Mississippi Soybean Promotion Board
Project No. 20-2015
2015 Annual Report

Title: Weed Management Programs for Mississippi Soybean Production
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Background and Objectives

Herbicide programs and their associated crop management practices place selection pressure on weed communities by reducing the frequency of some weed species or by selecting resistant biotypes of others. In addition to weaknesses in glyphosate-resistant (GR) production systems (lack of residual control, poor control of some species, and antagonism with some herbicide mixtures), the GR technology triggered a shift toward total POST weed control programs. Delaying glyphosate applications and increasing application rate and/or number of applications promoted a selection for glyphosate-tolerant weeds and contributed to evolution of GR species.

At one time, it was believed glyphosate resistance would not occur due to its mode of action, chemical structure, limited metabolism, and lack of soil residual activity. However, glyphosate resistance has spread rapidly with documented cases in 31 species worldwide. Fourteen species in the United States have developed resistance to glyphosate, and Mississippi populations of horseweed, Italian ryegrass, johnsongrass, Palmer amaranth, tall waterhemp, giant and common ragweed, goosegrass, and spiny amaranth have evolved resistance to glyphosate. Nine GR species is most of any state in the United States.

Glyphosate-resistant Palmer amaranth and Italian ryegrass represent the largest threats to crop production in Mississippi. Palmer amaranth competes for nutrients, water, light, and space because of its rapid, upright growth habit and allelopathic properties. Large populations of GR Italian ryegrass jeopardize burndown herbicide programs. Fields with GR Italian ryegrass not controlled at burndown will contain significant residue at planting. Residue will impede planting practices, contribute to competition between soybean seedlings and GR Italian ryegrass, and hinder herbicide programs due to inadequate coverage.

Herbicide-resistant weed species continue to spread across Mississippi and the United States. Large populations of herbicide-resistant weeds can jeopardize weed management programs. This has stimulated renewed interest in alternative weed management tools within the agricultural industry. Novel herbicide products and technologies such as dicamba-, 2,4-D-, and 4-HPPD-resistant soybean are approaching commercialization. Therefore, it is important to identify effective programs for managing GR species to prevent competition and yield reductions in Mississippi soybean.

1. Evaluate new and/or currently registered herbicides and herbicide-resistant soybean technologies for positioning into Mississippi weed management programs.
2. Determine response of Palmer amaranth and soybean to application of foliar fungicide.
3. Investigate use of PPO herbicides in soybean to (a) evaluate the effect of foliar nutrition products on soybean response to PPO herbicides.

Report of Progress/Activity

Objective 1 – 2015

Twenty-three studies were conducted at the Delta Research and Extension Center in 2015 to evaluate new and/or currently registered herbicides and herbicide-resistant soybean technologies for positioning into Mississippi weed management programs. Unfortunately, most of these studies focused on the efficacy of pre-mixes of currently registered herbicides or generic formulations of commercial herbicides. “New” herbicides under evaluation are 2,4-D, dicamba, Authority Max (sulfentrazone plus chlorimuron), and Warrant Ultra (a prepackaged mixture of fomesafen and encapsulated acetochlor), Pethoxamid is a new residual herbicide from FMC Corporation that is being tested as an at-planting residual treatment for grass and broadleaf weed control. Other studies evaluated herbicide applications in Roundup Ready 2 Xtend and Balance GT soybean.

Research has been conducted annually since 2010 at different sites in the Mississippi Delta to compare the efficacy of residual herbicides applied PRE for control of Palmer amaranth in soybean. Figure 1 shows that PRE herbicides containing flumioxazin caused greatest soybean injury 14 days after application. However, this injury did not translate into differences in soybean yield by season’s end.

Figure 1. Soybean injury 14 days after application of residual herbicides applied at planting. Data pooled across 6 site years from 2014 to 2015.

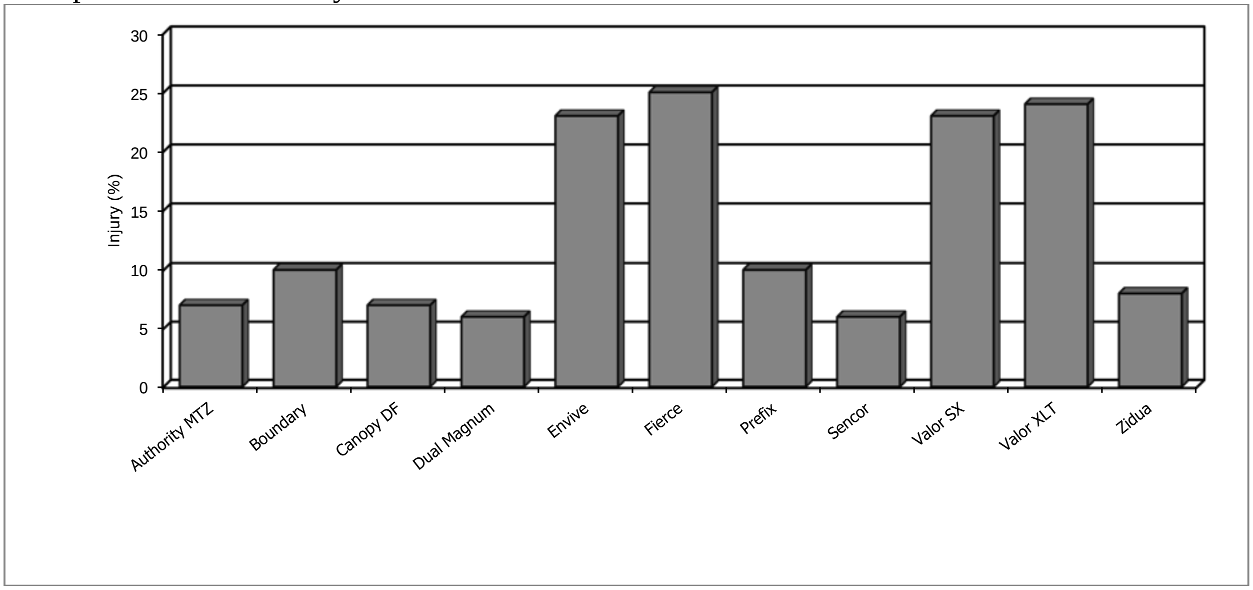
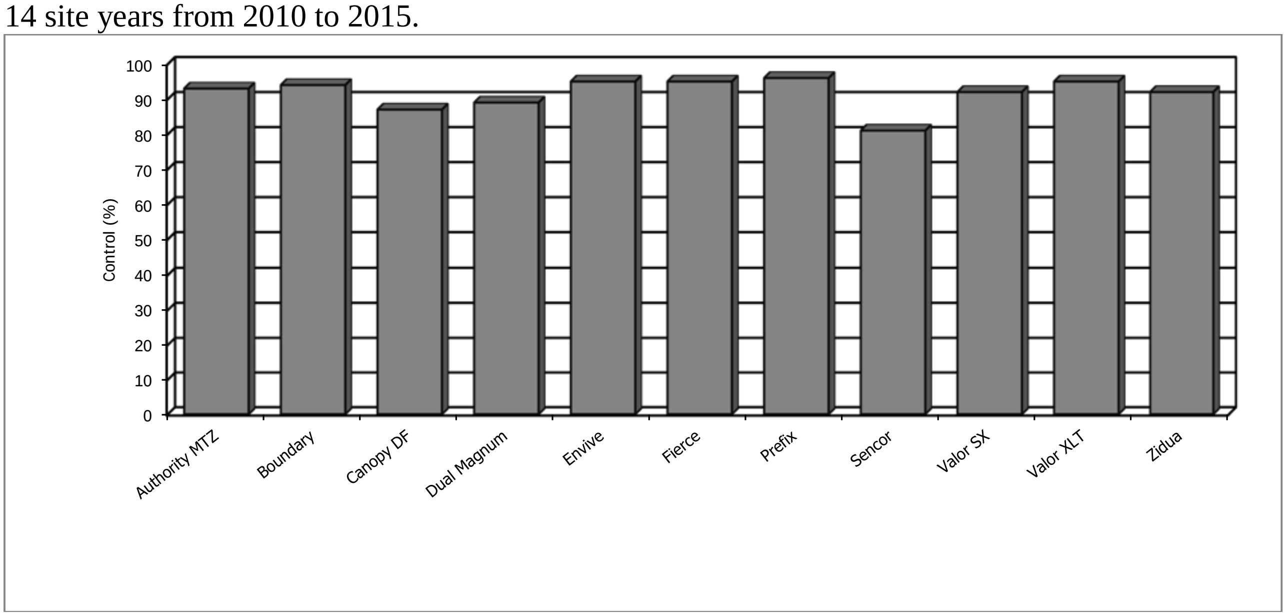


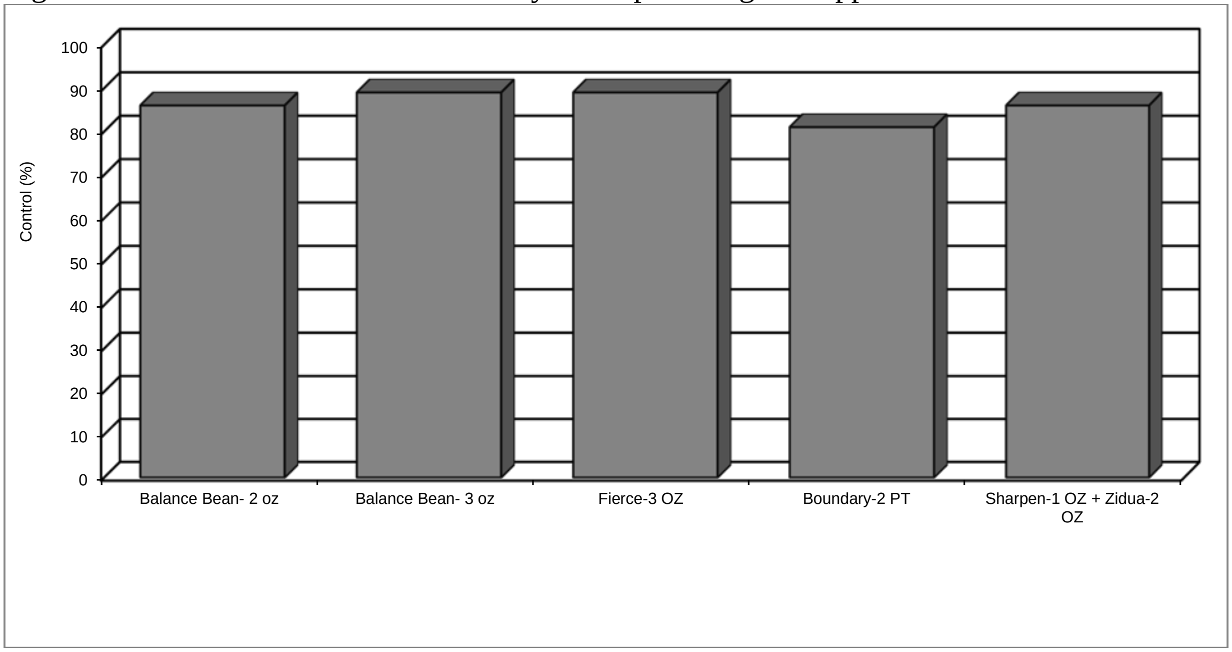
Figure 2 demonstrates that Palmer amaranth control 28 days after preemergence application was (1) best with treatments containing multiple herbicide modes of action and (2) was not 100% with any treatment. Additional herbicide treatments would be required POST for full-season control of Palmer amaranth.

Figure 2. Palmer amaranth control 28 days after preemergence applications. Data pooled across 14 site years from 2010 to 2015.



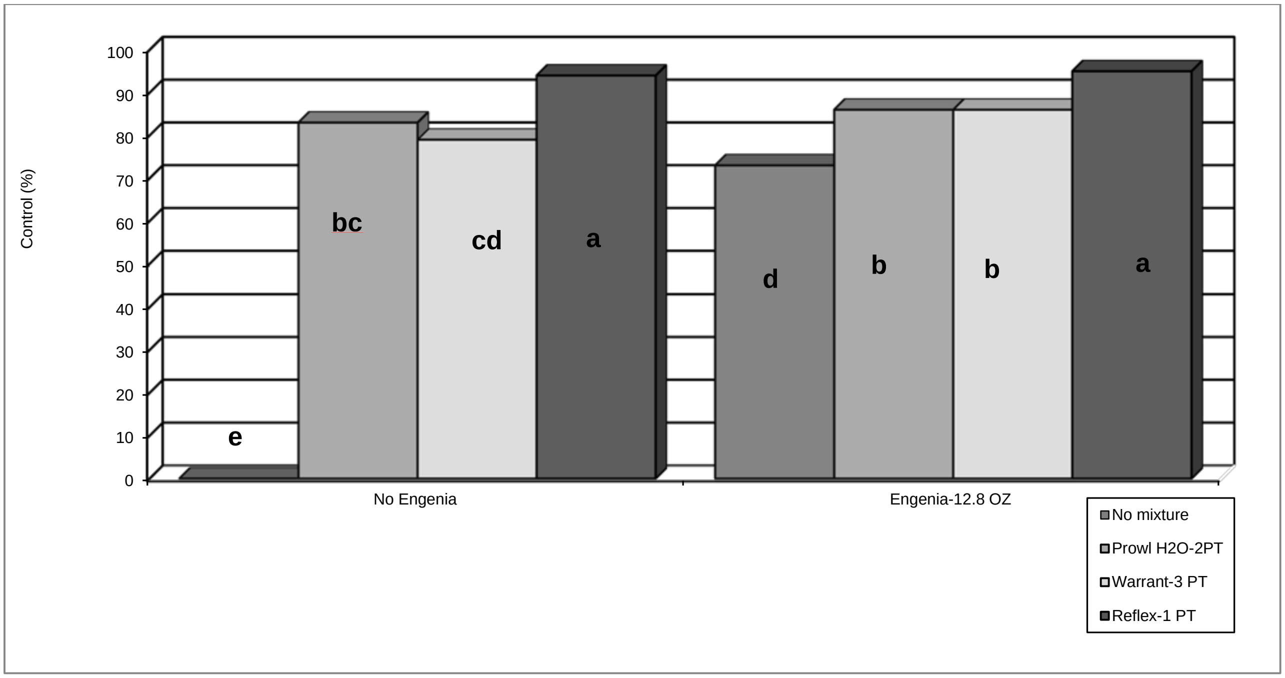
One herbicide-resistant soybean technology evaluated in 2015 was the Balance GT trait from Bayer Cropscience. Figure 3 demonstrates that Palmer amaranth control 31 days after preemergence application was similar with Balance Bean (isoxaflutole) and current residual herbicide standards.

Figure 3. Palmer amaranth control 31 days after preemergence applications



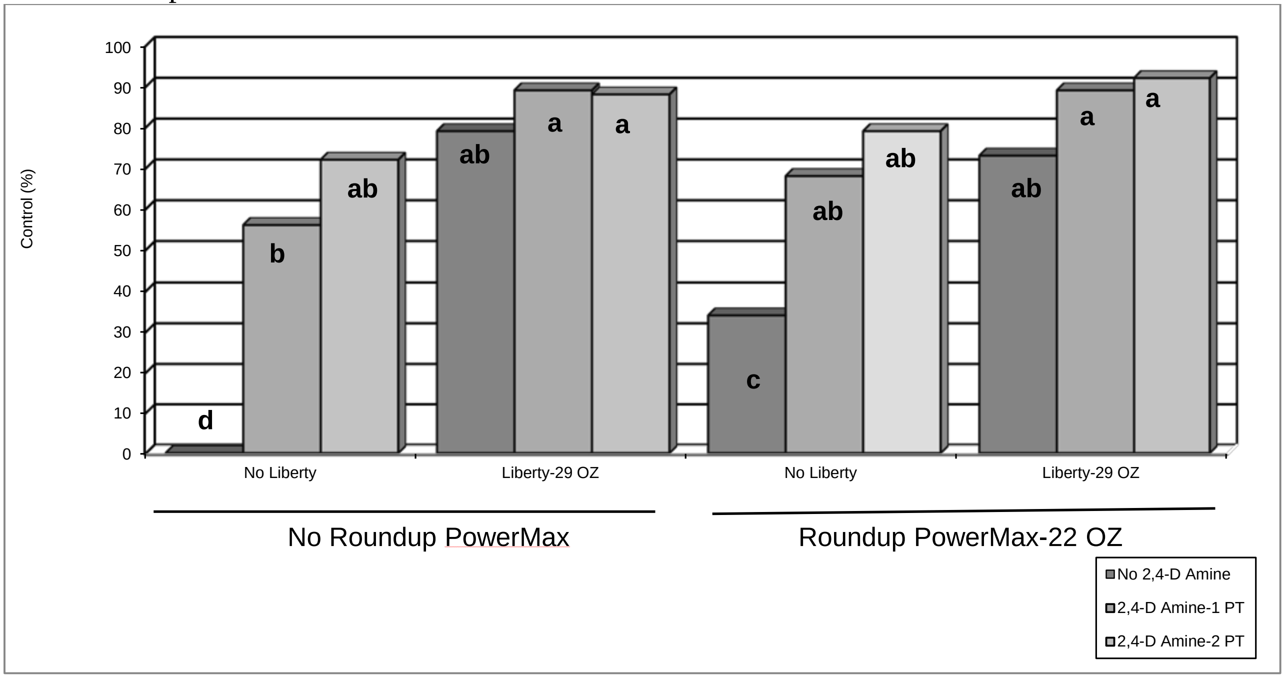
Different formulations of dicamba will ultimately be registered for application in Roundup Ready 2 Xtend soybean. Previous research at DREC (Blake Edwards' Master of Science thesis) demonstrated that dicamba was effective for POST control of GR Palmer amaranth. Results from that work on use of dicamba PRE were less conclusive. Engenia is a new formulation of dicamba from BASF that will be labeled for application in Roundup Ready 2 Xtend soybean. Figure 4 shows that Engenia provided residual control of Palmer amaranth, but control was less than that from Prowl H2O or Reflex.

Figure 4. Palmer amaranth control 28 days after preemergence application. Data pooled across two studies in 2014 and 2015.



The Enlist herbicide technology will offer resistance to glyphosate, 2,4-D, and Liberty 280. Figure 5 demonstrates that Liberty 280 will be a vital component of a herbicide program in Enlist soybean production. The overall conclusion from this research was that optimal control of GR Palmer amaranth with glyphosate plus 2,4-D programs is dependent upon application timing. Liberty 280 and 2,4-D both provide viable options for GR Palmer amaranth control; however, 2,4-D added no benefit to any herbicide mixture except glyphosate. These data were generated as a portion of Ben Lawrence's M.S. project in Plant and Soil Sciences at MSU.

Figure 5. Glyphosate-resistant Palmer amaranth control 28 days after application to 2- to 4-inch weeds. Data pooled over three studies.



Objective 2 – 2015

Research suggests foliar fungicide applications improved crop yields in the absence of disease. This study was originally designed to evaluate soybean and Palmer amaranth performance following foliar fungicide application. Following the critical period for weed control, some Palmer amaranth that survived or emerged after early-season herbicide applications may remain in the field.

This research was originally a component of Tyler Hydrick's Master of Science research. During Mr. Hydrick's initial graduate committee meeting, the committee discussed the possibility that this study may at best, return no positive results and, at worst, not be completed due to the erratic growth of Palmer amaranth. The study was initiated in early-May. Conditions were dry, and Palmer amaranth did not emerge. Palmer amaranth plants from adjacent areas in the same field were transplanted into the study area to achieve targeted plant densities in the different communities. However, transplanted Palmer amaranth cohorts did not grow as vigorously as non-transplanted cohorts. This introduced abnormal variance into the parameters measuring Palmer amaranth response to foliar fungicides.

At the beginning of the study, a major question was if female Palmer amaranth produce more seed in plots receiving a fungicide treatment. Therefore, Palmer amaranth seed production was among the highest priority parameters in the study. Palmer amaranth is a dioecious species, so it produces male and female plants. Problematically, there is no method for sex determination in Palmer amaranth prior to anthesis. The published sex ratio is 1:1. In the study design, the density of Palmer amaranth was intended to account for the dioecious nature of the species (Include 10 Palmer amaranth in each plot with the intention of 4 to 5 individuals being female.). This was not the case in 2015, as some plots produced no female plants. An additional problem caused by Palmer amaranth being dioecious is that female plants are often much larger than male plants. This was the case in the current work. Palmer amaranth dry weights were highly variable in 2015. However, it was concluded this resulted from unequal numbers of male and female plants rather than the treatments imposed in the study. Soybean yield were similar following all treatments in the study (Table 5).

Tables 1 and 3 show that soybean height and SPAD readings (degree of greenness and, by extension, plant health) responded to planting date with greater plant heights and SPAD readings 14 days after the R3 fungicide application at the later planting date. For Palmer amaranth at the early planting date, plant heights and SPAD readings were less in the mixed soybean and Palmer amaranth community compared with the Palmer amaranth only community (Tables 2 and 4). This was true regardless of fungicide application. These same trends were not present for Palmer amaranth height and SPAD readings at the later planting date.

This research revealed no agronomic benefit to R3 fungicide application on soybean or Palmer amaranth. However, as summarized earlier, a number of problems were encountered during the study. This study will be replaced in Tyler Hydrick's Master of Science research with additional studies based on results of studies under Objective 3 in 2015.

Table 1. Soybean height at 14 days after R3 fungicide application influenced by planting date and the presence of Palmer amaranth.[a]

	May 4 planting date		June 15 planting date	
Plant community	No fungicide	Quilt Xcel at 10.5 FL OZ/A	No fungicide	Quilt Xcel at 10.5 FL OZ/A
	cm			
Soybean only	118 bc	121 b	136 a	134 a
Palmer amaranth only[b]				
Soybean and Palmer amaranth	120 b	119 b	137 a	138 a

[a]Means followed by the same letter are not different at p=0.05.
[b]No soybean were present in the Palmer amaranth-only plant community.

Table 2. Palmer amaranth height at 14 days after fungicide application triggered at R3 soybean growth stage influenced by planting date and the presence of soybean.[a]

	May 4 planting date		June 15 planting date	
Plant community	No fungicide	Quilt Xcel at 10.5 FL OZ/A	No fungicide	Quilt Xcel at 10.5 FL OZ/A
	cm			
Soybean only[b]				
Palmer amaranth only	199 a	201 a	213 a	207 a
Soybean and Palmer amaranth	144 b	129 b	196 a	224 a

[a]Means followed by the same letter are not different at p=0.05.
[b]No Palmer amaranth were present in the soybean-only plant community.

Table 3. Soybean SPAD ready at 14 days after R3 fungicide application influenced by planting date and the presence of Palmer amaranth.[a]

	May 4 planting date		June 15 planting date	
Plant community	No fungicide	Quilt Xcel at 10.5 FL OZ/A	No fungicide	Quilt Xcel at 10.5 FL OZ/A
Soybean only	45 bc	47 b	51 a	50 a
Palmer amaranth only[b]				
Soybean and Palmer amaranth	44 c	43 c	51 a	52 a

[a]Means followed by the same letter are not different at p=0.05.
[b]No soybean were present in the Palmer amaranth-only plant community.-

Table 4. Palmer amaranth SPAD reading at 14 days after fungicide application triggered at R3 soybean growth stage influenced by planting date and the presence of soybean.[a]

	May 4 planting date		June 15 planting date	
Plant community	No fungicide	Quilt Xcel at 10.5 FL OZ/A	No fungicide	Quilt Xcel at 10.5 FL OZ/A
Soybean only[b]				
Palmer amaranth only	48 ab	53 a	43 bc	37 cd
Soybean and Palmer amaranth	36 cd	36 cd	40 cd	34 d

[a]Means followed by the same letter are not different at p=0.05.
[b]No Palmer amaranth were present in the soybean-only plant community.

Table 5. Soybean yield influenced by planting date, R3 fungicide application, and the presence of Palmer amaranth.[a]

	May 4 planting date		June 15 planting date	
Plant community	No fungicide	Quilt Xcel at 10.5 FL OZ/A	No fungicide	Quilt Xcel at 10.5 FL OZ/A
Soybean only	61 a	61 a	62 a	62 a
Palmer amaranth only[b]				
Soybean and Palmer amaranth	61 a	61 a	61 a	61 a

[a]Means followed by the same letter are not different at p=0.05.
[b]No soybean were present in the Palmer amaranth-only plant community.

Objective 2 – 2015

Two studies evaluating combinations of PPO herbicides with foliar fertilizers and plant hormones were conducted in 2015 and are also components of a Master's project for Tyler Hydrick.

Two weedy sites assessing weed control and two weed-free sites evaluating soybean response were utilized in the study. Treatments were arranged as a two-factor factorial in a randomized complete block design with four replications. Factor A was herbicide treatments and included no herbicide, Roundup PowerMax at 28.4 FL OZ/A, Roundup PowerMax plus Dual Magnum at 1.33 PT/A, Roundup PowerMax plus Flexstar at 1.5 PT/A, and Roundup PowerMax plus Cobra at 12.5 FL OZ/A. Factor B was Brandt Smart Trio (4-3-3-3-0.25% N-S-Mn-Zn-B) applied at 0, 0.2, and 4 PT/A. Treatments were applied when soybean reached the V3 growth stage.

In the weed-free experiment, no effect due to Brandt Smart Trio rate was detected for soybean injury at any evaluation. Additionally, Brandt Smart Trio rate did not influence soybean dry weight, nutrient content, mature height, or yield. In the weedy experiment, soybean injury was not reduced when Brandt Smart Trio was added to herbicide treatments. Soybean injury was greatest with Roundup PowerMax plus Cobra 3, 7, and 14 DAT. At 14 DAT, Palmer amaranth control was reduced when either rate of Brandt Smart Trio was mixed with Roundup PowerMax, Roundup PowerMax plus Dual Magnum, and Roundup PowerMax plus Cobra (Figure 6). Palmer amaranth control with Roundup PowerMax plus Flexstar was not affected by foliar fertilizer 14 DAT. Pooled across foliar fertilizer rates, barnyardgrass control 14 DAT with all herbicide treatments was lower when Brandt Smart Trio was included (Figure 7). Pooled across herbicide treatments, the addition of either rate of foliar fertilizer reduced barnyardgrass control 14 DAT.

Foliar fertilizer reduced Palmer amaranth control when mixed with Roundup PowerMax, Roundup PowerMax plus Dual Magnum, and Roundup PowerMax plus Cobra. Barnyardgrass control was lower with herbicide applications that included foliar fertilizer. Foliar fertilizer did not improve soybean agronomic performance or yield. Foliar fertilizer should not be included with POST herbicides due to reductions in herbicide efficacy and lack of soybean response to these mixtures.

Figure 6. Palmer amaranth control 14 DAT with mixtures of POST herbicides and a foliar fertilizer. Data pooled across two site years.

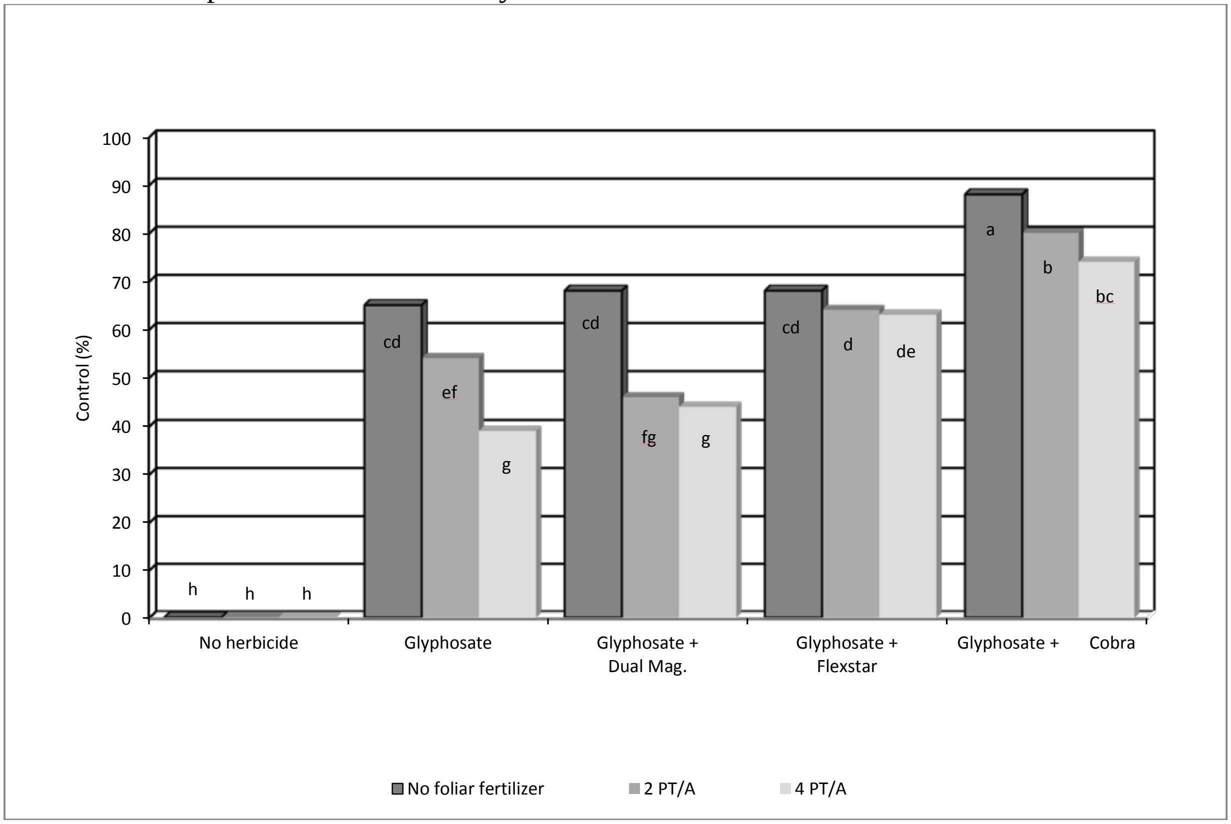
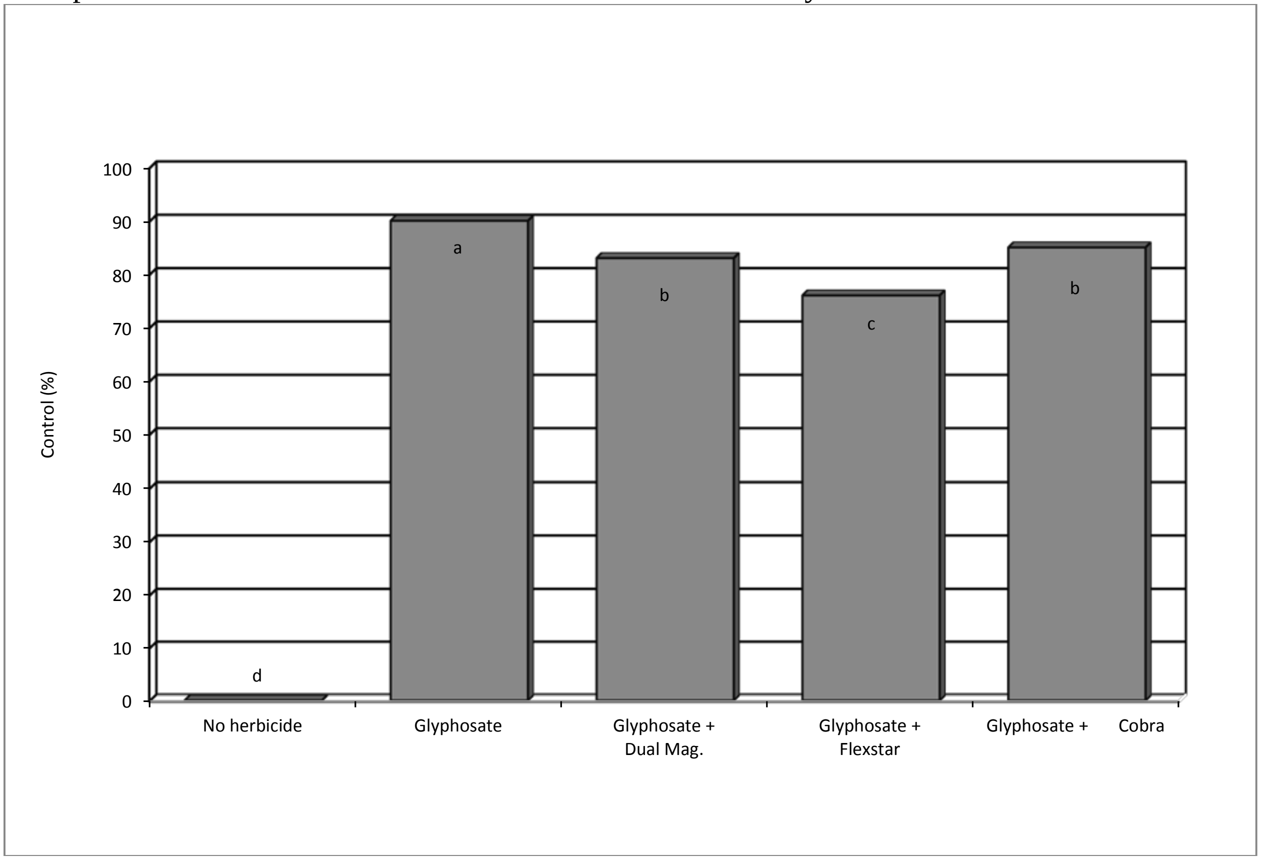


Figure 7. Barnyardgrass control 14 DAT with mixtures of POST herbicide and a foliar fertilizer. Data pooled over three foliar fertilizer treatments and two site years.



The hypothesis of the second study was that inclusion of plant hormone mixtures will have no effect on soybean injury or weed control with glyphosate-based herbicide treatments. The experimental design was a randomized complete block with a two-factor factorial treatment arrangement. Factor A was herbicide treatment and consisted of no herbicide, Roundup PowerMax at 28 FL OZ/A, Roundup PowerMax plus Dual Magnum at 28 plus 21 FL OZ/A, Roundup PowerMax plus Flexstar at 28 plus 24 FL OZ/A. Factor B was plant hormone mixtures and consisted of no plant hormone mixture, Ascend (mixture of cytokinin, gibberellic acid, and indole butyric acid) at 3.2 FL OZ/A, and Radiate (mixture of cytokinin and indole butyric acid) at 2 FL OZ/A. Plant hormones did not influence soybean injury or weed control with any of the treatments imposed in this study in 2015. The research will be repeated in 2016.

Impacts and Benefits to Mississippi Soybean Producers

Mississippi has averaged 1.98 million acres of soybean over the past five years, and a majority of soybean-producing counties contain at least one GR weed species. The data generated from this research will allow producers to implement effective control options for GR weeds, become aware of developing resistance problems, receive information on prevention and control tactics for resistant weeds, and allow Mississippi soybean producers to remain competitive regionally while improving economic returns.

Publications (23):

1. Bond, J. A., J. T. Irby, and D. B. Reynolds. 2015. Programs for managing herbicide-resistant Palmer amaranth in Mississippi soybean. Mississippi State University Extension Service. Mississippi State, MS. Information Sheet 2022.
2. Mangialardi, J. P., J. M. Orlowski, J. A. Bond, B. R. Golden, A. Catchot, B. H. Lawrence, J. D. Peeples, and T. W. Eubank. 2016. Influence of planting date and lactofen application on soybean growth and seed yield in the Midsouth. Agron J. 108:1-4.
3. 2016 Weed Control Guidelines for Mississippi. 2016. Mississippi State University Extension Service Publication P-1532.
4. Soybeans 2016 Planning Budgets. 2015. Mississippi State University Extension Service Publication P-2921.
5. 2015 Weed Control Guidelines for Mississippi. 2015. Mississippi State University Extension Service Publication P-1532.
6. Edwards, H. M., J. D. Peeples, B. H. Lawrence, H. T. Hydrick, T. L. Phillips, and J. A. Bond. 2016. Effect of rice herbicides on soybean with BOLT Technology. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at
7. Hydrick, H. T., J. A. Bond, B. R. Golden, B. H. Lawrence, J. D. Peeples, H. M. Edwards, and T. L. Phillips. 2016. Weed control in soybean with mixtures of herbicides and foliar nutrition products. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at
8. Mirsky, S. B., A. Davis, J. K. Norsworthy, M. V. Bagavathiannan, J. A. Bond, K. W. Bradley, W. S. Curran, D. Ervin, W. J. Everman, M. L. Flessner, G. Frisvold, A. G. Hager, B. Hartzler, N. Jordan, J. L. Lindquist, B. Schulz, L. E. Steckel, and M. VanGessel. 2016. An integrated weed management approach to addressing the multiple herbicide-resistant weed epidemic in three major U.S. field crop production regions. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at
9. Montgomery, G. B., L. E. Steckel, J. A. Bond, and H. M. Edwards. 2016. Combining cover crops and fall-applied herbicides for Italian ryegrass control. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at
10. Montgomery, G. B., L. E. Steckel, B. H. Lawrence, H. M. Edwards, and J. A. Bond. 2016. Environmental influences and time of day effects on PPO-inhibiting herbicides. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at

11. Montgomery, R. F., A. Mills, J. B. Willis, R. C. Scott, E. P. Prostko, P. Baumann, H. J. Beckie, J. A. Bond, B. Kirksey, H. James, J. T. Irby, E. Wesley, and. J. Martin. 2016. Efficacy and crop response of encapsulated acetochlor and fomesafen formulated as a premix: Warrant Ultra. Weed Science Society of America Annual Meeting. 8-11 Feb 16. San Juan, PR. [Online]. Available at

12. Barber, L. T., J. K. Norsworthy, J. A. Bond, L. E. Steckel, and D. B. Reynolds. 2015. Dicamba effects on soybean plants and their progeny. Proc. South. Weed Sci. Soc. 68:266.

13. Lawrence, B. H., J. P. Mangialardi, C. B. Edwards, J. D. Peeples, J. A. Bond, and T. W. Eubank. 2015. Utilization of flumioxazin plus pyroxasulfone and agronomic practices for Palmer amaranth (*Amaranthus palmeri*) in soybean (*Glycine max*). Proc. South. Weed Sci. Soc. 68:217.

14. Mangialardi, J. P., B. H. Lawrence, C. B. Edwards, J. D. Peeples, J. A. Bond, T. W. Eubank, and B. R. Golden. 2015. Can lactofen serve as a plant growth regulator in soybean? Proc. South. Weed Sci. Soc. 68:203.

15. Molin, W., A. A. Wright, V. K. Nandula, and J. A. Bond. 2015. Did ALS inhibitor resistance in *Amaranthus spinosus* come from *A. palmeri*? Weed Science Society of America Annual Meeting. 9-12 Feb 15. Lexington, KY. [Online]. Available at http://wssaabstracts.com/public/30/abstract-98.html

16. Nandula, V. K., M. Crampton, V. Kalavacharla, J. A. Bond, T. W. Eubank. 2015. Glyphosate resistance in common ragweed from Mississippi. Weed Science Society of America Annual Meeting. 9-12 Feb 15. Lexington, KY. [Online]. Available at http://wssaabstracts.com/public/30/abstract-105.html

17. Norsworthy, J. K., L. T. Barber, R. C. Scott, J. A. Bond, L. E. Steckel, and D. B. Reynolds. 2015. Understanding risks associated with increased use of auxin herbicides in Midsouth crops: what are the concerns? Proc. South. Weed Sci. Soc. 68:264.

18. Peeples, J. D., H. M. Edwards, J. A. Bond, C. B. Edwards, and T. W. Eubank. 2015. Residual herbicides for Palmer amaranth control in soybean. Proc. South. Weed Sci. Soc. 68:81.

19. Bond, J. A. 2016. PPO-resistant Palmer amaranth likely in Mississippi. [Online] Available at http://www.mississippi-crops.com/2016/01/15/ppo-resistant-palmer-amaranth-likely-in-mississippi/ (01/15/2016)

20. Bond, J. A. 2015. Auxin herbicide plantback restrictions. 2015. [Online] Available at http://www.mississippi-crops.com/2015/03/17/auxin-herbicide-plantback-restrictions/ (03/17/2015)

21. Bond, J. A. 2015. Choices of residual herbicides in Mississippi soybean. 2015. [Online] Available at http://www.mississippi-crops.com/2015/04/02/choices-of-residual-herbicides-in-mississippi-soybean/ (04/02/2015)

22. Bond, J. A. and T. Irby. 2015. Burndown scenarios for Mississippi soybean. [Online] Available at http://www.mississippi-crops.com/2015/03/27/burndown-scenarios-for-mississippi-soybean/ (03/27/2015)

23. Irby, T., J. M. Orlowski, and J. A. Bond. 2015. Soybean harvest aids. [Online] Available at http://www.mississippi-crops.com/2015/08/28/soybean-harvest-aids-2/ (08/28/2015)

Field Days (5):

1. Mississippi State University Turn Row Field Day – Mississippi weed management update; Clarksdale, MS (August 25, 2015)
2. Mississippi State University Row Crop Technology Showcase – Herbicide recommendations for weed control in Enlist and Roundup Ready Extend soybean; Starkville, MS (July 16, 2015)
3. Mississippi State University Row Crop Technology Showcase – Herbicide recommendations for weed control in Enlist and Roundup Ready Extend soybean; Brooksville, MS (July 15, 2015)
4. Mississippi State University Turn Row Field Day – Mississippi weed management update; Clarksdale, MS (July 9, 2015)
5. Mississippi State University Row Crop Technology Showcase – Weed control programs in Enlist soybean; Dundee, MS (July 7, 2015)

Technical Meetings/Training Sessions (28):

1. Coahoma County Production Meeting – Row crop panel discussion; Clarksdale, MS (March 8, 2016)
2. Syngenta Grower Meeting – Weed Management in the Mississippi Delta; Cleveland, MS (March 7, 2016)
3. Jimmy Sanders Grower Meeting – Weed Management in Mississippi; Verona, MS (February 22, 2016)
4. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Sumner, MS (February 17, 2016)
5. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Belzoni, MS (February 15, 2016)
6. Monroe County Corn and Soybean Grower Meeting – Weed control in Mississippi; Aberdeen, MS (January 27, 2016)
7. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Tunica, MS (January 25, 2016)
8. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Stoneville, MS (January 19, 2016)
9. Delta Ag Expo – Technology roundtable discussion; Cleveland, MS (January 21, 2016)
10. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Cleveland, MS (January 6, 2016)
11. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Hollandale, MS (January 5, 2016)
12. Jimmy Sanders Grower Meeting – Weed Management in the Mississippi Delta; Yazoo City, MS (January 4, 2016)

13. Mississippi Row Crop Short Course – Managing Palmer amaranth in Mississippi soybean; Starkville, MS (December 1, 2015)
14. Mississippi Row Crop Short Course – Herbicide-resistant technologies in Mississippi; Starkville, MS (November 30, 2015)
15. Syngenta Consultants' Meeting – Weed control in Mississippi; Eagle Lake, MS (February 18, 2016)
16. Mississippi Agricultural Consultants Association Meeting – Palmer amaranth control in 2016; Starkville, MS (February 3, 2016)
17. Simmons First Bank Ag Summit – Glyphosate-resistant weeds in the Midsouth; Dumas, AR (January 20, 2016)
18. Arkansas Crop Management Conference – Fall and spring control of Italian ryegrass; Little Rock, AR (January 20, 2016)
19. Bayer Cropscience Consultants' Meeting – Palmer amaranth control in 2016; Greenwood, MS (January 18, 2016)
20. Mississippi Agricultural Consultants' Association Research Exchange – Mississippi weed control update; Stoneville, MS (October 1, 2015)
21. Jimmy Sanders Training – Weed Management in the Mississippi Delta; Rayville, LA (September 24, 2015)
22. Mississippi Commissioner of Agriculture Field Tour – Herbicide-resistant weeds in Mississippi; Stoneville, MS (September 1, 2015)
23. Mississippi Congressional Delegation Tour of the Delta – Weed management in Mississippi crop production; Clarksdale, MS (August 19, 2015)
24. BASF Grow Smart Training Session – Weed management in soybean, corn, and rice; Burdett, MS (June 23, 2015)
25. Mississippi State University Extension Service Scout School – Identification of weed species common in Mississippi; Starkville, MS (June 4, 2015)
26. Mississippi State University Extension Service Scout School – Identification of weed species common in Mississippi; Verona, MS (June 2, 2015)
27. Mississippi State University Extension Service Scout School – Identification of weed species common in Mississippi; Clarksdale, MS (May 28, 2015)
28. Mississippi State University Extension Service Scout School – Identification of weed species common in Mississippi; Stoneville, MS (May 26, 2015)