWM. The pasture land was delineated into high and low smutgrass density zones and four mature smutgrass individuals were chosen in each zone for ground truth data (biomass and height). A Homeland Surveillance & Electronics Unmanned Aerial Vehicle was flown at 40 m to capture images in 4 bands (Blue, Green, Red, Near-infrared), imageries were then georeferenced and radiometrically corrected. The imageries coupled with canopy height model derived using structure from motion technique were fed into object-based image analysis (OBIA) algorithm followed by machine learning algorithm. The OBIA algorithm segments the image into homogeneous groups of pixels based on pre-defined criteria and the machine learning algorithm classifies the segmented objects into use-defined classes based on the training data the user provides. Preliminary results show that the fusion of multispectral and 3D information has potential to produce accurate smutgrass distribution maps

Mapping and Estimating Herbicide Drift Injury and Yield Loss in Cotton Using Remote Sensing Techniques. BB Sapkota*[1], ZS Howard[2], SA Nolte[3], N Rajan[1], PA Dotray[4], G Morgan[5], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX, [4]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [5]Cotton Incorporated, Cary, NC (15)

Off-target movement of herbicides onto sensitive crop cultivars is a serious concern in agricultural landscapes. Mapping herbicide injury and predicting their impact on crop yield using drone images can allow for rapid and informed management decision making by growers. In this study, both multispectral and thermal imageries were implemented for mapping and estimating injury caused by tembotrione (Laudis®) and dicamba (Xtendimax®) in cotton. The spectral responses of cotton plants to these herbicides were recorded with DJI Matrice 600 drones mounted with a multispectral camera (Micasense RedEdge) and a thermal camera (Infrared Inc.) at 7, 14, and 21 days after herbicide application (DAA) at two different growth stages (match-head square and early-bloom). Deep neural networks were used for the detection of herbicide injury and both univariate and multivariate regression techniques were used for predicting cotton lint yield loss due to herbicide injury. Several sets of remote sensing features, including vegetation indices, thermal values, and canopy height model were used in the mapping and the prediction process. Yield loss maps for the drift impacted areas were also produced using the best yield loss regression model and remote sensing features. Results showed that herbicide injury can be mapped with fair accuracy (73% and 68% respectively for tembotrione and dicamba at the match-head square stage) using aerial imagery. Results also showed that the multivariate regression technique is more effective in cotton yield loss prediction (R^2 values of 0.79 and 0.88 for tembotrione and dicamba, respectively) compared to the univariate regression technique (R^2 values of 0.73 and 0.84). The analysis for imageries collected during other timings is currently ongoing. Overall, this study demonstrates that remote sensing techniques can be used reliably to map herbicide injury and predict yield loss in cotton, though additional research is required to improve prediction accuracies.

A Multi-state Experiment to Evaluate Multi-tactic Management of Palmer Amaranth in Cotton in the Southern US. DC Foster[1], MM Houston[2], SE Kezar*[3], MV Bagavathiannan[3], PA Dotray[4], G Morgan[5], RG Leon[6], F Oreja[6], JK Norsworthy[2]; [1]Texas Tech University, Lubbock, TX, [2]University of Arkansas, Fayetteville, AR, [3]Texas A&M University, College Station, TX, [4]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [5]Cotton Incorporated, Cary, NC, [6]North Carolina State University, Raleigh, NC (16)

Despite the best efforts to control weeds in crop fields, they do manage to persist long-term, due primarily to seed production and seedbank replenishment by uncontrolled weed escapes prior to crop harvest (i.e. late-season escapes), and by individuals that germinate and establish after crop harvest (post-harvest recruits). The late-season escapes can be low in frequency and may not lead to crop yield loss in the current season, but can add substantial amounts of weed seed to the soil seedbank, resulting in future weed problems. Moreover, weeds that emerge after crop harvest, especially in more southern areas with adequate heat units, can produce seed prior to frost or planting the subsequent crop in spring, further adding to soil seedbank. With this critical truth in mind, seedbank management is certainly a key aspect of herbicide-resistant weed management. For cotton (*Gossypium hirsutum*), weeds such as Palmer amaranth (*Amaranthus palmeri*) that exhibit a wide emergence window can establish even after a late-post herbicide application, due to fairly open canopies. Similar to the late-season weed escapes, post-harvest weed recruits are also managed rarely since they are growing during off-season but have been shown to produce significant amount of seed within the short growing window, with fecundity varying across environmental conditions. This multi-state study was replicated in locations of Keiser, AR, Raleigh, NC, College Station, TX, and Lubbock, TX with grower practices, such as row spacing, being represented. Cotton planted contained XtendFlex® technology in a Randomized Complete Block Design with four replications. A number of tactics were evaluated and optimized for minimizing Palmer amaranth seedbank addition and population persistence within cotton-based production systems and discussed in this study. The treatment structure exhibits the value of a residual layby program in reducing escapes, testing the benefit of a dual-purpose harvest aid in reducing viable seed production, the effectiveness of precision weed removal, cover crop implications, and a standard herbicide program for comparison. It was determined that such treatments and subsequent Palmer amaranth pressures did not have an affect on overall yield by location. However, differences are significant when it comes to the efficacy of herbicide and management regimes. In Arkansas, precision spot-spray treatment of late-season escapes after layby merited the lowest Palmer amaranth density, while the standard herbicide program exhibited a significantly higher weed density throughout the growing season. Curiously, in Lubbock, TX, the highest Palmer amaranth density was revealed with the treatment containing cereal rye as a cover crop, but no residual with EPOST and MPOST applications. Here, the absence of residual programs certainly served as the weak point amongst late-season weed cohorts. Meanwhile, in College Station, TX, the treatment with a significantly lower Palmer amaranth density exhibited an effective harvest aid treatment, which helped minimize seed viability in the late-season escapes. Analyzing the number of seeds and the viability of the next generation of these escapes will provide an illustration of the resistant populations added to the seedbank each year, and how these treatment structures could provide various methods of mitigation. It is critical that seed production and seedbank addition from late-season weed escapes and post-harvest recruits are minimized to achieve effective long-term control and sustain the utility of existing herbicides.

Assessing Genetic Diversity in Weed-suppressive Cotton Chromosome Substitution Lines. W Segbefia*[1], GA Fuller[2], S Saha[3], T Tseng[4]; [1]Mississippi State University, Plant and Soil Science Department, Starkville, MS, [2]Mississippi State University, Starkville, MS, [3]USDA, Mississippi State, MS, [4]Mississippi State University, Mississippi State, MS (17)

Cotton production faces a constant threat of weed interference. Not only do these weeds increase production costs, but they also reduce fiber quality and serve as the breeding grounds for plant diseases. Weeds account for about 34% of yield losses. In Mississippi, Palmer amaranth (*Amaranthus palmeri*) has been identified as the most common and troublesome cottonweed. The absence of crop/farm rotation and the continuous application of a particular herbicide has resulted in weeds developing herbicide resistance over time. Palmer amaranth has proven to be resistant to glyphosate and other herbicides; therefore, there is a need to supplement chemical weed control strategies. Allelopathy, a promising weed control technique, uses secondary metabolites from a plant species to inhibit the growth and development of plants nearby. This project uses backcrossed chromosome substitution (CS) lines developed with a homologous pair of chromosome or chromosome arm of *G. barbadense* (CS-B), *G. tomentosum* (CS-T), and *G. mustellinum* (CS-M), substituted for homologous pair of *G. hirsutum* (TM-1) chromosome or chromosome arm, to screen for weed-suppressive ability. From the 50 CS lines, eight were tested in greenhouse assays to assess the extent of Palmer amaranth suppression. Four CS lines (CS-B01, CS-B18, CSOB16, and MNTN-4-15) were able to inhibit the growth of Palmer amaranth by reducing its height and root length by up to 60 and 40%, respectively. Height reduction was highest for BNTN 16-15 (mean value of 82) and lowest for Enlist (approximate mean value of 18). Besides, chlorophyll reduction was highest for BNTN 16-15, with a mean value of 65, and lowest for Enlist, with a mean value of 2. Additional CS lines will be screened and compared. From the greenhouse screening, 20 best cotton CS lines (per highest weed suppressive ability), and a commonly grown Upland cotton cultivar in Mississippi will be selected for future field bioassays using Palmer amaranth.

Allelopathic Effects of Sweetpotato Varieties on Palmer Amaranth Growth. V Varsha*[1], IS Werle[1], MW Shankle[2], T Tseng[3]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Pontotoc, MS, [3]Mississippi State University, Mississippi State, MS (18)

The present study was conducted with 17 varieties of sweet potato to evaluate the allelopathic effect of sweet potato on the growth of Palmer amaranth (*Amaranthus palmeri*). The study was conducted in the greenhouse in the Department of Plant and Soil Sciences at Mississippi State University, Mississippi State, under controlled conditions. The experiment was carried out in a stair-step setup. Data was collected for plant height at regular intervals and showed that Palmer amaranth could not survive for long in the presence of sweet potato varieties Centennial, Evangeline, and Hatteras. Reduction in Palmer amaranth's height was 32 and 20% in the presence of variety Centennial after two and four weeks, respectively, compared to Palmer amaranth control. In the presence of variety Evangeline, the Palmer amaranth height reduction was 27% after two weeks which gradually increased to 28 and 36% after four, and five weeks, respectively. In the presence of variety Hatteras, a drastic reduction in Palmer amaranth height was recorded from the 2nd to 4th week (3 to 85%, respectively). In the case of variety Morado, it was observed that Palmer amaranth germinated very late, *i.e.*, four weeks later compared to all other varieties; and even after that, growth was prolonged. Results of ANOVA for weekly plant height showed that variation because of sweet potato varieties is significant with a CD value of 1.73, thus suggesting different sweet potato varieties having significantly different effects on Palmer amaranth growth. The present findings show that varieties Centennial, Evangeline, Hatteras, and Morado suppressed the growth of Palmer amaranth and can be considered for further allelopathic studies to identify the cause and pathway responsible for weed growth suppression.

Genome-wide Association Study of Abiotic Traits in Weedy Rice (*Oryza sativa* Ssp.): A SSR Marker Approach. SD Stallworth*[1], S Shrestha[1], BC Schumaker[2], N Roma-Burgos[3], T Tseng[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS, [3]University of Arkansas, Fayetteville, AR (19)

Rice (*Oryza sativa*) is a primary food source for more than one-third of the world's population. To continue to provide for the growing population, rice production must increase by more than 70% over the next ten years. This task can prove difficult due to the consistent, negative impacts of climate change. Rice yields continue to decline under continuing stressors such as cold and heat. Cold temperatures below 17°C can reduce yield from 10 – 100%, while temperatures above 34°C can cause spikelet infertility leading to upwards of 60% yield reduction. Current rice-breeding programs lack the necessary genetic diversity to protect rice against these stressors, and potentially useful genes have been lost through domestication. To overcome this loss of genes, it is possible that a close, weedy relative of rice could be vital in rediscovering these lost traits. Weedy rice (WR), *Oryza sativa* ssp., is a noxious subspecies genetically similar to rice, with proven competitive ability within rice fields. Current phenotypic studies have identified abiotic stress-tolerant weedy rice lines, but further research is needed to determine the genetic mechanisms associated with this increased competitiveness. Using a standard panel of rice SSR markers, hierarchal clusters, and neighbor-joining trees, the relationship between rice and WR was studied. SSR markers successfully identified unique clusters among cold and heat-sensitive cultivated rice and tolerant WR lines. Additionally, an average of four (4) SSR markers with 100% probability were found to be associated with cold and heat-tolerant and sensitive rice and WR lines. These SSR markers were also linked to rice QTLs associated with cold tolerance in sensitive WR lines and plant height in heat-stress tolerant WR lines. These SSR markers can be used in the future to identify genes associated with stress tolerance in *O. sativa*.

Identifying Molecular Markers Associated with Tolerance to 2,4-D Drift Rate in Cotton Chromosomal Substitution Lines. JC Argenta*[1], T Tseng[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (20)

The off-site movement of 2,4-D herbicide to adjacent non-target crops and other plants is a concern worldwide, especially where sensitive crops are grown. To overcome this problem in cotton, the introduction of herbicide-tolerant cotton chromosome substitution lines (CS lines) into the cropping systems will allow farmers to have the option to plant a cultivar tolerant to possible 2,4-D drifts that could damage non-transgenic cotton and reduce its yield. In our previous study, we identified three cotton CS lines tolerant to the field rate of 2,4-D. The objective of this research was to identify molecular markers associated with tolerance to 2,4-D drift rate in selected cotton CS lines. Six different cotton CS lines/varieties were sprayed at 2-3 leaf stage with five different rates of 2,4-D (0, 56, 280, 560, and 840 g ae ha^{-1}). Ten days after application, the leaves of each treatment were collected, and DNA extraction was performed. The DNA was subjected to PCR using ten microsatellite markers, visualized in 1.5% agarose gel, and DNA bands were scored using CrossChecker. Results showed the line CS-T22sh presented amplification, whereas the other lines/varieties did not. The CS-T22sh amplification band has a size in the range of 200-300 base pairs in the presence of primer BNL3255. This molecular data corroborates with previous studies conducted in the greenhouse, which showed that CS-T22sh plants sprayed with the drift rate of 2,4-D (56 g ae ha^{-1}) presented higher herbicide injury (approximately 45%) at 28 DAT when compared to the others CS lines. More research needs to be conducted to identify additional microsatellite markers and possible genes related to 2,4-D tolerance. This information can be used as a genetic resource in cotton breeding programs to develop 2,4-D drift tolerant varieties.

Changes to Cotton Boll Distribution and Fiber Quality Following Low Rates of 2,4-D. KR Russell*[1], PA Dotray[2], IL Pabuayon[1], GL Ritchie[1]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX (21)

Since the release of auxin-tolerant cotton (*Gossypium hirsutum*), the number of preplant, preemergence, and postemergence applications of dicamba and 2,4-D choline to aid in the control of troublesome broadleaf weeds including glyphosate-resistant Palmer amaranth (*Amaranthus palmeri* S. Wats) has increased. With the rise in number of dicamba and 2,4-D choline applications, the risk of off-target movement to non-target crops also increases. A field study was conducted in 2019 and 2020 at the Texas Tech University New Deal Research Farm equipped with subsurface drip irrigation to evaluate dicamba-tolerant cotton response to various rates of 2,4-D choline when applied at four growth stages (first square + two weeks, first bloom, first bloom + two weeks, and first bloom + four weeks). Rates of 2,4-D choline applied were: 0.95 (1X), 0.095 (1/10X), 0.019 (1/50X), 0.0095 (1/100X), 0.0019 (1/500X), and 0.00095 (1/1000X) lb ae/a using a CO_2-pressurized backpack sprayer with a carrier volume of 15 gallons per acre using TTI11002 nozzles. Deltapine 1822 XF cotton was planted in 40-inch rows. Plots, 4-rows by 30 feet in length, were replicated four times and kept weed-free throughout the growing season. Cotton was box mapped prior to harvest to determine boll number and distribution as affected by rates and timings of 2,4-D. Plots were machine harvested to determine lint yield. Fiber quality measurements were analyzed at the Fiber & Biopolymer Research Institute at Texas Tech University. Relative to the non-treated control, total boll number decreased following all rates and timings of 2,4-D in 2019. In 2020, total boll number was decreased following 1/100X, 1/50X, 1/10X, and 1X rates at first square + two weeks, first bloom, and first bloom + two weeks. Lint reductions were observed following all rates and timings excluding 1/500X at first bloom + two weeks in 2019. In 2020, 2,4-D rates of 1/000X and 1/500X did not reduce lint production at any timing. Micronaire decreased from 4.4 (non-treated control) to 2.6 following 1X rate of 2,4-D at first bloom + four weeks. Following the 1/10X rate, micronaire was 3.5 following the first square + two weeks application and 3.75 after the first bloom application. In addition to decreased micronaire following a 1/10X rate of 2,4-D, seed coat neps (count/g) increased from 12.25 in the non-treated control to 45.25, 37.5, and 20 following applications at first square + two weeks, first bloom, and first bloom + two weeks, respectively. While 2,4-D is a useful tool in controlling broadleaf weeds, it is important to understand the implications off-target movement can have on susceptible cotton.

Paraquat at Cover Crop Planting Reduces Winter Weed Density But Not Cover Crop Biomass. C Sias*, ML Flessner, KW Bamber; Virginia Tech, Blacksburg, VA (22)

Winter weed competition may reduce cover crop establishment and development. Successful establishment is necessary to increase cover crop biomass, which is important for weed suppression, nutrient scavenging, and other cover crop functions. The application of a burndown herbicide such as paraquat at the time of cover crop planting is expected to both reduce the winter weed pressure and aid cover crop establishment and development. Research evaluated this hypothesis by evaluating a no cover crop check, barley (*Hordeum vulgare* L.) (56.8 kg ha^{-1}), cereal rye (*Secale cereale* L.) (68 kg ha^{-1}), hairy vetch (*Vicia villosa* Roth.) (17.04 kg ha^{-1}), crimson clover (*Trifolium incarnatum* L.) (17.04 kg ha^{-1}), and cereal rye + hairy vetch (45.5 kg ha^{-1} + 11.36 kg ha^{-1}) drilled with and without a burndown at planting (mid-October to Mid-November) of paraquat at 0.85 kg ha^{-1}. This experiment was conducted at three locations in Virginia in 2019-20 and each location was a randomized complete block design with four replications per treatment. Visible weed control was evaluated in mid-March and above ground cover crop biomass data were collected in early April. Data were subjected to ANOVA followed by contrast statements ($P < 0.05$) comparing with or without burndown within cover crop. While differences between locations were observed for weed species present and cover crop biomass accumulated, results clearly show that winter weeds are mostly controlled by paraquat at planting but total cover crop biomass is not affected by this burndown herbicide or weed competition. This information is useful for farmers to achieve varying objectives of cover cropping while managing costs. Future research is ongoing to investigate this result at two planting timings: after corn harvest and after soybean harvest.

Development of Vulcarus (Trifludimoxazin) for Use in Peanut. C Abbott*, EP Prostko; University of Georgia, Tifton, GA (23)

Trifludimoxazin is a new protoporphyrinogen oxidase-inhibiting (PPO) herbicide under development for use as a soil-residual herbicide in peanut (*Arachis hypogaea* L.). However, little information is known about peanut variety tolerance. Therefore, the objective of this research was to determine the effects of PRE applied trifludimoxazin on the growth and development of several peanut varieties. Irrigated, small-plot field trials were conducted in 2019 and 2020 at the UGA Ponder Research Farm near Ty Ty, Georgia. Twin-row peanuts were planted on May 1, 2019 and April 28, 2020. Treatments were arranged in a randomized complete block design with a three (variety) X four (rate) factorial arrangement with four replications. Peanut varieties included GA-06G, GA-16HO, and GA-18RU. Trifludimoxazin rates included 0, 25, 38, and 75 g ai ha^{-1}. All treatments were applied 1 day after planting (DAP) using a CO_2-powered, backpack sprayer calibrated to deliver 140 L ha^{-1} at 275 kPa with 11002AIXR nozzles. The plot area was maintained weed-free using a combination of labeled herbicides and hand-weeding. Data collected included peanut stand 7-14 days after application (DAA), visual estimates of peanut leaf necrosis (14-18 DAA), visual estimates of peanut stunting (54-57 DAA), and yield. All data were subjected to ANOVA using PROC GLIMMIX and means separated using the Tukey-Kramer Method (P=0.05). Peanut stand was not reduced by any rate of trifludimoxazin. Peanut leaf necrosis was significant when trifludimoxazin was applied at 75 g ai ha^{-1} across all varieties (12% necrosis). Trifludimoxazin at 75 g ai ha^{-1} caused minimal but significant stunting (5.4 %), when compared to the 0 and 25 g ai ha^{-1} rates across varieties. For peanut yield, when averaged over trifludimoxazin rate, there was a significant difference between varieties. GA-16HO yielded 6% to 8% less than GA-06G and GA-18RU, respectively. When averaged over variety, peanut yields were not reduced by any rate of trifludimoxazin. In summary, the peanut varieties evaluated in these studies were not sensitive to trifludimoxazin.

Evaluation of Glyphosate and Dicamba Antagonism on Annual Grasses. RD Langemeier*[1], S Li[1], A Culpepper[2], D Russell[3], CW Cahoon[4], KJ Price[1]; [1]Auburn University, Auburn, AL, [2]University of Georgia, Tifton, GA, [3]Auburn University, Madison, AL, [4]North Carolina State University, Raleigh, NC (24)

Glyphosate and dicamba are often tank mixed to achieve broad spectrum control of troublesome weeds in dicamba tolerant cotton and soybeans. While previous literature has documented antagonism between glyphosate and dicamba tank mixes an increase in the presence of the glyphosate tolerant/resistant grasses in areas of the southeastern United States has increased the importance of this problem. In addition, reduced nozzle and water conditioner selection due to dicamba label restrictions further reduce the tools available to overcome antagonism. The objectives of this study were to evaluate the annual grass control affected by 1) weed size at application, 2) tank mixing dicamba and glyphosate compared to glyphosate applied alone, 3) addition of a drift reduction agent, 4) higher spray volume, 5) increasing glyphosate rate, 6) separating dicamba and glyphosate application, and 7) addition of adjuvants. The study was conducted in summer of 2020 in Macon and Limestone counties in Alabama, Edgecomb county North Carolina, and two sites in Macon county Georgia. All sites utilized a completely randomized block design with four replications. Visual injury was recorded 10 and 20 days after treatment (DAT). Application A was applied to 10-15 cm tall grass while application B was applied to 15-20 cm tall grass. Biomass was recorded at 20 DAT. All grass species were combined into a single rating, which allowed for comparisons across sites even where species composition differed. Species present and density were recorded at each site. Addition of a DRA, nozzle selection or increasing spray volume did not have a significant effect on grass control efficacy. Application to smaller grasses numerically increased efficacy at all sites but this effect was only significant at the North Alabama site. Addition of dicamba to the tank mix significantly reduced grass control by 21-29% in North Alabama. Consistent, but smaller numerical reductions in grass control at other sites were observed but were not statistically significant. A trend for increased control was observed when dicamba and glyphosate applications were applied using two separate booms instead of as a tank mix. Applying dicamba with a separate boom, but within 30 seconds of glyphosate application resulted in 8-28% better control than a comparable tank mix. When the glyphosate rate was increased from 1260 to 1890 g ae ha^{-1} in the glyphosate + dicamba tank mix, there was a trend for increased control but control was numerically lower than glyphosate alone at 1260 g ae ha^{-1} at all sites. Trends in biomass were similar to those observed for grass control. Biomass was higher for all treatments where dicamba was included in the tank mix than comparable treatments where dicamba was not applied or was applied separately. At sites where >90% control was achieved by glyphosate alone, it is possible that high levels of grass control could be achieved with the standard rate (1260 g ae ha^{-1}) of glyphosate tank mixed with dicamba despite the antagonism, especially when grass size is small. Addition of a DRA, increased spray volumes and nozzle selection had no effect on grass control. However, control was improved by separating applications of glyphosate and dicamba and by increasing glyphosate rate.

Efficacy of Integrated Weed Management in Peanut Production Utilizing High Cover Crop Residue. KJ Price*[1], S Li[1], RD Langemeier[1], A Nagila[1], A Price[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (25)

As herbicide-resistant weeds continue to emerge and spread, alternative non-chemical control methods integrated into current control programs need to be evaluated. Few studies have been conducted to determine the effectiveness of residual herbicides sprayed onto cover crop residues compared to conventionally tilled systems in peanut. The objectives were to (1) evaluate the effectiveness of residual herbicides on weed control in conventionally tilled versus high cover crop residue systems in peanut production, (2) determine if weed control was greater with the combination of cover crops and residual herbicides compared to herbicide only programs. Field trials were conducted in Henry County in 2019, as well as Henry and Macon County in Alabama in 2020. Treatments included: acetochlor 1,260, flumioxazin 107, diclosulam 26, *S*-metolachlor 1,700 g ha^{-1}, conventionally tilled non-treated check (NTC), and high residue NTC. All treatments were applied with a backpack sprayer on the day of planting at 187 L ha^{-1}. Weed population counts were collected every 7 days till 56 days after planting when weed biomass was quantified. All treatments that included a heavy cover residue had significantly better control (>80%) of *Ipomoea spp.* and *Senna obtusfolia* compared to the conventionally tilled NTC over 2019-2020. *Amaranthus palmeri* control was more variable from year to year and cover crop residue alone was not enough to provide significantly better control than conventionally tilled plots with residual herbicides. Overall, total weed biomass in plots with residue cover and soil residual herbicides had significantly reduced weed biomass of 75-89% compared to conventionally tilled NTC in 2019-2020. Combinations of flumioxazin or diclosulam with heavy cover crop residue provided the greatest overall weed control in peanut. Generally, the combination of herbicides and cover crops had greater control than either component used alone. The combination of residual herbicides with a high cover crop residue provided more effective weed control overall compared to the high residue alone suggesting some residual herbicides reached the soil surface.

Phosphite Fertilization as a Weed Suppression Tactic in the *PtxD* Cotton System. S Singh*[1], D Pandeya[1], K Rathore[1], K Hake[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Cotton Incorporated, Raleigh-durham, NC (26)

Herbicide-resistant weeds have emerged as a serious problem in US cotton. Development and adoption of novel weed management strategies and approaches is of prime importance. Phosphorus (P) is an essential macronutrient required for the normal growth and development of plants. Plants can only metabolize P in the orthophosphate (Pi) form, but unable to utilize the phosphite (Phi) form. A transgenic variety of cotton with the bacterial phosphite dehydrogenase (*ptxD*) gene has the ability to convert Phi into Pi, whereas weeds lack this ability and thus can be negatively impacted by Phi application in a P deficient soil. In 2020, a series of studies were conducted to understand the effects of Phi application on cotton (*ptxD* and non-*ptxD* varieties) and weeds [Palmer amaranth (*Amaranthus palmeri*) and johnsongrass (*Sorghum halepense*)] in four soil types: very low P [10 parts per million (ppm)], low P (15 ppm), moderate P (25 ppm), and normal P (50 ppm). The experiments were conducted in a randomized complete block design with three replications, comparing soil (preemergence) as well as foliar applications (postemergence). Results showed that Phi application negatively impacted weed growth, but the degree of impact greatly varied across residual soil P level and weed species. The impact was particularly greater in low P soil (10 to 15 ppm) and on broadleaf weeds such as Palmer amaranth. Subsequent studies with glufosinate and Phi tank-mix combinations further improved weed control efficacies. Additional investigations are required to standardize the utilization of Phi as a weed suppression tool in cotton.

Efficacy of Potassium Tetraborate Tetrahydrate as a Dicamba Volatility Reduction Agent and Influence on Weed Control. MC Castner*, JK Norsworthy, TL Roberts, OW France, LB Piveta; University of Arkansas, Fayetteville, AR (27)

The *N*,*N*-bis(3-aminopropyl)methylamine (BAPMA) salt of dicamba (Engenia) and diglycolamine salt of dicamba with VaporGrip (XtendiMax) are labeled for preemergence and postemergence control of broadleaf weeds in Xtend cotton and soybean systems. Dicamba applications to cotton and soybean have resulted in a record number of complaints regarding off-target movement of the herbicide since introduction of the technology in 2017. To counteract the volatility associated with dicamba, the University of Arkansas has pursued potassium tetraborate tetrahydrate (potassium borate) as a tank additive. To investigate the impact of this additive on dicamba, small- and large-scale volatility studies were conducted along with trials to evaluate efficacy of dicamba when mixed with the additive. Diglycolamine (DGA) salt of dicamba plus potassium salt of glyphosate was applied in mixture with potassium borate at six molar concentrations (0, 0.00625, 0.0125, 0.025, 0.05, and 0.1 M) delivered at 140 L ha^{-1} to two moist flats placed under each tunnel. For weed control, two dicamba formulations (DGA and BAPMA) plus glyphosate were combined with potassium borate at 0, 0.02, 0.04, and 0.1 M concentrations. As potassium borate concentration increased, dicamba volatility likewise decreased for each of the three evaluated parameters of maximum soybean injury, average injury, and distance traveled. Air sample data closely aligned with qualitative assessments. For weed control, the addition of 0.02- to 0.1-M concentrations of potassium borate to either formulation of dicamba plus glyphosate was comparable to both dicamba formulations not containing the additive. Overall, the addition of potassium borate to dicamba has great potential in reducing off-target movement of dicamba via volatilization without compromising broadleaf and grass weed control when mixed with glyphosate.

Does the Presence of AMS Residue in the Tank and the Addition of Potassium Salt of Glyphosate Impact Dicamba Volatility? MM Zaccaro*, JK Norsworthy, LB Piveta; University of Arkansas, Fayetteville, AR (28)

The labels of the new dicamba formulations prohibit the addition of ammonium sulfate (AMS)-based adjuvants, but allow mixture with glyphosate. Recent studies showed that the addition of tank partners impacted the secondary movement of dicamba. The purpose of this experiment was to evaluate if AMS residues increased dicamba volatility when applied with potassium (K) salt of glyphosate. Treatments were set as a factorial in a RCB design. Factor-A was the absence or presence of glyphosate, and factor-B was rate of AMS (0, 0.005, and 2.5% v/v) in the tank with dicamba. Field experiments were conducted in 2019 and 2020 at the Milo J. Shult Agricultural Research & Extension Center, in Fayetteville, Arkansas. Low tunnels measuring 6-m in length were constructed over two rows of non-dicamba-tolerant soybean (*Glycine max* (L.) Merr.). Treatments were applied to soil contained in 53 by 41 by 5.5 cm-trays in a location approximately 1-km away from the research sites. Following the application, trays were transported to the field and placed at the center of the tunnels beside a high-volume air sampler. The soybean bioindicators were exposed to the treatments for 48 hours, and after that interval, the tunnel structures and trays were removed. Visual injury and distance from the center of the plot until soybean injury was = 5% were evaluated at 14, 21, and 28 days after treatment (DAT). The pH of the solutions was measured, and the concentration of dicamba trapped in the air sample filters was analyzed in the laboratory. Average injury at 21 DAT ranged from 12.4 to 13.6% for treatments with 2.5% AMS, with and without glyphosate. Dicamba treatments lacking glyphosate, and treated with 0% or 0.005% AMS were statistically similar, averaging 3.5 and 4.2% injury, respectively. Adding glyphosate to the dicamba increased injury to soybean. Glyphosate added to dicamba decreased the pH of the mixture by 0.5 units, while the addition of AMS had a smaller effect. Analysis of air samples showed that 4907 and 3839 ng of dicamba were detected in treatments with 2.5% AMS with and without glyphosate. Results indicated that dicamba detection in air samples for 0 and 0.005% AMS without glyphosate were comparable and less than that for 2.5% AMS without glyphosate. These results showed that it is unlikely that dicamba volatilization in the field is a result of AMS residues in the spray tank and greater risk for secondary movement would occur with the addition of glyphosate.

Are Cover Crops Effective for Weed Management in the Southeast USA? A Meta-analysis. NT Basinger[1], V Sykes[2], D Weisberger*[1]; [1]University of Georgia, Athens, GA, [2]University of Tennessee, Knoxville, TN (29)

Cover crops (CCs) have been studied as a component of integrated weed management systems for some time. However, their use remains limited in row crop systems. Ongoing challenges in the management of herbicide-resistant weeds have re-emphasized their potential importance, particularly over the last decade. The challenge of herbicide resistant weeds is particularly intense in the Southeast region of the US, due to a combination of environmental and management factors. Given this context, we conducted a meta-analysis of studies from the region by evaluating paired comparisons of CC vs. no CC for the response variables weed biomass and weed density. We identified 29 studies from 8 states (AL, AR, FL, GA, MS, NC, SC, and TN). This provided 138 comparisons for weed density and 153 for weed biomass. Information on management factors such as cover crop type (grass, legume, mixture) and tillage system (no-till, strip-till, tillage) was also extracted from these studies. Our goal was to determine i.) if CCs have a suppressive effect on those two response variables ii.) the size of this effect, and iii.) the moderating effect of specific management factors. Initial analyses indicate that, overall, CCs reduce both weed biomass and weed density (by 18% and 40%). Grasses reduced weed biomass and weed density (by 32% and 48%), followed by mixtures (by 29% and 24%), and legumes (by 0% and 14%). Systems that utilized tillage showed the greatest reductions in weed biomass and density (by 27% and 55%), followed by no-till (by 21% and 37%), and strip-till (by 0% and 26%). These initial results highlight the potential value that CCs offer to weed management in the Southeast.

Evaluating Peanut Seedling Development to Plant Growth Regulators and Flumioxazin. J de Souza Rodrigues*[1], NL Hurdle[2], TL Grey[3]; [1]University of Georgia/Department of Crop and Soil Science, Tifton, GA, [2]University of Georgia, Collierville, TN, [3]University of Georgia, Tifton, GA (30)

Georgia produces the majority of the peanuts cultivated across the US. To increase yield, proper weed control and the use of plant growth regulators (PGR's) can provide improved plant establishment and development within the season. This study aimed to evaluate the effects and interaction of flumioxazin and treatments with plant control regulators (3-indolebutyric acid plus cytokinin and gibberellic acid) in six peanut cultivars (TifNV-HO, GA 142728, GA 14N, GA 06G, GA 16HO, GA 18RU). Experiments were conducted in 2020 in Plains and Ty Ty GA. A split split-plot in a completely randomized block comprising the treatments of 6 cultivars, 3 plant growth regulators as seed treatment (non-treated control, 0.063 g a.i. ha^{-1} of 3-indolebutyric acid (IBA) and 0.011 g a.i. ha^{-1} of cytokinin, 14.82 g a.i. ha^{-1} of gibberellic acid), and herbicide (non-treated control and flumioxazin 105 g a.i. ha^{-1}). Seed were PGR treated one day before planting. Measures included injury (0 – 100%), stand counts (1 meter of row), plant height and width, and yield. Physiological measurements including intercellular CO_2, stomatal conductance, and electron transport using a Li-COR 6800. Data were analyzed by location using Agroestat®. Peanut at Ty Ty and Plains showed no differences in terms of emergence among the treatments and injury regarding herbicide treatments. Stand counts, plant height and width, and yield differences were observed at both locations, with peanut planted in Ty Ty demonstrating greater differences in the measurements evaluated. In Plains, no differences were observed for intercellular CO_2, stomatal conductance, and electron transport. However, in Ty Ty, all parameters showed differences in at least two evaluations during the season. The interaction of flumioxazin with the plant growth regulators varied across the locations tested and the cultivars used.

Influence of Dicamba Tank Mixes with Glyphosate on Junglerice Control. CM Perkins*[1], L Steckel[1], TC Mueller[2]; [1]University of Tennessee, Jackson, TN, [2]University of Tennessee, Knoxville, TN (31)

Junglerice (*Echinochloa colona* (L.) has become a major weed in Mid-south US and other areas. Glyphosate resistance has been documented on junglerice populations and is part of the reason for the increase in prevalence. However, poor junglerice control from glyphosate + dicamba tank mixes is observed in many fields where glyphosate resistance is not occurring. Glyphosate + dicamba application is applied on the majority of these row crop areas in Tennessee. Therefore, research was conducted assessing reduced grass control with glyphosate when applied with dicamba. This field experiment was replicated across three locations and two years for a total of six experiments. The research was arranged in a factorial design with nozzle selection and herbicide treatment being the factors. TTI nozzles and AIXR flat fan nozzles were tested in this experiment. The second factor was herbicide treatment included a non-treated (check), glyphosate (Roundup, Bayer Crop Protection, St. Louis, MO), clethodim (Intensity, Loveland Products, Greenville, MS), glyphosate + clethodim, glyphosate + dicamba (Engenia, BASF Corporation, Ludwigshafen, Germany), clethodim + dicamba, glyphosate + clethodim + dicamba, glyphosate + dicamba + DRA (OnTarget, Winfield United, Arden Hills, MN) and clethodim + dicamba + DRA. Herbicide rates were consistent throughout with glyphosate at 870 g ha^{-1}, dicamba at 560 g ha^{-1}, and clethodim at 105 g ha^{-1}. DRA was used at 0.25% v/v. Applications were made with a CO_2 back pack sprayer calibrated to apply 142 L ha^{-1} of water carrier. Each herbicide treatment was evaluated using each nozzle previously mentioned. Applications were made when junglerice plants were 8-10 cm in height. Control of junglerice was visually assessed on a scale of 0 to 100% where 0 = no injury and 100 = plant death at 7, 14, and 21 days after treatment. Dicamba addition decreased junglerice control of clethodim and glyphosate. This data suggests that tank mixes with dicamba results in 15% less junglerice control. An additional 7% control loss is observed from the TTI nozzles, and an additional 16% from adding a DRA to the tank. Moving forward, this data suggests separating glyphosate and/or clethodim applications with dicamba by a couple of days. Data shows that on average, 40% of the fields in Tennessee have both Palmer amaranth plus *Echinochloa* spp. Growers want to control all weeds with one application of glyphosate + dicamba. However, these data show that the addition of dicamba with glyphosate applied with labeled nozzles and DRA is resulting in reduced junglerice control.

Complete Residual Programs: Are They Feasible Options? JS Calhoun*[1], J Ferguson[2], T Barber[3], DM Dodds[2], A Brown[4], B Zurweller[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]University of Arkansas System Division of Agriculture, Lonoke, AR, [4]Mississippi State Chemical Laboratory, Mississippi State, MS (32)

Increasing herbicide resistance development in weed species have accelerated the focus on preserving all foliar postemergence herbicide chemistries. This research focuses on these herbicides as the foundation within the program, requiring sequential applications to achieve sufficient control. Shifting the program foundation to preemergence (PRE) herbicides, mitigates the selection pressure on postemergence herbicides, while preserving them as needed for weed control in season. Studies were conducted in 2019 and 2020 at three locations in Mississippi and one location in Arkansas to evaluate length of residual control of common soil-applied herbicides in cotton production. From those studies, herbicides with the longest observed duration of residual control were included in 4-pass programs designed to layer preemergence herbicides as the sole method of weed control in cotton. These programs were then tested in a separate study against local standard programs and a non-treated check using a randomized complete block design with 4 replications. All treatments were applied at recommended 1X field rates at 140 L ha^{-1}. Visual weed control was evaluated weekly following each application and harvest was collected. Data was subjected to ANOVA using R Studio and means separated using Fisher's protected LSD (a=0.05) where significance was observed. Results show that high levels of weed control are achievable using only the layered preemergence herbicide programs, where many programs resulted in similar levels of control compared to standard programs including foliar-applied chemistries. Results also indicate that in most programs, no yield impact is observed when layered residual programs are utilized.

Florpyrauxien-benzyl Research in Mississippi. HD Bowman*[1], JA Bond[2], BR Golden[2], HM Edwards[3], FR Kelly[3]; [1]Mississippi State University, Starkville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Stoneville, MS (33)

Barnyardgrass (*Echinochloa crus-galli* L. Beauv.) is difficult to control in rice (*Oryza sativa* L.) due to herbicide resistance. By competing for light, space, soil nutrients and moisture, barnyardgrass can reduce rice grain yield when left uncontrolled. Residual herbicides such as clomazone PRE control barnyardgrass; however, with multiple-resistant populations, POST herbicide options have become limited. To combat this, florpyrauxifen-benzyl was commercialized in 2018 for use in rice targeting not only barnyardgrass, but also aquatic and broadleaf weeds. With the introduction of any new herbicide, many questions arise regarding best management practices of the herbicide to optimize weed control and return on investment. To better understand florpyrauxifen-benzyl use in Mississippi rice, multiple field and controlled-environment studies were conducted in 2019 and 2020 at the Delta Research and Extension Center in Stoneville, MS. Soil was a Sharkey clay with a pH of 7.5 and 2.4% organic matter in all studies. The objective of the first field study was to evaluate barnyardgrass control with florpyrauxifen-benzyl following sub-lethal treatments of POST rice herbicides. The study was designed as a split-plot of initial herbicide treatment and sequential applications of florpyrauxifen-benzyl. Whole plots consisted of initial herbicide treatment and included no herbicide, imazethapyr at 53 g ai ha^{-1}, quinclorac at 210 g ai ha^{-1}, bispyribac-Na at 14 g ai ha^{-1}, and propanil at 2,240 g ai ha^{-1}. Subplots were florpyrauxifen-benzyl at 0 and 30 g ha^{-1} applied 7 or 14 d after the initial herbicide treatments. The second field study, intended to determine rice tolerance to florpyrauxifen-benzyl at different seeding rates, was also designed as a split-plot. Whole plots were rice seeding rates of 10, 17, 24, 30, and 37 kg ha^{-1}. Subplots consisted of florpyrauxifen-benzyl application rate of 0 and 30 g ha^{-1}. The first field study utilized the inbred 'CL 153' while the hybrid 'CL XL745' was seeded in the second. The controlled-environment study evaluated rice response to florpyrauxifen-benzyl applied at different levels of soil moisture. A split-plot design with four replications was utilized. Whole plots consisted of levels of soil moisture and included 180, 230, 260, 320, and 390 g H_2O kg^{-1} soil chosen to approximate the range between permanent wilting point and field capacity. Subplots were florpyrauxifen-benzyl application rate of 0 and 60 g ha^{-1}. An inbred cultivar, 'Diamond', was utilized to evaluate tolerance. Visible estimates of rice injury and/or barnyardgrass control were recorded at 7, 14, 21, and 28 d after final herbicide application in appropriate studies, and yield data collected at maturity in both field studies. Results from the first field study indicated greatest barnyardgrass control (>90%) with florpyrauxifen-benzyl following sublethal applications of other POST herbicides with florpyrauxifen-benzyl applied 14 d after initial application. Barnyardgrass control was $\leq$84% when florpyrauxifen-benzyl was applied following quinclorac, which is a synthetic auxin like florpyrauxifen-benzyl. In the second field study, no differences in rice yield were detected at any seeding rate following application of florpyrauxifen-benyl. Finally, results from the controlled environment study revealed rice injury with florpyrauxifen-benzyl increased with soil moisture. Rice injury of 22% and a height reduction of 7 cm was observed 28 d after florpyrauxifen-benzyl application in plots with 390 g H_2O kg^{-1} soil, which simulated flooded conditions. No other height reductions were recorded at other soil moisture levels. These results indicate that acceptable levels of barnyardgrass control were achieved with florpyrauxifen-benzyl following sublethal doses of other common rice herbicides. Also, florpyrauxifen-benzyl did not influence yield of CL XL745 at any seeding rate evaluated. Soil moisture influenced rice response to florpyrauxifen-benzyl; however, this research is ongoing to evaluate barnyardgrass control.

Collectively, these results suggest that with proper management practices, florpyrauxifen-benzyl can safely be utilized as a component of herbicide programs in Mississippi rice production.

Identifying Optimum Number of Sites of Action in a Full-Season Weed Control Program in Cotton and Peanut. JA Patterson*[1], J Ferguson[2], JS Calhoun[1], DM Dodds[2], A Brown[3], T Barber[4], B Zurweller[1]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State Chemical Laboratory, Mississippi State, MS, [4]University of Arkansas System Division of Agriculture, Lonoke, AR (34)

Widespread adoption of herbicide-resistant crop cultivars has reduced the use of multiple sites of action (SOA) for weed control, resulting in the evolution of herbicide-resistant weed populations. The use of multiple SOAs for the control of problematic weed species has long been a recommendation of researchers, but there is limited literature suggesting an optimum number of SOAs to effectively control these weeds. Thus, the objective of the experiments was to investigate the optimum number of herbicide SOAs used in a full-season herbicide program to maximize weed control in cotton and peanut. In 2020, two cotton field experiments were conducted at the R.R. Foil Plant Science Research Center in Starkville, MS, and at the Black Belt Branch Experiment Station in Brooksville, MS. Two peanut field experiments were conducted at the Coastal Plain Branch Experiment Station near Newton, MS, and at the R.R. Foil Plant Science Research Center in Starkville, MS. The experiments were implemented as randomized complete block designs with four replications and a nontreated check. Herbicides used in the cotton experiments included glufosinate (Liberty), fluometuron (Cotoran), fluridone (Brake), clomazone (Command), *S*-metolachlor (EverpreX), dicamba (Xtendimax), pyrithiobac (Staple LX), clethodim (Select Max), dimethenamid (Outlook), pendimethalin (Prowl H_20), glyphosate (Roundup PowerMAX II), diuron (Direx 4L), flumioxazin (Panther SC), prometryn (Caparol 4L), and MSMA. Herbicides used in the peanut experiments included flumioxazin (Panther SC), ethalfluralin (Sonalan), carfentrazone (Aim), pyroxasulfone (Zidua), paraquat (Gramoxone SL 2.0), glyphosate (Roundup PowerMAX II), bentazon (Broadloom), clethodim (Select Max), lactofen (Cobra), 2,4-DB, and imazapic (Cadre). In both crops, treatments included combinations of herbicides with increasing numbers of SOAs applied at multiple timings throughout the season. At Brooksville, in the cotton experiment, greater than 95% tall waterhemp [*Amaranthus tuberculatus* (Moq.) Sauer.] and barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] control was observed for all treatments containing a full season herbicide program with at least two SOAs. At Starkville, in the cotton experiment, there were no differences amongst treatments for tall waterhemp control at 21 days after the layby application. Conversely, greater than 92% broadleaf signalgrass [*Urochloa platyphylla* (Munro ex C. Wright) R.D. Webster] control was observed for all treatments containing a full season herbicide program with at least three SOAs. At Newton, in the peanut experiment, all treatments containing at least six herbicide SOAs provided greater than 93% control of broadleaf signalgrass and yellow nutsedge (*Cyperus esculentus* L.) at 21 days after the final herbicide application. At Starkville, treatments with at least three herbicide SOAs effectively controlled tall waterhemp and broadleaf signalgrass greater than 93% following the final application. At three out of four locations, only three herbicide SOAs were needed to achieve adequate weed control in cotton and peanut. Results from this research indicate that there is tremendous value in identifying an optimum number of herbicide SOAs in order to provide some protection against problematic weeds evolving resistance to unnecessarily overused herbicides. Additionally, these findings suggest that the use of multiple SOAs for weed control is imperative, but the optimum number of SOAs necessary to maximize weed control can vary by factors such as location. Thus, further research must be conducted to validate these conclusions.

Replant Cotton Tolerance to Warrant Applied PRE. AC Blythe*[1], CW Cahoon[2], GD Collins[2], W Everman[2], ZR Taylor[3], JD Joyner[4]; [1]North Carolina St. University, Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]North Carolina State University, Sanford, NC, [4]North Carolina St. University, Mount Olive, NC (37)

Preemergence herbicides are important for early weed control in cotton. Warrant (microencapsulated acetochlor; ME) is a common preemergence herbicide used in cotton production to control troublesome weed species such as Palmer amaranth (*Amaranthus palmeri*). Cotton tolerance to ME acetochlor applied PRE has been reported to be acceptable. Older, EC formulations of acetochlor were never registered for use in cotton due to injury concerns; microencapsulation of acetochlor was pursued to improve soybean and cotton tolerance. This presents a unique challenge in cotton re-plant situations where ME acetochlor was applied PRE to the initial planting. Once the micro-capsules break down, is re-plant cotton at risk for acetochlor injury? Field research was conducted near Rocky Mount and Lewiston, North Carolina in 2019 and 2020 to evaluate cotton tolerance to ME acetochlor applied 4, 3, 2 and 1 weeks before planting (WBP) across three tillage systems. Acetochlor applied PRE was included for comparison in 2020. Tillage systems included no-tillage, strip-tillage, and conventional-tillage. ME acetochlor was applied to bare soil at a rate of 1260 g ai ha^{-1} with a CO_2-pressurized backpack sprayer delivering 140 L ha^{-1}. Cotton was planted on 91 cm rows just after tillage treatments were performed. Visual estimates of cotton stunting and height were collected at first emergence, 14, 21, 28 and 42 days after planting (DAP). Cotton height was collected 28 and 42 DAP. Cotton biomass was collected at 28 DAP. Cotton was harvested and weighed in October 2019 and November 2020 to determine yield. All data was subject to SAS version 9.4 using GLIMIX with a=0.05. At Lewiston in both years, treatment differences were minimal. Tillage, timing, and the interaction between the two were not significant. At Rocky Mount in 2019, tillage and timing were significant while the interaction was not. At Rocky Mount, cotton stand across tillage systems 21 DAP was 123, 118 and 112 for no-till, strip-till, and conventional-till, respectively. Across application timing, cotton stand 21 DAP was 144, 128, 115, 101 and 101 for the untreated, 4, 3, 2 and 1 WBP applications, respectively. ME acetochlor applied 2 WBP reduced yield 24% whereas the herbicide applied 1 WBP reduced yield 30%. This research demonstrated that cotton stand and yield can be reduced as the time between ME acetochlor application and planting decreases from 4 to 1 WBP, regardless of tillage system. Cotton tolerance to ME acetochlor is highly dependent on early season environmental conditions. Cool, wet soils exacerbate cotton injury from ME acetochlor PRE and may explain why greater injury and yield loss was observed at Rocky Mount and not at the two Lewiston sites.

Common Lambsquarters' *(Chenopodium album*) Size Influences Glyphosate Tolerance. SJ Michael*, ML Flessner, S Askew; Virginia Tech, Blacksburg, VA (38)

Herbicide labels recommend proper height at application for various weed species. Generally, the smaller the weed is at application, the greater the likelihood of complete control. To determine potential increases in glyphosate tolerance as well as common lambsquarters (*Chenopodium album*) size effects, dose-response studies were conducted using different size classes. After surviving an application of glyphosate, common lambsquarters seed from both Salisbury, MD and Suffolk, VA were collected. A glyphosate-susceptible population from Blacksburg, VA was collected for comparison. Greenhouse experiments were conducted comparing these three populations and two size classes: 5.1-10.2 cm and 12.7-17.8 cm. Plants were randomized within height classes using a complete block design with 6 replications and two experimental runs were conducted. Treatments included glyphosate at 0, 0.001, 0.005, 0.01, 0.05, 0.1, 0.5, 1, 5, 10 kg ae ha^{-1} as well as 2,4-D amine at 1.13 kg ae ha^{-1}, and atrazine at 1.12 kg ha^{-1} with 1% v/v of COC. Visible injury ratings on a 0-100 scale, 0 being no injury and 100 being complete necrosis, were taken 21 days after application as well as above-ground biomass. Data were subjected to ANOVA followed by three parameter logistic regression for glyphosate dose response analysis or means separation using Fisher's protected $LSD_{(0.05)}$ for herbicide comparison at the 1x rate. Results of dose-response studies indicated there is increased glyphosate tolerance of the Salisbury population compared to the Blacksburg susceptible population and slightly increased tolerance in the Suffolk population. I50 values were 0.5 and 0.5 kg ha^{-1}, 1.12 and 3.58 kg ha^{-1}, 0.75 and 0.50 kg ha^{-1} for Blacksburg, Salisbury, and Suffolk populations at the 5.1-10.2 cm and 12.7-17.8 cm sizes, respectively. A resistance factor of 2.50 and 7.16 was determined for Salisbury:Blacksburg for the 5.1-10.2 cm and 12.7-17.8 cm sizes. Suffolk was deemed glyphosate susceptible. When comparing treatments of 2,4-D, atrazine, and glyphosate at 1.0 kg ae ha^{-1}, 2,4-D resulted in >93% control of all populations, which was the best performing treatment for Salisbury and Suffolk populations. Glyphosate resulted in similar control (93%) as 2,4-D of the Blacksburg population, but less control of Suffolk (74%) and Maryland (35%). Atrazine resulted in <40% control of all populations, confirming widespread resistance in the region. Future research will conduct further dose-response studies to confirm there is no increased tolerance present in the Suffolk population as well as investigate the mechanism of enhanced tolerance present in the Salisbury population.

Johnsongrass Control Programs for Fluazifop-Resistant Grain Sorghum. JA Fleming*[1], JK Norsworthy[1], MV Bagavathiannan[2], MM Houston[1], LB Piveta[1], RB Farr[1]; [1]University of Arkansas, Fayetteville, AR, [2]Texas A&M University, College Station, TX (39)

Genetic similarities between grain sorghum (*Sorghum bicolor*) and grass weeds such as johnsongrass (*Sorghum halepense*) limit herbicide options that can used for selective removal of this weed from the crop. Through a collaboration with Texas A&M University and the University of Arkansas, a breeding line of grain sorghum with resistance to the acetyl CoA carboxylase-inhibiting herbicide fluazifop was developed. A field trial was conducted in Fayetteville, AR in 2020, to understand the best methods for utilizing fluazifop to control johnsongrass. Fluazifop-resistant grain sorghum was sprayed at two stages, 2 to 3 leaf and 5 to 6 leaf, with two rates of fluazifop with and without atrazine. The goal was to better understand which rate and timing combination controlled johnsongrass without causing significant crop injury as well as to see if johnsongrass control was affected by the addition of atrazine to fluazifop. Both fluazifop rate and application timing had a significant effect on johnsongrass control. Fluazifop applied at 420 g ai ha^{-1} averaged 15 percentage points better at controlling johnsongrass than when applied at 280 g ha^{-1}, averaged over timings and atrazine use. Control was greatest averaged over fluazifop rate and atrazine use when applied at the 2- to 3-leaf stage of the crop. Grain sorghum injury did not exceed 10% regardless the fluazifop rate or application timing, and atrazine showed no significant effect on johnsongrass control. Findings from this study show that fluazifop can safely be mixed with atrazine for removal of johnsongrass from the fluazifop-resistant grain sorghum evaluated.

Performance of Isoxaflutole in HPPD Tolerant Cotton Herbicide Systems. DC Foster*[1], PA Dotray[2], C Thompson[3], G Baldwin[4], FT Moore[5]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]BASF Corp., Abernathy, TX, [4]BASF Corp., Research Triangle Park, NC, [5]BASF Corp., Lubbock, TX (40)

The southern US produces 90% of the nation's cotton and the Texas High Plains is the largest contiguous cotton producing region. Since 2011, glyphosate resistant Palmer amaranth (Amaranthus palmeri S. Watson) has challenged cotton production and alternatives to glyphosate are needed. Integrating soil residual herbicides into a weed management program is an important step to control glyphosate resistant weeds before they emerge. BASF Corporation is developing p-hydroxyphenylpyruvate dioxygenase (HPPD) tolerant cotton, which will allow growers to use isoxaflutole, an HPPD inhibiting WSSA Group 27 herbicide, in future weed management programs. In 2019 and 2020, field experiments were conducted at New Deal, Lubbock, and Halfway, Texas to evaluate HPPD-tolerant cotton response to isoxaflutole applied preemergence (PRE) or early-postemergence (EPOST) as well as to determine the efficacy of isoxaflutole when used as part of a weed management program. Crop response experiments at New Deal and Lubbock included the following treatments: prometryn at 1.35 kg ai/ha PRE followed by (fb) glufosinate at 0.88 kg ai/ha + S-metolachlor at 1.4 kg ai/ha EPOST, isoxaflutole at 0.11 kg ai/ha + prometryn PRE fb dimethenamid at 0.84 kg ai/ha + glufosinate EPOST, isoxaflutole + pendimethalin at 1.12 kg ai/ha PRE fb dimethenamid + glufosinate EPOST, isoxaflutole + prometryn + pendimethalin PRE fb dimethenamid + glufosinate EPOST, isoxaflutole + prometryn at 0.67 kg ai/ha (½ rate) PRE fb glufosinate + S-metolachlor EPOST, isoxaflutole + prometryn PRE fb glufosinate + S-metolachlor EPOST, isoxaflutole + fluometuron at 1.12 kg ai/ha PRE fb glufosinate + S-metolachlor EPOST, prometryn PRE fb isoxaflutole + glufosinate EPOST, and prometryn PRE fb isoxaflutole + glufosinate + glyphosate at 2.1 kg ai/ha EPOST. A blanket mid-postemergence (MPOST) application of glyphosate at 2.1 kg ai/ha + glufosinate at 0.88 kg ai/ha was made at first bloom and some treatments received diuron at 1.12 kg ai/ha postemergence-directed (PDIR) when cotton was at the bloom stage. At New Deal, cotton response was greatest following the EPOST application, but did not exceed 10%. Cotton response was greatest following the PRE application at Lubbock in 2019, but never exceeded 14%. In 2020 at Lubbock, cotton was replanted due to severe weather. There was <1% cotton response following the PRE application and maximum cotton response observed was 9% following EPOST and MPOST applications. By late season, no cotton response was detectable. There was no difference in cotton stand at either location. Cotton lint yield ranged from 1,214-1,425 kg/ha at New Deal and 675-758 and 1,544-1,729 kg/ha in Lubbock in 2019 and 2020, respectively. Lint yields were not different from the nontreated weed-free control. In non-crop weed control studies at Halfway, treatments mimicked the cotton response trials, but also included isoxaflutole + prometryn PRE fb glyphosate + dicamba at 0.56 kg ai/ha EPOST and prometryn PRE fb isoxaflutole + glyphosate + dicamba EPOST. These two treatments included glyphosate + dicamba MPOST. All PRE treatments containing isoxaflutole controlled Palmer amaranth =94% 14 and 21 days after treatment. All treatments controlled Palmer amaranth =94% 21 days after the EPOST application. Twenty-one days after the MPOST treatment, systems with isoxaflutole EPOST controlled Palmer amaranth 88-93% while systems with isoxaflutole PRE controlled Palmer amaranth 94-98%. End of season Palmer amaranth control was lowest in the system without isoxaflutole (88%) and when isoxaflutole was used EPOST (88-91%). These studies suggest that the opportunity to use

isoxaflutole in cotton weed management systems will improve season-long control of several troublesome weeds with no adverse effects on cotton yield and quality.

Cotton Tolerance to Non-Labeled Herbicides in Mississippi. Z Ugljic*[1], J Ferguson[1], DB Reynolds[1], DM Dodds[1], BK Pieralisi[2], G Morgan[3]; [1]Mississippi State University, Mississippi State, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Cotton Incorporated, Cary, NC (41)

Cotton (*Gossypium hirsutum L.*) growers utilize chemical control as their main method for in-season weed control. Herbicide tolerant cotton varieties have been developed to increase the number of herbicides that can be applied during the cotton growing season. Varieties that are tolerant to more than one herbicide are the most commonly planted across the Cotton-Belt, yet herbicide resistant weed species continue to develop in increasing populations each year. Application of the same herbicide over time leads to increased selection pressure resulting in herbicide resistant weed species development. Reducing selection pressure by increasing the number of herbicide options that can be used in cotton would be an effective way to limit herbicide resistant weed species development. Therefore a study was conducted to assess application of non-labeled herbicides over-the-top on cotton was started in 2020. Objectives of this study are (1) to evaluate cotton sensitivity to non-labeled herbicides, (2) to evaluate non-labeled herbicide impact on seed cotton yield. Field studies were conducted in 2020 at three locations in Mississippi: Black Belt Experiment Station in Brooksville, R.R Foil Plant Science Research Center (North Farm) in Starkville and W.B Andrews Agricultural Systems Research Farm (Andrews) in Starkville. Two cotton cultivars (Deltapine® 1646 B2XF and NextGen ® 3729 B2XF) were planted at 108,680 seeds ha^{-1} and sprayed with one of nine non-labeled herbicides at one of four application timings (3-5 leaf, 7-8 node, matchhead square, and early bloom) to assess their viability in cotton production systems. All studies were rated for injury 7, 14, 28 and 56 days after application. Treatments were applied with a CO_2 pressurized backpack sprayer with a four-nozzle boom equipped with four AIXR 11002 nozzles 48.3 cm apart calibrated to deliver 140 L ha^{-1} at 276 kPa. Treatments at each site-year were arranged in randomized complete block design with four replications. Data were analyzed using PROC GLM in SAS 9.4 and means separations were made using Fisher's protected LSD at a = 0.05. Imazapic, thiencarbazone-methyl plus tembotrione, and amitrole injured cotton at or above 78 % across all four timings at Black Belt and North Farm. Imazapic, metribuzin, and amitrole injured cotton at or above 82% across all four timings at Andrews. Bentazon resulted in the least injury across all timings and locations. Florpyrauxifen-benzyl was injurious at the third and fourth timings but resulted in less than 40% injury at the first and second timings across location. Seed cotton yield was decreased compared to the nontreated check by applications of imazapic, thiencarbazone-methyl plus tembotrione, or amitrole at all four timings at Black Belt and North Farm. At Andrews, imazapic, metribuzin, or amitrole significantly decreased yield relative to the nontreated check at all four timings. Bentazon, tolpyralate, topramezone, and florpyrauxifen-benzyl appear promising for further evaluation in 2021. Further research will assess use of these four herbicides in combination with labeled herbicides in cotton to evaluate crop injury and seed cotton yield on multiple varieties. It is clear that currently non-labeled herbicides could be made available for cotton growers to reduce selection pressure on existing herbicides to allay herbicide resistance development.

Impact of Environmental Conditions on Rice Injury Caused by Florpyrauxifen-benzyl. JW Beesinger*, JK Norsworthy, RB Farr, TH Avent; University of Arkansas, Fayetteville, AR (42)

The commercial launch of florpyrauxifen-benzyl led to reports of the herbicide causing inconsistent levels of injury across varying cultivars and environmental conditions. The ability to use florpyrauxifen-benzyl to control problematic weedy species in rice would be beneficial to producers, if injury caused by the herbicide could be minimized. A greenhouse study was established to determine the effect of soil moisture on rice injury caused by florpyrauxifen-benzyl. Rice cultivar XP753 was planted in 7.5 -L buckets filled with a silt loam soil maintained at moisture levels of 40, 60, 80, and 100% field capacity. Rice was then treated with florpyrauxifen-benzyl at 30 g ae ha^{-1} at the three-leaf stage. Another experiment was conducted in growth chambers to determine the effect of light intensity on rice injury caused by florpyrauxifen-benzyl. A similar setup and florpyrauxifen application rate was employed where the soil-containing buckets were maintained at 100% field capacity inside a growth chamber that provided a day/night temperature of 35/24C. A divider placed in the center of a growth chamber allowed one side to be supplied 1200 µmol/m^2/s (high light intensity) and the other 700 µmol/m^2/s (low light intensity) at the height of the crop. Injury ratings were taken weekly after treatment in both studies for 4 weeks and aboveground biomass harvested after the final evaluation. Soil moisture significantly affected the amount of injury observed with rice under the saturated condition displaying the greatest injury (35%) along with a reduction in biomass. When florpyrauxifen-benzyl was applied to rice in low light conditions, more injury and biomass reduction occurred than under the higher light intensity. Findings from these studies lead to the realization that applications of florpyrauxifen-benzyl made in low light conditions on saturated soils have the potential to amplify rice injury, especially when applied to hybrid cultivars with inherent sensitivity to the herbicide.

Minimizing Off-target Movement of Florpyrauxifen-benzyl to Soybean. BL Cotter*, JK Norsworthy, JW Beesinger, MC Castner, GL Priess; University of Arkansas, Fayetteville, AR (43)

Following commercial launch of Loyant® (florpyrauxifen-benzyl) in 2018, frequent off-target movement of the herbicide to adjacent soybean [*Glycine max* (L.) Merr] fields was observed. Hence, field experiments were conducted in 2020, in Fayetteville, AR, to compare drift rates (0.17625 g ai ha^{-1} to 5.625 g ai ha^{-1}) of florpyrauxifen-benzyl (FPB) as a foliar spray and impregnated on urea applied to V3 soybean, as well as, evaluating volatility of the herbicide. Response of soybean to FPB physical drift applied as a foliar spray and impregnated on urea was evaluated in a wide-row system over a range of rates. Additionally, volatilization of foliar spray and FPB impregnated on urea under various soil conditions was compared to dicamba + glyphosate using a low-tunnel setup where soybean served as a bio-indicator. Evaluations were taken at 14, 21, and 28 days after application in both experiments. In the physical drift experiment, FPB impregnated on urea and applied at 5.6 g ai ha^{-1} resulted in 20% injury whereas the equivalent rate of foliar spray resulted in complete crop death. At all timings, FPB impregnated on urea caused less injury than the comparable rate of foliar spray. In the volatilization experiment, no more than 1% injury to soybean was observed from any of the FPB applications to soil. Conversely, soybean injury was as high as 45% following application of dicamba + glyphosate to moist soil, an indication that a high degree of volatilization occurred for this treatment. Overall, FPB impregnated on urea reduced soybean injury 50 to 91 percentage points across all rating dates compared to foliar applications. Regardless of application method or soil condition, FPB appears to have minimal risk of volatilization. Impregnating FPB onto urea appears to substantially reduce the risk for off-target movement of the herbicide onto soybean via physical drift and volatilization, and future research needs to establish the effectiveness of this application technique on weed control.

Effects of Prohexadione Calcium Application Timing on Peanut (*Arachis hypogaea* L.) Growth and Yield in Mississippi. AB Gaudin*, J Ferguson, B Zurweller; Mississippi State University, Mississippi State, MS (44)

Excessive vegetative growth in peanut (*Arachis hypogaea* L.) can lead to decreased reproductive growth and harvest efficiency. Peanut vegetative growth is often managed with the plant growth regulator, prohexadione calcium. Although application of prohexadione calcium is recommended at 50% and 100% canopy closure, research on the optimal application timing has been minimal. The objective of this research was to evaluate the effect of prohexadione calcium application timing based on percent canopy closure. Experiments occurred at three different on-farm sites across Mississippi. Treatments included applications at 50% and 100% (canopy closure), before 50% and after 100%, 2 applications in 1 week at 100%, before 50% and before 100%, and 3 applications in a week at 100%. A non-treated control was included in all experiments. On all sites, prohexadione calcium applications were made at the manufacture recommendation of 140 g ai ha^{-1}. Treatment responses were evaluated based on peanut yield, pod loss, and harvest indices including pod weight, pod count, and dry plant weight. Peanut yield across field sites was evaluated as a percent untreated control. Average yields by treatment ranged from 6535 to 7000 kg ha^{-1}. On average, control treatments had a lower yield than treatments containing prohexadione calcium. Two applications in 1 week at 100% had the most significant effect on yield with an average of 8.9% increase in yield when compared to control treatments. The lowest performing treatments were the before 50% and after 100% and the 3 applications in 1 week at 100% with an average of 1.4% and 0.9% increase in yield when compared to control treatments. Application timing had little effect on pod count and pod loss. The use of prohexadione calcium in the growing season at optimized timings increased peanut yield and decreased vegetative growth, improving harvest efficiency and reduced harvest losses.

Evaluating Spring Burndown Programs to Maximize Italian Ryegrass (*Lolium perenne* Ssp. *multiflorum)* Control in Mississippi Corn. JH Hughes*[1], J Ferguson[2], EJ Larson[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS (45)

Italian ryegrass (*Lolium perenne* L. ssp. *multiflorum* (Lam.)) is a major weed problem for Mississippi corn growers, often resulting in reduced yields. Previous research over three years showed that application of a preemergence herbicide in the fall followed by a postemergence herbicide in the early spring resulted in maximum ryegrass control and corn yield. Recent fall seasons had above average rainfall, preventing fall preemergence herbicide applications. Finding spring burndown programs for Italian ryegrass would give growers increased flexibility to control this problematic weed species in corn regardless of the weather prior to planting. The two main objectives for this study were to identify an effective spring burndown program to control Italian ryegrass prior to corn planting, and to assess burndown program costs and benefits through a return on investment (ROI) analysis. Field studies were conducted at two locations in Mississippi from 2019-2020 at the R.R. Foil Plant Science Research Center in Starkville and the Coastal Plain Experiment Station in Newton. Experimental plots were drill-seeded with Italian ryegrass at 112 kg ha^{-1} in the fall of 2019. In the spring, herbicide treatments were applied 28 days prior to corn planting, a timing found to prevent yield loss of corn from previous studies. Treatments included a nontreated control, a weed-free control, the standard fall preemergence application and fourteen other spring burndown programs arranged in a randomized complete block design with four replications. The standard fall preemergence treatment was *S*-metolachlor plus metribuzin (Boundary 6.5 EC) at 2.28 kg ai ha^{-1} followed by an application of paraquat (Gramoxone SL 2.0) at 1,121 g ai ha^{-1} in the spring. Results showed that the fall preemergence followed by a spring application of paraquat provided 99% ryegrass control, a grower ROI of $313.88, and the highest yield at 10,927 kg ha^{-1}. The highest performing program contained clethodim (Select Max) at 136 g ai ha^{-1}, paraquat at 1,121.4 g ai ha^{-1}, dimethenamid-P (Outlook) at 1,103.9 g ai ha^{-1}, and COC at $277.70 resulting in 96.5% ryegrass control, and a yield of 10,801 kg ha^{-1}. Five burndown treatments showed statistically similar yields compared to the fall preemergence application. The study is underway for 2021, with the addition of a third site, the Black Belt Experiment Station in Brooksville, MS. Plots at all three sites were drilled with 112 kg ha^{-1} Italian ryegrass in the fall of 2020, and spring burndown programs will be applied compared to the fall preemergence program in February 2021. Burndown treatments were fine-tuned based on data from 2020, to further improve viability of spring burndown programs to allow growers maximum flexibility for controlling this yield reducing weed, while optimizing grower return on investment. Increasing the number of sites and optimizing herbicide programs is essential to reducing the effect this competitive weed has on corn growth and yield.

Utilizing Various Cover Crop Management Practices for the Control of Tall Waterhemp and Italian Ryegrass in Soybean. SR Reeves*[1], DB Reynolds[2], JA Bond[3], G Oakley[2], BJ Varner[2], HM Edwards[4], JM Taylor[1], CL Wilhite[1], B Blackburn[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Delta Research and Extension Center, Stoneville, MS, [4]Mississippi State University, Stoneville, MS (46)

As herbicide resistant weeds become more prevalent, non-herbicidal methods of control, such as cover crops, are becoming more widely used for weed suppression. Tall Waterhemp (*Amaranthus tuberculatus*) and Italian Ryegrass (*Lolium multiflorum*) are resistant to multiple herbicide modes of action and create agronomic difficulties in soybean (*Glycine max*). Various cover crop(s), rates, mixtures, and establishment methods were used to investigate the best overall cover crop management practice for the control of Tall Waterhemp and Italian Ryegrass. Multiple field experiments were conducted at three locations. Tall Waterhemp suppression experiments were conducted in Starkville, and Brooksville, MS. Italian Ryegrass suppression experiments were conducted in Stoneville, MS. The experiment consisted of a 6 x 4 factorial arrangement of treatments in a RCB design with Factor A being cover crops and Factor B being establishment methods. Six different cover crop rates and mixtures were used for this experiment: 134 kg/ha of cereal rye (*Secale cereal*), 134 kg/ha of wheat (*Triticum aestivum*), 11 kg/ha of radish (*Raphanus sativus*), 101 kg/ha of cereal rye with 7 kg/ha of radish, 101 kg/ha of wheat with 7kg/ha of radish, and a blend of 56kg/ha cereal rye, 56kg/ha of wheat and 5.6 kg/ha of radish. Four establishment methods were used in conjunction with all cover crop rates and mixtures. Interseeding of the cover crops, at the R7 soybean growth stage, is the only treatment occurring prior to harvest. Broadcast followed by tillage, tillage followed by broadcast and drilling occurred post-harvest of the previous year's soybean crop. Data were subjected to SAS 9.4 utilizing Fisher's protected LSD at a = .05. Weed control ratings were taken 0, 14, and 21 days after planting (DAP) at the Tall Waterhemp locations while weed control ratings were taken 0, 14, 21, and 28 DAP at the Italian Ryegrass location. Data suggest that interseeding at the R7 growth stage provided the least amount of tall waterhemp and Italian Ryegrass control. Weed control did not differ among cover crops at the Starkville location; however, they were different at Brooksville and Stoneville with wheat and wheat mixtures providing the greatest control. These preliminary data indicate that interseeding a covercrop is the least effective establishment method for obtaining in season weed control, while optimum cover crop selection was dependent upon location.

Screening of Chromosome Substitution (CS) Cotton Lines for Weed-Suppressing Potential in a Stair-Step Assay. GA Fuller*; Mississippi State University, Starkville, MS (47)

Palmer amaranth (*Amaranthus palmeri*) is a problematic weed species especially for cotton (*Gossypium hirsutum*). With the advent of chemical control, Palmer amaranth populations have developed resistance to commonly used herbicides. It is imperative to develop alternative weed control methods to slow the evolution of herbicide-resistant weed populations. Eleven chromosome substitution (CS) cotton lines (B26lo, T17, BNTN 16-15, BNTN 17-11, B12, T05sh, T26lo, T11sh, M11sh, B22, and B22lo) previously screened for weed-suppressing abilities were utilized in this study. The cotton lines were tested using the stair-step structure outline by Schumaker et al. (2019) and was replicated three times. Height (cm) and chlorophyll concentration was measured for each plant in the system, and statistical analysis indicated a difference in Palmer amaranth height reduction and chlorophyll concentration between the CS lines. The most competitive CS lines were determined to be: BNTN 16-15, B10, T26lo, T11sh, M11sh, and B22. The CS lines BNTN 16-15 and B22 were observed to reduce Palmer amaranth height by 88%; furthermore BNTN 16-15 was distinguished by a 65% reduction in Palmer amaranth chlorophyll concentration. Follow up experiments will screen the four top-performing CS lines (BNTN 16-15, B10, T26lo, and T11sh) in a field setting.

Classification of 2,4-D Formulations on Enlist Soybean and Enlist Cotton Utilizing FTIR Spectroscopy and Chemometric Analysis. B Blackburn*[1], DB Reynolds[1], A Brown[2], D Sparks[1], M Caprio[3], BJ Varner[1], G Oakley[1], JM Taylor[4], SR Reeves[4], J Boul[3], CL Wilhite[4]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State Chemical Laboratory, Mississippi State, MS, [3]Mississippi State Univ., Mississippi State, MS, [4]Mississippi State University, Starkville, MS (48)

With the introduction of Enlist crops, 2,4-D is now used to control broadleaf weeds in cotton (*Gossypium hirsutum*) and soybean (*Glycine max*). Along with its increased use, damage from off-target movement (OTM) is expected to increase. In order to mitigate damage, new formulations of 2,4-D with lower OTM have been introduced; however, damage to susceptible species caused by these formulations are visually indistinguishable from existing formulations. Experiments were conducted to determine if injured plants from various formulations of 2,4-D could be differentiated utilizing Fourier-transform infrared spectroscopy (FTIR) and if plant part sampled or time interval between exposure and sampling would affect classification.Treatments included 0.95 lb ae/a of 2,4-D acid (Unison), 0.95 lb ae/a of 2,4-D amine (Weedar 64), 0.95 lb ae/a of 2,4-D ester (Weedone LV4), 0.95 lb ae/a of 2,4-D choline (Enlist One), 1.95 lb ae/a of Enlist Duo, and 0.95 lb ae/a of glyphosate (Roundup PowerMax). 0.95 lb ae/a of glyphosate (Roundup PowerMax) was also added to all applications besides Enlist Duo. Each treatment was applied to two 76-cm spaced rows x 12.2 m plots with 4 replications for both Enlist cotton and Enlist soybeans. Each experimental unit was sectioned into 2.44 m sections for temporal sampling at 0, 7, 14, 21, and 28 DAT. Prior to application, colored ribbons were tied to 10 individual plant within each section, to mark the highest growth point for each plant. During sample collection, tissue was segregated according to age. Tissue samples collected below the ribbon were marked as present during application, samples collected above the ribbon were marked as new growth, and then composite samples were collected containing both treated leaves and new vegetative growth. Samples were immediately frozen after harvest until they could be processed for spectral analysisEach sample was then analyzed using FTIR spectroscopy and a spectra image was generated for each sample. The spectral data were then imported and analyzed using RStudio. Support vector machine design was used to construct various models using the timings and type of tissue samples as factors. Models constructed using soybean tissue samples present during application and the 7 and 21 DAT timing section, produced the highest accuracy with 83% accuracy, an increase from 68% produced by the model using all soybean tissue samples. Models constructed using all cotton tissue samples produced an accuracy of 63% while the model constructed utilizing tissue samples present during application and collected 21 DAT produced an accuracy of 89%. Timing and type of tissue sample collected significantly contributes to both cotton and soybean model accuracies in differentiating among various 2,4-D formulations, with models using tissue samples present during applications and collected at 7 and 28 DAT for soybeans and 21 DAT for cotton producing the highest accuracies.

Effects of Tank Mixed Chloroacetamide Herbicides and Glyphosate on XtendiMax Volatility. JM Taylor*[1], DB Reynolds[2], A Brown[3], SR Reeves[1], BJ Varner[2], CL Wilhite[1], G Oakley[2], B Blackburn[2]; [1]Mississippi State University, Starkville, MS, [2]Mississippi State University, Mississippi State, MS, [3]Mississippi State Chemical Laboratory, Mississippi State, MS (49)

Chloroacetamide herbicides are often added to dicamba applications to provide additional residual control in a single application. The known tendency of dicamba vapor movement makes an understanding of the interaction of these tank-mix partners imperative to mitigate dicamba volatility, injury, and yield loss. Field and humidome trials were established to evaluate the effect of chloroacetamide herbicides on dicamba volatility when applied alone or in combination with glyphosate. Field applied treatments included 2.24 kg ae/ha of diglycolamine salt of dicamba (XtendiMax plus VaporGripä), 2.24 kg ae/ha dicamba + 4.40 kg ai/ha *S*-metolachlor (emulsifiable concentrate in Dual Magnumä), 2.24 kg ae/ha dicamba + 5.04 kg ai/ha acetochlor (emulsifiable concentrate in Harnessä), 2.24 kg ae/ha dicamba + 5.06 kg ai/ha acetochlor (microencapsulated in Warrantä), and a pre-mix containing 2.2 kg ae/ha dicamba + 4.48 kg ai/ha *S*-metolachlor (capsule suspension in Tavium plus VaporGripä) applied alone and in combination with 3.47 kg ae/ha of potassium salt of glyphosate (RoundUp PowerMaxä). Field treatment rates represented a 4X use rate to ensure symptomology. Each treatment was applied to greenhouse flats filled with soil wetted prior to application. Applications were made using an enclosed track sprayer at a delivery volume of 140 L/ha and flats were then transported to the field test site. Treated flats were placed between two rows of soybeans in the center of each 15.24 m plot. A 6.2 x 1.5 m low tunnel dome covered with plastic was placed over the center of each plot and was not removed until 48 hours after application. Visual injury (%) and plant height (cm) was recorded in 30 cm increments from 0 to 762cm from the treated soil. Data were collected 14 and 28 days after treatment (DAT). Each low tunnel contained an air pump pulling air through a polyurethane foam tube (PUF) to capture dicamba molecules that had vaporized from the treated soil surface. PUF concentrations were analyzed using LC/MS to record concentration in ng/PUF. All data were subjected to analysis with PROC GLIMMIX and means were separated by LSMEANS (a=0.05). Injury data were also non-linearly regressed over distance (cm) with a 95% confidence interval using RStudio ggplot function with loess smoothing method. Identical treatment combinations were evaluated at a 1X rate in a closed humidome system. Humidome treatments included 0.56 kg ae/ha of diglycolamine salt of dicamba (XtendiMax plus VaporGrip™), 0.56 kg ae/ha dicamba + 1.12 kg ai/ha *S*-metolachlor (emulsifiable concentrate in Dual Magnum™), 0.56 kg ae/ha dicamba + 1.26 kg ai/ha acetochlor (emulsifiable concentrate in Harness™), 0.56 kg ae/ha dicamba + 1.26 kg ai/ha acetochlor (microencapsulated in Warrant™), and a pre-mix formulation of 0.56 kg ae/ha dicamba + 1.12 kg ai/ha *S*-metolachlor (capsule suspension in Tavium plus VaporGrip™). Each application of chloroacetamide and dicamba was tested with and without the addition of 0.86 kg ae/ha of potassium salt of glyphosate (RoundUp PowerMax™). Humidomes contained a treated soil flat and were sealed with humidity domes. Each dome was fitted with an air pump pulling air through a polyurethane foam tube (PUF) to catch dicamba molecules that vaporize from the treated soil surface. All PUF data were subjected to analysis with PROC GLIMMIX and means were separated by LSMEANS (a=0.05). Field and humidome data showed no interaction between chloroacetamide and glyphosate. The addition of glyphosate, regardless of chloroacetamide addition, increased soybean injury, distance of vapor travel, and amount of dicamba volatility measured by air sampling in both field and humidome experiments. Encapsulated formulations of both acetochlor and *S*-metolachlor were less volatile and injurious than the same a.i. formulated as

an emulsifiable concentrate in field experiments. Additions of emulsifiable concentrate acetochlor created the most volatile and most injurious dicamba solution in field trials. Dicamba applications containing capsule suspension dicamba + *S*-metolachlor were least volatile and least injurious when applied in field trials. No difference in volatility were found among chloroacetamide additions in humidome trials.

Effect of Flooding on Growth and Development of Fall Panicum. V Chiruvelli*[1], D Odero[2]; [1]University of Florida, Gainesville, FL, [2]University of Florida, Belle Glade, FL (50)

Effect of flood depth on fall panicum growth and reproduction Fall panicum (*Panicum dichotomiflorum Michx*.) is the most predominant and problematic grass weed in Florida rice. An outdoor experiment was conducted at the Everglades Research and Education Center (EREC) in Belle Glade, FL in 2020 to evaluate the effect of depth of flooding on fall panicum growth and reproduction. The experiment was a two-way factorial, repeated-measures in a randomized complete block design with a split-plot arrangement and four replications. The main plot was flooding depth (10, 15, 20, and 30 cm) and the subplot was fall panicum growth stage (2- to 4-leaf and 4- to 6-leaf stages at the initiation of flooding). The plants were placed in pots and flooded at different depths maintained in 0.6 m by 0.6 m by 1.2 m troughs for 7, 14, 28, 42, and 56 days before removal. Flooding depth had an effect on height for plants flooded at the 2- to 4-leaf stage at all evaluation timings with the 30 cm flooding depth having the most negative effect. In contrast, no effect on height was observed on plants flooded at the 4- to 6-leaf stage and these plants survived flooding better than the small sized plants. Increasing flooding depth had a negative effect on the leaf area index of plants flooded at the 2- to 4-leaf stage but had no effect on plants flooded at the 4- to 6-leaf stage. Plants flooded at the 4- to 6-leaf stage had more leaf area compared to plants flooded at the 2- to 4-leaf stage. There was no effect of flooding depth on aboveground biomass accumulation or partitioning of biomass into leaves and stems irrespective of the leaf stage at flooding at 56 days. However, the 4- to 6-leaf stage plants had more aboveground biomass with more partitioning to leaves and stems compared to plants flooded at the 2- to 4-leaf stage. Similar response was observed for belowground biomass accumulation. Fall panicum's reproductive capacity based on the number of panicle branches was higher for plants flooded at the larger size. These results indicate that flooding can be effective in reducing fall panicum growth and reproduction in the absence of postemergence herbicides when permanent flooding is initiated at earlier stages of growth. Further studies are ongoing to corroborate these results.

Winter *Brassica carinata* Production as Part of a Diversified Crop Rotation for Integrated Weed Management. R Tiwari*[1], P Devkota[1], MJ Mulvaney[1], JA Ferrell[2], RG Leon[3]; [1]University of Florida, Jay, FL, [2]University of Florida, Gainesville, FL, [3]North Carolina State University, Raleigh, NC (51)

Carinata (*Brassica carinata* A. Braun) is a recently introduced non-edible, oilseed winter crop in the southeastern U.S. which can help to diversify cropping system and improve integrated weed management. The objective of this research was to determine the influence of winter carinata production on the population dynamics of winter and summer annual weed species. Research was conducted in 2018-2019 and 2019-2020 cropping seasons with randomized complete block arranged as a split-plot design. Carinata was grown after different crop history: cotton, peanut, and a clean summer fallow were the main-plot factors. Sub-plot factors included winter carinata with or without *S*-metolachlor and a winter weedy fallow. Compared to summer fallow, the emergence of henbit (*Lamium amplexicaule* L.) was increased at least 40% after cotton and peanut in 2018-2019 and by 50% after cotton in 2019-2020. Similarly, the emergence of chickweed [*Stellaria media* (L.) Vill.] was increased over three-folds after peanut and cotton in 2019-2020. The emergence of smooth pigweed (*Amaranthus hybridus* L.) after peanut; and sicklepod [*Senna obtusifolia* (L.) H.S. Irwin & Barneby] after cotton was increased significantly ($p<0.05$) compared to summer fallow during carinata growing seasons in both seasons. Carinata reduced emergence of smooth pigweed (>27%) and sicklepod (>25%) compared to winter weedy fallow even without *S*-metolachlor. Carinata biomass was greater when grown after peanut (9,466 kg ha^{-1}) in 2018-2019. However, in 2019-2020, it was similar between peanut (7,647 kg ha^{-1}) and summer fallow (7,875 kg ha^{-1}). Carinata seed yield had a similar response as biomass in the 2018-2019, whereas in 2019-2020, seed yield was higher after peanut (2,417 kg ha^{-1}) and summer fallow (2,520 kg ha^{-1}) compared to cotton (1,710 kg ha^{-1}). Carinata biomass or yield was not affected by with or without S-metolachlor or winter fallow treatments in any of the experimental years, highlighting competitive ability of carinata against studied winter weeds. Results from this research suggested that carinata can be included as a part of a diversified a cropping system for developing integrated weed management strategy.

A Meta Analysis of North Carolina Spray Conditions Over a Two Year Period. M Fajardo Menjivar*, W Everman, CW Cahoon, DJ Contreras, DE Salazar, MA Granadino, EA Jones; North Carolina State University, Raleigh, NC (52)

North Carolina has a rich agricultural production in different crops across the state. Averaging 1.6 million acres of soybean production, this crop has the biggest footprint compared to any other crop in the state, followed by other important crops like corn, cotton, tobacco, peanuts and sweet potatoes. But with the richness of agricultural production, some obstacles have increased over the years, being herbicide resistant weeds one of them. That is why some new technologies to control this herbicide resistant weeds have surged and auxin resistant crops have gain importance to protect yields. Based on that, the objective of this study is to analyze weather conditions along different weather stations in the state to control possible herbicide spray drift that may affect susceptible crops. By analyzing them the hypothesis of what times during the day are the best to spray during a growing season can be detected. Data was collected by permanent weather stations that are connected to NCEconet that is part of the data network for the North Carolina Climate Office. Temperature measured at 2 and 9 meters above ground helps determine if there is a possible temperature inversion, and an anemometer at 2 meters above ground helps see the wind speed and wind gusts conditions and determine if conditions are suitable for herbicidal sprayings. Data was analyzed using the frequency procedure in SAS 9.4 and results consisted in determining the hours in each month where conditions in average were suitable for spraying. The dynamic results that each year and region showed gave the idea that temperature inversions and wind conditions can be further studied to avoid off target deposition of auxin herbicides and any other one that may cause problems to susceptible crops.

***Hydrilla verticillata* Tuber Response to Herbicide Treatments Under Simulated Drawdown Conditions.** TL Darnell*, BP Sperry, WT Haller; University of Florida Center for Aquatic Invasive Plants, Gainesville, FL (53)

Hydrilla [*Hydrilla verticillata* (L.f.) Royle] is one of the most troublesome submersed aquatic weeds in the US. One specific attribute of hydrilla that makes management difficult is the formation and persistence of subterranean turions (tubers). However, previous research has indicated that hydrilla tubers can be controlled with herbicide applications made during drawdown conditions (dewatering of an aquatic system). Consequently, a pond study was conducted to evaluate the efficacy of several herbicides registered for aquatic use on hydrilla tubers. The herbicides bispyribac-sodium, flumioxazin, florpyrauxifen-benzyl, imazamox, penoxsulam, and topramezone were applied at 0.5X, 1X, and 2X the maximum foliar use-rate to 11.4 L dishpans filled with sand/fertilizer containing 20 tubers per dishpan. The experiment was set up as a completely randomized design with four replications, a factorial arrangement of treatments (herbicide by rate), and included a nontreated control for reference. Dishpans were kept moist for five days after treatment until they were placed in ponds and allowed to grow for 18 weeks. At 18 weeks after treatment, aboveground biomass was harvested, dried, and weighed. Florpyrauxifen-benzyl at 0.5X, and topramezone at either 0.5X or 1X were the only treatments that did not reduce hydrilla biomass from the control. Conversely, bispyribac-sodium, imazamox, and penoxsulam provided >93% hydrilla biomass reductions regardless of rate. Flumioxazin at any rate and florpyrauxifen-benzyl at 1X and 2X provided 53 to 87% hydrilla biomass reductions. Based on these data, the three ALS-inhibiting herbicides tested showed the greatest potential for successful hydrilla control in drawdown treatments. Future research will investigate these treatments at operational scale as well as response of other hydrilla biotypes.

Influence of Hydrology on Treatments for Old World Climbing Fern (*Lygodium microphyllum*).

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(54)

Lygodium microphyllum (Cav.) R. Br. or Old World climbing fern (OWCF) is considered to be one of the most invasive plants in peninsular Florida. One highly impacted region is the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Loxahatchee NWR), a 59,647-ha wetland that is composed of mixed emergent marsh communities and tree islands. OWCF grows to the canopy of these tree islands and dominates the understory community with deep rachis mats. Management efforts involve herbicide applications of glyphosate, triclopyr, florpyrauxifen-benzyl, and metsulfuron by ground crews that access the refuge with airboats. A unique hydrology presents difficulty in accessing parts of the refuge during the dry season which provides ideal conditions for recruitment of new plants. During the wet season, OWCF can also remain inundated below the surface of the water which prevents applicators from achieving effective treatments. Given these hydrologic issues, our objective was to understand the influence of hydrologic regimes on herbicide treatments for OWCF control. This can assist managers greatly in determining when and where to focus their efforts. To address this, studies were conducted at the Loxahatchee mesocosm facility where the hydrological stage could be controlled. Plants were established from spores in 11 L pots and allowed to grow for 12 months prior to the experiments. In the mesocosm tanks, plants were assigned to one of three hydrologic conditions, completely submerged to -10 cm below the water line, 0 cm saturated conditions, or to 20 cm above the water line. Plants were then subjected to a broadcast application of either glyphosate, metsulfuron, triclopyr, or florpyrauxifen benzyl as well as non-treated controls. Shoot biomass was harvested at 75 days after treatment (DAT) and allowed to regrow until 150 DAT. At 150 DAT both above and below ground biomass were harvested, oven dried and weighed. Data was analyzed in R using analysis of variance and Tukey's HSD. There was no interaction between herbicide treatment and hydrologic stage for above and below ground biomass at 150 DAT and neither herbicide treatment nor hydrologic stage influenced belowground biomass compared to the non-treated control. This supports evidence from the field that regardless of treatment, OWCF is very difficult to control. Aboveground biomass was reduced by all herbicide treatments when compared to the non-treated control. However, across treatments, there was a significant hydrologic effect on regrowth. Elevated plants at 20 cm above the water line had significantly more biomass then submerged plants. Plants submerged completely at -4 cm did not regrow, suggesting that longer term flooding could inhibit the recovery of the plant following herbicide application, however effects from the length of time of inundation is not well understood. Future studies will examine the role of the period of inundation before and after a treatment on OWCF.

Weed-suppressive Sweetpotato Cultivars for Sustainable Weed Management. IS Werle*[1], M Machado Noguera[1], P Carvalho-Moore[1], JK Kouame[1], T Tseng[2], NR Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]Mississippi State University, Starkville, MS (55)

Sustainable farming systems have received an increasing endorsement, especially in minor crops, such as sweetpotato (*Ipomoea batatas* L.), which is labor-intensive. The screening of an extensive sweetpotato germplasm collection is a strategy to discover highly competitive, weed-suppressive sweetpotato genotypes. The objective of this research was to characterize the weed-suppressive ability of sweetpotato cultivars on troublesome weed species in sweetpotato production. Field experiments were conducted in 2020 at the Vegetable Station, Kibler, and at the MS Agricultural Research Center, Fayetteville. The effect of 11 sweetpotato cultivars was tested on Palmer amaranth (*Amaranthus palmeri* S. Wats.), junglerice (*Echinochloa colona* L.), morningglory (*Ipomoea* spp.), and yellow nutsedge (*Cyperys esculentus* L.) in Kibler, and the same species in Fayetteville, except junglerice. Treatments were arranged in a split-plot design with four replications. Sweetpotato cultivar was the main plot and weed species was the subplot. A weed-only plot was established as a check. Each mainplot had four rows, 3 m long, 1.82 m apart. Each row was a subplot, where one weed specie was broadcast-seeded at 20 plants m^{-2}. Sweetpotato cuttings were planted in a horizontal position, 75 cm apart in the row. Weeds were removed from the field 12 weeks after planting (WAP) to allow sweetpotatoes to develop storage roots. Weed density was counted by species at 8 WAP from 0.25 m^2 quadrat in each subplot. The dry shoot biomass of the target weed species, and the native weeds from this area was measured. Total marketable yield was calculated as the sum of jumbo, no. 1, and canner grades. Statistical analyses were performed using JMP 15.2.0 (SAS Institute Inc., Cary, NC). Data were subjected to analysis of variance (ANOVA) in a split-plot structure. Palmer amaranth density was reduced by over 85% in the presence of cultivars 33 and 17 in Fayetteville. The density of yellow nutsedge and morningglory were not influenced by cultivar. In Kibler, Palmer amaranth density was suppressed by 83% in the presence of cultivar 5. Junglerice and morningglory densities were not affected by cultivar. In Fayetteville, the dry shoot biomass of morningglory was reduced by 90% in plots with cultivar 5. Yellow nutsedge biomass decreased 83% in the presence of cultivar 24. In Kibler, cultivar 38 reduced morningglory biomass 57%. Junglerice biomass was suppressed 79% when grown with cultivar 17. Cultivars 17 (27,948 kg ha^{-1}) and 29 (27,491 kg ha^{-1}) had the highest sweetpotato yield in Fayetteville. In Kibler, cultivar 28 (34,159 kg ha^{-1}) had the highest yield. Yellow nutsedge had the least effect on total sweetpotato yield. Palmer amaranth and morningglory significantly reduced total yield in both locations as compared to junglerice and yellow nutsedge. Overall, sweetpotato cultivars 5, 17, and 24 showed the most competitive advantage against weeds.

Plant Hormones Improve Chemical Weed Management in Sweetpotato Field. GA Caputo*[1], MA Cutulle[2]; [1]Clemson University, Clemson, SC, [2]Clemson University, Charleston, SC (56)

Weed management is essential to maximize sweetpotato (*Ipomoea batatas* L. (Lam)) production. There are no selective postemergence (POST) herbicides registered in sweetpotato to suppress broadleaf weeds and yellow nutsedge (*Cyperus esculentus* L.). Expansion of bentazon herbicide label would be beneficial to sweetpotato growers. Experiments were conducted to determine the efficiency of melatonin and brassinosteroids (Vitazymes) tank-mixed with bentazon to reduce herbicide injury to sweetpotato plants cultivar 'Bayou Belle'. The research was conducted at Clemson Coastal Research and Education Center in Charleston SC and a commercial field in Cameron, SC. Treatments consisted included a nontreated control, bentazon (514 g ai ha^{-1}), melatonin (100 g ai ha^{-1}), Vitazyme (100 g ai ha^{-1}), bentazon + melatonin (514 g ai ha^{-1} + 100 g ai ha^{-1}), bentazon + vitazyme (514 g ai ha^{-1} + 100 g ai ha^{-1}) ,and bentazon+vitazyme+melatonin (514 g ai ha^{-1} + 100 g ai ha^{-1} + 100 g ai ha^{-1}). Treatments were applied 3 weeks after sweetpotato transplanting. Data collected included percent plant injury and weed percent weed cover at 3, 6, and 9 weeks after treatment (WAT). At the end of the experiment sweetpotatoes were harvested and graded as jumbo, number (no.) 1, or canner. We found that plant injury facilitated by bentazon applications was reduced when plants hormones were included in the tank-mix. Tank mixing bentazon with plant hormones did not reduce weed control. Tank mixing bentazon with Vitazyme and melatonin resulted in the greatest final marketable sweetpotato yield.

Assessing Brunswickgrass Response to Timed Hexazinone Applications. C Cooper*[1], BA Sellers[2]; [1]University of Florida, Lecanto, FL, [2]University of Florida, Ona, FL (57)

Brunswickgrass (*Paspalum nicorae* Parodi), sometimes referred to as "brown-seeded paspalum", is a problematic weed in summer perennial grass pastures in the southeast. In Florida we have seen increasing pressure to control this weed contaminate as it is becoming a major threat to livestock and bahiagrass seed industries. This rhizomatous grass is refused by cattle and seed could potentially restrict sales of contaminated bahiagrass seed lots. Currently, management options are limited; therefore, the objective of this research is to develop a management plan for Brunswickgrass in Bahiagrass seed production fields. Two experiments are currently underway with one being a continuation of a two-year titration study and the other focusing on application timing. Experiments were established within Citrus and Sumter in 2018 to address Brunswickgrass response to the application of hexazinone at 0.14, 0.28, 0.56, 0.84, and 1.12 kg ai ha^{-1} . In 2019, an application timing study was established assessing control differences between month and rate. Applications were made monthly starting in May until September at rates of 0.56, 0.84, and 1.12 kg ai ha^{-1}. In the titration study, hexazinone appears to have significant activity with all rates of hexazinone resulting in at least 44% control 30 days after treatment (DAT). Hexazinone at rates of at least 0.84 kg ha^{-1} resulted in at least 97% control 30 DAT. By 365 DAT there was no difference among treatments and control ranged from 0 to 60%; seedling recruitment is the likely cause of the increase in Brunswickgrass. A second application onto the same plots resulted in at least 80% Brunswickgrass control across all hexazinone rates, and rates of 0.28 kg ha^{-1} resulted in at least 93% control 30 DAT. By 365 DAT of the second hexazinone application, control ranged from 40 to 96% across all hexazinone treatments; only 1.12 kg ha^{-1} resulted in >90% control. There was no rate by month interaction at 30 or 365 DAT in the timing study, however, both month and rate were significant. Hexazinone at 0.56, 0.84, and 1.12 resulted in 81, 85, and 95% control at 30 DAT. Application of hexazinone in May resulted in the lowest level of control (63%), but all other application timings resulted in control of at least 86%. At 365 DAT, 0.56 kg ha^{-1} resulted in 56% control, and at least 74% control was achieved with the higher rates. Similar to 30 DAT, the May application timing resulted in the lowest level of control by 365 DAT (34%), whereas all other timings resulted in similar levels of control of at least 71%. Overall, these results are promising in the fact that we are seeing some initial success using hexazinone for Brunswickgrass management. However, it is evident that multiple annual applications may be necessary to deplete the soil seed bank. Also, applications should not be made prior to June for optimal activity.

Evaluation of Bermudagrass (*Cynodon dactylon)* Pasture Herbicide Programs for Control of Knotroot Foxtail (*Setaira parviflora*). LM Dyer*, NT Basinger; University of Georgia, Athens, GA (58)

Knotroot foxtail (*Setaria parviflora* Poir. Kerguélen) is the only *Setaria* species to be native to the United States (US) and is becoming increasingly problematic in pastures across the Southeastern US. Knotroot foxtail closely resembles yellow foxtail (*Setaria pumila* Poir. Roem. & Schult.) and shares identifiable features that can create scouting confusion for growers. Current PRE-herbicide programs can minimize the impact of annual *Setaria* spp., but an herbicide program for control of knotroot foxtail in pastures has not been established. To explore control options of knotroot foxtail in established bermudagrass (*Cynodon dactylon* L. Pers.) pasture, studies were established at two locations in Clarke County Georgia. Studies were a randomized complete block design with a factorial arrangement of 15 treatments of herbicides applied fall only, spring only, or combinations of fall and spring applications. Fall applications included glyphosate (352.08 g a.i. ha^{-1} and 701.58 g a.i. ha^{-1}), hexazinone (1,348.2 g a.i. ha^{-1}), nicosulfuron (59.03 g a.i. ha^{-1}) and metsulfuron-methyl (15.76 g a.i. ha^{-1}), [NTB1] and an untreated check. Spring applications included indaziflam (67.18 g a.i. ha^{-1}), pendimethalin (4,462.27 g a.i. ha^{-1}), and an untreated check. Bermudagrass yield and weed biomass of all species present, including knotroot foxtail, was collected at three harvest timings. Statistical analysis analyzed results based on all Spring applications and all Fall applications separately. Treatments containing nicolsufuron and metsulfuron-methyl were found to increase bermudagrass yield 66.99% compared to the untreated check. Applications of pendimethalin and indaziflam both increased yield in bermudagrass by 125.14% and 116.03%, respectively. Spring applied indaziflam increased the biomass of knotroot foxtail[NTB2] 71.64% % compared to pendimethalin and 125[NTB3] [NTB4] .36% compared to the untreated check. The best fall application for control of knotroot foxtail is nicosulfuron and metsulfuron-methyl and the the best spring application is pendimethalin.[NTB5] Indaziflam should be avoided in fields with knotroot foxtail, despite increases in bermudagrass yield, as indaziflam could increase the proliferation of knotroot foxtail. This study will be conducted at two additional field sites in 2021 with high native populations of knotroot foxtail and an additional study will examine the effects of indaziflam on knotroot foxtail seeds and rhizome control.

Flumioxazin Dissipation Under Field and Laboratory Environments. NL Hurdle*[1], KM Eason[2], TL Grey[2]; [1]University of Georgia, Collierville, TN, [2]University of Georgia, Tifton, GA (59)

Georgia leads the nation in producing multiple crops such as peanut and pecans. Pecan production in 2019 was 67 million pounds, well under the 107 million pounds produced in 2017. This yield reduction was due to hurricane Michael destroying over 700 thousand trees across the state, a 17% ha loss. As with any crop, weed control is essential for a profitable yield. A common method of weed control us through PRE residual herbicides. These herbicides will prevent weed emergence through crop germination and emergence, and even through vegetative growth. Eventually, these herbicides will begin to lose efficacy as the season progresses. Flumioxazin is a PRE residual herbicide that is commonly used in both peanut and pecan production in Georgia. The field conditions in which both crops grow differ, which may lead to a difference in length of control. Field and laboratory studies were performed from 2016 through 2018 investigating the length of flumioxazin residual control in a pecan crop. A pecan grove in Webster Co., GA was utilized in an RCD with 7 herbicide treatments including indaziflam, halosulfuron-methyl, flazasulfuron, simazine, flumioxazin, diuron, and rimsulfuron. Treatments were applied at labelled rates in spring of 2016 and 2017, with 20 samples taken over the duration of the study. Samples were analyzed using an UHPLC LC/MS to determine soil concentration. A laboratory study was performed to determine the flumioxazin dissipation rate on a thermogradient table. A 10ppb flumioxazin solution was placed on temperatures ranging between 11 and 40 C with samples taken from 0 hours to 336 hours of heat exposure. The 1mL aliquot was analyzed using an UHPLC LC/MS to determine flumioxazin concentration, which was further utilized to determine the activation energy using the Arrhenius equation. The field study indicated that the flumioxazin concentration decreased as time increased, being near complete dissipation at approximately 100 days. The half-life was determined to be approximately 15 days after application. The lab study indicated that as temperature increased, the half-life of flumioxazin decreased with the Arrhenius equation determining a 58.35 kJ/mol activation energy.

Turf Injury of 'MiniVerde' Bermudagrass Green to Common Goosegrass Herbicide Control Options. T Stoudemayer*, LB McCarty; Clemson University, Clemson, SC (60)

Goosegrass is a problematic summer annual grassy weed in highly maintained turf stands. It has a prostrate growth habit, allowing it to be mowed closely, and has a distinct white crown with a coarse leaf texture. It often occurs in highly compacted, poorly drained soils such as adjacent cart paths, high play areas, and walkways to putting greens. In recent years, it has become more pronounced on golf greens and with the development of herbicide resistant biotypes and cancellation of previously effective products, alternative effective and turf-safe product(s) are at a critical need level. The objective of this study was to determine the level of injury from herbicides used for the postemergence (POST) control of goosegrass in bermudagrass golf greens. In the summer of 2020, a trial was conducted and then replicated on a 'MiniVerde' bermudagrass green in Clemson, SC. The first trial was initiated on July 24 while the second one started on August 12. These mid- to late-season trials were purposively timed to simulate worse-case scenario in terms of trying to control mature plants during the peak of summer heat and humidity with minimum turfgrass injury. Rating dates were July 27 (3 DAT), August 3 (10 DAT), August 7 (14 DAT) for the first trial and August 15 (3 DAT), August 22 (10 DAT), and August 26 (14 DAT) for the second one. Turfgrass quality (TQ) was rated on a 1-9 (1 = a completely brown, necrotic turf, 7 = minimally acceptable, and 9 = thick, green, desirable turf). Treatments included: (1) Sencor 75DF [metribuzin] 4 oz/ac; (2) Pylex 2.8SC [topramezone] 0.25 oz/a + Sencor 75DF 4 oz/a; (3) Pylex 0.25 oz/a + Sencor 2 oz/a + Tribute Total 60.5WDG [foramsulfuron + halosulfuron + thiencarbazone-methyl] 3.2 oz/a; (4) Sencor 2 oz/a + Tribute Total 3.2 oz/a + Dismiss South 4L [imazethapyr + sulfentrazone] 10 oz/a; (5) Pylex 0.25 oz/a + Speedzone 2.2L [carfentrazone + 2,4-D + dicamba + MCPP] @ 5 pt/a; and (6) untreated control. Treatment combination were chosen from extensive previous field testing on higher mowed turf stands. However, being closely mowed golf greens, treatments used in this trial are at or below one-half their normal use rate on higher mowed turfgrasses. NIS was added at 0.25% v/v to all treatments and except for Pylex + Speedzone (treatment 5), all other treatments were followed immediately after application with hand calibrated irrigation at 0.25-in. For both trials, only Pylex + Speedzone at 0.25 oz/a + 5 pt/ac, respectively, had TQ below undesirable level (<7) at 3 and 10 DAT, however, all treatments had recovered to ≥7 at 14 DAT. By 14 DAT in both trials, no significant difference (a=0.05) occurred in TQ across all treatments (mean=7.36). This research is the first to suggest that irrigating in certain herbicide combinations on bermudagrass golf greens, allows one to avoid undesirable turfgrass phytotoxicity. This research also identifies possible additional herbicides for POST goosegrass than traditionally used. Future research should include screening not only additional products, but additional combinations of herbicides for a decrease in Pylex bleaching.

Using Vegetation Indexes from Aerial and Ground-Based Sensors to Evaluate Preemergence Herbicide Effects on St. Augustinegrass (*Stenotaphrum secundatum*) Sod Grow-in. AL Wilber*[1], JD McCurdy[2], J Czarnecki[1], D Sullivan[3], B Stewart[1], H Dong[1]; [1]Mississippi State University, Mississippi State, MS, [2]Mississippi State University, Starkville, MS, [3]TurfScout, LLC, Greensboro, NC (61)

St. Augustinegrass (*Stenotaphrum secundatum*) is a commonly produced lawn grass in the southeastern US. Preemergence herbicides, which are applied to sod production fields to prevent annual weed contamination, may also negatively affect sod grow-in. The objective of this study was to evaluate St. Augustinegrass grow-in following preemergence herbicide treatments using aerial and handheld multispectral sensors. Field research was conducted at Mississippi State University as a randomized complete block design with four replications replicated twice in time (2019 and 2020). Ten plugs (232 cm^2 apiece) of 'MSA 2-3-98' St. Augustinegrass were planted in each experimental unit (2.32 m^2) on 12 June 2019 and 14 May 2020. Preemergence herbicide treatments were applied one day after planting with a CO_2 pressurized back-pack sprayer in a water carrier volume of 374 L ha^{-1}. Treatments included a nontreated check, prodiamine, pendimethalin, oxadiazon, *S*-metolachlor, atrazine, atrazine + *S*-metolachlor, and dithiopyr, as well as a treated-check, indaziflam. A Holland Scientific RapidSCAN CS-45 Handheld Crop Sensor (h) and a MicaSense RedEdge-MX sensor (a) attached to an unmanned aerial vehicle (UAV) were used to collect multispectral reflectance data weekly; data were used to calculate plot values of Normalized Difference Vegetation Index (NDVI), Ratio Vegetation Index (RVI), and Chlorophyll Index-Red Edge (CI-RE). Visual percentage cover was also evaluated weekly. Data were regressed and fit to sigmoidal, variable slope curves to estimate days to reach 50% maximum (Max_{50}) nontreated response (GraphPad Prism 9.0.0, GraphPad Software, San Diego, CA). As a means of comparison, 95% confidence intervals were calculated for each estimate. Standard equivalence values (SEQ = slope/root mean square error) were used to compare assessment methodology. In 2019, prodiamine (0.60 kg ai ha^{-1}), pendimethalin (1.66 kg ha^{-1}), oxadiazon G (2.24 kg ha^{-1}), *S*-metolachlor (2.78 kg ha^{-1}), atrazine + *S*-metolachlor (2.24 + 1.74 kg ha^{-1}), dithiopyr (0.42 kg ha^{-1}), and indaziflam (0.033 kg ha^{-1}) increased days to reach 50% visual cover (Cov_{50}) compared to the nontreated. In 2020, prodiamine, *S*-metolachlor, dithiopyr, and indaziflam increased days to reach Cov_{50} compared to the nontreated. Visual data were largely confirmed by index values; for instance: in 2019, prodiamine increased days to reach Max_{50} hNDVI, hCI-RE, and aNDVI compared to the nontreated, while atrazine + *S*-metolachlor increased days to reach Max_{50} hNDVI. In 2020, pendimethalin increased days to reach Max_{50} hNDVI and hRVI, and *S*-metolachlor increased days to reach Max_{50} hNDVI, hRVI, and aNDVI. Dithiopyr increased days to reach Max_{50} hNDVI in 2020, and prodiamine increased days to reach Max_{50} aNDVI in 2020. In both years, indaziflam increased days to reach Max_{50} hNDVI, hRVI, hCI-RE, aNDVI, and aCI-RE. Oxadiazon WSP and atrazine did not increase days to reach Cov_{50} and Max_{50} and can be recommended for preemergence control of annual weeds in St. Augustinegrass grow-in. Based on increased days to reach Cov_{50} and Max_{50} of several indexes, prodiamine, pendimethalin, *S*-metolachlor, and indaziflam (at tested rates) unacceptably impede St. Augustinegrass grow-in, yet future research may justify their use if benefits in weed control outweigh delayed cover. For brevity, SEQ data is not discussed but will be presented. Sensor-based evaluations provided a relatively low resolution and should be accompanied by visual evaluation. We hypothesize that specific indexes are better suited for different relative growth stages and will test that hypothesis in the future. Overall plant health, such as water and nutrient status, can impact reflectance values while not affecting cover and must be considered when using spectral reflectance data. Future

research will explore new vegetation indexes that are more sensitive to changes in the visual cover of turfgrass canopies.

***PPO2* Mutations in *Amaranthus palmeri*: Implications on Cross Resistance.** P Carvalho-Moore*[1], G Rangani[1], M Machado Noguera[1], DA Findley[2], S Bowe[2], N Roma-Burgos[1]; [1]University of Arkansas, Fayetteville, AR, [2]BASF Corp., Research Triangle Park, NC (62)

For many years, farmers have used protoporphyrinogen IX oxidase (PPO) inhibiting herbicides as a tool to control Palmer amaranth (*Amaranthus palmeri* S. Wats.) populations resistant to glyphosate and/or acetolactate synthase-inhibitors. The repeated use of PPO herbicides imposed a high selection pressure towards PPO-resistant individuals. Resistance to PPO herbicides is mainly due to target-site mutations. Even though PPO mutations are well surveyed in Palmer amaranth, the effect of each mutation on the cross-resistance pattern is not yet known. Therefore, this study aimed to evaluate the response to multiple PPO-inhibiting herbicides of PPO-resistant Palmer amaranth harboring the *ppo2* mutations *?G210* and *G399*, separately or combined in the same plant. Prior to conducting the cross-resistance assay, selected field accessions (one susceptible and six resistant) were subjected to a dose-response assay with fomesafen. Some survivors from different fomesafen doses were genotyped to characterize the mutation profile. After determination of the level of resistance to fomesafen, cross-resistance assay was conducted with the labeled doses of flumioxazin (71.5 g ai ha^{-1}), carfentrazone (280 g ai ha^{-1}), fomesafen (280 g ai ha^{-1}), saflufenacil (25 g ai ha^{-1}), and trifludimoxazin (30 g ai ha^{-1}). The experiment was conducted twice with four replications per treatment. The experimental unit was a square pot, 11 x 11 cm, filled with commercial potting soil with four (in the first run) or five (in the second run) plants. Therefore, each accession had 16 and 20 total plants tested for the first and the second run, respectively. At 3 wk after treatment, mortality (%) was assessed. Mortality data were analyzed by herbicide by accession using JMP Pro v. 15 (SAS Institute, Cary, NC). Treatment means were compared using Student's t test ($p < 0.05$). The predicted fomesafen dose to control 50% of the population (LD50) ranged from 13 to 171 g ai ha^{-1} among the accessions classified as resistant. The accession with higher predicted LD50 had a higher frequency of *?G210*-homozygous survivors. Compared to the other mutation patterns, survivors accumulating mutations or *?G210*-homozygous were less injured at the highest fomesafen rate tested in the dose-response test. Palmer amaranth control with the PPO herbicides tested was as follows: flumioxazin < carfentrazone = fomesafen < saflufenacil < trifludimoxazin. The populations with a high number of *?G210*-homozygous survivors and with individuals accumulating *?G210+G399A* mutations exhibited high potential for cross-resistance to other PPO herbicides. The new PPO-inhibitor chemistries are good tools to integrate into management programs for PPO-resistant Palmer amaranth.

Effective SOA: an App to Facilitate Selection of Diverse Herbicide Sites of Action. ML Flessner*[1], MV Bagavathiannan[2], K Pittman[1], D Hathcoat[3], S Mirsky[4]; [1]Virginia Tech, Blacksburg, VA, [2]Texas A&M University, College Station, TX, [3]Texas A&M AgriLife Research, College Station, TX, [4]USDA- ARS, Beltsville, MD (63)

Applications that include multiple, effective herbicide sites of action (SOA) decrease the risk of herbicide resistance (HR) development and in many cases increases effectiveness. But it can be difficult and time-consuming for farm decision makers to know which herbicides are truly effective on which weeds and how many effective SOA are being applied to each weed. Therefore, we are developing an app to facilitate this process. A herbicide may not be effective due to either tolerance or resistance. To determine HR within the app, a user can input their own HR status, including no known HR, or opt to use the app's internal county-by-county database of HR, which was created from a survey of extension specialists and other experts. Herbicide tolerance is determined in two steps. First, the herbicide product must deliver an effective rate, which is set 75% of the minimum rate of the single active ingredient product. For example, the flumioxazin rate in Envive (flumioxazin + thifensulfuron + chlorimuron) must be at least 75% of the minimum rate for Valor SX (flumioxazin) to be considered effective. If the rate is sufficient, the app consults an internal efficacy table, compiled from various extension guides from across the eastern US. A herbicide is considered effective if its efficacy rating is 80% control or better. App users input information in 5 steps: (1) state and county, (2) crop (corn, soybean, or cotton) with herbicide tolerant trait, (3) weeds (selecting up to 3 of 9 driver weeds in the app), (4) herbicide resistance status (discussed above), and (5) herbicides applied. Within herbicides applied, a user can select up to 5 herbicides within burndown, preemergence, and postemergence. Results are tabulated within application timing and display both the total number of effective SOA and which herbicides are effective for each weed. Users can also link to information on why a herbicide was not effective. The app greatly simplifies identifying effective SOA, which we believe will increase use of best practices to mitigate herbicide resistance.

2020 Survey Results for the Most Common and Troublesome Weeds in Grass Crops, Pasture and Turf. L Van Wychen*[1], LC Hand[2]; [1]Weed Science Society of America, Alexandria, VA, [2]University of Georgia, Tifton, GA (64)

The 2020 Weed Survey for the U.S. and Canada surveyed the most common and troublesome weeds in the following grass crops: 1) corn (*Zea mays*); 2) rice (*Oryza sativa*); 3) sorghum (*Sorghum bicolor*); 4) turf; 5) pastures, rangeland, or other hay; 6) spring cereal grains; and 7) winter cereal grains. Common weeds refer to the weeds you most frequently see while troublesome weeds are the most difficult to control, but they might not be widespread. There were 317 total survey responses from the U.S. and Canada, of which 106 were from the following Southern Weed Science Society (SWSS) states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. The following weed survey results are for the 14 states in the SWSS region. The top three most common and troublesome weeds in corn were 1) *Ipomoea spp.*; 2) Palmer amaranth (*Amaranthus palmeri*); and 3) johnsongrass (*Sorghum halepense*). The top two most common and troublesome weeds in rice were 1) *Cyperus spp.*; and 2) *Echinochloa spp*. The top three most common weeds in sorghum were 1) *Ipomoea spp.*; 2) Palmer amaranth; and 3) a tie between johnsongrass and *Urochloa spp.* and the most troublesome weeds were: 1) *Urochloa spp*., 2) johnsongrass; and 3) Palmer amaranth. The top three most common weeds in turf were 1) *Digitaria spp*.; 2) annual bluegrass (*Poa annua*); and 3) *Cyperus spp.* and the most troublesome weeds were: 1) *Paspalum spp*., 2) annual bluegrass; and 3) Virginia buttonweed (*Diodia virginiana*). The top three most common weeds in pastures, rangeland, and other hay were 1) *Cirsium/Carduus spp*.; 2) *Ranunculus spp*.; and 3) horsenettle (*Solanum carolinense*) and the most troublesome weeds were a four way tie among: *Cirsium/Carduus spp*.; horsenettle; knotroot foxtail (*Setaria parviflora*); and smutgrass (*Sporobolus indicus*). The top three most common weeds in winter cereal grains were 1) Italian ryegrass (*Lolium perenne L. ssp. multiflorum*); 2) *Lamium spp.*; and 3) common chickweed (*Stellaria media*); and the most troublesome weeds were: 1) Italian ryegrass; 2) henbit (*Lamium amplexicaule*); and 3) a tie between horseweed (*Erigeron canadensis*) and annual bluegrass. The top three most common weeds among all grass crops in the SWSS region were 1) *Digitaria spp*.; 2) Italian ryegrass; and 3) *Ipomoea spp*. and the most troublesome weeds were: 1) Italian ryegrass; 2) Palmer amaranth; and 3) *Ipomoea spp.* The 2020 weed survey data is available at: www.wssa.net/wssa/weed/surveys/.

The Evaluation of Herbicidal Control for King Ranch (*Bothriochloa ischemum*) and Kleberg Bluestems (*Dichanthium annulatum*). MB McCutchen*[1], AM Umphres[2]; [1]Texas A&M University-Kingsville, Corpus Christi, TX, [2]Texas A&M University-Kingsville, Kingsville, TX (65)

King Ranch (KR; *Bothriochloa ischemum*) and Kleberg bluestem (*Dichanthium annulatum*) were once established in rangelands for hay production and erosion control, but now are dominating more productive plant communities. This study evaluated fifteen herbicide treatments, rates, and timings for the long-term management of these invasive grasses. The field trial was conducted in Banquete, TX during 2019. The treatments were arranged in a randomized complete block design with three replications of each treatment and one nontreated control (NTC). Bluestem density counts were conducted using a 0.3 m^2 square 3 times in each plot bi-weekly. Herbicide applications were made at three timings Spring (A), Summer (B), and Fall (C). At 49 days after application A (DAA) there was a decrease in bluestem density compared to the NTC of 80.42% from the treatment with imazapyr (0.34 kg ae ha^{-1}) + glyphosate (1.26 kg ae ha^{-1}). At 47 DAB there was a 55.3% decrease from pendimethalin (2.77 kg ai ha^{-1}) + glyphosate (1.26 kg ae ha-1; A, B). At the final evaluation, 25 DAC, the treatments of indaziflam (73.12 g ai ha^{-1}; A) + glyphosate (1.26 kg ae ha^{-1}; A, B, C) had a 79.40% decrease in bluestem density. During the Spring, Summer, and Fall application timings, single applications of nicosulfron + metsulfron-methyl (1.5, 1 and 0.5 oz ai ha^{-1}) and imazapyr (0.34 kg ae ha^{-1}) followed by glyphosate (1.26 kg ae ha^{-1}; A, B, C) proved to have reduced efficacy on these bluestems. This study found the use of a preemergent, such as indaziflam or pendimethalin, followed by sequential applications of glyphosate (1.26 kg ae ha^{-1}) can provide season-long management of KR and Kleberg bluestems.

Reproductive Biology of Cuban Bulrush (*Cyperus blepharoleptos*). J Jablonski*, C Prince, SF Enloe, G Macdonald, B Sperry; University of Florida, Gainesville, FL (66)

Cuban Bulrush, *Cyperus blepharoleptos* Steud., is an aquatic invasive sedge that has a range of distribution across the southeastern United States. There are limited descriptions of Cuban bulrush seed biology and potential for vegetative reproduction in the current literature. Here we evaluated the seed viability, germinability, and potential for regeneration from stolon fragments of Cuban bulrush. Seed viability was established using tetrazolium chloride assays. Two-month-old Cuban Bulrush seed had 39% viability when embryos were pierced and then stained under 37C for 12 hours without light. Germinability was established in controlled environments (30/25C and 12hr diurnal fluctuation) under exogenous application of two pre-treatments: deionized water and potassium nitrate. Germination was 1% and 4% for two-month-old seed treated with either deionized water or potassium nitrate, respectively. Vegetative reproduction was evaluated in a greenhouse experiment using a range of stolon sizes (1,2,3, and 4 nodes) under two hydrological conditions (floating in 8cm of water or buried 2-3cm beneath the soil), determined by shoot number or shoot height. Hydrology, either flooded or soil covered fragments, played a significant role in the capacity for stolon pieces to generate new shoots with higher shoot numbers emerging from flooded hydrology. Understanding the seed biology and propagule survival capacity will allow for more effective and targeted approaches to management of the species.

Detecting 2,4-D Injury Using an Unmanned Aerial System. U Torres*[1], PA Dotray[2], KR Russell[1], W Guo[3], MM Maeda[4]; [1]Texas Tech University, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas Tech University and Texas A&M AgriLife Research, Lubbock, TX, [4]Texas A&M AgriLife Extension, Lubbock, TX (68)

The use of auxinic herbicides like 2,4-dichlorophenoxyacetic acid (2,4-D) allows cotton growers to use a novel herbicide mode of action to control glyphosate resistant Palmer amaranth (*Amaranthus palmeri* S. Wats). Although this herbicide has been effective at controlling small weeds postemergence, off-target movement of 2,4-D is problematic to non-target cotton varieties. Cotton is highly sensitive to 2,4-D at very low rates and visible symptomology will be apparent within a few hours after exposure. With the use of unmanned aerial systems (UAS), information can be collected that will aid in detecting the extent and severity of off-target herbicide movement. Research was conducted at the Texas Tech New Deal Research Farm near Lubbock, TX to detect low rates of 2,4-D injury in cotton using UAS-based multispectral imagery. Treatments included five low rates of 2,4-D (1.07 g ae ha^{-1}, 2.14 g ae ha^{-1}, 10.7 g ae ha^{-1}, 21.4 g ae ha^{-1}, 107 g ae ha^{-1}), the full labeled rate of 2,4-D (1070 g ae ha^{-1}), and a non-treated control. Herbicides were applied with a CO_2 pressurized backpack sprayer to DP 1822XF, a non-2,4-D tolerant cotton at first square plus two weeks. Weekly flights at an altitude of 30 meters were conducted starting at the day of application. Several vegetation indices were applied to the multispectral imagery and differences between treatments were assessed with and without the soil background at three spatial resolutions (1.3 cm $pixel^{-1}$, 5.2 cm $pixel^{-1}$, and 10.4 cm $pixel^{-1}$). The highest rate of 2,4-D caused the greatest cotton injury and all vegetation indices with p-values less than 0.05 showed differences between the highest rate and the other treatments. Differences between the non-treated control, the low rates and the full rate were observed with the vegetation indices starting at 15 days after application. Similar results were observed with all three spatial resolutions for all indices at 15 days after application. Injury in the treated plots increased as the cotton continued to grow after herbicide exposure, resulting in greater differences between treatments later in the season.

Determining the Optimal Light Conditions and Camera Parameters for Effective Weed Detection in Digital Images Using Artificial Neural Networks. C Hu*[1], BB Sapkota[1], JA Thomasson[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Mississippi State University, Starkville, MS (69)

Recent computer vision techniques based on convolutional neural networks (CNNs) are considered as state-of-the-art tools in weed mapping. However, their performance has been shown to be sensitive to image quality degradation. In addition, variation in light conditions adds another level of complexity to weed mapping. We focus on determining the influence of image quality and light consistency on the performance of CNNs in weed mapping by simulating the image formation pipeline. Mask R-CNN is used as a CNN example for object detection and instance segmentation while semantic segmentation is represented by Deeplab-v3. The image quality degradations simulated in this study include resolution reduction, overexposure, Gaussian blur, motion blur, and noise. The results show that the CNN performance is most impacted by resolution, regardless of plant size. Mask R-CNN is moderately tolerant to low levels of overexposure, Gaussian blur, motion blur, and noise. Deeplab-v3, on the other hand, tolerates overexposure, motion blur, and noise at all tested levels. Light inconsistency also reduces CNN performance. Increasing the diversity of light conditions in the training images may alleviate the performance reduction but does not provide the same benefit from the number increase of images with the same light condition. These results provide insights into the impact of image quality and light consistency on CNN performance. Also, the quality threshold established in this study can be used to guide the selection of camera parameters in future weed mapping applications.

Does Florpyrauxifen-benzyl Volatilize When Applied to Rice Foliage, Bare Soil, or Open Water? DC Walker*[1], E Webster[2], DO Stephenson, IV[3], SY Rustom[1], C Webster[1], B Greer[2], JA Williams[1]; [1]Louisiana State University AgCenter, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA, [3]Louisiana State University AgCenter, Alexandria, LA (70)

Does Florpyrauxifen-benzyl Volatilize when Applied to Rice Foliage, Bare Soil or Open Water? Walker D.C., Webster E.P., Stephenson D.O., Rustom S.Y., Webster L.C., Greer W.B., Williams J.A. Florpyrauxifen-benzyl is a new synthetic auxin herbicide that has activity on select broadleaf, grass, sedge, and aquatic weeds in rice (*Oryza sativa* L.). With the introduction of a new synthetic auxin also comes an increase in risk for off-target movement of this herbicide. Similar herbicides of the synthetic auxin group such as dicamba and 2,4-D have shown to volatilize and be subject to vapor drift under certain environmental conditions. Furthermore, florpyrauxifen is often applied to rice fields that neighbor susceptible vegetation like soybean [*Glycine max* (L.) Merr.] and poses an increased risk of off-target damage. Therefore, the potential volatility of florpyrauxifen was evaluated when applied to rice foliage, bare soil and open water using soybean as a bioindicator to measure distance moved. To induce high humidity and steady wind speeds, a 6.1 m wind tunnel was placed in the middle of two, 15.2 m long, 96.5 cm spaced rows of soybean. Treated flats of either rice foliage, bare soil, or open water were placed in the center of the plots, in the wind tunnel for 48 hours after application. Flats were then removed, and soybean visual injury and plant height was recorded in one-foot increments from the center of the plot at 7, 14, 21 and 28 DAT. At crop maturity, individual soybean yield components were recorded to determine how vapor drift of florpyrauxifen affected vegetative and reproductive growth of soybean. Results indicate that florpyrauxifen, unlike other synthetic auxins, is not susceptible to volatilization after application and moved no more than 61 cm regardless of the substrate it was applied to and visual injury was only evident 7 DAT. Furthermore, there was no difference in individual yield components between treatments, suggesting that while there have been instances of off-target movement of florpyrauxifen to soybeans, it is not due to volatilization but instead, physical spray droplet movement.

Evaluation of an RTK-GPS Enabled Herbicide Spray Drone for Site-specific Management of Johnsongrass. M Kutugata*[1], DE Martin[2], C Hu[3], BB Sapkota[3], MV Bagavathiannan[3]; [1]Texas A&M, College Station, TX, [2]United States Department of Agriculture, College Station, TX, [3]Texas A&M University, College Station, TX (71)

This study was designed to evaluate the efficacy of a remotely piloted aerial application system (RPAAS) for the site-specific application of herbicide. Results from the RPAAS were compared to those from a CO_2-pressurized backpack sprayer. Two types of herbicide were used on late-season johnsongrass (*Sorghum halepense*), glufosinate at 2.12 L · ha^{-1} plus 1% ammonium sulfate and 1% crop oil concentrate and glyphosate at 2.34 L · ha^{-1} application rates. Weeds were first geolocated using a hand-held real-time kinematic (RTK) global navigation satellite system receiver then uploaded to the RPAAS flight controller coupled with onboard RTK. Applications of glyphosate by RPAAS were similar or more effective than backpack sprayers in causing weed damage both 10 and 20 days after application. RPAAS applications, however, were more sensitive to wind which increase lateral and longitudinal nozzle movement and reduced spray deposition, an especially important factor for contact herbicides like glufosinate. Results indicate that a RPAAS is an effective method for the site-specific management of late-season johnsongrass.

Acuron GT: A New Option for Broad Spectrum Weed Control in Corn. BD Black*[1], RD Lins[2], TH Beckett[3], M Kitt[3]; [1]Syngenta Crop Protection, Searcy, AR, [2]Syngenta Crop Protection, Rochester, MN, [3]Syngenta Crop Protection, Greensboro, NC (72)

Acuron® GT is a new herbicide coming soon from Syngenta for weed control in glyphosate tolerant field corn. Acuron GT will contain S-metolachlor, mesotrione, bicyclopyrone and glyphosate for postemergence application with knockdown and residual control of grasses and broadleaves. In 2020, field and greenhouse trials were conducted to evaluate Acuron GT for weed control and crop tolerance. Results show that Acuron GT effectively controls many difficult weeds and provides improved residual control and consistency compared to other commercial standards. Acuron GT is not registered for sale or use in the US and is not being offered for sale.

Precision Herbicide Applications for Broadleaf Weeds in Strawberry. N Boyd*[1], A Schumann[2], SM Sharpe[3]; [1]University of Florida, Balm, FL, [2]University of Florida, Lake Alfred, FL, [3]Agriculture and Agri-Food Canada, Saskatoon, SK, Canada (74)

Broadleaf weeds such as Carolina geranium (*Geranium carolinianum*) occur in non-uniform patches in commercial strawberry fields. When they emerge in planting holes they reduce berry yields, hinder harvest efforts, and increase labor costs. Clopyralid can be applied over the top of strawberry plants for selective control of some species. The application of clopyralid only where weeds occur would reduce herbicide usage and minimize risk. Field trials were conducted at the Gulf Coast Research and Education Center in Wimauma, Florida, to evaluate smart spray technology equipped with artificial neural networks trained to detect Carolina geranium in a strawberry canopy. Weed detection accuracy ranged from 70-78% and increased with the use of supplemental lighting. Precision sprays compared with banded applications used 50-69% less spray volume. Field trials have proven that broadleaf weeds within a strawberry canopy can be selectively targeted using smart spray technology.

Residual Weed Control with Preemergence Herbicides as Affected by Adjuvants. K Kouame*, J Coetzee, P Carvalho-Moore, M Machado Noguera, IS Werle, N Roma-Burgos; University of Arkansas, Fayetteville, AR (75)

As weed resistance to herbicides of different sites of action continues to rise in the United States and worldwide, proper use of residual herbicides has been strongly recommended to complement foliar herbicides. Generally, soil-applied herbicides 'break' in three to four weeks. Prolonging the period of effective residual activity is highly beneficial. Certain adjuvants may be able to accomplish this. A field experiment was conducted at the University of Arkansas Vegetable Research Station, Kibler, to evaluate the influence of adjuvants on the residual control of weeds by preemergence herbicides. A factorial experiment was conducted with herbicide (Factor A) at two levels (Sharpen and Authority MTZ) and adjuvant (Factor B) at 6 levels (None, OR-079-B, OR-369-A, OR-298-D, Grounded, Captis). Two nontreated controls were included. The treatments were arranged in a randomized complete block design with six replicates. The herbicides were sprayed using a CO_2 pressurized backpack sprayer at 20 GPA. The treatments were sprayed on bare soil and sprinkler-irrigated ½ inch within 48 h. Overall weed control and weed emergence were quantified at 28 and 49 DAT. Data were analyzed using the Glimmix procedure within SAS 9.4 and means separation was done using the lsmeans statement. Results showed no two-way interaction and no significant effect of adjuvant 28 DAT. Pooled across adjuvants Authority MTZ provided better overall control (98±0.5%) than Sharpen (88±0.5%). However, there was a significant two-way interaction ($p<0.1$) at 49 DAT and both herbicide and adjuvant had a significant effect on overall weed control. All adjuvants improved the residual activity of Sharpen, but did not matter for Authority MTZ of which efficacy ranged between 92 and 97%.

Sequencing of the Acetyl CoA Carboxylase (*ACCase*) Gene in Resistant Barnyardgrass (*Echinochloa crus-galli*) Populations. F Gonzalez Torralva*[1], JK Norsworthy[2], LB Piveta[2]; [1]Universtiy of Arkansas, Fayetteville, AR, [2]University of Arkansas, Fayetteville, AR (76)

Barnyardgrass is the globally considered the most troublesome weed of rice production systems. Several barnyardgrass accessions have evolved resistance to many herbicides with different sites of action. In the US, accessions with low susceptibility to PSII, synthetic auxins, ACCase, lipid inhibitors, and cellulose inhibiting-herbicides have been reported. The goal of this research was to describe the presence of target site mutations in two ACCase-resistant barnyardgrass accessions collected in Arkansas. For that purpose, genomic DNA was extracted from resistant (R1 and R2) and susceptible (S) accessions. A set of primers were designed to amplify 1.6 kb of the *ACCase* gene. PCR and gel electrophoresis were carried out following standard protocols, and samples purified and sequenced accordingly. Comparison of the nucleotides and their predictive protein among accessions displayed no amino acid substitution in any of the positions reported previously or in the rest of the sequences obtained. In the accessions analyzed, results showed that target site mutations are unlikely to be involved in resistance to several ACCase-inhibiting herbicides, suggesting the presence of non-target site resistance mechanisms are likely.

Quantifying Herbicide Dissipation in Georgia Pecan Soils. KM Eason*, TL Grey, L Wells; University of Georgia, Tifton, GA (77)

Pecan production continues to increase in the United States as exports to foreign markets stimulate the crop's value. Georgia remains the largest pecan producing state in the United States, accounting for over 30% of all planted hectares. After hurricane *Michael* in 2018 destroyed trees in the highest production area of Southwest Georgia, growers immediately began to trigger replants. Increased demand and value coupled with replanting destroyed groves can lead to the exposure of newly planted trees to herbicides applied in previous seasons that are currently not labeled for non-bearing trees. The extent of persistence and behavior in soil of residual herbicides labeled for use in pecan has not been fully evaluated, therefore field experiments were conducted to establish half-lives (DT_{50}) for several residual herbicides commonly used in Georgia pecan production. Field studies were conducted from 2016-2018 at two locations (Webster and Sumter County, Georgia) using indaziflam (0.07 kg ai/ha), flumioxazin (0.22 kg ai/ha), and rimsulfuron (0.07 kg ai/ha). Soil cores were collected at various sample timings and stored at -10°C until analysis. Samples were analyzed using a Waters™ ACQUITY Arc UHPLC System coupled with a Waters™ PDA UV Detector and Waters™ QDa Mass Spectrometry Detector using various chromatographic conditions for each respective herbicide. The DT_{50} for indaziflam, flumioxazin, and rimsulfuron was 64, 15, and 2 days, respectively. Indaziflam persisted the longest, while rapid dissipation was observed for rimsulfuron. From these data, it was concluded that there is minimal risk of carry-over injury with less residual weed control to new trees from rimsulfuron and marginal risk with greater residual weed control from indaziflam and flumioxazin. Georgia pecan growers can use this information to make viable weed control decisions in long-term and newly replanted groves.

Crossroads: the Intersection of Herbicide Resistant Weed Control, Tillage, and Soil Quality. AJ Price*[1], A Gamble[2]; [1]USDA-ARS-NSDL, Auburn, AL, [2]Auburn University, Auburn, AL (78)

Agricultural producers and scientists have long recognized both beneficial and detrimental aspects of soil tillage. With the development and adoption of herbicide-resistant crops, particularly glyphosate-resistant crops, herbicides such as glyphosate replaced the need for tillage either before or after crop planting. Thus, tillage has become less important for weed management and has been a primary enabler for the success of the majority of conservation production systems. Currently, herbicide-resistant and troublesome weeds are continually challenging agricultural decisions throughout the world. Conservation tillage hectarage are at constant risk of being converted to higher-intensity tillage systems due to lack of weed control. The shift to higher-intensity tillage facilitates burial of weed seed through use of inversion tillage and/or use of surface tillage to facilitate preplant incorporated herbicides for control of herbicide resistant or troublesome weeds, especially in non-irrigated production. For example, Palmer amaranth (*Amaranthus palmeri*) has become the dominant weed problem in United States row crop production because of evolved resistance to glyphosate. Inversion tillage was clearly demonstrated to be an effective tool in helping the management of this weed. However, there is no question that most tillage operations promote soil loss, adversely affect (lower) surface water quality, and negatively impact soil productivity. Depending on the severity of the herbicide-resistant or troublesome weed infestation, multiple strategies involving integration of cultural as well as chemical weed control will be needed to overcome the need for tillage. Utilizing high biomass conservation tillage systems, such as those used extensively in South America and introduced to the United States, can help reduce the emergence of weeds by suppressing weed germination and growth. When the winter cover crop is planted early and managed for maximum growth, a dense mat is formed on the soil surface. Because weed emergence and growth are suppressed by the physical barrier and shading provided by the residue, more residue results in increased weed control. In addition, conservation tillage systems that minimize soil disturbance (direct seeding or minimum tillage) can help reduce weed seed germination. In addition, allelopathy plays a role in weed suppression, however quantifying allelopathic effects in applied research is rarely accomplished. Creative research programs have been developed that meet conservation compliance requirements and at the same time judiciously use tillage as an element for management of this species. Similar programs are needed to help manage other herbicide resistant or troublesome weed species in other regions and cropping systems. Further research is critically needed in instances when few or no other options are available to ensure the economic viability of farming operations while addressing long-term soil quality concerns.

Seed Viability of Barnyardgrass (*Echinochloa crus-galli*) as Influenced by Different Rice Herbicides and Hormones Applied During Reproduction. I Ceperkovic*[1], J Samford[2], X Zhou[3], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Research, Eagle Lake, TX, [3]Texas A&M University, Beaumont, TX (79)

Barnyardgrass is the most problematic weed species in southern US rice, and minimizing seedbank addition is critical for effective long-term management of this species. Herbicide applications made during mid- to late-season help minimize crop yield loss from barnyardgrass and other weeds that were left uncontrolled from earlier applications, but a substantial proportion of them may have already transitioned to reproduction by that point. While herbicides provide marginal control of these weeds due to large sizes, their impact on seed viability is unknown. Experiments were conducted in Eagle Lake, TX to determine the effect of 11 different chemicals (herbicides and hormones) applied at three different stages of reproduction on barnyardgrass seed viability. The field study was arranged in a split-plot design with four replications. Spray treatments consisted of eight POST herbicides applied at recommended label rates [cyhalofop-butyl (285 g ai ha-1), imazamox (120 g ai ha-1), propanil (479 g ai ha-1), quinclorac (180 g ae ha-1), fenoxaprop-p- ethyl (70 g ai ha-1), penoxsulam (240 g ai ha-1), bispyribac- sodium (38 g ai ha-1), florpyrauxifen-benzyl (25 g ai ha-1)], and two hormones [abscisic acid (ABA, 0.0072%) and gibberellic acid (GA, 0.08%)]. The three reproductive growth stages at application include 50% of open flowers (stage 1), 50% seed development (stage 2), and 100% seed maturity (stage 3). All applications were made using a backpack sprayer fitted with four XR110015 nozzles, calibrated to deliver 140.3 L ha-1 at 276 kPa pressure, traveling at a speed of 1.3 m s-1. Panicles were tagged at application and harvested at 21 days after treatment (DAT). Germination and tetrazolium tests were performed to determine seed viability. Among the three stages, the stage 1 exhibited the most impact, with penoxsulam causing the greatest reduction in seed viability at 26%. Among the herbicides, propanil showed consistently high impact on barnyardgrass seed viability across the application stages. More research with additional environments are necessary to validate the findings. Overall, preliminary findings show that late-season application of certain rice herbicides have significant impact on barnyardgrass seed viability, which can be an added benefit, but the economic and long-term biological implications of these herbicide applications, if they are specifically targeted to reduce seed viability, is yet to be determined.

Understanding Seedling Emergence Patterns of *Poa annua* in Two Climatic Zones in Texas.

AW Osburn*[1], MV Bagavathiannan[1], R Bowling[2]; [1]Texas A&M University, College Station, TX, [2]Texas A&M University, Dallas, TX (80)

Annual bluegrass (*Poa annua* L.) is one of the most problematic winter annual weeds in various turfgrass systems across the country, severely increasing management costs and greatly reducing the aesthetic value of these systems. A sound understanding of weed seedling emergence pattern allows for appropriate timing of management interventions, yet this knowledge is limited for annual bluegrass in Texas. To document annual bluegrass seedling emergence pattern, experiments are being conducted over multiple growing seasons between the fall of 2019 and the spring of 2022 in two different USDA climatic zones, 4 and 5, in Texas. For this purpose, artificial annual bluegrass seedbanks (8 replications of 1 m^2 quadrats) were established in each location in a turf field area cleared of any vegetation. Seedling emergence is evaluated on a biweekly basis throughout the year by counting and removing emerged seedlings till seedlings cease to emerge any further. Artificial seedbanks were replenished on an as-needed basis. Additionally, corresponding weather parameters such as soil temperature and moisture are measured at a depth of 5 cm using sensors installed on the site. Preliminary results from two Texas locations are presented from the fall of 2019 through the fall of 2020. Between fall of 2019 and spring of 2020, one large fall germination event was observed at the zone 4 location with 95% emergence observed within 9 weeks of initial germination. Conversely, the zone 5 location had two large germination events with 95% emergence observed within 19 weeks of initial germination counts. The preliminary results of this study indicate that variability in environmental conditions lead to differential seedling emergence events; effective pest management programs will benefit from timely preemptive applications based on local environmental conditions.

Tolerance of Cotton Chromosome Substitution Lines to 2,4-D: a Dose-response Study. W Daróz Matte*[1], LM Perez[2], SL Saha[3], J Ferguson[2], T Tseng[2]; [1]Maringá State University, Maringá - Paraná State, Brazil, [2]Mississippi State University, Mississippi State, MS, [3]USDA-ARS, Mississippi State, MS (81)

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

Response of Italian Ryegrass (*Lolium multiflorum*) to Temperature, CO_2, and Drought Stress. A Maity*[1], S Singh[1], V Cieza[2], Z Vasic[3], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Federal University of Pelotas, Pelotas, Brazil, [3]University of Belgrade, Belgrade, Serbia (82)

The impact of climatic scenarios such as high temperature, elevated CO_2 concentrations, and soil moisture stress on weed growth and development are not well understood. In this study conducted under controlled growth chamber conditions, we examined the effect of two air temperature regimes, 25°/20°C and 30°/25°C day/night; two atmospheric CO_2 concentrations, 400 ppm and 700 ppm; and two levels of soil moisture, 100% and 25% of field capacity, on plant morphological and reproductive traits of six Italian ryegrass (*Lolium multiflorum*) populations collected from the Texas Balcklands wheat production region. Results indicated that increased temperature conditions significantly increased leaf, tiller and spike count/plant, however decreased plant height, flag leaf length, flag leaf sheath length, spike length, spikelet count/spike, seed filling (%), and seed yield/plant. Elevated CO_2 increased plant height, flag leaf length, flag leaf sheath length, root length, and seed shattering (%) (especially at current temperature level), but decreased shoot dry biomass, seed count/spike, seed filling (%) (especially at current temperature level) and seed dormancy (%). Soil moisture level increased shoot dry biomass (especially at current CO_2 level), root dry biomass (especially at current temperature), and seed filling (at current CO_2 level), however reduced spike count/plant (especially at high temperature and CO_2). Significant interactions were observed among the stressor factors for various traits. Among them, temperature*CO_2 interaction was the most impactful, influencing reproductive traits more so than the vegetative traits measured. Findings provide novel insights into likely changes in ryegrass demographic parameters under future climatic scenarios.

Characterization of F_1 Progenies Derived from Interspecific Hybridization Between *Sorghum bicolor* and *S. halepense*.

UR Pedireddi*[1], C Sias[1], S Ohadi[2], NK Subramanian[1], G Hodnett[1], W Rooney[1], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]University of California, Davis (83)

Hybridization between crop sorghum and its weedy relative johnsongrass has significant agronomic and environmental implications. The persistence of the F_1 hybrid progenies under field environments can be governed by various morphological and reproductive traits. Experiments were conducted at the Texas A&M field research facility near College Station, TX to characterize the F_1 progeny originating from crosses between various grain sorghum parental lines and johnsongrass and in the opposite direction between johnsongrass and grain sorghum. A total of 10 morphological traits were characterized as of yet, including plant height, stem diameter, number of internodes, internodal length, number of tillers, width of the flag leaf, number of panicles/plant, length of panicle, number of rhizomatous shoots, and length of the longest rhizome. F_1 progenies derived from both maternal genetic backgrounds showed significant growth differences under field conditions. The results also indicated that there were great variation for these morphological traits among the hybrid progenies within the same parental background and ploidy type. In general, the tetraploid progenies were more robust and aggressive compared to the triploid progenies. Moreover, most of the triploid progenies did not survive the winter. The number of tillers and rhizomatous shoot production were in the increasing order of triploids, tetraploids, pentaploids, and hexaploids. On an average, the production of rhizomatous shoots was greater in the crosses with johnsongrass as the female parent compared to those with grain sorghum as the maternal parent. More research is ongoing to better understand competitive differences and persistence of different hybrid progenies.

Characterization of Sicklepod Extract as a Deer Repellent and Insecticide for Soybean Looper (Lepidoptera: Noctuidae). Z Yue*[1], CL Cantrel[2], N Krishnan[3], DJ Lang[1], M Shankle[4], TP Tseng[1]; [1]Mississippi State University Plant and Soil Sciences, Mississippi State, MS, [2]USDA ARS Natural Products Utilization Research Unit, Oxford, MS, [3]Mississippi State University Biochemistry, Molecular Biology, Entomology & Plant Pathology, Mississippi State, MS, [4]Mississippi State University Plant and Soil Sciences, Verona, MS (84)

Insects and deer (*Odocoileus virginianus*) are two main pests of soybean (*Glycine max* L.) production in the US. The annual deer damage on row crop was estimated around $4.5 billion in the US . The annual soybean insect losses were estimated around $3.9 billion in the US. Sicklepod, (*Senna obtusifolia* L.), one of the top ten trouble weeds in agriculture in the southeast of US, was used to prepare an extract that has both deer repelling and insect antifeedant effects. New formulations of sicklepod extracts were made to test deer browsing and insect feeding effects on soybean looper *Chrysodeixis includens* (Walker) (Lepidoptera: Noctuidae), one of the top three most economically damaging insects in the midsouth of US. For deer browsing, the deer repelling effects of 2019 were Liquid Fence (LF) > Sicklepod > Hinder, where LF and Hinder were commercial deer repellents. The results of spring 2020 were LF = Sicklepod > Hinder and those of fall 2020 were Sicklepod > LF > Hinder. All the results were on statistical basis and reflected the improvement of the extract. For insect feeding effects, the sicklepod extract was fractionated into five fractions of A, B, C, D, E by a column. Soybean loopers fed with leaves treated with 2000 ppm water-based dispersions of the five fractions, respectively, for five days. The looper wet biomass gains were in negative correlation with the anthraquinone concentrations of the fractions, indicating anthraquinones were the active ingredient of the sicklepod extract. In addition, four formulations of sicklepod extracts were prepared and tested by soybean loopers. Soybean loopers were fed by Roundup Ready soybean leaves treated with the four extracts, respectively, for five days. The wet biomass gain of the treated leaf-fed loopers were between 1/2 to 1/3 of that of the untreated leaf-fed loopers. Hence, the newly formulated sicklepod extract is an effective deer repellent and insect antifeedant with anthraquinones as the active ingredients.

Evaluation of Acetochlor for Weed Control in Rice. TH Avent*, JK Norsworthy, LB Piveta, MC Castner, JW Beesinger; University of Arkansas, Fayetteville, AR (86)

The evolution of clomazone-resistant barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] has driven Arkansas rice producers to pursue alternative sites of action for improved residual control early in the growing season. Acetochlor is a chloroacetamide herbicide which has demonstrated control of barnyardgrass, weedy rice (*Oryza sativa* L.), and other weedy grass species in rice. Acetochlor is currently not labeled in rice, partly due to variability in rice tolerance and stand loss at early application timings. Therefore, research was conducted to pursue a herbicide safener to use as a seed treatment to mitigate rice injury from chloroacetamides. To determine the weed control expectations provided by acetochlor and evaluate the safening effects of the seed treatment, field trials were conducted at the Rice Research and Extension Center near Stuttgart, AR in the spring of 2020. The experiment was a three-factor randomized complete block design which included a fenclorim seed treatment (0 and 2.5 g ai kg^{-1} seed), acetochlor application timings (preemergence (PRE), delayed-preemergence (DPRE), spiking, and 1-leaf), and microencapsulated acetochlor rates of (0, 630, 1,260, and 1,890 g ai ha^{-1}). As the rate of acetochlor increased, likewise injury and weed control increased. DPRE applications provided better barnyardgrass control than spiking and 1-leaf treatments, and at DPRE, acetochlor at 1,260 g ha^{-1} provided better weedy rice control than later applications. The fenclorim seed treatment did not influence weed control and reduced rice injury 21 days after each treatment from 33 and 54% to 13 and 20% for acetochlor rates of 1,260 and 1,890 g ha^{-1}, respectively. Furthermore, commercial tolerance was achieved at 1,260 g ha^{-1} DPRE, providing an average of 87% barnyardgrass control 21 days after treatment. These findings appear promising for the use of a fenclorim seed treatment in rice to safen microencapsulated chloroacetamide herbicides allowing chemistry not currently labeled in the crop in the U.S. to be safely applied.

Long-term Palmer Amaranth Soil Seedbank Management: Economic and Ecological Implications of Integrated Strategies. RB Farr*[1], JK Norsworthy[1], T Barber[2], JW Beesinger[1], TH Avent[1], GL Priess[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (88)

The rise of herbicide-resistant weeds, such as Palmer amaranth (*Amaranthus palmeri* S. Wats.), has resulted in a need to adopt a multifaceted approach to weed control that reduces selection for herbicide resistance. Previous research has suggested that non-chemical practices such as cover crops, establishing a zero-tolerance threshold for weeds, and deep tillage along with the use of effective residual and postemergence herbicides can disrupt the emergence of weeds and reduce weed seedbank populations. To study how these tactics impact weed populations in cotton (*Gossypium hirsutum* L.) production systems over time, a long-term study was initiated near Marianna, AR during the fall of 2018. This study was arranged as a split, split, split-plot in a randomized complete block design with zero-tolerance being the whole-plot factor, deep tillage the sub-plot factor, cover crops the sub-sub-plot factor, and herbicide programs the sub-sub-sub-plot factor. Weed densities and emergence were measured in four, one-meter squares per plot at 21, 42, 63, and 70 days after the initial herbicide application. An economic analysis was conducted on each program utilizing crop input costs, labor, and cotton lint yield to determine overall profitability for each program. The use of effective management strategies helped reduce overall Palmer amaranth emergence from the first year to the second year. Plots that utilized zero-tolerance strategies showed a 63% reduction in Palmer amaranth in the second year while the use of a moldboard plow reduced populations by 73% after two years. Net profits were impacted by the use of added integrated weed management inputs. In the second year, the use of cover crops increased profitability while a dicamba-based, in-crop herbicide program generated higher profits than those without dicamba most likely because of residual control from the dicamba in the absence of rainfall after planting. Results from the first two years of the long-term study have yielded insights into how successful the use of integrated weed management strategies are at reducing Palmer amaranth populations while also portraying some of the economic impacts of these strategies.

Influence of Planting Date and Row Spacing on Sicklepod Suppression in Peanut. P Kharel*[1], P Devkota[1], G MacDonald[2], B Tillman[3]; [1]University of Florida, Jay, FL, [2]University of Florida, Gainesville, FL, [3]University of Florida, Marianna, FL (89)

Cultural practices can provide weed suppression and contribute to integrated weed management program. A field study was conducted in summer 2019 and 2020 to evaluate the influence of peanut planting date and row spacing on sicklepod suppression. The research was an RCB split-plot design with planting date as main plot factor and row spacing as subplot factor. Planting date included: early (early May), mid (mid-May), or late (early June); and row spacing included: single-row spacing at 91 cm center and twin-row spacings at 12.7 cm, 17.8 cm, or 22.9 cm on 91 cm centers. 2,4-DB was sprayed at 6 weeks after planting (WAP) to prevent sicklepod from outgrowing peanut. Analysis of variance (ANOVA) showed three-way interaction between year, planting date, and row spacing for canopy width and a two-way interaction between year and planting date for canopy height. Sicklepod height at 8, 10, 12 WAP was similar across all planting dates in 2019. However, sicklepod height in late planting> mid planting>early planting in 2020. Sicklepod biomass was greater in early planting followed by mid and late planting in 2019. Conversely, sicklepod biomass was greater for late planting followed by mid planting and early planting in 2020. Peanut yield was greater in early or mid planting (= 6,567 kg ha^{-1}) compared to late planting (4,232 kg ha^{-1}) in 2019, but effect of planting date was not significant in 2020. Row spacing did not influence peanut yield in 2019 but yield was lower with single row spacing (2,258 kg ha^{-1}) compared to all the twin rows (= 2750 kg ha^{-1}) in 2020. The differences in results between the two years are likely due to less rainfall during 2019 (77 cm) than in 2020 (137 cm) growing season. These findings suggest that peanut planting date can influence sicklepod suppression; however, influence could vary depending upon environmental conditions.

2,4-D Antagonizes Cutleaf Groundcherry (*Physalis Angulata* L.) Control by Glyphosate. JD Joyner*[1], CW Cahoon[2], ZR Taylor[3], W Everman[2], G Collins[2]; [1]North Carolina St. University, Mount Olive, NC, [2]North Carolina State University, Raleigh, NC, [3]North Carolina State University, Sanford, NC (91)

Cutleaf groundcherry (*Physalis angulata* L.) is controlled well by glyphosate but research is limited on control of this weed by 2,4-D or glyphosate + 2,4-D. In 2018, a cotton producer complained of poor cutleaf groundcherry by Enlist Duo® (2,4-D choline + glyphosate). Seed from this population was collected and a preliminary greenhouse screening was conducted. The preliminary findings indicated glyphosate controlled cutleaf groundcherry well, but treatments containing 2,4-D choline and 2,4-D choline + glyphosate did not. This led to the initiation of greenhouse studies to test for antagonism. Treatment structure consisted of a 3 by 3 factorial including 3 rates of 2,4-D choline by 3 rates of glyphosate. Rates of 2,4-D choline included 0, 532 (1/2X), and 1064 (1X) g ae ha^{-1} whereas of rates of glyphosate were 0, 433 (1/2X), and 866(1X) g ae ha^{-1}. Treatments were arranged in a RCBD with 4 replications. Two runs of the 2,4-D experiments have currently been conducted. Treatments were applied in a CO_2 pressurized spray chamber when cutleaf groundcherry height averaged 6.5 and 8 cm in each run, respectively. Visual estimates of percent weed control were collected 14 and 28 days after application (DAA). Additionally, cutleaf groundcherry height and biomass were collected 28 DAA. Data were subjected to ANOVA using the PROC GLIMMIX procedure in SAS and means separated using Fisher's Protected LSD at $p \leq 0.05$. Colby's method was used to calculate expected weed control as well as expected biomass as a percent of the nontreated check (NTC) for combinations of 2,4-D choline and glyphosate. A separate ANOVA using PROC GLIMMIX was used to compare expected values calculated using Colby's method to observed weed control by combinations of 2,4-D choline and glyphosate. Both rates of 2,4-D choline controlled cutleaf groundcherry < 10% 28 DAA. In contrast, glyphosate alone at the 1/2X and 1X rate controlled cutleaf groundcherry 70 and 94%, respectively. The 1/2X rate of 2,4-D + glyphosate 1/2X provided 46% cutleaf groundcherry control compared to an expected value of 70%; 2,4-D 1X + glyphosate 1/2X resulted in 45% control compared to 71% expected. The 1/2X rate of 2,4-D + glyphosate 1X controlled cutleaf groundcherry 72% compared to 95% expected whereas 2,4-D 1X + glyphosate 1X controlled the weed 54% compared to expected control of 94%. In general, control by combinations of 2,4-D choline + glyphosate provided less control than glyphosate alone, and the observed control by combinations were statistically less than expected control calculated using Colby's method. These experiments demonstrate that 2,4-D antagonizes control of cutleaf groundcherry by glyphosate.

Peanut Response to Flumioxazin and S- Metolachlor Under High Moisture Conditions. P Dulaney*[1], NT Basinger[1], EP Prostko[2]; [1]University of Georgia, Athens, GA, [2]University of Georgia, Tifton, GA (92)

Georgia is responsible for producing over 45% of the United States peanut crop. To combat and prevent weed infestations, herbicide treatments containing flumioxazin and *S*-metolachlor are often applied PRE. Despite herbicide effectiveness for weed control, peanut injury (burning of foliage or J rooting) following heavy rainfall can be problematic. The objectives of this study are to evaluate the impact of injury from flumioxazin and *S*-metolachlor after a heavy rainfall on peanut biomass and yield. Plots were planted at the Ponder Research Farm located near Ty Ty, Georgia using conventional tillage practices and twin row spacing. Treatments included PRE-applications of flumioxazin (0, 107.07 and 214.14 g ai ha^{-1}) alone or in combination with *S*-metolachlor (0, 1068.11, 1401.90, 2803.80 g ai ha^{-1}) and were applied using a CO_2 powered backpack sprayer. Irrigation and rainfall after planting were > 20 cm in the 30 days after planting (DAP) to mimic heavy rainfalls. The study design was a randomized complete block design with a three by four factorial arrangement of treatments with four replications. Plots were maintained weed-free using pendimethalin, diclosulam, imazapic, 2,4-DB, and hand-weeding. Above and belowground plant parts were harvested by hand for biomass from a 1-meter section of a row at 21 DAP to determine peanut density, whole-plant fresh weight biomass, and J-rooting. Visual estimates of injury and stunting were then assigned using a scale of 0 (no injury) to 100 (complete plant death). At 150 DAP, peanut yield data was obtained by mechanically harvesting at maturity. Treatments containing flumioxazin at 214.14 g ai ha^{-1} had the greatest visual injury (>60%) and less fresh weight m^{-1} at 21 days compared to other treatments. Peanut emergence and stand counts were not impacted by flumioxazin or *S*-metolachlor. Despite significant injury early season, there was no effect on J-rooting or on final yield. Despite early season injury in treatments containing flumioxazin, end of season yield was not negatively impacted and was similar to the untreated check or treatments containing *S*-metolachlor. Results from this study suggest that injury and reduction in plant size resulting from heavy rainfall events after the application of flumioxazin and *S*-metolachlor do not affect yield and that severe injury caused by these herbicides can be tolerated.

Preemergence and Postemergence Weed Control in Sweet Corn on Organic Soils. AG Rodriguez*[1], D Odero[2]; [1]University of Florida / Agronomy Department, Belle Glade, FL, [2]University of Florida, Belle Glade, FL (93)

Weed management is a major cost associated with sweet corn production on organic soils in southern Florida. Atrazine and cultivation have been the foundation of weed management programs in the region. However, a shift to mainly grass weed species and reduced efficacy of atrazine has necessitated the need for alternative weed management programs for sweet corn on these soils. Therefore, field experiments were conducted on organic soil in Belle Glade, FL, in 2020 to evaluate preemergence and postemergence weed management programs for sweet corn using novel broad-spectrum herbicides and cultivation. Preemergence herbicides included pyroxasulfone alone (188 to 245 g/ha) or in combination with atrazine (1,403 to 2,245 g/ha) + fluthiacet-methyl (5 to 8 g/ha), *S*-metolachlor alone (1,790 g/ha) or in combination with atrazine (3,360 g/ha), and atrazine alone (3,360 g/ha). Postemergence herbicides included tembotrione (92 g/ha), mesotrione alone (105 g/ha) or in combination with atrazine (560 to 2,240 g/ha), topramezone alone (25 g/ha) or in combination with atrazine (560 to 2,240 g/ha) or bentazon (92 g/ha), and mechanical cultivation between the V4 and V8 stages of sweet corn. The experimental design was a randomized complete block design with four replications. Fall panicum, common lambsquarters, spiny amaranth, ragweed parthenium, and common purslane were the predominant weed species with fall panicum being the most prevalent. In the preemergence study, fall panicum control was >85% at 56 days after treatment (DAT) for all treatments that included pyroxasulfone. In contrast, *S*-metolachlor applied alone or in combination with atrazine only provided 75% fall panicum control. Furthermore, atrazine alone did not control fall panicum at 56 DAT. Broadleaf weeds control was 5 to 56% when *S*-metolachlor was applied alone. However, *S*-metolachlor in combination with atrazine and all treatments that included pyroxasulfone provided >86% control of broadleaf weeds at 56 DAT. In the postemergence study, all treatments that included topramezone provided 71 to 94% fall panicum control and 89 to 100% control of broadleaf weed species at 42 DAT. Treatments with mesotrione and tembotrione provided poor fall panicum control (11 to 36%) at 42 DAT. All postemergence herbicides provided 89 to 100% broadleaf weeds control at 42 DAT with the exception of 70 and 75% common purslane control with mesotrione applied alone and tembotrione, respectively. Cultivation alone did not provide acceptable weed control. Overall, the results suggest that pyroxasulfone can be used to provide efficacious residual control of problematic weeds on organic soils. In addition, topramezone alone or in combination with atrazine or bentazon can be used for effective control of fall panicum and broadleaf weed species in sweet corn on organic soils. Further field studies are ongoing to corroborate these results.

Control of Failed Stands of Corn and Soybean. GA Mangialardi*[1], JA Bond[2], B Lawrence[3], JD Peeples[3], HD Bowman[4]; [1]Mississippi State University, Shelby, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Stoneville, MS, [4]Mississippi State University, Starkville, MS (94)

Cool and wet conditions during planting season in Mississippi have led to non-uniform emergence of corn (*Zea mays* (L.) and soybean [*Glycine max* (L.) Merr.]in recent years. In cases necessitating replanting, questions on herbicide treatments and application timings for termination of failed stands of corn and soybean were common. Therefore, research was conducted to identify optimum herbicide treatment and application timing combinations for control of simulated failed stands of corn and soybean. Two studies (Corn Study and Soybean Study) were conducted in 2020 at the Delta Research and Extension Center in Stoneville, MS. Both studies were designed as a two-factor factorial in a randomized complete block with four replications. For the Corn Study, Factor A was herbicide treatment and included paraquat at 0.84 kg ai ha^{-1} plus (COC) at 0.5% v/v, paraquat at 0.84 kg ai ha^{-1} plus metribuzin at 0.21 kg ai ha^{-1} plus COC at 0.5% v/v, or glyphosate at 1.12 kg ae ha^{-1} plus clethodim at 0.053 kg ai ha^{-1} plus NIS at 0.25% v/v. Factor B was application timing and included applications to corn in the cotyledon stage (VC) and 5 (VC + 5 d), 10 (VC + 10 d), 15 (VC + 15 d), or 20 (VC + 20 d) after VC. A nontreated control was included for comparison. All levels of both factors in the Soybean Study were similar to the Corn Study except glyphosate plus clethodim was not included as a herbicide treatment. Control of corn or soybean was visibly estimated 3 and 14 d after treatment (DAT). . All data were subjected to ANOVA and estimates of the last square means were used for mean separation at $p \leq 0.05$. The addition of metribuzin to paraquat improved control 8 to 54% 3 DAT compared with paraquat alone for all application timings. Paraquat plus metribuzin and glyphosate plus clethodim controlled more corn 14 DAT than paraquat alone across all application timings. Glyphosate plus clethodim controlled simulated failed corn stand 14 DAT as well as paraquat plus metribuzin with applications made at VC + 5, 15, or 20 d. Control with paraquat plus metribuzin was optimized at VC + 5 d. Soybean control 3 DAT was greatest with applications at VC + 10 d. Control with applications at VC + 5 and 20 d was similar, and this control was greater than with VC applications. Soybean control 14 DAT was similar and $\leq$ 73% following paraquat or paraquat plus metribuzin applied at VC. Control with paraquat plus metribuzin was optimized at 96 to 99% with applications at VC + 5 d. For maximum soybean control with paraquat alone, applications needed to be delayed until VC + 15 or 20 d. In conclusion, clethodim plus glyphosate was effective for control of simulated failed corn stand from VC to VC + 20 d. Paraquat plus metribuzin controlled failed stands of corn and soybean, but both can be both too small or large for optimal control.

Louisiana Soybean Response to Multiple Dicamba Drift Events at Various Time Intervals. BN Hiatt*[1], LM Lazaro[2], DO Stephenson, IV[3], JT Copes[4]; [1]Louisiana State University, Enid, OK, [2]Louisiana State University AgCenter, Baton Rouge, LA, [3]Louisiana State University AgCenter, Alexandria, LA, [4]Louisiana State University Ag Center, St. Joseph, LA (95)

Overreliance on herbicides to combat weed pressure within soybean [*Glycine max* (L.) Merr] systems has resulted in increased selection pressure on weeds leading to herbicide resistance. To combat this, dicamba resistant soybean cultivars have become an effective tool in managing herbicide-resistant weeds. However, the introduction of dicamba within soybean systems has increased the risk of injury by drift to neighboring sensitive crops. Previous research has focused on single drift events with variables of growth stage and herbicide rates but in areas with a large acreage of dicamba-tolerant soybean, multiple exposures are likely. The objective of this research is to identify and quantify soybean injury data associated with exposure to dicamba at multiple simulated drift events at various time intervals and frequencies during the growing season. Three field locations at research stations across Louisiana were observed. Treatments of simulated dicamba drift events were applied at the V3/V4 growth stage at a rate of 7 g ae a^{-1} simulating drift events. Subsequent applications were made at intervals of 0, 1, 3, 5, 7 and 10 days over 1, 2, or 3 applications. Soybean exposure was then assessed through height measurements and visual injury assessments at 7, 14 and 28 days after application. Soybean yield indicators of nodes, pods, seeds, and seeds per pod were counted from ten plants per plot to make yield estimates. Data revealed significant statistical differences between treatments for injury assessments of two locations with the third location showing marginal significant variability among treatments. Yield indicator data also showed significant differences among treatment groups across all locations. Overall data indicated that the smaller the interval between simulated drift events as well as increased frequency of drift events resulted in higher crop injury. These findings can help equip growers with the knowledge they need to make decisions regarding management strategies depending on the frequency and timing that their soybean crop was exposed to dicamba drift events.

Gambit Plus Propanil Mixture Interactions for Broadleaf Weed Management in Rice. JA Williams*[1], E Webster[2], C Webster[1], SY Rustom[1], B Greer[2], DC Walker[1]; [1]Louisiana State University Ag Center, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA (96)

Producers often mix multiple herbicides to help broaden weed control spectrum and save money. Often these herbicides are not compatible for some reason and control decreases compared with the products applied alone. Producers in Louisiana have mentioned a reduction in the control of alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.] and other broadleaf weeds when treated with a co-application of a pre-packaged mixture of 50% halosulfuron and 29% prosulfuron, sold under the tradename Gambit®, plus propanil. A study was conducted at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the interaction between three rates of Gambit and two formulations of propanil. Plot size was 3-m by 9.1-m with 16-19.5 cm drill-seeded rows of long grain imidazolinone-resistant 'CL-111' rice at 78 kg ha^{-1}. The study had a randomized complete block design with a two-factor factorial arrangement of treatments with three replications. Factor A consisted of an application of Gambit at 0, 27.7, 55.4, or 82.9 g ai ha^{-1}. Factor B consisted of two different propanil formulations, an EC and SC, applied at 0 or 3360 g ai ha^{-1}. Gambit and propanil were applied at the three- to four-leaf stage of rice, or mid-postemergence (MPOST). A 1% v v^{-1} crop oil concentrate (COC) was added to any spray solution containing the SC formulation of propanil or Gambit applied alone. No COC is required with the EC formulation. A uniform standard treatment of clomazone at 336 g ai ha^{-1} was applied preemergence (PRE) for grass control. All herbicides were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 93.4 L ha^{-1}. Visual evaluations for this study included alligatorweed and hemp sesbania [*Sesbania herbacea* (Mill.) McVaugh] at 14 and 28 days after treatment (DAT). At 14 DAT, control of alligatorweed treated with Gambit at 22.7 g ha^{-1} applied alone was 60%. However, when 22.7 g ha^{-1} of Gambit was mixed with either formulation of propanil at 3360 g ha^{-1}, control decreased to less than 20%. Alligatorweed treated with Gambit applied at 55.4 g ha^{-1} alone resulted in 70% control; however, the addition of either formulation of propanil at 3360 g ha^{-1} to that rate of Gambit decreased alligatorweed control to 33 to 47%. At 28 DAT, alligatorweed treated with 22.7 g ha^{-1} of Gambit alone was controlled 60%, but with the addition of the EC or SC formulation of propanil, alligatorweed control was decreased to 30 and 23%, respectively. Increasing the rate of Gambit to 55.4 g ha^{-1} alone controlled alligatorweed 80%; however, alligatorweed control dropped significantly when Gambit at 55.4 g ha^{-1} was mixed with either formulation of propanil to 43% control. At both 14 and 28 DAT, no visual reduction in control was observed when 82.9 g ha^{-1} of Gambit was mixed with the EC or SC formulations of propanil. No negative interactions were observed when hemp sesbania was treated with any rate of Gambit mixed with either formulation of propanil. In conclusion, this research indicates that Gambit at 22.7 and 55.4 g ha^{-1} co-applied with either the EC or SC formulations of propanil results in decreased control of alligatorweed when compared with Gambit applied alone at the same rates. If growers targeting alligatorweed use broad spectrum mixture of Gambit and propanil, Gambit should be applied at 82.9 g ha^{-1}; however, Gambit alone can be applied at 55.4 g ha^{-1} for similar control.

Tolerance of ACCase-resistant Rice to Quizalofop. N Godara*, JK Norsworthy, LB Piveta, MM Houston; University of Arkansas, Fayetteville, AR (97)

Quizalofop-resistant rice technology was commercially available for Midsouth growers in 2018 and was followed by injury to quizalofop-resistant cultivars from postemergence applications of quizalofop. A field experiment was conducted in 2020, at Rice Research and Extension Center, Stuttgart, Arkansas to determine the amount of injury caused by sequential applications of quizalofop at 120 (1X) and 240 g ai ha^{-1} (2X) to PVL01, PVL02, and RTV7521 cultivars that were planted in early April and mid-May. The experiment was implemented as a randomized complete block design with split-plot arrangement and was replicated four times. Sequential applications of quizalofop were applied to cultivars with first application at the 2-leaf stage followed by a second application at the 5-leaf stage before flooding. Analysis of data showed that at the 21 days after the second application (DAB), there was no significant injury differences between treatments other than the RTV7521 cultivar, which had 40% more injury at the higher dosage of quizalofop averaged over planting dates. RTV7521 showed 30% more groundcover loss at 1x rate of sequential applications compared with PVL01 and PVL02. Even though higher injury and groundcover loss was observed in RTV7521, it showed a higher overall yield potential compared to PVL01 and PVL02 cultivars following sequential 1x rates. PVL01 and PVL02 showed less sensitivity to quizalofop compared to RTV7521, but they were not able to show as high of yield potential as RTV7521. In conclusion, growers can expect to see injury from sequential applications of quizalofop in quizalofop-resistant cultivars.

Sensitivity of Different Cover Crop Species to Soil Residual Herbicides Used in Cotton. HR Taylor*[1], E Osco Helvig[2], MV Bagavathiannan[1]; [1]Texas A&M University, College Station, TX, [2]Universidade Estadual do Centro Oeste, Guarapuava, Brazil (98)

Cover crops provide many benefits to an agroecosystem that are important for the future of farmlands. Certain herbicides applied in the summer can affect subsequent winter cover crop establishment. With that, for this study, we examined the effects of residual herbicide concentrations on winter cover crops following a cotton production system in College Station, Texas. Five cover crop species were planted in ships clay loam soil and sprayed with eight different herbicides at rates of 0.0625X. 0.125X, 0.25X, 0.5X, and 1X. Visual injury of cover crops were estimated following herbicide application. It was confirmed that crimson clover displayed the highest account of injury, while winter pea displayed the least injury among six of eight herbicides. It was determined that a 1X rate caused the most significant damage among seven of eight herbicides, with the eight-herbicide displaying more injury at a 0.0625X rate. Overall, this research showed that various cover crop species react differently to incremental rates of residual herbicide left in the soil. This study will help relieve unclear areas for selection of cover crops following a cotton production system in Texas.

Rice Response and Weed Control from Clomazone Applied at Different Timing in a Continuous Rice Flood System. A Becerra-Alvarez*[1], K Al-Khatib[2]; [1]University of California Davis, Davis, CA, [2]UNIVERSITY OF CALIFORNIA, Davis, CA (99)

The majority of California rice (*Oryza sativa* L.) is grown in a continuous rice flood system where rice is seeded into a field with a four to five inch flood. The continuous flood system has led to few adapted, competitive and difficult to control grass and sedge weeds. Difficult to control grass weeds include watergrass (*Echinochloa* spp.*)* and sprangletop (*Leptochloa fusca).* Emergence of grasses can occur early or later in the season depending on the species. Many growers use clomazone in a micro encapsulated granule (Cerano®) at day of seeding to control sprangletop and other early emerging grasses. However, some growers applied clomazone after leathering which is a method used in water-seeded systems by draining the field within the first few days after seeding and re-flooding once the crop has established shallow roots, roughly one week after seeding. This allows for good crop establishment and rooting, but also allows weeds the opportunity to become highly competitive with adequate moisture for germination and low water depths for emergence and rapid development. Cerano® label has a day of seeding application timing with a 14-day water holding period once applied to a field. This study was set to find the effects on rice injury and weed control from applying clomazone at different timing. Clomazone was applied at 0.45 kg ai ha^{-1}, 0.56 kg ai ha^{-1} and 0.6 kg ai ha^{-1} on the day of seeding and seven days after seeding with the flood lowered to a skim and then re-flooded. In both years there was a reduction in yield from the later application of clomazone. There was greater weed control of *Echinochloa* spp. and *Leptochloa fusca* the first year averaging 99 to 100% for all grass species, but poor weed control of *Echinochloa* spp. the second year averaging from 21 to 71%. *Leptochloa fusca* control the second year was decent for the early application from 92 to 95% and 70 to 71% at the later application. Application of clomazone at a later application with a lowered flood increased rice injury and had variable weed control.

Viability of Weed Seeds Subject to Narrow Windrow Burning. MP Spoth*[1], ML Flessner[1], SC Haring[2], W Everman[3], C Reberg-Horton[3], KW Bamber[1]; [1]Virginia Tech, Blacksburg, VA, [2]University of California, Davis, Davis, CA, [3]North Carolina State University, Raleigh, NC (100)

Narrow windrow burning (NWB) is a form of harvest weed seed control in which crop residues and weed seeds harvested with the crop are concentrated into windrows behind the combine. Subsequent burning of windrows has been shown to kill a large percentage of weed seeds within. NWB has proven effective and economical in Australian wheat production, but research is limited in U.S. wheat/soybean double crop systems. Specifically, there is limited data investigating the relationship between the heat index (HI) or effective burn time (EBT) of windrows and the resulting viability of weed seeds. HI is the sum of temperatures achieved during the burning act above the ambient air temperature, and EBT is the cumulative time that the temperature of the windrow burning exceeded 300°C. The objectives of this study were to determine how varying NWB temperatures and durations in wheat and soybean will 1) affect seed survival of Italian ryegrass (IR, *Lolium perenne* L. *ssp multiflorum* (Lam.) Husnot) and Palmer amaranth (PA, *Amaranthus palmeri* S. Wats.) and 2) determine if there is a relationship between HI or EBT post-NWB viability of both species. Separate experiments were conducted with Italian ryegrass populations being investigated in wheat and Palmer amaranth in soybean. During harvest, windrows were formed by depositing all field residues from a 4.6m wide combine header in a 0.5m wide windrow. Windrows were ignited at one end and allowed to burn down the windrow completely until no crop residue remained. Burn temperature was recorded with two-subsamples per windrow. Crop residue and weed seed therein were collected from windrows prior to and after burns were conducted. The residue was spread on top of potting soil in a greenhouse setting and candidate weed seed germination was recorded until emergence concluded. Trays were subject to cold storage 2 times between weed emergence counts. Each experiment was conducted across two locations over two years in Virginia with four or five replications per treatment in a randomized complete block design. Data were pooled across site-year and subjected to a paired two-tailed t-test ($p<0.05$) for pre versus post-burn comparison or non-linear three-parameter logistic regression for analyses including HI and EBT. Average soybean and wheat windrow HI totaled 125,187 and 54,904, and 116 and 56 seconds of EBT respectively. Our results indicate there was a 73.9% reduction in IR survival and a 94.5% reduction in PA over all replications with NWB. Based on regressions, 100% PA seed kill during soybean NWB was achieved at a HI of 145,000 but was not achieved in wheat NWB to control IR. 100% weed seed kill based on EBT was achieved at 235 in soybean for PA and 118 in wheat for IR. These results validate the effectiveness of NWB's ability to diminish weed populations and prevent weed seedbank deposition. It may have huge potential to improve weed management and combat herbicide resistance in these two problematic weed species across vast acreage.

Are Overlays of Residual Herbicides Needed in Upland Rice? C Webster*[1], E Webster[2], SY Rustom[1], B Greer[2], DC Walker[1], JA Williams[1]; [1]Louisiana State University Ag Center, Baton Rouge, LA, [2]Louisiana State University, Baton Rouge, LA (101)

Upland rice (*Oryza sativa* L.), has recently gained popularity in mid-south rice production. A study was conducted in 2019 and 2020 at the H. Rouse Caffey Rice Research Station near Crowley, Louisiana to evaluate the overlaying of residual herbicides in upland rice production. Plot size was 3-m by 9.1-m with 16-19.5 cm drill-seeded rows of hybrid long grain 'Gemini' at 39 kg ha^{-1}. The study was a randomized complete block with a two-factor factorial arrangement of treatments with three replications. Factor A consisted of early postemergence (EPOST) applications, at the one- to two-leaf rice growth stage, of 1) no EPOST application, 2) a pre-packaged mixture of imazethapyr plus quinclorac at 560 g ai ha^{-1}, 3) imazethapyr at 70 g ai ha^{-1} mixed with clomazone at 211 g ai ha^{-1}, and 4) imazethapyr at 70 g ha^{-1} mixed with pendimethalin at 1120 g ai ha^{-1}, 5) imazethapyr at 70 g ha^{-1} mixed with a pre-packaged mixture of clomazone plus pendimethalin at 717 g ai ha^{-1}, or 6) imazethapyr at 70 g ha^{-1} mixed with a pre-packaged mixture of halosulfuron plus prosulfuron at 83 g ai ha^{-1}. Factor B consisted of either no late postemergence (LPOST) application or a LPOST application at the four- to five-leaf rice growth stage of imazethapyr at 70 g ha^{-1} plus bispyribac at 34 g ai ha^{-1}. The second application of imazethapyr provided additional residual activity plus postemergence activity along with bispyribac. A uniform standard treatment of clomazone at 211 g ha^{-1} was applied preemergence. All herbicide applications were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 93.5 L ha^{-1}. Visual evaluations for the study included barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.] and Texasweed [*Caperonia palustris* (L.) St. Hil.] control at 14 days after the EPOST (DAEPOST) application and 28 days after the LPOST (DALPOST) application. Rough rice yields were obtained and adjusted to 12% moisture. At 14 DAEPOST, barnyardgrass was controlled 87 to 89% when treated with a pre-packaged mixture of imazethapyr plus quinclorac. All other herbicide combinations applied EPOST controlled barnyardgrass 68 to 80% at 14 DAEPOST. At the 28 DALPOST rating date, barnyardgrass was controlled 36 to 64% when treated with any mixture applied EPOST but not followed with a LPOST application. However, barnyardgrass treated with imazethapyr plus quinclorac applied EPOST resulted in 81% control. All barnyardgrass treated with EPOST applications followed by a LPOST application of imazethapyr plus bispyribac resulted in barnyardgrass control of 85 to 94% at 28 DALPOST. Rice treated with any EPOST application followed by a LPOST application yielded 4670 to 5732 kg ha^{-1}; however, rice treated with EPOST applications of imazethapyer mixed with a pre-packaged mixture of clomazone plus pendimethalin and a pre-packaged mixture of imazethapyr plus quinclorac yielded 4746 and 4750 kg ha^{-1}, respectively. This study indicates the addition of a prepackaged mixture of imazethapyr plus quinclorac at the EPOST application timing provides an extended period of broad-spectrum residual control before an LPOST herbicide application is needed. These results suggest to overlay residual herbicides throughout the growing season in upland rice production.

Herbicide Programs for Soybean Planted on Different Row Configurations. FR Kelly*[1], JA Bond[2], BR Golden[2], JT Irby[3]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS, [3]Mississippi State University, Mississippi State, MS (102)

Crops should produce the greatest yields when planted in equally distanced planting patterns. Row spacing should be considered based on how producers plant, cultivate, spray, and harvest. Earlier research reported a decrease in soybean [*Glycine max* (L.) Merr.] row spacing increased soybean yield. Historically, soybean row spacings ranged from 96 to 100 cm to facilitate weed control with conventional tillage equipment. However, narrow soybean row spacings (= 96 cm) require higher plant densities as well as specialized equipment for planting and cultivation to produce yields comparable to traditional row spacings. Research was conducted in 2020 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate herbicide programs including PRE and POST applications for soybean planted in different row configurations. Experimental design was randomized complete block with a two-factor factorial treatment arrangement and four replications. Factor A was row configuration and consisted of soybean planted in single- or triple-row planting patterns. Factor B was herbicide treatment and consisted of no herbicide treatment, PRE only, early-POST (EPOST) at soybean growth stage V3 (vegetative growth stage where three unfolded trifoliate leaves are visible), LPOST (late post application at 14 d after V3), PRE followed by (fb) EPOST, PRE fb LPOST, and PRE fb EPOST fb LPOST. The PRE treatments were metribuzin plus *s*-metolachlor, and POST treatments were a combination of glyphosate, dicamba, and acetochlor. Visible estimates of Palmer amaranth (*Amaranthus palmer*i S. Wats.) control were recorded 14 d after EPOST (DA-EPOST) and 14 d after LPOST (DA-LPOST) 21 DA-PRE. Soybean yield was collected with a small-plot combine and adjusted to 13% moisture content. All data were subjected to ANOVA utilizing PROC GLIMMIX in SAS 9.4. Differences in Palmer amaranth control 14 DA-EPOST and 14 DA-LPOST were detected among herbicide treatments in soybean grown in single- and triple-row configurations. With the exception of the no herbicide treatment, Palmer amaranth control 14 DA-EPOST was least with LPOST applications regardless of row configuration. For PRE-only treatments, Palmer amaranth control 14 DA-EPOST was greater in triple- compared with single-row soybean configurations. Control in single- and triple-row configurations was similar among EPOST-only and treatments including PRE fb POST herbicide programs. In all plots receiving a LPOST-only treatments, Palmer amaranth control 14 DA-LPOST was greater in triple- compared with single-row configurations. LPOST-only treatment controlled less Palmer amaranth than all other herbicide treatments across both row configurations. Additionally, treatments with PRE fb POST herbicide programs provided comparable Palmer amaranth control across both row configurations. Soybean yields following any herbicide treatment were greater than in plots receiving no herbicide for soybean grown in single- or triple-row configurations. Soybean yield in plots receiving EPOST-only treatments was greater in triple- compared with single-row configuration. For both soybean row configurations, PRE fb EPOST herbicide programs led to greater yields than PRE fb LPOST treatments.

Integrated Weed Management Practices to Control PPO Resistant Palmer Amaranth in Peanut. A Nagila*, S Li, KJ Price, RD Langemeier; Auburn University, Auburn, AL (103)

Integrated weed management practices to control PPO resistant Palmer amaranth in peanut Palmer amaranth (*Amaranthus palmeri*) is an economically damaging weed found throughout southeastern United States. Over reliance of herbicides in management has caused development of herbicide resistance in Palmer amaranth including ALS-inhibitors and PPO inhibitor herbicides. Without ALS and PPO inhibitor herbicides peanut producers are severely limited in options to control Palmer. Evaluation of alternative preemergent herbicides and cultural practices (tillage, row spacings, 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), row pattern and pre-emergent herbicides programs in peanut cropping systems to control for resistant Palmer amaranth. Field trials were conducted under irrigation in Henry and Macon Counties Alabama in 2020. Treatments included a CT system and CC system that were side by side at each site. CT system were planted with both single and twin rows and treatments were as follows: 1) acetochlor, 1260 g ai ha^{-1} + norflurazone, 1585 g ai ha^{-1} + pendimethalin, 1064 g ai ha^{-1} 2) acetochlor, 1260 g ai ha^{-1} + fluridone, 241 g ai ha^{-1} 3) acetochlor, 1260 g ai ha^{-1} + pendimethalin, 1064 g ai ha^{-1} and, 4) non-treated check. The CC system was planted only in the single row configuration and treatments were as follows: 1) acetochlor, 1260 g ai ha^{-1} + norflurazone, 1585 g ai ha^{-1} 2) acetochlor, 1260 g ai ha^{-1} + fluridone, 241 g ai ha^{-1} 3) acetochlor, 1260 g ai ha^{-1} + pendimethalin, 1064 g ai ha^{-1} and, 4) non-treated check. A post treatment of 2,4-DB, 280 g ai ha^{-1} + Imazapic, 52.5 g ai ha^{-1} + S-metolachlor, 1420 g ai ha^{-1} in the CC system and 2,4-DB, 280 g ai ha^{-1} + Paraquat, 210 g ai ha^{-1} + Clethodim, 101 g ai ha^{-1} in the CT system was applied to all pre-treated plots at 36-42 DAP to control emerged Palmer amaranth. All treatments were applied with a CO_2 pressurized backpack sprayer at 140 L ha^{-1}. Palmer counts were collected every seven days from 21 to 70 DAP from the entire center row middle (7 m^2) and peanut canopy widths were collected from 28 DAP to 56 DAP. CC biomass was collected in seven-day intervals from 0 to 56 days after peanut planting. Palmer biomass was collected 130 DAP. Approximately 7000-8000 kg ha^{-1} CC residue was present at peanut planting and 2000-3000 kg ha^{-1} residue was present at 56 days after peanut planting in both locations. All preemergent herbicide treatments provided effective control of Palmer amaranth with more than 90 % control compared to the non-treated check in all planting systems through 70 DAP. Twin row planting did not significantly reduce Palmer amaranth counts or increase peanut canopy width compared to CC and CT single row systems. The CC non-treated check had 77% less Palmer amaranth compared to CT twin row and 64% less palmer compared to CT single row at 70 DAP. This data shows that high biomass cover crop residue allowed for quicker canopy closure and as well as controlled Palmer through physical suppression allowing for season long weed control. These results suggest that alternative approach of preemergent herbicides and high biomass CC residue are effective ways to control ALS and PPO resistant Palmer amaranth while maintaining peanut crop growth.

Using Dose Response Field Studies to Identify Herbicide Safety in *Brassica carinata* (A.) Braun.

SA Ramsey*[1], AR Post[1], T Reinhardt Piskackova[2], ME Camacho[3], RG Leon[1]; [1]North Carolina State University, Raleigh, NC, [2]Czech University of Life Sciences Prague, Prague 6 - Suchdol, Czechia (Czech Republic), [3]Department of Crop Science, Raleigh, NC (104)

Brassica carinata (A.) Braun, or carinata, is an oilseed crop that is currently being developed for biofuel production. Southeastern growers have been interested in growing carinata as a winter crop because of biofuel industry demand and potential use as a rotational crop. As a new crop, there are no herbicides registered for use in carinata, so preliminary screening was used to identify herbicides safe for the use in carinata. This objective of this study was to assess the safety of select preemergence and postemergence herbicides at varying rates on carinata seedling establishment and plant growth. The preemergence herbicides used were diuron, napropamide, and clomazone. The postemergence herbicides used were simazine and clopyralid. The rates that were tested included a recommended label rate, one-quarter, one-half, two times, four times, and eight times the recommended label rate for each herbicide. Napropamide was a candidate preemergence herbicide for carinata production, while diuron could be used for control of volunteer carinata in rotational crops. In the future, further investigation of the development of cultural and mechanical approaches are needed to provide growers with more weed control options for carinata production.

Weed Management Systems in Igrowth Sorghum. CR White*[1], W Keeling[1], PA Dotray[2], JA McGinty[3], R Bryant-Schlobohm[4]; [1]Texas A&M AgriLife Research, Lubbock, TX, [2]Texas Tech University and Texas A&M AgriLife Research and Extension Service, Lubbock, TX, [3]Texas A&M AgriLife Extension, Corpus Christi, TX, [4]UPL, Amarillo, TX (105)

Herbicide options for grass control are limited in grain sorghum. Commercialization of herbicide resistant sorghum systems will allow producers improved weed control options. Advanta® has developed igrowth® sorghum, which features non-GMO resistance to the imidazolinone (IMI, WSSA Group 2) herbicide family. ImiFlex™ (imazamox) will be sold by UPL NA, Inc. and is the only IMI herbicide certified for use in igrowth sorghum as a preemergence (PRE) or postemergence (POST) application. ImiFlex provides broad spectrum, residual control of key grass and broadleaf weeds. Palmer amaranth (*Amanranthus palmeri*) and Texas millet (*Urochloa texana*) are two key weeds that cause significant competition to grain sorghum grown in the Southern Great Plains. Utilization of ImiFlex in an integrated herbicide management system will be key to successful weed control in igrowth sorghum. The objectives of the study were to evaluate weed management systems in igrowth sorghum using ImiFlex herbicide both PRE and POST for Palmer amaranth and Texas millet control. Studies were conducted in 2020 at three locations across Texas: Lubbock, New Deal, and Corpus Christi. Applications were made using a CO_2-pressurized backpack sprayer calabriated to deliver 140 L ha^{-1} with TurboTeeJet 11002 nozzles. No injury was observed from any treatment at the New Deal or Corpus Christi location. In Lubbock, 11-14% injury was observed 14 days after the POST treatments that included 2,4-D. There were no differences among treatment for sorghum stand at the Lubbock or New Deal locations. At Lubbock, Palmer amaranth control increased with ImiFlex plus tank mixes compared to the ImiFlex alone applied PRE. PRE control was greater than with Coyote applied preplant (PP). At New Deal, end of season Palmer amaranth control was greatest with Coyote applied PP followed by ImiFlex plus atrazine POST. At Corpus Christi, Texas milled control was > 80% with ImiFlex applied PRE, and Palmer amaranth was controlled >98% for all treatments. ImiFlex herbicide performs best when used with a tank mix partner and in a comprehensive herbicide program.

Cultural and Hormonal Management of Palmer Amaranth. R Vulchi*[1], MV Bagavathiannan[1], JA McGinty[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]Texas A&M AgriLife Extension, Corpus Christi, TX, [3]Texas A&M AgriLife Extension, College Station, TX (106)

Field trials were conducted during 2019 and 2020 in irrigated (College Station) and dryland (Thrall) locations in Texas to determine the influence of tillage, crop rotation and herbicide programs on weed management. High Input herbicide program (HI) with residual herbicides was compared against Low Input herbicide program (LI) without residual herbicides in Cover cropping, Strip till and Conventional till practices under cotton-cotton and cotton-sorghum rotation schedules for their efficacy on Palmer amaranth (AMAPA) control. A weedy check and weed free check were also maintained alongside for comparison purposes. During 2019 at both locations, HI herbicide program in cover cropping and conventional tillage provided not less than 92% and 95% AMAPA control, respectively, throughout the cropping season. During 2020 at College Station, conventional tillage provided more than 95% AMAPA control whereas AMAPA control in cover crop was significantly lower compared to 2019. However, at Thrall, cover crop and conventional tillage provided not less than 90% AMAPA control throughout the cropping season. During 2020, cover crop biomass at College Station was approximately between 1500 and 2200 kg/ha for both HI and LI treatments, whereas at Thrall, it ranged from 4000-6000 kg/ha. HI treatments reduced the AMAPA density early in the season by more than 50% compared to LI treatments. Conventional till and cover crop had the lowest and highest AMAPA density, respectively.

Efficacy Evaluations of Dicamba and Glufosinate Applications on North Carolina Large Crabgrass (*Digitaria sanguinalis*) Populations. EA Jones*, DJ Contreras, M Fajardo Menjivar, RG Leon, W Everman; North Carolina State University, Raleigh, NC (107)

Experiments were conducted to determine the efficacy of dicamba and glufosinate on a pervasive weed of North Carolina, large crabgrass (*Digitaria sanguinalis*) at two locations. Herbicide treatments (non-treated, dicamba, glufosinate, and dicamba+glufosinate) were applied the weeds at two different sizes (10 and 20 cm). All herbicide combinations were applied sequentially one week after the initial treatment on both weed sizes. Visual control ratings and height reduction measurements were conducted weekly for four weeks. Dicamba+glufosinate treatments were analyzed by statistical deviations away from the glufosinate-only treatments to determine if the application resulted in additive, antagonistic, or synergistic control. A significant three-way interaction was detected for visual control; thus, all variables were separated for analysis. No significant interactions were detected for large crabgrass height reduction; thus, data were pooled across treatments. No differences in control across all treatments and weed sizes were detected at the Kinston location except for glufosinate followed by dicamba applied to 20 cm large crabgrass providing the lowest control. Glufosinate-only and sequential applications containing two applications of glufosinate provided the highest control compared to the other treatments containing dicamba at the Rocky Mount location. Decreased height reduction between sequential herbicide applications was realized when dicamba was applied first on large crabgrass. Dicamba+glufosinate applied to large crabgrass resulted in additive control as no deviations from glufosinate-only treatments were detected assessed with visual control or height reduction. Results of the experiment provide evidence that dicamba+glufosinate and sequential applications of dicamba and glufosinate are efficacious on large crabgrass; however, if large crabgrass is a prominent weed in the field being treated, sequential applications where dicamba is applied first or only one application of glufosinate may result in reduced control and facilitate this species to remain persistent in treated fields.

Effect of Simulated Herbicide Drift on Agronomic Crops. RR Rogers*[1], PJ Maxwell[2], SS Ramanathan[2], D Freund[2], M LeCompte[2], T Gannon[2]; [1]North Carolina State University Crop and Soil Science, Raleigh, NC, [2]North Carolina State University, Raleigh, NC (108)

Studies were conducted to quantify corn (*Zea* mays L.) and soybean (*Glycine max* L.) response as affected by simulated herbicide drift at various timings. Seven herbicides (2,4-D + 2,4-DP-p, Clopyralid + triclopyr, Imazapic, Imazapyr, Metsulfuron-methyl, Sulfometuron-methyl and Triclopyr ester) were applied at four pre-plant timings and two post-plant timings with 1, 5, 10 and 100 % of a typical North Carolina roadside vegetation management rate. Above ground biomass was quantified. Synthetic auxin treatments contributed to the highest reduction of above ground biomass. At 4 WAP triclopyr ester applied at 1, 5 and 10 % rates reduced soybean aboveground biomass from 42.1-98.9%. Sulfometuron proved to be the most detrimental herbicide to corn above ground biomass when applied at 1, 5 and 10 % rates for PRE and at timings.

Herbicide Coated Fertilizer for Aquatic Weed Management in Rice. B Greer*[1], E Webster[1], C Webster[2], SY Rustom[2], DC Walker[2], JA Williams[2]; [1]Louisiana State University, Baton Rouge, LA, [2]Louisiana State University Ag Center, Baton Rouge, LA (109)

Aquatic weed infestations can be a major problem in Louisiana rice production due to the annual rotation between rice and crawfish. Florpyrauxifen-benzyl is an important herbicide in the control of aquatic weeds; however, there have been issues with off-target movement of the herbicide. Surface-coating herbicides onto fertilizer not only eliminates an application by the grower, it also decreases the potential of off-target movement of the herbicide. A study was conducted in 2020 at the Rice Research Station near Crowley, Louisiana to evaluate foliar applications of herbicides and herbicides surface-coated onto granular urea fertilizer, 46-0-0, for control of 4 aquatic weed species. The experimental design was a randomized complete block design with a three-way factorial arrangement of treatments. Factor A was florpyrauxifen at 0, 7.3, 14.6, and 29.1 g ai ha^{-1}. Factor B was a prepackaged mixture of halosulfuorn + prosulfuron at 0, and 83 g ai ha^{-1}. Factor C was either a foliar application or a herbicide surface-coated urea application. Each 1.5 by 5.2 m plot was broken down into two components; a 1.5 by 3.6 m area that was water-seeded with 'Gemini' rice planted at a rate of 39 kg ha^{-1}, and a 0.91 m^2 galvanized metal ring area. The rings were placed in the back third of the first and third replicate and the front third of the second and fourth replicate. Aquatic weed species were collected, transplanted into rings, and clipped 14 days prior to herbicide applications to ensure active growth. All treatments including nontreated control received a fertilizer application to ensure that the herbicide treated urea did not have an advantage over the foliar treatments. Urea fertilizer was applied by hand into 6-cm flood at a rate of 168 kg ha^{-1} with weed foliage up to 40cm. Visual control ratings were taken at 14 and 42 days after treatment (DAT), fresh biomass data was collected at 42 DAT, and rice yield was collected at 85 DAT. Ducksalad (*Heteranthera limosa* (Sw.) Willd) control was 94 to 96% across all treatments evaluated at 14 DAT. At 42 DAT, the herbicide mixtures, and the florpyrauxifen on fertilizer showed 97 to 98% control of ducksalad. Ducksalad biomass was reduced 91 to 100% when compared with nontreated. Creeping water primrose (*Ludwigia peploides* (Kunth) P.H. Raven) was controlled 96 to 98% by the herbicide mixtures, but when florpyrauxifen was applied alone there was 78 to 89% control. Creeping waterprimrose was reduced 98 to 100% in the treatments containing the prepackaged mixture, whereas it was reduced 48 to 84% in the treatments containing florppyrauxifen alone. At 42 DAT, grassy arrowhead (*Sagittaria graminea* Michx.) was controlled above 88% control for all treatments except the lowest rate of florpyrauxifen applied foliarly, and the surface coated fertilizer applications of florpyrauxifen alone. For pickerelweed (*Pontederia cordata* L.); the herbicide mixtures, the foliar application of the prepackaged mixture and the florpyrauxifen at 29.1 g ai ha^{-1} on herbicide coated fertilizer gave 93 to 99% control. These treatments also reduced pickerelweed biomass 87 to 100% as compared with the nontreated. The foliar applications of florpyrauxifen and the prepackaged mixture alone controlled pickerelweed at 78 to 86%. These treatments reduced pickerelweed biomass 66 to 86% which aligned with the control ratings observed. The 7.3 and 14.6 g of florpyrauxifen surface coated fertilizer treatments only controlled pickerelweed 36 to 39%, and a reduction of 7 to 19% as compared with the nontreated. No visual injury was observed during the growing season, but foliar applications of each treatment showed higher yields as compared to the same treatments applied on fertilizer. This is likely due to the improved weed control in the foliar treatments. While herbicide coated fertilizer does have an application in certain situations, it is not an adequate replacement for the weed control provided with foliar application of these herbicides.

Soybean Response to Dicamba Exposure. ZR Treadway*[1], TA Baughman[1], RW Peterson[1], MR Manuchehri[2]; [1]Oklahoma State University, Ardmore, OK, [2]Oklahoma State University, Stillwater, OK (110)

Weed resistance to acetolactate synthase (ALS) and protoporphyrinogen oxidase (PPO) inhibiting herbicides in addition to glyphosate has become increasingly problematic to soybean producers. This resistance has led to an increased reliance on newer herbicide technologies, such as Roundup Ready 2 Xtend® soybean systems. This system allows the producer to apply dicamba over-the-top of tolerant soybean to control problematic weeds. A major issue faced by applicators though, is offsite movement of dicamba herbicide. Experiments were conducted during the 2018, 2019, and 2020 growing seasons at the Oklahoma State University Mingo Valley Research Station near Bixby, Oklahoma to simulate the effects of single and multiple exposures of dicamba on non-dicamba tolerant soybean. Liberty-Link® soybean (*Glycine max* L.) were planted on May 22, 2018, June 13, 2019, and June 1, 2020. Plots were four 30-inch rows by 25 feet long and included four replications. The center two rows were sprayed with dicamba (Xtendimax®) at 0.56 g ae ha^{-1} (1/1,000X) and 0.056 g ae ha^{-1} (1/10,000X). Individual treatments were applied at the V2-V3 growth stage or the R1 growth stage. Treatments were either applied once or followed with two additional applications 7-14 and 21-28 days after initial treatment. A V2 followed by R1 application was also included. Plots were maintained weed free throughout the growing season. Visual soybean injury occurred with all treatments, however varied by application rate and timing. Visual injury 2 WAT never exceeded 10% when dicamba was applied at 0.056 g ae ha^{-1}. When dicamba was applied at 0.56 g ae ha^{-1} visual soybean injury 2 WAT did not exceed 10% in 2018, except for 3 applications beginning at V2 (24%) and 3 applications beginning at R1 (18%). Visual injury exceeded 15% with all applications except the V2 alone in 2019 (5%) and 2020 (13%). Visual injury 2 WAT exceeded 20% all three years with the V2 followed by 2 additional POST treatments. This was also true for the R1 followed by 2 additional POST treatments in 2019 and 2020. Soybean yields were not affected by any treatment in 2018 regardless of application timing or rate. This was true even in the instances where visual soybean injury exceeded 20%. Yields were lower in all cases when multiple soybean exposure to dicamba occurred in both 2019 and 2020. The differences in 2018 compared to 2019 and 2020 may be due to the earlier planting and environmental conditions allowing for soybean to recover from injury that year. Yields were never affected by a single exposure of dicamba at V2 and only in 2020 from a single exposure at R1. Data from these experiments shows that plant injury does not always equate to yield loss. However, care should always be taken when applying dicamba around susceptible soybean since visual plant damage and yield reductions can occur from off-site movement

Delaying Dicamba-resistant Palmer Amaranth Development Using Cover Crops, Preemergence Herbicides, and Layby Applications in Cotton. LC Hand*[1], TM Randell[1], RL Nichols[2], L Steckel[3], A Culpepper[1]; [1]University of Georgia, Tifton, GA, [2]Cotton Incorporated, Cary, NC, [3]University of Tennessee, Jackson, TN (111)

Weeds are constantly adapting to weed management practices by evolving resistance to herbicidal mechanisms of action. Dicamba-tolerant cotton (*Gossypium hirsutum* L.) was commercialized during 2017 and accounted for 74% of U.S. acreage in 2020. With increased dicamba use, implementing sound management programs to delay resistance is paramount. An experiment was conducted four times during 2018-2019 in GA and TN to evaluate the reduction in dicamba selection pressure associated with the utilization of integrated weed management strategies. Treatments were arranged in a split-plot design with the whole-plot comparing conventional tillage to a rolled cereal rye (*Secale cereale* L.) cover crop (biomass of 1,575 to 6,019 kg ha^{-1}). Cotton was planted in May with row spacings of 92-98 cm placing 2 seeds every 23 cm. The split-plot consisted of four herbicide systems: (1) no herbicide; (2) 3 POST applications of glyphosate (1.12 kg ha^{-1}) + dicamba (0.57 kg ha^{-1}); (3) fomesafen (0.17 kg ha^{-1}) + diuron (0.57 kg ha^{-1}) PRE fb glyphosate + dicamba POST three times; and (4) fomesafen + diuron PRE fb glyphosate + dicamba POST two times fb diuron (0.84 kg ha^{-1}) + MSMA (1.38 kg ha^{-1}) as a directed layby. At plant, POST 1, POST 2 and POST 3 or layby applications were made when cotton was planted, 1-2 leaf, 4-5 leaf, and 8-10 leaf, respectively. At the first POST application, Palmer amaranth (*Amaranthus palmeri* S. Wats.) were 10 to 46 cm in height. To quantify reductions in selection pressure associated with cover crops, preemergence herbicides, and layby applications, Palmer amaranth was counted 1 day before each POST herbicide application. To quantify which plants were treated more than once with dicamba, Palmer amaranth counts were separated into plants showing herbicide damage or not at the POST 2 and POST 3/layby timing. This allowed for dicamba exposure over the entire season to be calculated for each herbicide and tillage system. Similar counts were conducted for crowfootgrass (*Dactyloctenium aegyptium* (L.) Willd.), yellow nutsedge (*Cyperus esculentus* L.), and pitted morningglory (*Ipomoea lacunosa* L.). Cotton was harvested for yield comparison. The cover crop alone reduced Palmer amaranth density 75, 70, and 54% at POST 1, POST 2, and POST 3/layby applications, respectively. PRE herbicides reduced densities 99, 99, and 96% at the aforementioned application timings, respectively, in both the tillage and cover crop systems. The number of Palmer amaranth plants surviving POST 1 was reduced 43% by a cover crop and 98% by PRE herbicides. For the entire season, over 2.1 million Palmer amaranth ha^{-1} were exposed to dicamba when applying 3 sequential applications of dicamba + glyphosate in the conventional system. Adding a cover crop or PRE herbicides reduced exposure 65% and 98%, respectively. When comparing the PRE fb 3 POST system to the PRE fb 2 POSTs fb layby, a numeric reduction in exposure to dicamba of 68% was noted. Crowfootgrass and yellow nutsedge responded similarly. However, pitted morningglory populations were not impacted by cover crop or PRE herbicide, but were adequately controlled with POST and layby herbicides. At harvest, all weeds were controlled at least 99% with herbicide programs. Cotton yield was 16% higher when including PRE herbicides (early-season weed competition) and 14% higher when planting into a cover crop (improved cotton stand and moisture availability).

Rice Performance Following Multiple Exposures to Paraquat. TL Sanders*[1], B Lawrence[2], HM Edwards[2], JD Peeples[2], JA Bond[3]; [1]Mississippi State University: Delta Research & Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS, [3]Delta Research and Extension Center, Stoneville, MS (112)

Paraquat is utilized as a herbicide, desiccant, defoliant, and plant growth regulator. It can be applied preplant, PRE, or post-directed in corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), peanut (*Arachis hypogaea* L.), soybean [*Glycine max* (L.) Merr.], grain sorghum [*Sorghum bicolor* (L.)], and other vegetable and fruit crops for nonselective weed control and preplant or PRE only in rice (*Oryza sativa* L.) In Mississippi, rice is routinely drill-seeded at same time that preplant and/or PRE herbicide treatments to corn, cotton, and soybean are applied. Paraquat-based herbicide treatments are commonly applied preplant and/or PRE; therefore, off-target movement onto rice planted adjacent to these crops may occur. Because paraquat-based treatments can be utilized season-long, multiple exposures to rice are possible. Although previous research has documented rice response to early- and late-season off-target movement of paraquat, research identifying rice after multiple exposures to paraquat is not available. Therefore, research was conducted to evaluate rice growth and yield after exposure to sub-lethal concentrations of paraquat multiple times during the rice life cycle. A study was conducted in 2020 at the Mississippi State University Delta Research and Extension Center in Stoneville, MS, to evaluate rice performance after exposure to sub-lethal concentrations of paraquat multiple times during the rice life cycle. Treatments were arranged as a two-factor factorial within a randomized complete block design and four replications. Factor A was early-season exposure timing and consisted of no early-season exposure and paraquat applied at 84 g ai ha^{-1} to rice in the spiking to one-leaf (VEPOST) and three- to four-leaf (MPOST) growth stages. Factor B was late-season exposure and consisted of no late-season exposure and paraquat applied at 28 g ha^{-1} to rice when 50% of plants in a plot had visible panicles (HEAD), to rice the day of draining (DRAIN), and a sequential treatment with rice exposure at HEAD followed by (fb) DRAIN. Visible estimates of rice injury were recorded 3, 7, 14, and 21 d after DRAIN (DA-DRAIN) on a scale of 0 to 100% where 0 indicated no injury and 100 indicated complete plant death. Plots were harvested with a Zurn 150 combine to obtain rough rice yield. Rough rice grain yields were recorded and adjusted to 12% moisture for uniform statistical yield analysis. All data were subjected to ANOVA with means separated with estimates of the least square means at P=0.05. Rice injury 3 DA-DRAIN was >38% for all paraquat treatments including VEPOST exposure. Greatest injury (>53%) 3 DA-DRAIN was observed with VEPOST fb HEAD fb DRAIN. At 7 DA-DRAIN, rice injury for all paraquat applications including VEPOST and MPOST fb DRAIN exposure was similar. Injury following exposure to paraquat VEPOST fb DRAIN was >38% compared with 18% and 19% following exposures at HEAD fb DRAIN and MPOST fb HEAD, respectively. Similarly, there was no difference in rice injury 14 DA-DRAIN following VEPOST applications compared to MPOST applications, except MPOST fb DRAIN. The greatest injury 14 DA-DRAIN following MPOST applications was for exposure MPOST fb DRAIN (>20%). By 21 DA-DRAIN, rice injury was 5 to 23%, with the greatest injury from exposure VEPOST fb DRAIN (>23%). Rough rice yield following all treatments including multiple exposures to paraquat were similar to that in plots not exposed to paraquat (10,100 kg ha^{-1}) except for an 8% reduction following exposure VEPOST fb DRAIN (8100 kg ha^{-1}). This study indicates multiple exposures to sub-lethal concentrations of paraquat negatively affected rice performance. Multiple exposures to paraquat had the greatest effect on rice performance when the exposure occurred both early- and late-season. Rice was most sensitive

following exposure VEPOST fb DRAIN. Although rice can recover from multiple exposures to paraquat, severe injury and reduced yields may occur. To mitigate detrimental effects from rice exposure to paraquat-based herbicide treatments, caution should be exercised when applications are made to fields in proximity to rice if conditions are conducive for off-target movement.

Evaluation of Annual HPPD-inhibitor Herbicide Treatments During a Three-year Sugarcane Cropping Cycle. DJ Spaunhorst*; USDA-ARS, Houma, LA (113)

South Louisiana's sub-tropical humid climate is conducive for sugarcane cultivation and year-round weed emergence. Each spring (February – March) sugarcane emerges from winter dormancy, but slow crop growth and warming soil temperatures promote weed emergence and rapid growth in the absence of a well-developed sugarcane canopy. The severity of weed infestation, and the species present, influences the number of sugarcane harvests from a single planting before the crop is terminated due to yield decline. The objectives of this study were to (1) determine the effects of annual spring-applied HPPD-inhibitor herbicides over a three-year sugarcane cropping cycle on weed control and density, cane injury, and yield of two commercial sugarcane cultivars: HoCP 96-540 and L 01-299; and (2) compare them to spring herbicide programs currently adopted by growers. An annual spring application of atrazine + bicyclopyrone + mesotrione + *S*-metolachlor (Acuron® at 2.9 kg ai ha^{-1}) or topramezone at 0.045 kg ai ha^{-1} + triclopyr at 1.1 kg ai ha^{-1} to HoCP 96-540 resulted in 6 to 7% more sucrose yield and 59 to 64% fewer weeds when compared with the nontreated over a three-year cropping cycle. The premix formulation of atrazine + bicycloyrone + mesotrione + S-metolachlor (Acuron®), indaziflam, and topramezone at rates evaluated in these studies showed no adverse effect on sugarcane yield components when compared to herbicides currently labeled on sugarcane in Louisiana. In the absence of economically devastating weeds, like itchgrass, during the first and second harvest seasons, clomazone at 1.2 kg ha^{-1} + diuron at 2.8 kg ha^{-1} reduced L 01-299 cane and sucrose yield by 17% when compared to the nontreated. Growers should be cautious when applying clomazone at 1.2 kg ha^{-1} + diuron at 2.8 kg ha^{-1} during spring in Louisiana, especially when fields are planted to L 01-299, and should only treat fields with a history of significant itchgrass pressure to reduce seed spread and improve crop yield.

Evaluation of Residual Herbicides for Broad Spectrum Weed Control in Mississippi Corn. T Bararpour*, G Singh; Mississippi State University, Stoneville, MS (114)

Palmer amaranth (*Amaranthus palmeri*) control has become a challenge because of its high propensity to evolve herbicide resistance, resulting in reduced herbicide options in infested crops such as corn, soybean, and cotton. A field study was conducted in 2020 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate the residual activity of AAtrex, Dual II magnum, Sencor, Lexar, Callisto, Prowl, Outlook, Zidua, Corvus, ImpactZ, Capreno, Warrant, and Acuron, on glyphosate-resistant Palmer amaranth. The experiment was conducted as a randomized complete block design with 18 herbicide treatments and four replications. Plot size was 4 (40 inch) rows 13.3-ft wide by 20-ft long with 10-ft alleys between replications. Glyphosate-resistant Palmer amaranth seed was broadcasted in the entire experiment site to make sure for uniform Palmer amaranth distribution per plot. Visual estimates of glyphosate-resistant Palmer amaranth emergence/control were recorded at prescribed intervals after peremergence herbicide applications on May 14. The following herbicide treatments were used: 1) Dual II Magnum (*S*-metolachlor) at 1.3 pt/A; 2) AAtrex (atrazine) at 2 qt/A; 3) Dual II Magnum + AAtrex at 1.5 qt/A; 4) Outlook (dimethenamid-p) at 14 oz/A; 5) Outlook + AAtrex at 1.5 qt/A; 6) Callisto (mesotrione) at 6.5 oz/A; 7) Callisto + AAtrex at 1.5 qt/A; 8) Callisto + AAtrex at 1.5 qt/A + Dual II Magnum; 9) Sencor (metribuzin) at 0.5 lb ai/A; 10) Sencor + Dual II Magnum; 11) Corvus (isoxoflutole + thiencarbazone) at 5.6 oz/A; 12) ImpactZ (topramezone + atrazine) at 8 oz/A; 13) Prowl (pendimethalin) at 3 pt/A; 14) Lexar (*S*-metolachlor + mesotrione + atrazine) at 3 qt/A; 15) Capreno (thiencarbazone + tembotrione) at 3 oz/A; 16) Zidua SC (pyroxasulfone) at 4.5 oz/A; 17) Warrant (acetochlor) at 3 pt/A; 18) Acuron (*S*-metolachlor + atrazine + bicyclopyrone + mesotrione) at 2.5 qt/A. A nontreated check was included in the study. The visual Palmer amaranth control was evaluated 2, 3, 4, 5, 6, and 7-weeks after herbicide application (WAA). Glyphosate-resistant Palmer amaranth control was 86, 95, 100, 94, 100, 97, 100, 100, 95, 96, 96, 94, 75, 100, 80, 88, 70, and 99% for herbicide treatment 1 through 18 by WAA, respectively. By 7 WAA, glyphosate-resistant Palmer amaranth control was 60, 73, 76, 75, 76, 74, 88, 95, 84, 81, 83, 73, 28, 90, 40, 74, 45, and 94% for treatment 1 through 18, respectively. Entireleaf morningglory (*Ipomoea hederacea Jacq. var. integriuscula*) was difficult to control. Only Callisto + AAtrex + Dual II Magnum (Trt. 8), Corvus (Trt. 11), and Lexar (Trt. 14) treatments provided 84 to 91% control of morningglory by 7 WAA. All herbicide treatments provided 93 to 100% control of prickly sida (*Sida spinosa*) except treatment 17 (Warrant) by 4 WAA. By 7 WAA, Prowl (81%) and Warrant (68%) were the weakest herbicide treatments to control prickly sida. Overall, herbicide treatments 1, 3, 5, 7, 8, 10, 11, 14, 16, and 18 provided 94 to 98% barnyardgrass (*Echinochloa crus-galli*) control 4 WAA. By 7 WAA, only herbicide treatment 1, 8, 11, 14, 16, and 18 provided 90 to 95% control of barnyardgrass. Sencor treatment (Trt. 9) provided 84 and 99% control of Palmer amaranth and prickly sida, respectively. In summary, only three residual herbicide treatment of Callisto + AAtrex + Dual II Magnum, Lexar, and Acuron provided the best and longer residual activity (up to seven weeks) for glyphosate-resistant Palmer amaranth control (>90%). Only Callisto + AAtrex + Dual II Magnum and Corvus treatments provided 95% control of barnyardgrass by 7 WAE. Callisto + AAtrex + Dual II Magnum, Corvus, and Lexar treatments provided 84 to 91% control of entireleaf morningglory by 7 WAA.

One-Shot Weed Management Programs in Mississippi Corn. T Bararpour*[1], G Singh[1], JA Bond[2], B Lawrence[1]; [1]Mississippi State University, Stoneville, MS, [2]Delta Research and Extension Center, Stoneville, MS (115)

For corn (*Zea mays*) production to be most profitable in the Mississippi Delta region, input costs must be reduced. A field study was conducted in 2020 at the Delta Research and Extension Center, in Stoneville, Mississippi, to evaluate one-shot herbicide application programs for glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), broadleaf signalgrass (*Urochloa platyphylla*), and hemp sesbania (*Sesbania herbacea*) control in Mississippi corn. Corn (Pioneer 1662 YHR) was planted on beds with 40-inch row spacing at a seeding rate of 2.5 seeds ft^{-1} on May 6, 2020 and emerged on May 14. 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% for all herbicide treatments at final evaluation (July 20).PRE: Acuron (*S*-metolachlor + atrazine + mesotrione + bicyclopyrone) at 80 fl oz/A applied preemergence provided 88, 100, 99, 91, and 95% control of broadleaf signalgrass, hemp sesbania, Palmer amaranth, pitted morningglory, and prickly sida by 8 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 and Axiom (flufenacet + metribuzin) at 14 oz/A + AAtrex at 64 fl oz/A as one-shot preemergence treatments provided comparable 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-shot) postemergence at V2-V3 stage of corn provided 100, 100, 99, 94, and 94% control of broadleaf signalgrass, hemp sesbania, Palmer amaranth, pitted morningglory, and prickly sida by 8 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 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-shot) postemergence at V3-V4 stage of corn provided 100, 100, 100, 97, 95% control of broadleaf signalgrass, hemp sesbania, Palmer amaranth, pitted morningglory, and prickly sida by 8 WAE. ImpactZ + AAtrex + Roundup PowerMax + MSO and Halex GT + Sencor provided comparable results in terms of broad-spectrum weed control and corn yield as standard treatment. Therefore, these treatments can be used as alternative treatment as standard treatment for herbicide program at V3-V4 stage of corn. Weed interference reduced corn yield 79% (nontreated check with 36 bu/A) as compared to the weed-free check (170 bu/A). In conclusion, there are some one-shot 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.

Benefits of Chaff Lining in Soybean to Minimize Weed Populations in Louisiana. KM Mestayer*, LM Lazaro, G LaBiche; Louisiana State University AgCenter, Baton Rouge, LA (116)

Weeds are continually adapting and evolving resistance to herbicides. Harvest weed seed control is an integrated weed management tactic that utilizes nonchemical weed control methods to target potential herbicide resistant weeds from entering back into the soil seedbank. One of those methods is chaff lining, which funnels the chaff and weed seed into a windrow to break down or decay over winter. Simulated chaff lines with weed seed additions were distributed in a weed-free soybean field. Three herbicide programs, PRE only, PRE plus POST, and PRE plus POST with a residual herbicide, were evaluated and weed counts were taken at 7, 14, and 21 days after the PRE application as well as before harvest both inside and outside of the chaff lines. Additionally, weed control ratings were evaluated. The chaff lines effectively concentrated weed seed emergence within the chaff lines. Approximately 17 and 39% of Palmer amaranth and large crabgrass emerged, respectively. Weed control ratings in the chaff lines resulted in about 98% at harvest. These results indicate the use of chaff lining with a robust herbicide program utilizing a preemergence herbicide can lead to a more sustainable approach to weed control.

Peanut Response to Soil-Applied Glyphosate. EP Prostko*, C Abbott; University of Georgia, Tifton, GA (117)

Glyphosate is one of the most widely used herbicides for weed control in many crops. Glyphosate has an average ½-life in soils of 30 days with a range of 5.7 to 40.9 days. The majority of research suggests that soil-applied glyphosate is tightly adsorbed and therefore, has a low potential to cause plant phytotoxicity. However, there have been some reports of soil applications causing unacceptable crop injury depending upon numerous factors including species sensitivity, rate, soil type, and phosphate fertilizer competition. Limited research has focused on the potential negative effects of soil-applied glyphosate on peanut. Therefore, the objective of this research was to determine the effects of soil-applied glyphosate on peanut growth and yield. An irrigated, small-plot field trial was conducted in 2020 at the UGA Ponder Research Farm near Ty Ty, Georgia. The soil type at this location was a Tifton sand (0.61% OM, 94% sand, 2% silt, 4% clay, 6.0 pH, and 2.2 CEC). Twin-row 'GA-06G' peanuts were planted on May 4, 2020. Treatments were arranged in a randomized complete block design with a 2 (timing) X 6 (rate) factorial arrangement with 4 replications. Timings were 6 days before planting (PPLNT) and 1 day after planting (PRE). Glyphosate rates were 0, 1.13, 2,25, 3.38, 4.50, and 5.63 lbs ae/A (Roundup PowerMax® II). Treatments were applied with a CO_2-powered backpack sprayer calibrated to deliver 15 GPA (40 PSI, 3.5 mph, 11002AIXR nozzles). The plot area was maintained weed-free using a combination of labeled herbicides and hand-weeding. Data collected included peanut plant density, canopy height/width, and yield. All data were subjected to ANOVA and means separated using Tukey's HSD ($P = 0.10$). There were no interactions between glyphosate timing and rate ($P > 0.14$). When averaged over rate, timing had no effect on peanut plant density, canopy height/width, and yield ($P > 0.15$). When overaged over timing, rate had no effect on peanut plant density, canopy height/width, and yield ($P > 0.20$). These results suggest that glyphosate can be used for PPLNT/PRE weed control programs in peanut without causing undesirable crop injury.

Efficacy of Integrated Weed Management in Peanut Production Utilizing High Cover Crop Residue. KJ Price*[1], S Li[1], RD Langemeier[1], A Nagila[1], A Price[2]; [1]Auburn University, Auburn, AL, [2]USDA-ARS, Auburn, AL (118)

As herbicide-resistant weeds continue to emerge and spread, alternative non-chemical control methods integrated into current control programs need to be evaluated. Few studies have been conducted to determine the effectiveness of residual herbicides sprayed onto cover crop residues compared to conventionally tilled systems in peanut. The objectives were to (1) evaluate the effectiveness of residual herbicides on weed control in conventionally tilled versus high cover crop residue systems in peanut production, (2) determine if weed control was greater with the combination of cover crops and residual herbicides compared to herbicide only programs. Field trials were conducted in Henry County in 2019, as well as Henry and Macon County in Alabama in 2020. Treatments included: acetochlor 1,260, flumioxazin 107, diclosulam 26, *S*-metolachlor 1,700 g ha^{-1}, conventionally tilled non-treated check (NTC), and high residue NTC. All treatments were applied with a backpack sprayer on the day of planting at 187 L ha^{-1}. Weed population counts were collected every 7 days till 56 days after planting when weed biomass was quantified. All treatments that included a heavy cover residue had significantly better control (>80%) of *Ipomoea spp.* and *Senna obtusfolia* compared to the conventionally tilled NTC over 2019-2020. *Amaranthus palmeri* control was more variable from year to year and cover crop residue alone was not enough to provide significantly better control than conventionally tilled plots with residual herbicides. Overall, total weed biomass in plots with residue cover and soil residual herbicides had significantly reduced weed biomass of 75-89% compared to conventionally tilled NTC in 2019-2020. Combinations of flumioxazin or diclosulam with heavy cover crop residue provided the greatest overall weed control in peanut. Generally, the combination of herbicides and cover crops had greater control than either component used alone. The combination of residual herbicides with a high cover crop residue provided more effective weed control overall compared to the high residue alone suggesting some residual herbicides reached the soil surface.

A23372A - A Broad-Spectrum Solution for Superior Weed Management in Soybean. R Jackson*[1], BR Miller[2], TH Beckett[3], P Eure[4]; [1]Syngenta Crop Protection, Carrollton, MS, [2]Syngenta Crop Protection, Fargo, ND, [3]Affiliation Not Specified, Greensboro, NC, [4]Syngenta Crop Protection, Greensboro, NC (119)

A23372A - A Broad-Spectrum Solution for Superior Weed Management in Soybean. Ryan Jackson*[1], Brett R. Miller[2], Tom H. Beckett[3] and Pete Eure[3], [1]Syngenta Crop Protection, Carrollton, MS, [2]Syngenta Crop Protection, Fargo, ND, [3]Syngenta Crop Protection, Greensboro, NC. A23372A is a new herbicide being developed by Syngenta Crop Protection for broad-spectrum control of annual grasses and key broadleaf weeds in soybeans. The active ingredients contained in A23372A are *S*-metolachlor, metribuzin and cloransulam-methyl in a ratio that delivers robust rates of all three herbicides in a convenient mixture. In field testing, A23372A displays excellent crop safety across soil types and environments in all regions of the country. This new herbicide mixture controls annual grasses and most small-seeded broadleaves like waterhemp (*Amaranthus rudis*) and Palmer amaranth (*Amaranthus palmeri*) as well as many key larger-seeded weeds including common and giant ragweed (*Ambrosia artemisiifolia* and *trifida*), morningglories (*Ipomoea*) and velvetleaf (*Abutilon theophrasti*). A23372A is being developed for broad use across all geographies, soil types and tillage systems, and is compatible with common burndown herbicides such as Gramoxone 3.0 SL, glyphosate, 2,4-D and dicamba. A23372A protects soybean yield by providing early season weed management and will provide an excellent preplant or pre-emergence product as the strong residual base for weed management programs regardless of soybean trait platform.

Evaluation of Multiple Growth Regulating Herbicides Effect on Soybean Injury at Vegetative and Reproductive Growth Stages. AN McCormick*[1], TR Butts[2], LM Collie[3], TW Dillon[2], J Davis[4]; [1]University of Arkansas System Division of Agriculture, Newport, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Lonoke, AR, [4]University of Arkansas System Division of Agriculture, Batesville, AR (120)

The use of synthetic auxin herbicides has increased in recent years with the development of auxin-resistant soybean technology. Although these herbicides provide control of problematic broadleaf weeds, significant phytotoxicity and yield loss can result if off-target movement occurs onto susceptible crops. Two field trials were conducted in 2020 at the Newport Extension Center near Newport, AR, with the objective to compare visual soybean injury symptoms from multiple synthetic auxin herbicides at reduced rates and determine yield loss associated with this injury at different soybean growth stages. A secondary objective was to utilize unmanned aerial system (UAS) imagery to collect reflectance data which subsequently could be used in efforts to determine the specific auxin herbicide causing injury and predict yield loss. The experimental design for both trials was a randomized complete block with a 4 (herbicide) x 3 (rate) factorial arrangement of treatments. A weed-free control was included for comparisons. Dicamba, 2,4-D-choline, florpyrauxifen-benzyl, and quinclorac were applied at 0.1x, 0.01x, and 0.001x of their respective label rates to LLGT27 soybean during the V5-V6 and R2 growth stages. Visual estimations of injury and UAS imagery reflectance data were collected at 7, 14, 21, and 28 days after application and yield was harvested when the crop reached full maturity and adjusted to 12.5% moisture. Injury observed from each synthetic auxin herbicide varied slightly in symptomology. General symptoms, although influenced by rate, were as follows: florpyrauxifen-benzyl caused trifoliates to flip upside-down, dicamba caused leaf cupping, 2,4-d-choline caused leaf strapping, and quinclorac caused leaf cupping, strapping, and bubbling. All treatments resulted in visual injury at both application timings; however, only florpyrauxifen-benzyl at the 0.1x rate applied at the V5-V6 growth stage and dicamba and florpyrauxifen-benzyl at the 0.1x rate applied at the R2 growth stage caused reductions in yield. The greatest visual injury and yield loss occurred from the 0.1x rate of florpyrauxifen-benzyl at the V5-V6 growth stage which resulted in 100% plant death. Reflectance data from UAS imagery closely matched visual estimations of injury. Further analysis is required to assess correlations between reflectance data and herbicide active ingredient or yield loss. Results from this research indicate that multiple reduced rates of synthetic auxin herbicides can cause severe phytotoxicity to soybean, but the visual injury does not always result in yield loss. Dicamba and florpyrauxifen-benzyl were the most damaging synthetic auxin herbicides to soybean at reduced rates and were capable of causing yield loss. Further research needs to evaluate the implications of reduced rates of each of these synthetic auxin herbicides on soybean and the role UAS imagery may play in their identification.

White-Margined Flatsedge (*Cyperus flavicomus* Michx.): Controlling This New Problematic Weed in Arkansas Rice. TR Butts*[1], T Barber[1], JK Norsworthy[2]; [1]University of Arkansas System Division of Agriculture, Lonoke, AR, [2]University of Arkansas, Fayetteville, AR (121)

A relatively new problematic sedge, white-margined or white-edge flatsedge (*Cyperus flavicomus* Michx.), has broadened its distribution across Arkansas and become increasingly troublesome to successfully control in rice. The objective of this research was to find key identification characteristics and effective control methods of white-margined flatsedge in rice. Two on-farm field trials evaluating burndown and preemergence residual herbicides and one greenhouse trial evaluating postemergence herbicides were conducted in 2020. From conducted research and field visits, the following identification characteristics were revealed. White-margined flatsedge is an annual with no rhizomes or nutlets, and no characteristic pine needle smell like that of rice flatsedge (*Cyperus iria* L.). Plants develop extremely white undersides on their leaves while keeping a green midvein; the tops of some leaves may also turn a silver-white color and the roots are a deep red. The base of the sedge plant has an extremely waterlogged, fleshy feel. Results from the herbicide evaluations revealed several viable options to successfully control white-margined flatsedge. Glyphosate and paraquat both provided greater than 95% control when applied in a burndown scenario to 5-cm tall plants. Thiobencarb and saflufenacil were the best preemergence herbicides for white-margined flatsedge control providing 88% and 86% control, respectively. ALS-inhibiting herbicides provided little control of white-margined flatsedge postemergence. Bentazon and florpyrauxifen-benzyl provided the greatest level of control postemergence (>90%) when applied to 15-cm tall plants. Overall, there are several viable options to successfully manage this weed species; however, proper identification and resulting herbicide selection paired with an appropriate application timing is key.

Evaluation of Reviton for Soybean Desiccation. D Miller*[1], DO Stephenson, IV[2], T Barber[3], RC Doherty[4], M Mize[5]; [1]Louisiana State University Ag Center, St Joseph, LA, [2]Louisiana State University AgCenter, Alexandria, LA, [3]University of Arkansas System Division of Agriculture, Lonoke, AR, [4]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [5]Louisiana State University Ag Center, Baton Rouge, LA (122)

A field study was conducted in 2020 at the Northeast Research Station near St. Joseph, La, the Dean Lee Research Station near Alexandria, La, and near Tillar, AR with the objective to evaluate Tergeo for soybean desiccation prior to harvest. Harvest aid treatments evaluated included tergeo (Tergeo) applied alone at 0.012, 0.025, 0.037, or 0.044 kg ai/ha; saflufenacil (Saflufenacil) applied alone at 0.012, 0.025, 0.037, or 0.045 kg ai/ha; paraquat (Paraquat) applied alone at 0.28 kg ai/ha; and tergo (0.025 kg ai/ha) or saflufenacil (0.025 kg ai/ha) co-applied with paraquat at 0.14 kg ai/ha or 0.28 kg ai/ha or sodium chlorate at 2.2 kg ai/ha. All treatments included methylated seed oil at 1% v/v. Treatments were applied at the R6.5 growth stage at St. Joseph (9/1/20) and Tillar (9/14/20) and at majority plants at R6.7 at Alexandria (9/14/20). Parameter measurements included percent desiccation 3 and 7 d after application (DAT) and percent harvest moisture 9 DAT at St. Joseph; percent desiccation at 2, 4, and 7 DAT at Alexandria; and percent desiccation 3, 7, and 15 DAT at Tillar. At St. Joseph, when applied at the R6.5 growth stage, at 3 days after treatment (DAT) the only treatments that provided greater than 80% desiccation were those that included paraquat at the higher rate of 0.28 kg ai/ha (83-86%). Tergeo applied alone resulted in no greater than 54% desiccation at the highest rate applied. When co-applied with paraquat at the lower rate of 5.35 oz/A or sodium chlorate, however, desiccation with tergeo at 1 oz/A was 74 and 71%, respectively, and equivalent to that with treatments containing the highest paraquat rate. At 7 DAT, with the exception of tergeo alone at the lowest rate (82%) and salflufenacil alone at rates lower than 2 oz/A (68 to 88%), all treatments resulted in equivalent desiccation of at least 96%. Combine harvest sample moisture for treatments above or below those in the 13% range were not statistically different. At Alexandria, when applied at majority R6.7 growth stage, at 2 DAT paraquat at the highest rate co-applied with tergeo or salflufenacil at 1 oz/A were the only treatments that resulted in 80% or greater desiccation. All treatments including Paraquat and sodium chlorate co-applied with tergeo resulted in equivalent desiccation ranging from 71 to 75%. Tergeo or saflufenacil applied alone resulted in no greater than 29% desiccation. At 4 DAT, tergeo co-applied with paraquat at the low or high rate resulted in 91% desiccation, which was equivalent to that observed with tergeo alone at 1 (81%) or 2 (80%) oz, paraquat alone at the high rate (84%), Paraquat at the high rate co-applied with saflufenacil (90%), and treatments including sodium chorate (83 and 90%), and greater than all other treatments. At 7 DAT, 94 % or greater desiccation was observed with tergeo applied alone at rates greater than 0.5 oz/A, all treatments including helmquat, and sodium chlorate co-applied with tergeo.At Tillar, when applied at the R6.5 growth stage, at 3 DAT paraquat co-applied at the high rate with tergeo or salflufenacil resulted in 69 and 61% desiccation, respectively. Paraquat alone at the highest rate (45%), all other co-applications (39 to 50%), and tergeo or saflufenacil applied alone (13 to 24%) resulted in no greater than 50% desiccation. At 7 DAT, paraquat and sodium chlorate co-applications with tergeo resulted in equivalent desiccation of 79 to 93%. Tergeo alone resulted in no greater than 56% desiccation while saflufenacil alone resulted in no greater than 40% desiccation. At 15 DAT, paraquat alone resulted in complete desiccation, which was equivalent to all treatments except the lowest rate of tergeo alone (90%) and saflufenacil applied alone at the two lowest rates (80 and 84%, respectively).

***Gossypium hirsutum* Tolerance to Post-direct Applications of Florpyrauxifen-benzyl.** RC Doherty*[1], T Barber[2], LM Collie[3], ZT Hill[4], A Ross[3]; [1]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas, Lonoke, AR, [4]University of Arkansas Cooperative Extension Service, Monticello, AR (123)

Cotton (*Gossypium hirsutum*) herbicide systems that contain multiple modes of action and are applied timely are essential in controlling Palmer amaranth (*Amaranthus palmeri*) resistant to multiple herbicides. Arkansas cotton growers are in need of new and improved methods and chemistry, to manage this and other troublesome weeds. Trials were established 2019 and 2020 to evaluate weed efficacy and crop response following Loyant post-directed in cotton. In 2019 and 2020 trials were established at Marianna, AR in a Loring silt loam soil and at Tillar, AR in a Herbert silt loam soil. In 2019, PHY 350 W3FE was established at Tillar and DP 1646 B2XF at Marianna, while in 2020 PHY 400 W3FE was established at both locations. The trials were arranged in a randomized complete block design with four replications. All treatments received Brake FX preemerge at 1.13 lb ai/A (fluometuron 0.94lb ai/A + fluridone 0.19 lb ai/A) followed by Liberty (glufosinate) at 0.53 lb ai/A plus Dual Magnum (metolachlor) at 0.95 lb ai/A at 3-4 leaf cotton. Post-directed herbicides evaluated included Loyant (florpyrauxifen-benzyl) at 0.013 and 0.026 lb ai/A, Durango (glyphosate) at 1 lb ai/A and Roundup PowerMax (glyphosate) at 1.12 lb ai/A. In 2019 and 2020 post-direct applications of Loyant were applied to 8 or 10 node cotton. Visual crop injury and weed control ratings of Palmer amaranth, morningglory, and multiple grass species were recorded at 20 days after post-direct applications. Cotton was harvested and seed cotton yield was recorded. In 2019, Epinasty at Marianna increased as the Loyant rate increased. Epinasty ranged from 2.5% with Loyant at 0.0081 lb ai/A to 11.3% with Loyant at 0.026 lb ai/A. No visual injury was noted, in any Loyant treatment, at Tillar. Weed control was not recorded at Marianna. Loyant plus glyphosate provided 89-99, 99, and 94-99% control of Palmer amaranth, goosegrass, and morningglory respectively, at Tillar 21 days after the 10 node application. Cotton yield was reduced by 9 of the 10 Loyant treatments on XtendFlex cotton at Marianna, while yield was equal or greater than the weed-free check with all Loyant treatments at Tillar. The highest yield reduction was noted when Loyant was applied at 0.026 lb ai/A to 8 node XtendFlex cotton. In 2020, Epinasty at Marianna ranged from 0% with Loyant at 0.013 lb ai/A to 6% with Loyant at 0.026 lb ai/A. No visual injury was noted, in any Loyant treatment, at Tillar. Weed control was not recorded at Marianna. Loyant provided 74-99% control of Palmer amaranth at Tillar 21 days after the 10 node application, with Loyant at 0.0081 lb ai/A providing the least control. Marianna cotton yield was reduced by Loyant at 0.026 lb ai/A applied to 8 node cotton, while yield was equal or greater than the weed-free check with the other 9 Loyant treatments. Cotton yield at Tillar was equal or greater than the weed-free check with all Loyant treatments. Preliminary data from 2019 and 2020 suggest that Loyant may be a viable option for pigweed control when post-directed in older (10 node) cotton.

Herbicide Programs for Combating Old and New Weed Species in a Row Rice Production System. BM Davis*[1], LM Collie[1], TR Butts[2], D Johnson[3]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]FMC Agricultural Solutions, Madison, MS (124)

With an increase of rice (*Oryza sativa* L.) acres planted to row (furrow-irrigated) rice in Arkansas, weed control programs need to be shifted from the conventional paddy rice programs to facilitate weed control without the cultural benefit of a flood. The objective of this research was to determine successful season-long weed control herbicide programs for row rice on common and atypical Arkansas rice weeds. A study was conducted in the summer of 2020 at the University of Arkansas at Pine Bluff Small Farm Outreach Center near Lonoke, AR. Hybrid rice cultivar Full Page RT7521 was drill seeded at 33.6 kg ha^{-1} on 19-cm spacings and 76-cm bed widths. Experimental design was a randomized complete block with four replications. Nine herbicide program treatments were applied at preemergence (PRE), early postemergence at 2-3 leaf rice (EPOST), mid-postemergence at 1 tiller rice (MPOST) and late postemergence at 3 tiller rice (LPOST) with a tractor mounted sprayer equipped with AI 110015 tips calibrated to deliver 94 L ha^{-1}. A nontreated control was also included for comparisons. Visual estimations of weed control were taken weekly and were estimated using a scale of 0% to 100%, where 0% is no control and 100% is complete plant death. Yield was harvested with a plot combine and adjusted to 12.5% moisture. Data were subjected to analysis of variance and means were separated using Fisher's protected least significant difference test at a 5% level of significance. At 2 weeks after LPOST treatments were applied (WALPOST) and prior to harvest (preharvest), barnyardgrass (*Echinochloa crus-galli* P. Beauv.) control was >95% with all herbicide programs. Rice flatsedge (*Cyperus iria* L.) control 2 WALPOST was >90% for all herbicide programs excluding Treatment 8 which only provided 80% control. Hemp sesbania [*Sesbania herbacea* (Mill.) McVaugh] at 2 WALPOST was controlled >98% with all programs. Prior to harvest, hemp sesbania control was reduced to 85% in herbicide program treatments that relied solely on a PREFLD application of florpyrauxifen-benzyl for broadleaf weed management. Yields ranged from 8,726 to 10,845 kg ha^{-1}, but no statistical differences among herbicide programs were observed. Some atypical rice paddy weeds present, but not in populations conducive for control ratings, were cutleaf groundcherry (*Physalis angulate)*, sicklepod (*Senna obtusifolia*), carpetweed (*Mollugo verticillate),* and gooseweed (*Sphenoclea zeylanica*). Herbicide treatments containing synthetic auxin or ALS-inhibiting (halosulfuron + prosulfuron) herbicides exhibited control of these atypical weeds. Initial findings in this study suggest that growers should target weeds, common or atypical, early when small and apply preemergence herbicides with overlapping residual herbicides to have a successful season-long weed control program in the absence of a permanent flood.

Are Dicamba and Glufosinate Still Viable Options for Palmer Amaranth in U.S. Soybean Production Systems?

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Palmer amaranth is the most troublesome weed of U.S. agriculture of many reasons; one being it rapidly evolves resistance to herbicides. As fewer herbicides are available for control of this weed, it is imperative to understand which ones remain effective. Dicamba and glufosinate are two commonly applied postemergence herbicides in cotton and soybean, with the continued effectiveness of both being vital to successful control of Palmer amaranth through use of multiple sites of action. For this reason, Palmer amaranth accessions were collected fall of 2018 and 2019 from production fields in areas where either dicamba or glufosinate had been relied upon for multiple years. More than 150 accessions were collected for screening from Arkansas, Illinois, Mississippi, Missouri, Nebraska, and Tennessee fields. Greenhouse grown 5- to 6-leaf Palmer amaranth plants from each accession were treated with glufosinate and dicamba at a 7.5- to 10-cm height. Both herbicides were applied at a 0.5 and 1X rate, which was 297 and 594 g ai/ha for glufosinate and 280 and 560 g ae/ha for dicamba. The screening was conducted in two runs of 50 plants per accession each winter in the greenhouse. However, some accessions failed to germinate and some had limited seed supply that prevented establishment of sufficient plants for evaluation of all herbicide treatments. A total of 122 and 124 accessions were sufficiently evaluated for response to dicamba at a 0.5 and 1X rate, respectively, based on the criteria of 100 treated plants. For 0.5 and 1X glufosinate, 138 and 139 accessions were tested, respectively. Palmer amaranth survival exceeded 20% for 48 of 122 accessions following dicamba at 280 g ae/ha (0.5X). Increasing the dicamba rate to 560 g/ha resulted in 7 of 124 accessions having more than 20% survival. For glufosinate, survival exceeded 20% for 15 of 138 accessions following treatment with the 0.5X rate. Following treatment with the 1X glufosinate rate, 5 of 139 accessions had more than 20% survival. Achievement of 100% mortality or no survival is needed to ensure the absence of seed production, especially in areas of a field or time of year that competition from a crop is minimal. However, complete control (no survival) was only accomplished for 23 of 124 and 101 of 139 accessions following treatment with the 1X rate of dicamba and glufosinate, respectively. These results indicate that there are many fields where Palmer amaranth survival would be likely following a single application of either herbicide, especially considering that well-watered, succulent plants grown under greenhouse conditions were treated at a spray volume of 187 L/ha. Conditions during treatment, timing, and spray coverage were likely far better than would be expected under field conditions. Accession 19-62, collected from a field in Arkansas in 2019, was further evaluated for sensitivity to dicamba and glufosinate because of the ineffectiveness of both herbicides in the screen. Accession 19-62 was compared to a susceptible standard over a range of dicamba and glufosinate doses. Accession 19-62 was 2.1-fold less sensitive to glufosinate and dicamba than a susceptible standard based on LD_{50} values. A few plants survived treatment with a 2X rate of both herbicides. The field where this Palmer amaranth accession was collected had previously been in production of glufosinate-resistant cotton and soybean for approximately 10 years with multiple applications of the herbicide often applied each year. The findings from this screening indicate there are biologically significant differences in sensitivity of Palmer amaranth

to glufosinate and dicamba among crop fields today, with some fields containing progeny capable of surviving labeled rates of dicamba and glufosinate, even when applied under ideal conditions.

Evaluating the Tolerance of FullPage Rice to Acetolactate Synthase Inhibiting (ALS) Herbicides. ZT Hill*[1], T Barber[2], RC Doherty[3], LM Collie[4], A Ross[4]; [1]University of Arkansas Cooperative Extension Service, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas, Lonoke, AR (126)

Herbicide-resistant Italian ryegrass (*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot.), has been a prevalent early-season competitor to multiple crops, including rice (*Oryza sativa* L.) across the MidSouth, with resistance to some acetolactate synthase inhibiting and ACCase inhibiting herbicides. Rimsulfuron and nicosulfuron containing products have been used to control Italian ryegrass at planting or prior to planting corn. In 2020, FullPage™ rice was introduced as improved imidazolinone (IMI) tolerant cultivars and may offer some tolerance to sulfonylurea herbicides due to its dual gene IMI resistance. Two experiments were conducted on a silt loam soil in Tillar, AR in 2020, to determine the tolerance of FullPage™ rice to preemergence (PRE) and postemergence (POST) applications of sulfonylurea herbicides. Both experiments were conducted as a randomized complete block design with four replications, and plot sizes of 6.33 feet (ft) by 30 ft. In both experiments, sulfonylurea herbicide treatments were applied either PRE or 4- to 5-leaf rice growth stage and consisted of rimsulfuron + thifensulfuron, nicosulfuron + rimsulfuron, and nicosulfuron. Herbicides were applied at various rates, and all treatments were applied with 0.25% nonionic surfactant. Visual phytotoxicity ratings were taken at 7, 14, and 35 days after the POST application (DAPOST), and were compared to a nontreated control. Stunting was observed from most PRE treatments up to two weeks after application; however, no further injury or yield reduction was observed throughout the season. When applied POST, various types of phytotoxicity were observed including stunting, chlorosis, leaf malformation, and necrosis. At 7 DAPOST, rice stunting and chlorosis was observed from all treatments. A rate response was observed, with treatments applied at a higher rate resulting in greater injury than the lower rates. Overall, the combination of nicosulfuron at 0.0234 lb ai/A + rimsulfuron at 0.0119 lb ai/A mixture, resulted in >25% stunting and chlorosis at 7 DAPOST, regardless of the rate. At 14 DAPOST, stunting from most treatments had dissipated except for nicosulfuron at 0.0234 lb ai/A + rimsulfuron 0.0119 lb ai/A, nicosulfuron at 0.0118 lb ai/A + rimsulfuron at 0.0058 lb ai/A, and rimsulfuron at 0.0143 lb ai/A + thifensulfuron at 0.0031 lb ai/A. By 35 DAPOST, both rates of nicosulfuron at 0.0234 lb ai/A + rimsulfuron 0.0119 lb ai/A and nicosulfuron at 0.0118 lb ai/A + rimsulfuron at 0.0058 lb ai/A exhibited significant levels of stunting over that of other treatments. Despite the observed injury earlier in the season, comparable yields were observed from all treatments, as well as the nontreated control. When applied at planting, applications of sulfonylurea herbicides caused little injury and no yield loss, which may allow for the possible use of these herbicides to control ryegrass prior to planting or potentially in season with FullPage™ rice. When applied POST, these data suggest that although no yield reduction was observed from any treatment, significant levels of phytotoxicity was observed within two weeks after the POST application.

Postemergence Timing of Residual Herbicides for Grass Control in Arkansas Row Rice. ZT Hill*[1], T Barber[2], RC Doherty[3], LM Collie[4], A Ross[4]; [1]University of Arkansas Cooperative Extension Service, Monticello, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas, Lonoke, AR (127)

Furrow-irrigated rice acreage has increased over the past few years in Arkansas rice production due to such advantageous benefits as water conservation, time, labor, and costs. However, there are some concerns that exist for the possible change in pests that are normally observed in flooded rice production. With the lack of weed control via flood conditions, increased weed pressure will be a concern in furrow-irrigated rice production, which will likely result in the need to use more residual herbicides throughout the season. Two experiments were conducted in 2020, one in Tillar, AR, and the other in Marianna, AR, to determine the most effective residual herbicide program and timing to provide control of problematic grasses in furrow-irrigated rice. Both experiments were set up as a randomized complete block design, with four replications and plot sizes of 6.33 feet by 30 feet. Visual efficacy ratings were taken at 14 and 36 days after the final treatment (DAT) in Tillar, AR, and at 7 and 14 DAT in Marianna, AR, in addition to being compared to a nontreated check. Herbicide programs consisted of clomazone applied preemergence (PRE) alone or in tank-mixture with quinclorac followed by (fb) postemergence (POST) tank-mixtures of various residual herbicides applied at 14 days after the PRE application (DAA) and 21 DAA.Regardless of the location, clomazone + quinclorac applied PRE provided greater control of barnyardgrass and broadleaf signalgrass than clomazone applied PRE alone. In Tillar, clomazone at 0.3 lb ai/A fb pendimethalin at 0.5 lb ai/A + thiobencarb at 3 lb ai/A at 14 DAT provided increased control of barnyardgrass compared to applying at 21 DAT. Treatments with clomazone at 0.3 lb ai/A + quinclorac at 0.375 lb ai/A applied at planting fb pendimethalin at 0.5 lb ai/A + thiobencarb 3 lb ai/A provided greater than 95% control of barnyardgrass regardless of the POST application timing. Greater than 90% control of broadleaf signalgrass was observed throughout the season in Tillar, AR from all herbicide programs. In Marianna, AR, variable barnyardgrass control was observed due to frequent heavy rainfall events. Similar to what was observed in Tillar, AR, the clomazone at 0.3 lb ai/A + quinclorac at 0.375 lb ai/A PRE fb pendimethalin at 0.5 lb ai/A + thiobencarb at 3 lb ai/A provided the greatest control of barnyardgrass, regardless of the POST timing. Based on these data, the utilization of multiple residual herbicides incorporated into a herbicide program are necessary to provide control of problematic grass weeds, such as barnyardgrass in furrow-irrigated rice. Tank-mixing clomazone at 0.3 lb ai/A with quinclorac at 0.375 lb ai/A applied at planting, provided increased control of barnyardgrass than when clomazone at 0.3 lb ai/A was applied alone. Regardless of the location or timing of the second application, clomazone 0.3 lb ai/A + quinclorac at 0.375 lb ai/A fb pendimethalin at 0.5 lb ai/A + thiobencarb at 3 lb ai/A provided increase control of barnyardgrass compared to most treatments.

Control of Weedy Rice with Benzobicyclon as a Function of Genotype and Growth Stage. LB Piveta*, JK Norsworthy, MM Houston; University of Arkansas, Fayetteville, AR (128)

Weedy rice (*Oryza sativa*) is a troublesome weed that can cause economic losses by reducing grain yield and grain quality. Taxonomically, weedy rice and cultivated rice are the same species, and thus selective chemical control of weedy rice in cultivated rice is challenging. The pro-herbicide benzobicyclon is a 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibitor under registration in the midsouthern United States for control of several annual grasses, sedges, broadleaves, and aquatic weeds in flooded rice. Rice sensitivity to benzobicyclon is cultivar-specific, but at a broad-scale, tolerance diverges among rice subspecies. Tolerance to benzobicyclon in cultivated *japonica* rice, but not *indica* or *aus*-like cultivars, is conferred by a fully functional *HPPD Inhibitor Sensitive 1* (*HIS1*) gene. In order to establish the relationship weedy rice growth stage has on the efficacy of benzobicyclon, experiments were conducted near Colt, Arkansas in 2019, and Stuttgart, Arkansas, in 2020. A total of 15 weedy rice genotypes and five known rice cultivars were planted at two separate timings and flooded when the initial planting reached 4 to 5 leaves at both locations to determine the efficacy of benzobicyclon at multiple growth stages. Treatments were arranged as a two-factor split-plot with three replications, with the whole-plot factor being size at application (1-2 or 4-5 leaves) and sub-plot factor being genotype. An interaction of genotype and application timing was observed for injury at 14, 21, and 28 days after treatment (DAT). Overall, the later planted smaller genotypes showed more significant injury in comparison to earlier planted larger genotypes. However, susceptible genotypes were effectively controlled or severely injured at both application timings. Benzobicyclon is most effective when applied to weedy rice before the 3-leaf growth stages or when weedy rice plants do not express a functional *HIS1* gene. Injury from a cross between Purple Marker, a sensitive cultivar, and RoyJ, a tolerant cultivar, showed partial tolerance when applications were beyond the 3-leaf stage.

Weed Control in Southern Minor Crops with Bicyclopyrone:. B Fraser*[1], E Rawls[1], GD Vail[2], TH Beckett[2], P Eure[3], C Dunne[1], V Mascarenhas[4], H McLean[5], M Vandiver[6], J Gordy[6], T Trower[7], SA Payne[8]; [1]Syngenta Crop Protection, Vero Beach, FL, [2]Affiliation Not Specified, Greensboro, NC, [3]Syngenta Crop Protection, Greensboro, NC, [4]Syngenta Crop Protection, Nashville, NC, [5]Syngenta Crop Protection, Perry, GA, [6]Syngenta Crop Protection, Vero Beach, TX, [7]Syngenta Crop Protection, Vero Beach, WI, [8]Syngenta Crop Protection, Slater, IA (129)

Bicyclopyrone is an HPPD-inhibitor (Group 27) herbicide and is one of the active ingredients in Acuron® herbicide. Syngenta is currently pursuing registrations in sixteen minor use crops: banana, plantain, papaya, pineapple, rosemary, lemongrass, broccoli, garlic, hops, horseradish, sweet potato, bulb onion, green onion, timothy grown for seed, strawberry, and watermelon. The application rate ranges from 37.5 to 50 g ai ha^{-1}. Bicyclopyrone offers a great deal of versatility in application methods including preplant, preemergence, pre-transplant, row middle, post-directed, and postemergence, depending on crop. Crop tolerance to bicyclopyrone varies by crop, application rate, and application method. Directions for use include not exceeding 50 g ai ha^{-1} bicyclopyrone per acre per crop year, not exceeding one application per year, adding a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v for postemergence applications. Soil applications will provide 3-4 weeks of residual control or partial control of several grass and broadleaf weeds. Postemergence applications of bicyclopyrone to 5 cm-tall or shorter weeds will provide control or partial control of several grass and broadleaf weeds. Bicyclopyrone will provide for an additional active ingredient, and in some cases, a new site of action for managing herbicide-resistant weeds in crops with limited weed control options.

Herbicide Programs for Broadleaf Weed Management in 2,4-D Tolerant Soybean. MW Marshall*; Clemson University, Blackville, SC (130)

Broadleaf weeds, including Palmer amaranth (*Amaranthus palmeri* S. Wats), are among the most common and troublesome weeds in the Southeastern United States. Recent introduction of soybean varieties tolerant to the Group 4 herbicides (2,4-D and dicamba) have provided growers a new mode-of-action to combat broadleaf weeds postemergence. Incorporating 2,4-D choline into existing herbicide programs in soybean for broadleaf weed management will provide a new tool. Weed size is at the time of application is critical for success. Studies were initiated to evaluate the effectiveness of 2,4-D choline plus other herbicides in 2,4-D tolerant soybean. Field experiments were conducted in 2019 and 2020 at the Edisto Research and Education Center (EREC) located near Blackville, SC. Experimental design was a randomized complete block with 3 replications with individual plot sizes of 3.8 by 12 m. Preemergence (PRE) treatments included flumioxazin plus chloransulam at 0.088+0.029 and 0.106 + 0.036 kg ai/ha, flumioxazin + pyroxasulfone at 0.071 + 0.09 kg ai/ha, chlorimuron + flumioxazin + thifensufluron at 0.026+0.082+0.008 kg ai/ha, flumioxazin + thifensulfuron + tribenuron at 0.072 + 0.009+0.008 kg ai/ha, and pyroxasulfone at 0.15 kg ai/ha. Postemergence treatments included glyphosate + 2,4-D choline at 1.12+1.12 kg ai/ha, 2,4-D choline + glyphosate + acetochlor at 1.12+1.12+1.26 kg ai/ha, glufosinate + s-metolachlor at 0.59 + 1.05 kg ai/ha, 2,4-D choline + glufosinate at 1.12 + 0.59 kg ai/ha, glufosinate at 0.59 kg ai/ha, and 2,4-D choline + glyphosate + s-metolachlor at 1.12+1.12+1.05 kg ai/ha. Treatments were applied after planting (mid-May) followed by POST1 (APT1) at V2-V3 and POST2 (APT2) V6-V7. Palmer amaranth and pitted morningglory (*Ipomoea lacunosa* L.) percent visual control ratings were evaluated at APT1, APT2, and 2 weeks after APT2 (2WPT2) on a 0 to 100% scale with 0 indicating no control and 100% equal to complete control. Soybean plots were harvested for yield (October). Palmer amaranth and pitted morningglory control and soybean yield data were analyzed using ANOVA and means separated at the P = 0.05 level. No differences among the PRE treatments were observed at the APT1 timing. Palmer amaranth control in 2019 decreased to 94% at the APT2 timing. At 2WAPT2, Palmer amaranth control increased to 96%. All other treatments provided excellent control of Palmer amaranth (99-100%) at 2WAPT2. Similar to 2019, Palmer amaranth control was excellent (98-100%) across all treatments. In 2019, PRE pitted morningglory control at planting was excellent (99-100%). At the APT2 timing, pitted morningglory control decreased to 94% in due to emergence of new plants; however, the second application of glufosinate provided excellent control at 2WAPT2. Pitted morningglory control ranged from 87 to 98% with pyroxasulfone PRE alone providing the least control. After the APT1 timing, pitted morningglory control was excellent (98-100%). Preemergence control was excellent for Palmer amaranth; however, pyroxasulfone PRE alone was weaker on pitted morningglory than other PRE combinations in this study. The postemergence combination of 2,4-Choline + glyphosate or glufosinate provided excellent control of Palmer amaranth and pitted morningglory. The use of overlapping residuals, such as s-metolachlor or acetochlor, reduced the incidence Palmer amaranth and pitted morningglory in between POST treatments. No differences in soybean yield were observed across the herbicide treatments.

Managing Kochia with Engenia PRE/POST Combinations. W Keeling, CR White*, J Spradley; Texas A&M AgriLife Research, Lubbock, TX (131)

Kochia (*Bassia scoparia*) is effectively controlled by preplant incorporated dinitroaniline herbicides in conventional tillage cotton production. With increasing no-till, kochia is a major early-season weed problem that emerges in March and can continue growing throughout the season. Dry conditions in the spring often make postemergence control difficult, especially with larger kochia. Studies were conducted in 2019 and 2020 near Lubbock, Texas to evaluate preemergence (PRE) and postemergence (POST) control using Engenia, glyphosate, and residual herbicides. Applications were made using a CO_2-pressurized backpack sprayer at a volume of 15 gallons per acre. Dicamba treatments were sprayed with Turbo TeeJet Induction 11002 nozzles. The non-dicamba treatments were applied using Turbo TeeJet 11002 nozzles. In both 2019 and 2020, Engenia tank-mixed with residual herbicides controlled kochia >95% when applied PRE. In 2019, Engenia alone or in a tank-mix improved kochia control when compared to 2,4-D treatments. In 2020, Engenia with a tank-mix residual herbicide improved kochia control compared to Engenia PRE alone. In 2019, effective POST control was achieved using Engenia and glyphosate. POST control of kochia was not affected by the addition of tank-mix residual herbicides.

Change in Weed Richness and Frequency of Glyphosate-Resistance After Eight Years of Glyphosate and Dicamba in Cotton. MD Inman*[1], DL Jordan[2]; [1]Clemson University, Florence, SC, [2]North Carolina State University, Raleigh, NC (132)

Research was established in 2011 to determine the impact of glyphosate and dicamba on glyphosate-resistant (GR) Palmer amaranth populations and the frequency of GR Palmer amaranth after 8 yr of use and to determine changes in weed richness over the course of the study. During the first four years, treatments included three sequential POST applications of glyphosate with or without pendimethalin plus diuron PRE; three sequential POST applications of glyphosate plus dicamba with and without these PRE herbicides; and a POST application of glyphosate plus dicamba plus acetochlor followed by one or two POST applications of glyphosate plus dicamba without PRE herbicides. Biennial rotations of POST applications of glyphosate only and glyphosate plus dicamba POST with and without PRE herbicides were also included. Glyphosate plus dicamba was applied to the entire test area for the final 4 years of the study. Following a rapid increase in Palmer amaranth density and frequency of the resistance during the first 4 years following glyphosate only, density decreased in a similar manner during the final 4 years when glyphosate plus dicamba was applied 2 or 3 times. Frequency of GR did not decrease from the maximum level observed after the first 4 years. Weed richness did not change over the course of the study. No difference in tolerance to dicamba was observed from GR Palmer amaranth populations after 8 yr of the experiment.

Peanut Tolerance to Preemerge Applications of Fluridone. A Ross*[1], T Barber[2], LM Collie[1], RC Doherty[3], ZT Hill[4]; [1]University of Arkansas, Lonoke, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR, [3]University of Arkansas Division of Agriculture Research & Extension, Monticello, AR, [4]University of Arkansas Cooperative Extension Service, Monticello, AR (133)

In recent years peanut acreage in Arkansas has substantially increased. Multiple herbicide-resistant Palmer amaranth is the number one weed management issue in Arkansas peanut production. PPO-resistant Palmer amaranth populations are becoming widespread in peanut producing counties of Arkansas. New tools are needed for effective pigweed control in Arkansas peanut production. Studies were conducted in 2019 and 2020 at the University of Arkansas System Division of Agriculture Extension Center near Newport, Arkansas. Georgia 06G peanut variety was planted on a Bosket fine sandy loam soil on June 6, 2019 and April 21, 2020. Herbicide treatments were arranged in a randomized complete block design with plots 5 by 30 feet. Treatments consisted of three different fluridone rates (0.15, 0.3 and 0.6 lb ai/A), one rate of fluridone in combination with flumioxazin 0.096 lb ai/A, one flumioxazin 0.096 lb ai/A alone for comparison, and an untreated check. Crop injury was evaluated 14, 28, and 35 days after emergence (DAE). Yield could not be collected in 2019 due to extensive rainfall during harvest. Yield data was collected in 2020 utilizing a small peanut plot combine. A significant interaction occurred when data was analyzed across years; therefore site-years were analyzed separately. This interaction is likely attributed to the difference in amount of total rainfall received. In 2019 the yearly rainfall total was 65.89 inches or 17.79 inches above normal. Overall peanut injury was high in 2019 regardless of herbicide combination or rate applied. As fluridone rate increased, peanut injury also increased with the highest injury (65%) recorded at 14 DAE from fluridone applied at 0.6 lb ai/A. Injury to peanut continued at similar levels by 28 DAE in 2019 mostly due to continued rainfall and saturated soil conditions. Peanut injury was overall less in 2020, but trends continued with increasing injury as fluridone rates increased 14 DAE. Injury from combinations of fluridone plus flumioxazin was higher than fluridone alone at 0.15 or 0.3 lb ai/a, but not different from flumioxazin alone either year. However, by 28 DAE, injury decreased for most treatments in 2020. The highest levels of injury in 2020 (28%) occurred at 28 DAE with fluridone at 0.6 lb ai/A. Levels of injury for all other treatments 28 DAE in 2020 were 15% or less. Peanut yields in 2020 were highest for fluridone applications at 0.15 lb ai/A at 7307 lb/A. This did not differ from fluridone at 0.3 lb /A, flumioxazin alone or the combination of flumioxazin plus fluridone at 0.15 lb ai/A. Data suggest that peanut can tolerate 0.15 lb ai/a fluridone on this sandy loam soil type. However, injury could significantly increase at rates of 0.3 lb ai/A or higher, especially in wet years, although no yield loss was observed. Yield loss was significantly reduced to 3314 lb/A when the fluridone rate was increased to 0.6 lb ai/A, so caution is needed moving forward. The addition of flumioxazin to fluridone appears to have the potential to increase injury and lower yields so more data is necessary before this mixture will be recommended.

Assessing Antagonism of Clethodim and Fluazifop-p-butyl by Commonly Applied Fungicides in Peanut. J Ferguson*[1], S Li[2], KJ Price[2]; [1]Mississippi State University, Mississippi State, MS, [2]Auburn University, Auburn, AL (134)

Fungicide applications are a common management practice in peanut production. Peanut growers in Alabama and Mississippi have observed reduced grass weed control over recent years and suspect the fungicide in the tank-mixture is antagonizing the grass control herbicide. The objective of this research was to assess fungicide additions to common DIM and FOP grass herbicides for antagonism for grass weed control in peanut. Studies were conducted at two sites in Mississippi and two sites in Alabama in 2020. Applications at all four site-years were made using a CO2 backpack sprayer with four AIXR 11002 nozzles calibrated to 140 L ha^{-1} and 276 kPa. Clethodim (Select Max) and fluazifop-p-butyl (Fusilade DX) were applied alone and in combination with five commonly used fungicides in peanut. Clethodim applications were made at 136 g ai ha^{-1} and fluazifop-p-butyl applications were made at 210 g ai ha^{-1}. Each site-year included thirteen and an untreated check arranged in a randomized complete block design with four replications. Applications were made when grass plants were between 20 and 25 cm tall. Grass species rated for control were: Texas millet (*Urochloa texana* (Buckley) R. Webster), crowfootgrass (*Dactlyoctenium aegyptium* L. Willd), and southern crabgrass (*Digitaria ciliaris* (Retz.) Koeler). Grass control at 28 days after application was variable by site year, ranging from 89 to 10% with the fluazifop-p-butyl plus fluxapyroxad plus pyraclostrobin treatment from Mississippi to the E.V. Smith site-year in Alabama. Poor grass control at both Alabama site-years were also due to late applications over drought stressed and greater maturity stage grass weeds than at the Mississippi site-years. Field studies will be conducted again in 2021, as 2020 data was not conclusive, especially with the range of control observed for the same treatments across site year.

Air Temperature Effect on Barnyardgrass (*Echinochloa crus-galli*) Control from Postemergence Rice Herbicides. LM Collie*[1], BM Davis[1], D Ellis[2], T Barber[3], TR Butts[3]; [1]University of Arkansas, Lonoke, AR, [2]Corteva, Arlington, TN, [3]University of Arkansas System Division of Agriculture, Lonoke, AR (135)

Arkansas rice producers have noticed a decrease in barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv.] control when herbicide applications have been made later in the growing season with greater daytime temperatures even when all other environmental factors were favorable for herbicide efficacy. The objective of this research was to determine if greater daytime air temperature affects postemergence herbicide efficacy on barnyardgrass. A field study was conducted at the University of Arkansas at Pine Bluff Small Farm Outreach Center near Lonoke, Arkansas in 2020 using a randomized complete block design. All herbicide applications were made with a spray volume of 94 L ha^{-1} and visual estimations of weed control were taken 1 week after treatment (WAT) and 3 WAT. Rice cultivar RT 7521 FP was planted at 34 kg ha^{-1} on two separate dates to allow for applications to be made to equivalent sized barnyardgrass and rice but achieve different daytime air temperatures. Herbicide treatments were applied to 3 to 4 leaf barnyardgrass on May 27 at a lower air temperature (daytime high of 26.1 C) and the same herbicides were applied on June 19 at a higher air temperature (daytime high of 32.2 C) to equivalent size barnyardgrass. When applied at the lower air temperature, all herbicides provided 65% or greater control, excluding florpyrauxifen-benzyl (Loyant) alone (55%), 1 WAT. Efficacy of florpyrauxifen-benzyl was reduced at the higher temperature (32.5%) compared to the lower temperature (50%) 3 WAT. Cyhalofop (Clincher) and bispyribac-sodium (Regiment) provided 60% and 65% control, respectively, when applied at the lower temperature 3 WAT, but control dropped to 25% and 20% control, respectively, at the higher temperature. At the higher temperature, imazamox (Postscript) provided 80% control 3 WAT while all other remaining treatments provided less than 55% control. Efficacy of penoxsulam (Grasp) and imazamox (Postscript) on barnyardgrass was not affected by the increased daytime air temperature. Conversely, efficacy of florpyrauxifen-benzyl (Loyant), cyhalofop (Clincher), and bispyribac-sodium (Regiment) was severely negatively impacted by increasing daytime air temperature from 26.1 C to 32.2 C. Overall, barnyardgrass was better controlled when herbicide applications were made with lower daytime highs (26.1 C). If applications are made when air temperature highs are greater (32.2 C) producers should expect to see a reduction in the efficacy of some herbicides, and appropriate herbicide selection becomes even more critical to maximize control of barnyardgrass.

Initial Year of a Long-Term Study Evaluating Weed Management Strategies on Palmer Amaranth Population Dynamics in Soybean. MM Houston*[1], JK Norsworthy[1], T Barber[2], RB Farr[1], LB Piveta[1]; [1]University of Arkansas, Fayetteville, AR, [2]University of Arkansas System Division of Agriculture, Lonoke, AR (136)

Palmer amaranth is the most troublesome weed in soybean production throughout the Midsouth. With herbicide resistance in Palmer amaranth to seven sites of action, soybean producers are looking for alternative control methods. To evaluate potential alternative solutions and current programmatic herbicide options, an experiment was established in Newport, AR beginning spring of 2020. A cereal rye cover crop was established in fall of 2020 and a seed destructor was integrated into the trial as a factor being tested at crop harvest. For these reasons, the results from the initial summer of the trial could be impacted only by herbicide programs. Herbicide programs were evaluated with 12 replications per treatment where plots were 25 by 390 ft. These treatments consisted of Enlist ($227 ha^{-1}), Xtendflex ($233 ha^{-1}), and POST-only Xtendflex ($74 ha^{-1}) soybean programs. The Enlist and Xtendflex soybean programs, which included residual herbicides, limited Palmer amaranth emergence and provided season-long control (0 Palmer amaranth per m^2 at harvest). The POST-only Xtendflex program, which did not include residual herbicides, was able to reduce Palmer amaranth densities with postemergence applications of dicamba + glyphosate (560 + 1260 g ae ha^{-1}) followed by glufosinate + glyphosate (656 g ai ha^{-1} + 1260 g ha^{-1}), but escapes were still present at harvest (0.26 Palmer amaranth per m^2 at harvest). Future efforts in this trial will focus on the impact of the three herbicide programs with and without a cereal rye cover crop and use of a seed destructor on weed populations in the seedbank and present at harvest as well economics of the production systems over a five-year period.

Weed Management in Corn with Pyridate. DO Stephenson, IV*; Louisiana State University AgCenter, Alexandria, LA (137)

Pyridate is a photosystem II inhibiting herbicide that is in the phenyl-pyridazine family. Tough 5EC is a formulation of pyridate commercialized by Belchim Crop Protection USA and is labeled for use in field corn, chickpea, and mint. Research was conducted to evaluate pyridate in a Louisiana corn weed management program. Historically, weed management programs in Louisiana corn only require a single in-season herbicide application for season-long weed control. Therefore, pyridate utility was evaluated following a V4-V5 application timing in corn. Treatments were pyridate at 0.4 kg ai ha^{-1}, atrazine at 1.1 kg ai ha^{-1}, pyridate plus atrazine, and pyridate and atrazine plus glyphosate at 1.3 kg ae ha^{-1}. Crop oil concentrate was included in all treatments at 1% v/v. Treatments were applied to 20 to 30 cm tall corn and weeds were 1 to 6 cm in height. Weeds evaluated were barnyardgrass, glyphosate-resistant (GR) Palmer amaranth, ivyleaf morningglory, sicklepod, and hophornbeam copperleaf. Little to no corn injury was observed following pyridate alone or in combination with atrazine and glyphosate. The three-way co-application of pyridate, atrazine, and glyphosate provided greater barnyardgrass control than pyridate alone 14 DAT. At 28 DAT, both atrazine alone and the three-way co-application controlled barnyardgrass greater than pyridate alone. All treatments provided greater GR Palmer amaranth control than pyridate alone 14 and 28 DAT, except the three-way co-application 28 DAT. The decrease following the three-way co-application may be due to the lack of glyphosate activity. All treatments provided at least 80% ivyleaf morningglory control 14 and 28 DAT. However, the control data range, 80 to 97% indicating variability in the data. At 14 DAT, all treatments provided greater sicklepod control than pyridate alone, but no differences were observed 28 DAT. All treatments provide excellent control of hophornbeam copperleaf. Corn yield following all herbicide treatments did differ and ranged 11,900 to 12,600 kg ha^{-1}. Data indicates that pyridate has use for ivyleaf morningglory control, but is not a replacement for atrazine. Pyridate is not a good option for GR Palmer amaranth control. Based upon the weed spectrum evaluated in this research, pyridate may not have utility in Louisiana corn. However, when considering that weed management programs in Louisiana corn are oftentimes a single pass program, additional research is needed to evaluate pyridate efficacy on other problematic weed species to determine if it has utility in Louisiana corn.

Peanut Response to Glyphosate Plus 2,4-D Rate and Exposure Timing. P Devkota*, P Kharel, MJ Mulvaney; University of Florida, Jay, FL (138)

In southeastern US, peanut is commonly grown in close proximity to Enlist cotton, soybean, or corn fields. 2,4-D choline plus glyphosate is primarily applied for weed control in Enlist system, so there is potential for herbicide drift to adjacent peanut. A field research was conducted to evaluate response of peanut exposure timing (at 25, 50, and 75 days after planting) to different rates of 2,4-D plus glyphosate applied at: 1.9 plus 2.0; 7.4 plus 7.9; 29.7 plus 31.5; and 118.8 plus 126.2 g ae ha^{-1}, respectively. Significant interaction was observed between peanut exposure timing and 2,4-D plus glyphosate rate on peanut injury, and canopy width & height reduction. The interaction illustrated that peanut injury, canopy height or width reduction was higher when exposed during early growth timing with the higher herbicide rate. At 2 WAT, peanut injury was =14% when exposed at 25 DAP compared to 75 DAP; however, similar result was not observed at 4 or 8 WAT. Herbicide rate effect was observed for peanut injury where higher rate resulted in greater injury. 2,4-D plus glyphosate exposure 25 DAP resulted higher peanut canopy reduction (=13%) compared at 50 or 75 DAP; however, there was no difference on height reduction. Difference in peanut canopy and height reduction was observed with herbicide rate. Yield reduction was not influenced by peanut growth timing; however, significant difference was observed with 2,4-D plus glyphosate rate. This research highlighted that 2,4-D choline plus glyphosate drift can cause significant injury on peanut depending on herbicide rate and exposure timing, and yield reduction could depend on the herbicide rate.

Sentris™ Buffering Technology for Dicamba Based Dicamba-Tolerant Crop Herbicide Products. S Bangarwa, A Adams, T Rowlandson, S Bowe*; BASF Corp., Research Triangle Park, NC (139)

Sentris™ is an alkaline buffering adjuvant which can be used to raise spray solution pH, stabilize cation balance and improve equipment clean out when using Engenia herbicide (BAPMA dicamba) in dicamba tolerant crops alone or mixed with other approved herbicides / pesticides or adjuvants. Some commonly used tank mix partners such as glyphosate can lower spray solution pH and/or alter cation balance potentially increasing secondary loss (e.g. volatility) of dicamba. Sentris at 293 to 585 ml ha^{-1} (4 to 8 fl oz A^{-1}) was tested in combination with labelled rates of BAPMA dicamba (560 g ae ha^{-1}) and potassium (K) glyphosate (1120 to 1260 g ae ha^{-1}) across a range of laboratory (quantitative humidome), greenhouse (bioassay humidome) and field (low tunnel bioassay, mid/large-scale air sampling/bioassay) methodologies and found to provide a consistent reduction in secondary loss of dicamba. The 293 ml rate of Sentris typically reduced secondary loss of BAPMA dicamba + glyphosate to that of BAPMA dicamba alone and 585 ml (8 fl oz) provided further reduction to compensate for the potential impact of other mix partners, spray water quality and environmental conditions. The addition of Sentris to the spray solution was also found to reduce retention of dicamba on spray equipment surfaces such as EPDM rubber hose providing an additional equipment clean out benefit. Other trials confirmed that the addition of Sentris had no effect on dicamba or dicamba + glyphosate weed control or crop tolerance. Sentris is labeled for use with Engenia alone and approved tank mixes at a rate of 585 ml ha^{-1} (8 fl oz A^{-1}) See www.engeniatankmix.com for approved tank mix products. While Sentris can mitigate the secondary loss impact of tank mix partners like glyphosate on dicamba, any Engenia application must always be applied according to label directions with particular attention to approved tank mixes, proper spray equipment configuration and weather conditions that maximize efficacy and minimize both primary (e.g. spray drift) and secondary off target movement.

Evaluation of PPO and Metribuzin Combinations in Soybean. TA Baughman*, ZR Treadway, RW Peterson; Oklahoma State University, Ardmore, OK (140)

Soybean growers continue to wrangle with weeds as one of their most difficult production issues. Weed resistances to many of the available classes of herbicides has dominated those struggles. Soybean weed management trials were conducted at the Oklahoma State University Mingo Valley Research Station near Bixby, OK; during the 2019 and 2020 growing seasons. Both Roundup Ready 2 Xtend® and LibertyLink®/ LibertyLink GT27® soybean technologies were planted in early June of each year. All trials included protoporphyrinogen oxidase (PPO) inhibitor herbicides applied preemergence alone or in combination with TriCor 75 DF (metribuzin) at either 4 oz/A or 8 oz/A. All PRE treatments were followed by either 1 postemergence application of Engenia (dicamba) + Roundup PowerMax (glyphosate) or 2 postemergence applications of Liberty (glufosinate). Injury to soybean was 5% or less with all treatments. The only PRE treatment that controlled Palmer amaranth (*Amaranthus palmeri* L.) at least 95% prior to POST treatment both years regardless of technology was Spartan (sulfentrazone) + Tricor at 8 oz/A. Late season Palmer amaranth control was at least 97% with all PRE treatments in the Xtend and LibertyLink system in 2020. Similar results were observed in both systems in 2019 except with Tricor 4 oz/A (74%) in the Xtend system. Large crabgrass control was at least 97% late season with all treatments in both the Xtend and LibertyLink system. Similar results were observed with both systems in 2019. Soybean yields with the Xtend system were at least 55 bu/A both years with all PRE treatments except with Tricor PRE alone and any PRE treatment that included Sharpen (saflufenacil) in 2019. Soybean yields with the LibertyLink system were at least 50 bu/A with all PRE treatments except with Reflex (fomesafen) or Spartan in combination with 8 oz/A of Tricor and any treatment that included Valor (flumioxazin) in 2019. Observations from these trials indicated that combinations of metribuzin (Tricor) with a PPO herbicide can provide effective residual control of Palmer amaranth and large crabgrass when used in combination with postemergence herbicide technologies. The use of metribuzin in combination with a PPO herbicide can assist in preventing resistance to both PPO herbicides as well as the new herbicide technologies.

Carry-over Effects of Soil Residual Herbicides Applied to Cotton on Winter Cover Crops. D Hathcoat*[1], E Osco Helvig[2], SL Samuelson[3], H Taylor[4], C Daniel de Goes Maciel[5], MV Bagavathiannan[4]; [1]Texas A&M AgriLife Research, College Station, TX, [2]Universidade Estadual do Centro Oeste, Guarapuava, Brazil, [3]Corteva, Bryan, TX, [4]Texas A&M University, College Station, TX, [5]UNICENTRO, Guarapuava, Brazil (141)

The use of cover crops following a cash crop can be a very beneficial practice on soil health and water use efficiency (Snapp et al. 2005). Some herbicides applied in the summer to cotton can persist in the soil for prolonged periods. These long-term residual herbicides are strongly influenced by the properties of soil, water and other environmental factors (Rector 2019). Herbicide carryover and its effects on winter planted cover crops following a cotton cash crop was studied in this trial conducted at the Texas A&M Research Farm for 2 cycles from 2019 to 2021. Cover crop injury and biomass production were the factors observed. During this experiment, the differences in environmental conditions varied greatly, therefore it caused a significant reduction in stand the second year. Thus, observations were only observed on Austrian winterpea, cereal rye, oats, oilseed radish, triticale, and winter wheat. Throughout this study it was noted that oats overall had the most tolerance to all of the herbicides tested. Eight treatments of the eleven tested were found to have no significant difference across all six cover crop species. Of the remaining 3 treatments, Formesafen showed the highest level of injury to both oilseed radish and winter wheat. Ultimately, this research showed that there were significant carryover effects of some herbicides on some of the cover crop species tested. Additionally, this research emphasizes the proper selection of cover crop species based on the residual herbicide used during the cotton production.

Effect of Fragment Length and Clump Size on Desiccation Tolerance of *Hydrilla verticillata* . TL Darnell*[1], BP Sperry[1], CM Prince[2]; [1]University of Florida/ Center for Aquatic Invasive Plants, Gainesville, FL, [2]University of Florida, Gainesville, FL (142)

Hydrilla verticillata (hydrilla) is an aquatic invasive plant that forms dense mats in waterbodies. These mats break apart when watercraft pass through them, and lodge on different parts of the vessel and boat trailer. Stem fragments can subsequently be carried to other waterbodies where they can establish new populations; however, little is known about their ability to regenerate following periods of desiccation (i.e., on a boat trailer). Our objective was to evaluate the desiccation tolerance of individual and clumped fragments. To this end, hydrilla fragments were exposed to nine desiccation times (0.5, 1, 2, 4, 8, 12, 24, 48 hours) as single fragments or clumped fragments (1, 3, 6, or 12 fragments per clump). Clumps were loosely folded in half with a 45° rotation to simulate a clump and keep the material together. Plant material was desiccated for predetermined intervals and were subsequently placed in rehydration vessels for 48 hours. Post-rehydration, unbleached, turgid green stems with preserved apices were planted and carried for two weeks then harvested. The regenerative capacity of fragments and clumps was a significant function of both desiccation time and fragment and clump size. Destructive dry weight data were regressed over desiccation time using three and four parameter log-logistic model which shows an ED_{50} (effective time needed to inhibit 50% of the population from surviving values for individual fragments to be 0.90, 0.94, and 0.68 hours for fragment sizes of 7, 15, and 30 cm, respectively, with respective ED_{90} values of 0.99, 1.02, and 1.03 hours. For clumps, ED_{50} values were 1.24, 1.81, 1.95, 3.0 hours for 1, 3, 6, and 12 fragment clumps, respectively, while the ED_{90} values were 2.13, 2.27, 3.6, and 6.15 hours. Desiccation tolerance of hydrilla was different between individual fragments and clumps as supported by the ED_{50} , ED_{90} , and three and four variable log logistic models. These data suggest that longer, denser clumps have an increased ability to establish new colonies elsewhere. Future research will include expanding testing parameters into uncontrolled exterior environments, simulated boat bunk studies, and water loss percentage threshold determination for loss of regenerative capacity.

Effect of Cultivation Timing and Crop Canopy Architecture on Weed Control in Organically Grown Sweetpotato. CD Blankenship*[1], KM Jennings[2], LD Moore[2], SC Smith[2], SJ Ippolito[2], KC Sims[3], DL Jordan[2], SL Meyers[4], D Monks[2], JR Schultheis[2], DD Suchoff[2]; [1]Affiliation Not Specified, Raleigh, NC, [2]North Carolina State University, Raleigh, NC, [3]Affiliation Not Specified, Goldsboro, NC, [4]Purdue University, West Lafayette, IN (143)

Sweetpotato is a valuable vegetable crop in North Carolina. In recent years, organic sweetpotato production has increased in the United States, leading to an increased demand for research recommendations for organic growing practices including weed control. Cultivation is a commonly used practice for weed control in sweetpotato production and is even more important in organically produced sweetpotato. Sweetpotato canopy architectures also presents another possible avenue for weed control via clone selection; thus, a field study was conducted in 2020 to determine the effects of cultivation frequency and timing and crop canopy architecture on weed control in organically produced sweetpotato. Three sweetpotato clones with different growth habits were planted (NC 04-531: bunch, Covington: long-internode, and Murasaki: longer-internode) and each was subjected to nine different cultivation treatments. Two wk cultivation followed by hand removal through harvest resulted in 90% weed control at 10 WAP. Total yield of all treatments other than 2 wk cultivation followed by hand removal and 1st weed emergence cultivation treatments were similar to the nontreated control. Murasaki yielded the best of all clones . Results indicate cultivation timing is more important than cultivation frequency. Murasaki's higher yields potentially highlights increased competitiveness with weeds. Further research is necessary to confirm the results of this study across different environments

Weed Management in Reduced-tillage Sweetpotato. SC Smith*[1], KM Jennings[1], D Monks[1], MR Schwarz[2], DL Jordan[1], C Reberg-Horton[1]; [1]North Carolina State University, Raleigh, NC, [2]Affiliation Not Specified, Raleigh, NC (144)

Sweetpotato is an economically important commodity for the southeastern U.S. and California. Continuous tillage is a requirement in current production systems but is detrimental to soil structure and decreases soil organic matter content. The utilization of a high-residue rye cover crop mulch in sweetpotato production has the potential to reduce the need for and impact of tillage. Before reduced-tillage systems can be adopted, weed management programs need to be evaluated for efficacy. Thus, field studies were conducted at the Horticultural Crops Research Station in Clinton, NC and Caswell Research Station in Kinston, NC in 2019 and 2020, respectively. Treatments included two production systems (conventional, or reduced-tillage with rye cover crop). Herbicide program treatments included flumioxazin, fomesafen, indaziflam, or bicyclopyrone pre-transplant, with or without clomazone after transplanting, and S-metolachlor with or without linuron at 2 WAP. Herbicide programs including linuron at 2 WAP had the greatest broadleaf weed control in the reduced-tillage system. All programs resulted in similar broadleaf weed control in the conventional tillage system. Flumioxazin followed by clomazone followed by S-metolachlor tank mixed with linuron resulted in similar total storage root yield as the weed-free check in the reduced-tillage system. All herbicide programs in the conventional tillage system resulted in similar total storage root yield as the weed-free check.

Tolerance of Strawberry to 2,4-D Choline Applied to Row Middles. KC Sims*[1], K Jennings[2], D Monks[2], DL Jordan[2], M Hoffmann[2]; [1]Affiliation Not Specified, Goldsboro, NC, [2]North Carolina State University, Raleigh, NC (145)

A field study in strawberry (*Fragaria* × *ananassa* Duch.) grown on polyethylene mulched raised beds was conducted from 2019 to 2020 to determine 'Chandler' strawberry tolerance to 2,4-D choline directed to the row middle between beds. Treatments included 2,4-D choline at 0, 0.53, 1.06, 1.60, and 2.13 kg ha^{-1} applied alone, and sequential treatments [0.53 followed by (fb) 0.53 or 1.06 fb 1.06 kg ha^{-1}]. Initial treatments were applied in January 2020 and sequential applications were applied in March 2020. Strawberry plants were actively growing at both applications. No differences among treatments were observed for visual foliage injury, fruit yield, and fruit quality (Brix, titratable acidity, and pH).

The Critical Period of Weed Control for Newly Established Southeastern US Vineyards. NT Basinger*[1], CC Hickey[2]; [1]University of Georgia, Athens, GA, [2]Pennsylvania State University, State College, PA (146)

The establishment of a vineyard is an expensive and labor-intensive process. Pest management of young vines, however, is often overlooked as an important component of effective vineyard establishment. The wine industry is growing throughout the southeastern US; thus, many novice farmers are engaging in agricultural entrepreneurship by planting vineyards. During vineyard establishment, new growers may (1) neglect to implement appropriate weed management strategies, or (2) fail to effectively manage weeds throughout the entire growing season. The goal of our project was to utilize these two basic scenarios of improper weed management to determine a critical period of weed control (CPWC) for newly established vineyards. The first scenario tested the effect of weed competition establishment at various timings after planting (0, 4, 8, 16, 24 – weeks after planting (WAP)). The second scenario tested the effect of weed competition removal at various timings after planting (0, 4, 8, 16, 24 – weeks after planting). Soil volumetric water content was different between treatments especially during times of low rainfall. Growth rate indicated that weeds should be managed from 4.2 WAP through the end of the season. However, winter pruning trunk diameters indicated that the CPWC is between 3.4 and 8.7 WAP. Since vegetative measurements like trunk diameter can be indicative of future plant maturation and productivity.

Impact of Reduced Rates of Liberty/Enlist One on Sweet Potato Growth and Yield. D Miller*; Louisiana State University Ag Center, St Joseph, LA (147)

A field study was conducted in 2021 at the Sweet Potato Research Station near Chase, 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), 1/10, 1/32, 1/64, or 1/100 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 July 16. Parameter measurements included visual crop injury (chlorosis, stunting, twisting, leaf crinkling) 7, 14, and 28 d after application (DAT), NDVI reading prior to harvest, and yield (U.S. #1, canner, jumbo, and total). A significant herbicide rate effect was noted at 7 DAT. Averaged across application timing, sweetpotato injury was greatest at the highest herbicide rate (67%). The 1/32x rate resulted in 37% injury, which was equal to the 20% injury observed at the 1/64x rate and greater than the 16% at the lowest herbicide rate. A significant herbicide rate by application timing interaction was noted both 14 and 28 DAT. At the 10 DAP application timing 14 DAT, a significant stepwise reduction in injury was observed from greatest of 97% at the highest 1/10x herbicide rate down to 14% at the lowest rate. At 30 the DAP application timing, a significant stepwise reduction in injury was observed from greatest of 74% at the highest 1/10x herbicide rate down to 21% at the lowest rate. Within each herbicide rate, injury was greater at the 10 DAP timing with only the two highest herbicide rates. At the 10 DAP application timing 28 DAT, the highest 1/10x herbicide rate resulted in greatest injury of 95%. The 1/32x herbicide rate resulted in 33% injury, which was greater than the equivalent injury of 16 and 6% observed at the two lowest rates, respectively. At the 30 DAP application timing, the highest 1/10x herbicide rate resulted in greatest injury of 46%. The 1/32x herbicide rate resulted in 20% injury, which was equivalent to the 14% injury at the 1/64x rate and greater than the 8% at the lowest rate. Within each herbicide rate, greater injury was observed at the two highest herbicide rates at the earlier 10 compared to 30 DAP application timing (95 vs 46 and 33 vs 20%, respectively) while injury was similar at the two lowest herbicide rates regardless of application timing (6 to 16%). A significant herbicide rate by application timing interaction was noted with respect to NDVI readings prior to harvest. At the 10 DAP application timing, the highest 1/10x herbicide rate resulted in an NDVI value of 0.430, which was lower than all other herbicide rates and the nontreated which resulted in equivalent values ranging from 0.770 to 0.804. At the 30 DAP application timing, all herbicide rate resulted in equivalent NDVI values to that observed for the nontreated (0.773 vs 0.733 to 0.795). Within each herbicide rate, a lower NDVI value was only observed at the highest rate at 10 DAP in comparison to the 30 DAP application timing (0.430 vs 0.733).A significant herbicide rate effect was noted for all yield components. In comparison to the nontreated, U. S. no. 1 and canner yield were reduced 70% and 68%, respectively, at only the highest herbicide rate when averaged across application timing. Jumbo yield, averaged across application timing, was significantly reduced in comparison to the nontreated following herbicide application at all rates. Greatest reduction was observed at the highest 1/10x herbicide rate (98%), which was equal to the 77% observed with the 1/32x rate and greater than the 51 and 66% reduction observed with the two lowest rates, respectively. Total yield, averaged across application timing, was significantly reduced in comparison to the nontreated following herbicide application

at all rates. Greatest reduction was observed at the highest 1/10x herbicide rate (78%), which was greater than all other herbicide rates which resulted in equivalent yield reduction ranging from 29 to 38%. 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.

Evaluating Efficacy and Crop-safety of the Pre-emergent Herbicide S-metolachlor Application Under Plastic Mulch in Vegetable Production. R Kanissery*; University of Florida - IFAS, Immokalee, FL (148)

Weed management is a fundamental step in successfully growing vegetable crops in Florida under plasticulture production system. Traditionally, production of crops like bell pepper was reliant on fumigants like methyl bromide for control of various soilborne diseases, nematodes, and weeds. However, phasing out of methyl bromide from the industry resulted in a lack of broad-spectrum activity in weed suppression in plastic mulched raised beds. Pre-emergence herbicides like s-metolachlor can be utilized as an option available for controlling tough weeds like nutsedges in the plastic beds. However, herbicide applications on the beds under plastic mulch are severely limited due to the potential for crop phytotoxicity. Hence, tremendous interest has developed recently in understanding the impacts of s-metolachlor on crop safety and yield while providing adequate weed control. A study was conducted at the Southwest Florida Research and Education Center (SWFREC) in Immokalee to evaluate the efficacy and crop safety of pre-emergent herbicide s-metolachlor in vegetable plasticulture. The study demonstrated the potential of this pre-emergent herbicide in vegetable plasticulture production. The observations show >95% control of nutsedge (*Cyperus* spp.), 45 days after application, within the raised beds under bell pepper production. Utilizing low rates of s-metolachlor (355 ml/acre) provided the much-needed crop safety from herbicide injury to transplants as observed from the plant vigor measurements. Moreover, the yield was enhanced considerably with s-metolachlor application due to reduced competition from weeds in the beds.

IR-4: Weed Control Project Updates - Food Crops. RB Batts*[1], JJ Baron[1], DL Kunkel[2], MP Braverman[2]; [1]IR-4 Project HQ, NC State University, Raleigh, NC, [2]IR-4 Project Headquarters, Princeton, NJ (149)

In 2020, IR-4 data led to just under 600 new uses. This number was quite a bit lower than most years. Twenty of these uses are for herbicides and plant growth regulators (including prohexadione calcium, sethoxydim, s-metolachlor, isoxaben, saflufenacil and 2,4-D) in a wide range of crops (alfalfa, globe artichoke, caneberry subgroup, hops, dill, rosemary, fig, chia, basil, sesame and intermediate wheatgrass). Also in 2020, IR-4 data petitions were submitted to EPA for ethalfluralin/stevia, glufosinate/fruiting vegetables, curcurbits, fig, avocado and hops, 2,4-D/clover and floransulam/grasses grown for seed. Along with these direct requests, these petitions also included request for several crop group conversions and crop group expansions for these compounds. Sixteen new herbicide magnitude-of-residue studies began in 2020. The number of on-going herbicide Product Performance studies in 2020 was twenty. Development of Product Performance data (efficacy and crop safety research) to support labeling of new uses for specialty crop pest management tools continues to be an important priority in the IR-4 Project's annual research plan as the data are often required by registrants and states (e.g.California) to complete the registration process. The 2021 field research plan for herbicides and plant growth regulators includes fifteen residue studies and twenty-two continuing or new Product Performance studies. The recently-established IR-4 Integrated Solutions Program is designed to address pest problems without solutions, resistance management, products for organic production and pesticide residue mitigation. Five new weed control Integrated Solutions studies will also begin in 2021, bringing the list of active Integrated Solutions weed control studies to seven. These projects are addressing need in grapes, apples, blueberries, processing tomatoes, sweetpotatoes, haskap, and date palm. The transition of IR-4 Headquarters to NC State University continues, but was slowed for various reasons during 2020. This relocation should be completed by September 2021.

Injury Assessment of Glyphosate and Auxin Herbicides on Southern Ornamentals and Influence of Trimming on Recovery. RD Langemeier*[1], S Li[1], J Pickens[2], KJ Price[1], A Nagila[1]; [1]Auburn University, Auburn, AL, [2]Auburn University, Mobile, AL (150)

The widespread use of synthetic auxin and glyphosate herbicides increases the risk of off-target movement to sensitive landscape ornamentals. In Alabama, the nursery and greenhouse industry contribute over $500 million to the state's economy annually. The importance of aesthetics in the ornamental industry combined with the high value of these crops allow very little tolerance to herbicide damage due to off-target movement. Damage to ornamental plants can result in significant economic and aesthetic damage to both commercial growers and homeowners. Additionally, published literature provides little guidance on best management practices following herbicide injury to reduce economic losses and decrease recovery time. The first objective of this study was to evaluate herbicide sensitivity of three common southern landscape ornamentals to simulated drift of 2,4-D, dicamba, glyphosate, and glyphosate + synthetic auxin combinations. The trial consisted of two locations in Lee and Mobile Counties in Alabama. Japanese Holly (*Ilex crenata* x 'Compacta'), Azalea (*Rhododendron* x 'Hardy Gardenia') and Hydrangea (*Hydrangea macrophylla* x 'Penny Mac') were potted in mid-April 2020 and sprayed in mid-May 2020. The site in Lee county had 8 replications and the site in Mobile county had 12 replications. Both sites used a completely randomized design. Herbicides were applied at either 5 or 10% of row crop use rates which were considered to be 1120, 560, and 1260 g ae ha^{-1} for 2,4-D, dicamba, and glyphosate respectively. Visual injury was assessed at 2, 4, 6, and 11 weeks after initial treatment (WAIT). Plants were trimmed in a consistent manner at each site at 6 WAIT. Saleability and growth indices [(Height x Width x Width)/3] were recorded at 6 and 11 WAIT. Visual injury was the highest in all species for combinations of synthetic auxins and glyphosate. Following trimming conducted at 6 WAIT, visual injury was reduced for all treatments and for hydrangea and holly, zero injury was observed at 11 WAIT. In Azalea the 10% glyphosate + dicamba treatment resulted in average injury of 19% following trimming, however this was the only treatment with injury levels >1%. No significant reduction in growth indices were observed for azalea, but growth indices reductions >30% for one or more treatments at each site were observed for holly and hydrangea. Following trimming only one azalea treatment resulted in a significant reduction in growth index. Azalea recovery following trimming tended to be inconsistent from plant to plant within treatments that resulted in more severe injury. Percentage of plants saleable increased or remained at 100% for all treatments across all species with the exception of the 10% glyphosate + dicamba treatment on azalea. These results indicate that trimming may be an effective method to improve saleability, mitigate economic loss and reduce recovery time following herbicide damage to ornamental crops.

Response of Sweetpotato Cultivars to Dicamba and 2,4-D. Z Yue*[1], I Werle[2], S Meyers[3], M Shankle[4], TP Tseng[1]; [1]Mississippi State University Plant and Soil Sciences, Mississippi State, MS, [2]Arkansa State University Weed Science, Fayetteville, AR, [3]Purdue University, West Lafayette, IN, [4]Mississippi State University Plant and Soil Sciences, Verona, MS (151)

Sweet potato ((*Ipomoea batatas* (L.) Lam.) is the seventh most important crop in the world.It can produce more edible energy per hectare and per day than other C3 crops such as wheat, rice and cassava. Mississippi annually grows 28,000 to 30,000 acres of sweet potatoes and ranks No. 3 after North Carolina and California by USDA. Weed competition can reduce sweet potato yield by 40-90%. Early-season competition from weeds is extremely critical. The main weeds include palmer amaranth, yellow nutsedge, and purple nutsedge. Except for preemergence and burndown herbicides, there are few herbicide options that can be used for early season weed control. This project tried to evaluate responses of different sweet potato cultivars to dicamba and 2,4-D, identifying tolerant cultivars to these two herbicides. These cultivars will be used for sweet potato production or breeding lines. The experiments included two steps: first 1X dicamba and 0.5X 2,4-D were used to screen the survivals from 20 sweet potato cultivars; second 0.4 X dicamba and 0.2X 2,4-D were used to evaluate the responses of the tolerant cultivars from the first step and palmer amaranth seedlings two weeks after treatment. Both tolerant cultivars that survived 1X dicamba and 0.5X 2,4-D were identified. The second step evaluations are underway.

Cover Crops and Tillage Regime Alter Weed Pressure in Organic Cotton Production. MV Bagavathiannan, MJ Barth*; Texas A&M University, College Station, TX (152)

Weeds present a major challenge in organic production systems and there is a great need for developing effective weed management options in these systems while reducing the dependency on destructive tillage. The objective of this study was to evaluate the impact of two tillage systems (strip-till and conventional-till) and four cover crop species (oats, mustard, winter pea, and a mix of all three species) on weed dynamics in organic cotton production. The field experiment was conducted at the Texas A&M field research facility in Burleson County, TX. Observations included weed seedling emergence patterns over the growing season and weed biomass production during mid-season and at harvest. Preliminary results showed that weed control is very challenging in strip-till plots; total crop failure occurred in some of the plots. Cover crops provided significant weed suppression, though the degree of impact varied among the cover crop species, and in the following order of efficacy from high to low: oats, mustard, cover crop mix, and winter pea. Even in strip-till plots with high weed infestations, the presence of cover crop residues provided considerable weed suppression. Weed seedling emergence patterns and weed biomass production also followed similar trends with respect to the tillage and cover crop treatments. Findings of this study reveal that cover cropping is a highly valuable tool for weed suppression in organic cotton production, but the inclusion of more robust weed management options are necessary for strip-tillage.

Optimizing Weed Management with US-1136, US-1137, and US-1138 Cowpea Cover Crop Lines. P Aryal*, CA Chase; University of Florida, Horticultural Sciences Department, Gainesville, FL (153)

In addition to its food and forage uses, cowpea [*Vigna unguiculata* (L.) Walp.] can provide agroecosystem services when used as a cover crop and green manure. Cowpea is well-adapted for use in the southern United States. The widely marketed cultivar, Iron Clay, is hard-seeded; however, the USDA Agricultural Research Service's germplasm releases (US-1136, US-1137, and US-1138) for cover crop use do not produce hard seeds and show promise for cropping systems in which volunteers are undesirable. Therefore, the objective of this trial was to compare the efficacy of weed suppression by the three USDA germplasm lines and to determine the optimum seeding rates of the germplasm lines for use as cover crops in the southern region. In summer 2020, the germplasm lines were planted with a cone-seeder at five seeding rates (45, 67, 90, 112, and 135 kg ha^{-1}) and a no cover crop, weedy control treatment was initiated in a randomized complete block design with four replications in Citra, FL. Shoot biomass, density, and canopy cover of the cowpea lines and weeds were quantified at 12 weeks after planting (WAP). Whereas cowpea canopy cover and shoot biomass were highest with US-1138, intermediate with US-1136, and lowest with US-1137; plant density with US-1138 was higher than with both US-1136 and US-1137. However, averaged over seeding rate, all three germplasm lines were similarly effective at suppressing weed biomass, density, and cover. Whereas all cowpea seeding rates resulted in similar cowpea canopy cover and shoot biomass by 12 WAP, cowpea density averaged over germplasm line increased with increasing seeding rate until 90 kg ha^{-1}. The lowest seeding rate of 45 kg ha^{-1} resulted in significantly lower weed density, weed cover, and weed biomass than the weedy control. Further decreases in weed suppression did not occur with the higher rates seeding rates. Multistate research is proposed for acquiring the region-wide information needed to develop recommendations for the affordable use of these cowpea germplasm lines by determining the lowest seeding rates that maximize cowpea biomass production and weed suppression under a range of soil and environmental conditions.

Phenoxy and Picolinic Acid Herbicide Combinations for Control of Southern Broadleaf Species. WJ Stutzman*[1], ZS Howard[2], M Matocha[3], SA Nolte[4]; [1]Texas A&M University Agrilife Extension, College Station, TX, [2]Texas A&M, College Station, TX, [3]Texas AgriLife Extension Service, College Station, TX, [4]Texas A&M AgriLife Extension, College Station, TX (154)

Carolina horsenettle (*Solinum carolinese*), Texas bullnettle (*Cnidoscolus texanus*), and marsh elder, (*Iva angustifolia*), are typical broadleaf species that commonly invade pasture and rangeland systems in the southeast United States. Levels of control by 2,4-D mixtures have been studied on horsenettle and bullnettle in the past with varying degrees in success. Very little has been evaluated with more recent chemical treatments, however. Fifteen treatment combinations with experimental compounds, Weedar 64, Clash, NFA Dual Salt Weedmaster, Grazonnext HL, and Duracor were evaluated for the control of the three species at two locations. Bullnettle proved to be the most difficult to control with an overall average of 72% control. It was consistently controlled by products including 2,4-D or 2,4-D with aminopyralid (81-98%). Horsenettle was best controlled by phenoxy herbicides, with an overall average control of 90.5% while marsh elder was controlled by all treatments (>87%), except the first experimental compound by itself (28%), as well as the low rate of Weedar 64 (70%). Average control of marsh elder across treatments was 93%. NFA Dual Salt Weedmaster controlled all three species consistently when mixed with Milestone, with average control increasing with quantity formulated at 97% and 99%, respectively. While the majority of treatments provided reliable control, the difficulty of Texas bullnettle and variety in experimental compound results warrants future research. Additional work would evaluate the effects of a variety of application rates and tank-mix combinations to provide more efficacious control methods for these three pasture weeds.

The Impact of Nozzle Selection on Herbicide Efficacy for Controlling Smutgrass (Sporobolus Indicus). MT House*[1], ZS Howard[2], SA Nolte[3]; [1]Texas A&M University, College Station, TX, [2]Texas A&M, College Station, TX, [3]Texas A&M AgriLife Extension, College Station, TX (155)

The broad range of variables involved in herbicide applications can make achieving effective weed control very challenging. These variables include application timing, methodology, weather and many other factors. The impacts of some variables have been researched extensively in several weed species; however, no research has been published evaluating application nozzle type and the methodology required to significantly improve smutgrass control. In 2019, a trial was conducted in Brazos County, TX comparing flat-fan air-induction nozzles to bi-directional nozzles spraying labeled smutgrass control programs through both nozzles; in order to determine relative fitness of each nozzle to the herbicide program. Results of this study show that glyphosate at 1.54 kg hA[1] followed by hexazinone at 1.26 kg ha^{-1} resulted in 100% control approximately one year after application and resulted in no significant injury to the bermudagrass *(Cynodon dactylon)* within the plots, as compared to the untreated check. However, both nozzles resulted in 100% control with this herbicide treatment, which means there was no difference in control that could be contributed to the nozzles. Also, of the four herbicide treatments tested in 2019, the nozzles did not create significant difference in any of the herbicide programs' efficacy 365 days after treatment. This trial was applied again in October 2020 at a second location, using the same treatments and nozzles and will be rated at 30-day intervals until 365 days after treatment.

Evaluation of Active Ingredients and Application Timing on Chinese Tallow (*Triadica sebifera*) Using Hack-and-squirt IPT. H Quick*[1], JD Byrd, Jr.[1], D Russell[2], KL Broster[1]; [1]Mississippi State University, Mississippi State, MS, [2]Auburn University, Madison, AL (156)

Herbicide active ingredients and seasonal application control were evaluated for Chinese tallow (*Triadica sebifera*) at two locations in Mississippi starting in 2019. Eight factorially arranged treatments (4x8) in a randomized complete block design with four reps were applied winter, spring, summer, and fall by one hack with one squirt (0.5 or 1 ml) per three inches diameter at breast height. All herbicides were undiluted nor was surfactant used with treatments. Applications were made with a Camelbak Hydration Backpack attached to a Primos 1-2 ml adjustable line vaccinator veterinary dose gun that allowed for accurate herbicide quantities to be directly injected into the hack created by a hatchet. Leaf necrosis was evaluated at 1, 6, and 12 months after herbicide treatment (MAT). Herbicide treatments that resulted in the greatest necrosis of Chinese tallow at 1 MAT included isopropylamine salt of imazapyr (Polaris AC Complete), potassium salt of aminocyclopyrachlor (Method 240SL) at 1 ml per hack and choline salt of triclopyr (Vastlan) at 0.5 ml per hack. Isopropylamine and dimethylamine salt of glyphosate (Roundup Pro and Accord XRTII), triethylamine salt and butoxyethyl ester of triclopyr (Garlon 3A and Triclopyr 4) at 1 ml per hack and triclopyr acid (Trycera) at 0.5 ml per hack failed to provide satisfactory control. Isopropylamine salt of imazapyr and potassium salt of aminocyclopyrachlor at 1ml per hack remained effective herbicides for all seasons at 12 MAT. The dimethylamine salt of glyphosate at 1ml per hack provided poor control throughout all seasons at 12 MAT. Variance in data was analyzed in SAS and means separated by Fisher's LSD (a=0.05).

Green Antelopehorn Milkweed (*Asclepias virdis*) Respose to Forage Herbicides. KL Broster*, JD Byrd, Jr., H Quick; Mississippi State University, Mississippi State, MS (157)

Green antelopehorn milkweed (*Asclepias virdis*) is a native wildflower of Mississippi, which can be problematic in forages, as the milky latex produced by milkweed is toxic to animals when consumed. A field study conducted in Oktibbeha Co., Mississippi at two locations with dense populations of established green antelopehorn: a cattle pasture and a hayfield, to monitor the response of green antelopehorn milkweed to herbicides. Prior to herbicide application, the experimental area was rotary mowed for height uniformity of the green antelopehorn. Fourteen herbicide treatments were applied in a randomized complete block design with four replications to plots 2.4 by 3 meters. Before application, green antelopehorn densities were averaged and recorded from 2 1 m^2 subsamples per plot and was repeated at the end of the growing season prior to frost and will be repeated at emergence next spring. Vastlan (choline salt of triclopyr [4 lb ae/gal]) at 4.67 and 2.34 L ha^{-1}, Remedy Ultra (butoxyethylester of triclopyr [4 lb ae/gal]) at 4.67 and 2.34 L ha^{-1}, Garlon 3A (triethylamine salt of triclopyr [3 lb ae/gal]) at 6.23 and 3.12 L ha^{-1}, Trycera (triclopyr acid [2,87 lb ae/gal]) at 6.52 and 3.26 L ha^{-1}, MezaVue (potassium salts of aminopyralid [0.49 lb ae/gal] and picloram [0.83 lb ae/gal] and methylheptyl ester of fluroxypyr [0.83 lb ae/gal]) at 2.34 and 1.17 L ha^{-1}, DuraCor (potassium salt of aminopyralid [0.667 lb ae/gal] and florpyrauxifen-benzyl [0.067 lb ae/gal]) at 1.46 and 0.73 L ha^{-1}, and Grazon P+D (triisopropanolamine salt of picloram [0.54 lb ae/gal] and triisopropanolamine salt of 2,4-D [2 lb ae/gal]) at 9.35 and 4.67 L ha^{-1} were applied June 11, 2020, with a CO_2 backpack sprayer calibrated to deliver 281 L ha^{-1} . Visual green antelopehorn control ratings were taken 2 and 4 weeks after application (WAT). Data were analyzed with R Studio (Version 1.3.959), subjected to ANOVA with means separated by Fisher's LSD (a = 0.05). At 4 WAT, milkweed response varied by location and were analyzed separately. The cattle pasture visual ratings showed very few differences, except for DuraCor at 0.73 L ha^{-1} provided only 72.5% control. Stand counts 3 months after application (MAT) indicated Trycera failed to control green antelopehorn. More differences in green antelopehorn visual control were observed at the hayfield location, Grazon P+D at 9.35 L ha^{-1} provided 100% visual control, which was more effective than low rates of Vastlan, Remedy Ultra, Vastlan, or DuraCor or high rates of Garlon 3A and Trycera. At 3 MAT, stand counts in the hayfield observed effective control of green antelopehorn with more than 90% reduction. This study indicates that different populations of green antelopehorn respond differently to herbicides and that the treatments were effective during the growing season. Future stand counts will need to be collected at the beginning of next spring to determine the effect on returning green antelopehorn populations.

Efficacy of Florpyrauxifen-benzyl + Aminopyralid in Florida Pastures. CA Rossi Sales*[1], BA Sellers[1], P Devkota[2]; [1]University of Florida, Ona, FL, [2]University of Florida, Jay, FL (158)

Tropical soda apple (*Solanum viarum*) and dogfennel (*Eupatorium capillifolium*) are two of the most problematic weeds in Florida pastures and rangeland. A premix of florpyrauxifen-benzyl & aminopyralid has been introduced as a new resource for Florida ranchers. However, little research has been conducted to determine if this herbicide combination is effective to control Florida pasture weeds and if tank-mix partners are needed for optimum weed control. Consequently, experiments were implemented to determine the efficacy of florpyrauxifen-benzyl & aminopyralid alone and with tank-mixes. Research was conducted at Limestone, FL (dogfennel at 30 cm tall) and Lake Wales, FL (dogfennel at 90 cm tall and tropical soda apple at 40 cm tall). In general, the addition of triclopyr & fluroxypyr at 210 + 70 g ai ha^{-1}, dicamba & 2,4-D at 420 + 1,121 g ai ha^{-1} and 2,4-D at 1,597 g ai ha^{-1} improved dogfennel control over that with florpyrauxifen-benzyl & aminopyralid alone at 9 + 93 g ai ha^{-1}, and control was similar to that provided by the standard tank-mix of 2,4-D & aminopyralid + triclopyr & fluroxypyr. While using methylated seed oil (MSO) as a surfactant versus non-ionic surfactant (NIS) as the adjuvant provided better initial dogfennel control by 30 DAT, there was no surfactant effect by 60 DAT at the Limestone location. Florpyrauxifen-benzyl & aminopyralid alone and with tank-mixes provided at least 85%, except when tank-mixed with 2,4-D, which resulted in no greater than 57% by 30 DAT. Adjuvant type does not appear to have an impact on tropical soda apple control. Frost precluded further evaluations at the Lake Wales location. Overall, these data suggest that MSO may result in quicker kill of dogfennel plants than NIS when florpyrauxifen-benzyl & aminopyralid is tank-mixed with appropriate herbicides, however, this difference in efficacy diminishes over time. Furthermore, this new herbicide combination with a tank-mix results in similar control of dogfennel and tropical soda apple as compared to the standard tank-mix of 2,4-D & aminopyralid + triclopyr & fluroxypyr.

Impact of Fertilizer Application on Broomsedge Management in Bahiagrass Pastures. ML Silveira[1], BA Sellers*[2]; [1]University of Florida - IFAS, Ona, FL, [2]University of Florida, Ona, FL (159)

Broomsedge (*Andropogon*) species are native, warm-season, short-lived perennial bunchgrasses with an average life span of 3 to 5 years. While some species are desirable in many natural areas and native rangeland, they are becoming problematic in improved bahiagrass pastures throughout central and south Florida as mature broomsedge is typically avoided by cattle. Management tactics in other areas of the U.S. have indicated that increasing soil fertility through lime or macronutrient application has resulted in a decrease in broomsedge density, with phosphorus being implicated in much of the research. However, subsoils P levels in Florida are relatively high and application of P is no longer recommended in bahiagrass pastures without tissue testing in conjunction with soil testing. This research was conducted to determine which soil amendments are responsible for reducing broomsedge populations in bahiagrass pastures as well as to determine which macronutrient may be responsible. Two experiments were conducted. The first experiment was initiated in 2012 at three locations on three different broomsedge species: Arcadia (bushy bluestem; *Andropogon glomeratus* (Walter) Britton et al.), Ona (purple bluestem; *Andropogon glomeratus* (Walter) Britton et al. var. *glaucopsis* (Elliott)C.Mohr), and St. Cloud (broomsedge bluestem; *Andropogon virginicus* L. var. *virginicus*). Following soil testing, treaments included: 1) Lime or annual elemental S (112 kg ha^{-1}) applications vs. untreated, 2) N + P + K (56 + 28 + 56 kg ha^{-1}) vs. untreated, and 3) a micronutrient blend (Frit 503G; 28 kg ha^{-1}). With the exception of lime all soil amendments were applied annually; lime was applied only as needed as suggested through soil testing. The experimental design was a factorial arrangement of treatments in a randomized complete block with 4 replications; individual plots measured 30 x 30 m. The second experiment was initiated in 2017 at two locations containing primarily broomsedge bluestem near Ona and Lake Placid. Lime was applied as needed to each location prior to macronutrient treatments: 1) N (56 kg ha^{-1}), 2) P (28 kg ha^{-1}), 3) K (56 kg ha^{-1}), 4) N + P, 5) N + K, 6) P + K, 7) N + P + K, and 8) untreated. The experimental design and plot layout was as described above. Broomsedge densities were recorded from 4, geo-referenced locations in each plots annually within a 3 m diameter area. Initial broomsedge densities were utilized as a covariate for analysis; means were separated using Tukey's HSD when appropriate. A reduction in bushy bluestem density was observed following one year of NPK application at the Arcadia location; a 16% reduction in density was recorded in plots receiving NPK. Over time, bushy bluestem density continued to decline in both untreated and treated plots and was at least 36% lower from 2014 through 2020, except for 2017; this decline could be attributed to annual mowing. Application of elemental S had no effect on bushy bluestem density, but has began decreasing soil pH from 7.8 to near 6.0 after 5 years of application. Purple bluestem density was not impacted by soil amendments until 2015 when the 2012 lime application resulted in a 55% reduction compared to non-limed plots. Liming at the appropriate rate has resulte din at least a 64% reduction in purple bluestem density since 2016; this location has also been mowed annually. Broomsedge bluestem densities near St. Cloud have not been affected by soil amendments since 2012; this site has not been mowed consistently. Potassium application in the second experiment is the only macronutrient shown to decrease broomsedge densities by as much as 74% within three years of the first annual application. No other macronutrient has resulted in a decrease in broomsedge density. Overall, there is not a consistent treatment for all broomsedge species for optimum management, and the identification of individual species may be important to make the appropriate management decisions in Florida.

Hybrid Bermudagrass Tolerance to Application of Imazapic for Growth Regulation. BD Pritchard*; University of Tennessee, Knoxville, TN (160)

Imazapic is an acetolactate synthase inhibiting herbicide labeled for postemergence weed control and growth regulation in pastures, rangeland, and non-crop areas. Field research was conducted in Knoxville, TN in summer 2020 to evaluate the tolerance of four hybrid bermudagrass (Cynodon dactylon x C. transvaalensis Burtt Davy) cultivars to applications of imazapic. Separate experiments were conducted on 'TifTuf', 'Tifway', 'Tahoma 31', and 'Latitude 36' hybrid bermudagrass maintained as golf course fairways. Each experiment included plots (1.5 m2) arranged in a randomized complete block design with four replications. Treatments were applied on 14 August 2020 and included imazapic at 35, 52.5, 70, and 105 g ha^{-1} mixed with methylated seed oil adjuvant at 0.5% v/v. A non-treated check was included for comparison. Tolerance of each cultivar was assessed via visual ratings of turfgrass injury on a 0 (i.e., no injury) to 100 (i.e., complete kill) percent scale relative to the non-treated check at 3, 10, 14, 21, and 28 days after treatment (DAT). Growth regulation was quantified on the same dates by harvesting and weighing clippings collected from each experimental plot. Pronounced injury (33 to 60%) was observed 10 DAT with imazapic on Tifway, TifTuf, and Tahoma 31 with few differences detected among rates; a similar response was observed on Latitude 36, but did not manifest until 14 DAT. All cultivars recovered from imazapic-induced injury by 28 DAT except TifTuf (= 9% injury). No significant differences in growth regulation were detected among rates of imazapic applied to Tifway, TifTuf, and Latitude 36; these treatments reduced clipping yield to = 25% of the non-treated check by 14 DAT. Growth regulation persisted through 28 DAT on TifTuf and Latitude 36; however, clipping yields on Tifway exceeded the non-treated check by 28 DAT. Growth regulation of Tahoma 31 varied among imazapic rates. Experiments will be repeated in the summer of 2021; preliminary findings suggest imazapic can regulate hybrid bermudagrass growth if pronounced, albeit transient, injury can be tolerated.

Weeds and Warm-season Turfgrass Response to Duration of Direct Flame. CG Goncalves*, S Askew; Virginia Tech, Blacksburg, VA (161)

In recent years, the search for weed control options in turfgrass systems managed organically or pesticide-free has been an increasing focus of turfgrass research. Flaming could be a pesticide-free alternative for controlling weeds in turfgrass. Only one preliminary report of a non-repeated study could be found regarding flame in ornamental turf ('Patriot' hybrid bermudagrass). From a meta-analysis of 500 search returns via google and google scholar, we found that flaming had a high likelihood of occurring in consumer searches for organic weed control options in ornamental turf. Due to the paucity of information available on the use of flaming for weed control in turfgrass systems, studies were conducted to assess the response of different warm-season turfgrass species and weeds to duration of flame exposure. Field trials were conducted during the 2020 growing season at Virginia Tech's Glade Road Research Facility in Blacksburg, VA, to examine the efficacy of flame duration for weed control in bermudagrass (*Cynodon dactylon*) and zoysiagrass (*Zoysia* sp.). Treatments included flaming at 1, 2, 3, and 4 minutes per 1.1 m^2 at a speed of ? 0.4, 0.2, 0.1, and 0.05 mph, and a nontreated check. Data on weed control and turfgrass recovery was collected and analyzed. Bermudagrass recovered from flame treatments quickly with acceptable turf cover reestablished in under four weeks. However, zoysiagrass recovery was lower and flame-duration dependent. All durations of flame controlled corn speedwell and chickweed 100%. Annual bluegrass and white clover were controlled up to 85% depending on flame duration. Common dandelion, buckhorn plantain, horseweed, and broadleaf dock were initially burned back by flaming, but recovered by 49 DAT regardless of flame duration.

Investigating How Rainfall Amount Influences Herbicide Relocation Within a Zoysiagrass Turf Canopy. JM Craft, S Askew*; Virginia Tech, Blacksburg, VA (162)

Many turf managers attest that zoysiagrass injury from nonselective herbicides occurs in one year but not in other years although turf conditions at application were similar. We hypothesized that conditions that lead to rapid greening of zoysiagrass following treatment may allow previously treated herbicide to be dislodged by rainfall and relocated to newly developing green shoots. To test this theory, we first conducted laboratory and growth chamber experiments to determine how long water-extractable glyphosate and glufosinate could persist on dormant zoysiagrass leaves. We then designed a method to measure the relocation of herbicide + colorant solution from a dormant zoysiagrass leaf to underlying green shoots and surrounding areas via spectrophotometric analysis of extracted colorant. When 2.5-cm sections of dormant zoyisagrass leaves were treated with 4.0 kBq ^{14}C-glyphosate or ^{14}C-glufosinate and incubated at 30/25 C with 12-h, 330 µmol m^{-2} s^{-1} PAR for six time periods from 0.2 to 21 d, 63% of radioactivity was water extractable regardless of herbicide, harvest time, or trial. These data suggest that herbicide may persist for weeks following treatment to dormant turf and would be present for relocation to new shoots during greenup. Simulated raindrops removed colorant from dormant zoysiagrass leaves in a linear fashion between 0 and 10 drops cm^{-2} that accounted for approximately 7% colorant loss per simulated raindrop. After 10 raindrops, only 20% of colorant remained on the treated leaf. As colorant was lost from the treated leaf, it was recovered on leaves and stems of an underlying green shoot and on filter paper out to 7.5 cm away from the treated leaf. These data, based on colorant movement of a glyphosate + colorant solution, suggest it may be possible for glyphosate or other herbicides to be dislodged from treated leaves and relocated to other foliage and stems in the surrounding turf canopy. It should be noted that 1 raindrop cm^{-2} is equivalent to 2.7 mm of rain. Thus, a moderate rain shower of 13.5 mm (or 5 drops cm^{-2}) would remove less than 50% of herbicide applied to dormant foliage (assuming a relationship between colorant mobility and herbicide mobility). It would take a heavy rainfall of 28 mm (10 drops cm^{-2}) to 56 mm (20 drops cm^{-2}) to remove over 80% of applied product.

A New Turf Herbicide from Bayer to Meet Customer Needs. JW Hempfling[1], S Wells[2], PW Burgess[3], J Hope[4], J Michel[5], RK Saran[6], B Spesard*[7]; [1]Bayer Crop Science, Murrieta, CA, [2]Bayer Crop Science, Milledgeville, GA, [3]Bayer Crop Science, Cary, ND, [4]Bayer Crop Science, Mebane, NC, [5]Bayer Crop Science, Cary, NC, [6]Bayer Crop Science, Auston, TX, [7]Bayer Environmental Science, A Division of Bayer CropScience, Cary, NC (163)

Bayer is introducing a new herbicide in 2021 that was created based on customer insights. Feedback from lawn care operators (LCOs) indicated a need for a single product that could provide control of broadleaf weeds and sedges at a reasonable price. Rationale for this desire included, but was not limited to, a reduced risk of mixing errors due to fewer products on application trucks. Additionally, LCOs communicated the need for products that are safe to use on all major warm season home lawn turf types. To address these customer needs, Bayer developed a new herbicide containing three acetolactate synthase (ALS)-inhibiting herbicides (WSSA group 2) to serve as an all-in-one postemergence herbicide that delivers broadleaf weed and sedge control and is safe to use on sensitive turf types like St. Augustine grass (*Stenotaphrum secundatum*). It is a non-phenoxy herbicide that offers low odor and operational flexibility due to low PPE requirements. Upon EPA registration, the new herbicide is expected to have a “Caution” signal word. The rate structure will be based on 525 or 701 grams of product per hectare (7.5 or 10 oz acre^{-1}) and is designed to avoid difficult measurements such as 259 g ha^{-1} (3.7 oz acre^{-1}). The general recommended rate structure will be 525 g ha^{-1} (7.5 oz acre^{-1}) followed by 525 g ha^{-1} (7.5 oz acre^{-1}) at a 6- to 8-week interval, which is a typical customer visit interval for LCOs. The seasonal max will be 1051 g ha^{-1} (15 oz acre^{-1}) and the formulation will be a water-dispersible granule (WG). Lastly, the new herbicide will also be labeled for use on sites beyond lawn care such as commercial and institutional sites like golf courses, sod farms, and athletic fields. During 2018, 2019, and 2020, a total of 62 trials were conducted in cooperation with 23 university, extension, or private researchers from 14 universities across 18 states. Also, 23 trials were conducted internally at Bayer. Studies were arranged in a randomized completed block design with a minimum of four replications. Treatments were one or two applications of the new herbicide at the aforementioned rates and intervals and contained NIS at 0.25 % v/v. Competitive standards were also included at label rates and intervals for comparison. Efficacy was assessed across more than 60 broadleaf, sedge, and kyllinga species and turf safety was assessed across all major warm season turf types. When pooled across all years of study, one or two applications of the new herbicide (the number of applications depended on the weed) provided good to excellent control (90% or greater) of many weeds including but not limited to: black medic (*Medicago lupulina*), blackseed plantain (*Plantago rugelii*), bracted plantain (*Plantago aristata*), broadleaf filaree (*Erodium botrys*), broadleaf plantain (*Plantago major*), buckhorn plantain (*Plantago lanceolata*), California burclover (*Medicago polymorpha*), Carolina ponysfoot (*Dichondra carolinensis*), Cat's ear dandelion (*Hypochaeris radicata*), Chamber bitter (*Phyllanthus urinaria*), clumpy ryegrass (*Lolium perenne*), cockscomb kyllinga (*Kyllinga squamulata*), common chickweed (*Stellaria media*), common dandelion (*Taraxacum officinale*), common lespedeza (*Lespedeza cuneata*), creeping beggarweed (*Desmodium incanum*), creeping woodsorrel (*Oxalis corniculata*), dogfennel (*Eupatorium capillifolium*), dollarweed (*Hydrocotyle bonariensis*), hairy fleabane (*Erigeron bonariensis*), Florida betony (*Stachys floridana*), ground ivy (*Glechoma hederacea*), globe sedge (*Cyperus croceus*), green kyllinga (*Kyllinga brevifolia*), horseweed (*Erigeron canadensis*), mouse-ear chickweed (*Cerastium fontanum*), red sorrel (*Rumex acetosella*), spotted cat's ear (*Hypochaeris radicata*), spotted spurge (*Euphorbia maculata*), sweetclover (*Melilotus officinalis*), lesser

swinecress (*Coronopus didymus*), plumeless thistle (*Carduus acanthoides*), tufted kyllinga (*Kyllinga pumila*), white clover (*Trifolium repens*), white kyllinga (*Kyllinga nemoralis*), wild garlic and wild onion (*Allium* spp.), wild violet (*Viola papilionacea*), yellow nutsedge (*Cyperus esculentus*), and yellow woodsorrel (*Oxalis stricta*). Moreover, the new herbicide showed tolerance on all warm season turf species including bermudagrass (*Cynodon dactylon*), zoysiagrass (*Zoysia japonica*), St. Augustine grass, centipedegrass (*Eremochloa ophiuroides*), and buffalograss (*Bouteloua dactyloides*). Bayer submitted a request for registration to the U.S. EPA in May 2020, and the new herbicide is expected to launch during the third quarter of 2021.

Herbicide Application Timing for Barnyardgrass and Palmer Amaranth Control in Furrow-irrigated Rice. JW Seale*[1], JA Bond[1], FR Kelly[2], HD Bowman[3], TL Sanders[4], GA Mangialardi[5], HM Edwards[2], JD Peeples[2]; [1]Delta Research and Extension Center, Stoneville, MS, [2]Mississippi State University, Stoneville, MS, [3]Mississippi State University, Starkville, MS, [4]Mississippi State University: Delta Research & Extension Center, Stoneville, MS, [5]Mississippi State University, Shelby, MS (164)

Studies focused on non-flooded, or aerobic, rice (*Oryza sativa* L.) production reported a yield decrease compared with a conventionally flooded culture. An aerobic rice concept known as the furrow-irrigated culture consists of growing rice on raised beds and irrigating through the furrows. Alternate wetting and drying cycles in a furrow-irrigated culture may increase germination and emergence of summer annual weeds in the non-flooded portion of the field. More specifically, barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] and Palmer amaranth (*Amaranthus palmeri* S. Wats.) are among the most common weeds of rice in Mississippi. Furthermore, these weed species emerge throughout the growing season, which requires repetitive herbicide applications to maintain season-long control. Therefore, two field studies (Barnyardgrass Study and Palmer Amaranth Study) were conducted at the Delta Research and Extension Center in Stoneville, MS, to evaluate initial herbicide application timing and number of sequential applications needed to achieve > 95% weed control. The Barnyardgrass Study and Palmer Amaranth Study were both designed as a randomized complete block with four replications. Treatments included initial herbicide applications made 7, 14, 21, 28, or 35 d after rice emergence (DAE). Each treatment included two sequential applications (First and Second Sequential Application) applied at 14-d intervals following the initial application. A nontreated control and weed-free check (WFC) were included for comparison. In both studies, visible rice injury and weed control were recorded 14 d after each herbicide application. All data were subjected to ANOVA in SAS 9.4 and estimates of the least square means were utilized for mean separation with p = 0.05. For the Barnyardgrass Study, initial herbicide applications were imazethapyr at 105 g ai ha^{-1} plus quinclorac at 565 g ai ha^{-1} plus COC at 1% v/v. Sequential applications included propanil at 3,360 g ai ha^{-1} plus clomazone at 420 g ai ha^{-1} applied 14 d after initial application (First Sequential Application) and imazethapyr at 105 g ai ha^{-1} plus pendimethalin at 1,060 g ai ha^{-1} plus COC at 1% v/v applied 14 d after the First Sequential Application (Second Sequential Application). Plots designated as WFC were treated with clomazone at 420 g ha^{-1} PRE and received the same POST treatments as other plots and initiated 14 DAE. For the Palmer Amaranth Study, initial herbicide applications were a prepackaged mixture of propanil at 3,360 g ha^{-1} plus thiobencarb at 3,340 g ai ha^{-1}. Sequential applications included florpyrauxifen-benzyl at 30 g ai ha^{-1} plus MSO at 0.417% v/v applied 14 d after initial application (First Sequential Application) and carfentrazone-ethyl at 37 g ai ha^{-1} plus triclopyr at 280 g ae ha^{-1} plus COC at 1% v/v applied 14 d after First Sequential Application (Second Sequential Application). Plots designated as WFC were treated with of saflufenacil at 50 g ai ha^{-1} PRE and received the same POST treatments as other plots and initiated 14 DAE. Treatments initiated 7 DAE controlled barnyardgrass = 98% 2 wk after initial application. When initial application was delayed until 14 DAE, barnyardgrass control was 75% 2 wk after initial application. However, barnyardgrass control in the same plots improved to = 95% 2 wk after the First Sequential Application. When the initial application was delayed until 21 DAE, both sequential applications were required to control barnyardgrass = 95% 2 wk after the Second Sequential Application. Treatments initiated 28 or 35 DAE provided 54 and 35% barnyardgrass control 2 wk after initial application, respectively, and barnyardgrass control never exceeded 89% with all sequential applications in these treatments. For Palmer Amaranth Study, treatments

initiated 7 or 14 DAE controlled Palmer amaranth >95% 2 wk after initial applications. When initial application was delayed until 21 DAE, Palmer amaranth control was 59% 2 wk after initial application. Palmer amaranth was controlled 93% 2 wk following both sequential applications in plots where initial application was applied 21 DAE. Treatments initiated 28 or 35 DAE provided only 23 and 5% Palmer amaranth control 2 wk after initial application, respectively. Even after both sequential applications, Palmer amaranth control was 60 and 43% 2 wk after final treatments for initial applications made 28 and 35 DAE, respectively. Based on these studies, initial herbicide applications made during early crop and weed growth controlled barnyardgrass and Palmer amaranth greater than delayed initial herbicide applications in a furrow-irrigated rice culture.

Exploring the Use of Cover Crops for Suppressing Weeds in Florida's Citrus (*Citrus sinensis*) Orchards.

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Florida ranked second in citrus production for the 2019-20 season; citrus production is of great importance for the state's economy. Weed management is a big challenge for citrus growers; the weeds can compete with citrus trees for nutrients, moisture, and other resources. Growers typically use a combination of mechanical and chemical strategies to manage vegetation in the areas between tree rows, also known as row-middles. Recently, utilizing cover crops in the row-middles has been gaining a lot of interest in citrus production. However, there is sparse information available on the benefits associated with the use of cover crops in Florida citrus. The current study's primary goal is to evaluate the effects of cover crops on the suppression of weeds. The mixture of cover crop (CC) tested in the Summer season include sunn hemp (*Crotalaria juncea* L.), cowpea (*Vigna unguiculata* L.), white clover (*Trifolium repens*), brown top millet (*Urochloa ramose*), buckwheat (*Fagopyrum esculentum*), and dove millet (*Panicum miliaceum* L.).Winter/spring CC mix evaluated consisted of sunn hemp (*Crotalaria juncea* L.), cow pea (*Vigna unguiculata* L.), daikon radish (*Raphanus sativus var*. L.), oats (*Avena sativa*), and wrens grain rye (*Secale cereale*). The results indicate that the use of cover crop mixtures has a considerable effect on weed suppression in citrus row-middles. There was a statistically significant reduction in weed density (up to 89%) in cover crop treated row-middle areas compared with the no cover crop control. Besides, it was observed that cover crops improved the biodiversity in the treated row middles while sedges and grasses took over the non-treated control. These preliminary results demonstrate the potential of cover crop use in citrus weed management. The results also provide insights into the types of cover crops that could be adopted to Florida's citrus-growing conditions.

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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