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Postemergence Herbicides and Trifluralin for Control of Rhizome Johnsongrass in Cotton

Johnsongrass has remained a problem for cotton producers in the southern United States despite technological advances in herbicide application (4, 12). This perennial grass can reduce cotton yield (7, 8, 9) and make harvesting difficult where infestations are heavy.

Most articles about johnsongrass control in cotton pertain to control with the dinitroaniline herbicides (5, 7, 8, 16). However, numerous reports describing several methods for johnsongrass control in soybeans have been published (1, 2, 13, 14).

The dinitroaniline herbicides at high application rates have been reported to inhibit lateral root production by cotton plants. Seedling johnsongrass can be controlled on a sandy soil with 0.75 lb/acre, which is twice the normal rate of trifluralin (Treflan®); however, greenhouse studies indicated that tap-root length and lateral root production by cotton plants were reduced (8).

Until recently, the methanearsonates (MSMA and DSMA) were the only available selective herbicides that could be used postemergence (POE) to control johnsongrass in cotton. Keeley and Thullen (9) reported a 20% increase in cotton yield and a 64% reduction in johnsongrass density following application of disodium methanearsonate (DSMA); however, the yield obtained with this treatment was 40% less than the yield of the hand-weeded plot. Herbicides to which cotton is tolerant and johnsongrass is susceptible have been developed recently (3, 6, 10, 15, 18) Because of the growth habit of this rhizomatous weed (11), POE herbicides must be translocated basipetally to the rhizomes to result in plant death (19).

Johnsongrass that is allowed to grow to maturity in cotton fields is harvested along with the cotton and results in grade and price reduction of lint due to grass content and color.

This research was conducted to determine (a) the phytotoxicity of several POE herbicides applied to cotton for rhizome johnsongrass control, (b) whether one or two applications are necessary for control and (c) if the normal use rate (1X) of Treflan applied as a preplant incorporated (PPI) treatment will enhance johnsongrass control with the POE grass herbicides. The use rate of Treflan by itself in this study was not selected to control rhizome johnsongrass but was included to see if this herbicide in sequential combination with the POE treatments would increase johnsongrass control.

MATERIALS AND METHODS

The field experiment was initiated in 1981 at the MAFES Delta Branch on a Bosket silt loam soil with a natural infestation of rhizome johnsongrass. Initial herbicide treatments were arranged in a randomized complete block design with three replications. Each plot was four 40-inch wide and 40-ft long rows. The field was bedded with a four-row hipper in March and was rebedded in April. Nitrogen was applied at 90 lb/acre as a broadcast treatment before the initial bedding operation. Application and weather data are presented in Table 1.

A bed conitioner was used to level all rows, and Treflan was applied at 0.75 lb/acre to one-half of the plots. The bed conditioner was used again on April 27 to prepare the final seedbed by incorporating the Treflan to a depth of about 2 inches. Cotton was planted at the rate of 15 lb/acre on April 27.

CGA-82725, 0.5 lb/acre; fluazifop (Fusilade®), 0.5 lb/acre; DPX-Y6202 (Assure®), 0.5 lb/acre; sethoxydim (Poast®), 0.5 lb/acre and haloxyfop (Verdict®), 0.25 lb/acre were applied POE 27 days after planting to plots that had received Treflan treatment and to plots with no prior herbicide treatment. The POE treatments were applied to the foliage of 2- to 5-inch seedling and 12-inch rhizome johnsongrass. An example of the johnsongrass infestation level following cultivation is shown in Figure 1.

About one month later, one half of each plot was treated POE again at one-half the rate used earlier, except for the full rate of Assure applied after Treflan. The second POE treatment was applied to 5-to 24-inch johnsongrass on two rows of the four-row plot so that one and two treatments could be compared. The number of applications would, therefore, be considered a subunit treatment in a split-plot design.

All herbicides were applied with a tractor-mounted spray boom calibrated to deliver 20 gallons of spray solution per acre. A nonionic surfactant (Sterox NJ®) was added to each POE treatment at 0.25% (v/v).

The experiment was repeated in 1982 with the addition of Fusilade at 0.25 lb/acre followed by 0.125 lb/acre applied POE to a plot that had been treated with Treflan. The experimental design, number of replications and johnsongrass size

Table 1. Treatment and weather information for a johnsongrass control experiment at the MAFES Delta Branch, 1981.

Treatment		Application[a]		Weather data				
Herbicide(s)	Rate lb/acre	Date	Method	Days between last rainfall and treatment	Rainfall inches	Days between treatment and first rain	Rainfall inches	Temperature at treatmen (°F)
CGA-82725 + CGA-82725	0.5 + 0.25	5/21;7/3	POE	5;2	1;1	4;2	.75;1	73;81
Fusilade® + Fusilade	0.5 + 0.25	5/21;7/3	POE	5;2	1;1	4;2	.75;1	73;81
Assure® + Assure	0.5 + 0.25	5/21;7/3	POE	5;2	1;1	4;2	.75;1	73;81
Poast® + Poast	0.5 + 0.25	5/21;7/3	POE	5;2	1;1	4;2	.75;1	73.81
Verdict® + Verdict	0.25 + 0.125	5/21;7/3	POE	5;2	1;1	4;2	.75;1	73;81
Treflan® + CGA-82725 + CGA-82725	0.75 + 0.25 + 0.25	4/27;5/21; 7/3	PPI + POE	4;5;2	.5;1;1	13;4;2	.5;.75;1	86;73;81
Treflan + Assure + Assure	0.75 + 0.25 + 0.25	4/27;5/31; 7/3	PPI + POE	4;5;2	.5;1;1	13;4;2	.5;.75;1	86;73;81
Treflan + Poast + Poast	0.75 + 0.5 + 0.25	4/27;5/21; 7/3	PPI + POE	4;5;2	.5;1;1	13;4;2	.5;.75;1	86;73;81
Treflan + Verdict + Verdict	0.75 + 0.25 + 0.125	4/27;5/21; 7/3	PPI + POE	4;5;2	.5;1;1	13;4;2	.5;.75;1	86;73;81
Treflan	0.75	4/27	PPI	4	.5	12	.5	86
None	---	---	---	---	---	---	---	---

[a]Planting date was April 27.

were as described previously. The PPI (April 28) and first POE treatments (May 26) were applied with a tractor-mounted spray boom, and the second POE treatments (June 30) were applied with a CO^2-pressurized backpack sprayer calibrated to deliver the same carrier rate as did the tractor-mounted sprayer. Atplus 411 F®, a crop oil-surfactant blend[1], was used as an adjuvant at 0.5% (v/v). Application and weather data are listed in Table 2.

Johnsongrass control on a scale of 0 to 100% (0 = no effect and 100 = death of all plants) was rated visually each year. Initial johnsongrass control ratings were made 44 and 37 days after treatment (DAT) in 1981 and 1982, respectively, and preharvest control ratings were made each year. The cotton was machine harvested each year.

All data each year were subjected to analysis of variance. Means of initial ratings of single herbicide applications were separated by Waller-Duncan's Bayesian *k*-ratio (k = 100) *t*-test (<0.05) (17). LSD (<0.05) values for pre-harvest

Figure 1. Example of initial johnsongrass infestation levels before POE treatment.

[1]83% mineral oil/17% surfactant (oxysorbic polyoxyethylene sorbiton fatty acid ester

Table 2. Treatment and weather information for a johnsongrass control experiment at the MAFES Delta Branch, 1982.

Treatment		Application[a]		Weather data				
Herbicide(s)	Rate lb/acre	Date	Method	Days between last rainfall and treatment	Rainfall inches	Days between treatment and first rain	Rainfall inches	Temperature at treatment (°F)
CGA-82725 + CGA-82725	0.5 + 0.25	5/26;6/30	POE	1;3	.5;1.5	8;1	.5;.5	83;84
Fusilade® + Fusilade	0.5 + 0.25	5/26;6/30	POE	1;3	.5;1.5	8;1	.5;.5	83;84
Assure® + Assure	0.5 + 0.25	5/26;6/30	POE	1;3	.5;1.5	8;1	.5;.5	83;84
Poast® + Poast	0.5 + 0.25	5/26;6/30	POE	1;3	.5;1.5	8;1	.5;.5	83;84
Verdict®	0.25 + 0.125	5/26;6/30	POE	1;3	.5;1.5	8;1	.5;.5	83;84
Treflan® + CGA-82725 + CGA-82725	0.75 + 0.5 + 0.25	4/28;5/26; 6/30	PPI, POE	9;1;3	1.5;.5;1.5	1;8;1	.75;.5;.5	73;83;84
Treflan + Fusilade + Fusilade	0.75 + 0.25 + 0.125	4/28;5/26; 6/30	PPI, POE	9;1;3	1.5;.5;1.5	1;8;1	.75;.5;.5	73;83;84
Treflan + Assure + Assure	0.75 + 0.25 + 0.25	4/28;5/26; 6/30	PPI, POE	9;1;3	1.5;.5;1.5	1;8;1	.75;.5;.5	73;83;84
Treflan + Poast + Poast	0.75 + 0.5 + 0.25	4/28;5/26; 6/30	PPI, POE	9;1;3	1.5;.5;1.5	1;8;1	.75;.5;.5	73;83;84
Treflan + Verdict + Verdict	0.75 + 0.25 + 0.125	4/28;5/26; 6/30	PPI, POE	9;1;3	1.5;.5;1.5	1;8;1	.75;.5;.5	73;83;84
Treflan	0.75	4/28	PPI	9	1.5	1	.75	73
None	---	---	---	---	---	---	---	---

[a]Planting date was April 28.

johnsongrass control ratings and yield determinations were calculated. The LSD tests were used to test rate-by-compound subclass means. The intended use of the LSD values was for comparisons of one and two applications within a compound or comparison of all herbicides with one or two applications and was not intended for use as a multiple range test.

Results and Discussion

One application of each POE herbicide in 1981 gave > 90% control of johnsongrass at 44 DAT (Table 3), and differences among treatments were not significant ($P < .05$). A single application of POE herbicides in 1982 also gave > 90% control at 37 DAT except for CGA-82725 alone, Poast alone and Poast applied after Treflan. Degrees of initial burndown are shown in Figure 2.

Banks and Tripp (3) reported better johnsongrass control with two applications of Poast than with one, and our data imply the same for Poast. Two applications of the POE herbicides tested in this study gave > 90% control of johnsongrass at harvest except for CGA-82725 alone and Treflan + Poast in 1982 (Table 4).

Table 3. Johnsongrass control in cotton following one postemergence application of five postemergence herbicides alone and in sequence with trifluralin, by treatment, MAFES Delta Branch, 1981 and 1982.

Treatment		Johnsongrass control	
		1981	1982
Herbicide(s)[a]	Rate (lb/a)	OAT[b] 44	OAT[b] 37
		---------(%)---------	
CGA-82725	0.5	96 a	88 cd
Fusilade®	0.5	99 a	98 ab
Assure®	0.5	97 a	100 a
Poast®	0.5	97 a	83 d
Verdict®	0.25	100 a	98 ab
Treflan® + CGA-82725	0.75 + 0.5	96 a	95 abc
Treflan + Fusilade[c]	0.75 + 0.25	--	92 bc
Treflan + Assure	0.75 + 0.25	99 a	99 ab
Treflan + Poast	0.75 + 0.5	98 a	82 d
Treflan + Verdict	0.75 + 0.25	100 a	99 ab
Treflan	0.75	0 b	0 e
Control	--	0 b	0 e

[a]Means within a column followed by the same letter are not significantly different at the 5% level using Waller-Duncan's Bayesian K-ratio (K=100) t-test.
[b]Days after foliar treatment.
[c]Not applied in 1981.

Pre-harvest control of johnsongrass with two applications of the POE herbicides tested in this study was equal to or better than control with one application (Table 4), and only two treatments (CGA-82725 and Poast following Treflan) failed to give > 90% control when applied twice. However, one application of Fusilade alone, Verdict alone and Assure or Verdict following Treflan gave > 90% control each year, and an example of the control attained with one application of these herbicides is shown in Figure 3.

Control of johnsongrass with one application was significantly lower ($P < .05$) than with two applications of CGA-82725 alone, Poast alone and Treflan + CGA-82725 each year and Treflan + Poast in 1982 (Table 4). This suggests that two applications of CGA-82725 and Poast at the rates evaluated, with or without Treflan, are needed to increase johnsongrass control in cotton significantly.

Treflan has been used extensively in the Delta of Mississippi for control of johnsongrass in cotton for many years but has not eradicated it. Use of Treflan at twice the recommended rate has reduced johnsongrass populations and increased cotton yields significantly (8). However, pre-harvest johnsongrass control ratings in our study revealed that the addition of Treflan at 0.75 lb/acre did not increase johnsongrass control.

Two applications of POE herbicides in 1981 resulted in consistently higher yields (but not significant at the 5% level) across herbicides except for Fusilade without Treflan and Treflan + Verdict. This was not evident in 1982.

All treatments resulted in significantly higher yields than from the untreated control and the Treflan standard, which will not control rhizome johnsongrass in cotton effectively. Consequently, johnsongrass populations in the Treflan plot (Figure 4) were so dense that lint yield was very low in 1981, and mechanical harvesting was not possible in 1982.

Figure 2. Degrees of initial burndown with the POE herbicides.

Table 4. Pre-harvest control of johnsongrass and seed cotton yield as affected by one or two applications of five postemergence herbicides alone and in sequence with trifluralin, by treatment, MAFES Delta Branch, 1981 and 1982.

Treatment		Johnsongrass control		Yield seed cotton	
Herbicide(s)	Rate (lb/Acre)	1981	1982	1981	1982
		----(%)-----		--(lb/A)----	
CGA-82725	0.5	78	63	1510	2420
CGA-82725 + CGA-82725	0.5 + 0.25	90	87	2420	2490
Fusilade®	0.5	95	99	2370	2760
Fusilade + Fusilade	0.5 + 0.25	98	100	1610	2900
Assure®	0.5	89	100	1580	2400
Assure + Assure	0.5 + 0.25	99	100	1650	2740
Poast®	0.5	85	55	1650	2130
Poast + Poast	0.5 + 0.25	98	92	1760	2120
Verdict®	0.25	98	100	1450	2780
Verdict + Verdict	0.25 + 0.125	99	100	1520	2600
Treflan® + CGA-82725	0.75 + 0.5	70	78	1540	2840
Treflan + CGA-82725 + CGA-82725	0.75 + 0.5 + 0.25	99	99	1810	2960
Treflan + Fusilade	0.75 + 0.25	--[a]	86		3130
Treflan + Fusilade + Fusilade	0.75 + 0.25 + 0.126	--	100	--	2750
Treflan + Assure	0.75 + 0.25	94	99	1830	2840
Treflan + Assure + Assure	0.75 + 0.25 + 0.25	99	100	1920	2790
Treflan + Poast	0.75 + 0.5	92	53	1590	2190
Treflan + Poast + Poast	0.75 + 0.5 + 0.25	98	86	1930	2030
Treflan + Verdict	0.75 + 0.25	98	99	1770	2840
Treflan + Verdict + Verdict	0.75 + 0.25 + 0.125	98	100	1680	2970
Treflan	0.75	0	0	470	0
None	--	0	0	110	0
LSD ($P < .05$) One versus two applications within herbicide		11	15	500	600
		14	19	550	780
LSD ($P < .05$) Between herbicides with one or two applications					

[a]Not applied in 1981

Figure 3. Example of johnsongrass control attained with one application of Fusilade, Verdict or Assure.

Figure 4. Johnsongrass populations in a plot treated with the Treflan standard.

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Literature Cited

1. Azlin, W.R. and C.G. McWhorter. 1981. Johnsongrass (*Sorghum halepense*) control in soybeans (*Glycine max*) with metriflufen applied postemergence. Weed Sci. 29:139-143.
2. Banks, P.A. and P.W. Santelmann. 1977. Glyphosate as a postemergence treatment for johnsongrass control in cotton and soybeans. Agron. J. 69:579-582.
3. Banks, P.A. and T.N. Tripp. 1983. Control of johnsongrass (*Sorghum halepense*) in soybeans (*Glycine max*) with foliar applied herbicides. Weed Sci. 31:628-633.
4. Dale, J.E. 1981. Control of johnsongrass (*Sorghum halepense*) and volunteer corn (*Zea mays*) in soybeans (*Glycine max*). Weed Sci. 29:708-711.
5. Harvey, R.G. 1973. Field comparisons of twelve dinitroaniline herbicides. Weed Sci. 21:512-516.
6. Hill, E.R. and J.W. Peek. 1982. CGA-82725 - A new grass herbicide for broadleaf crops. Abstr. Weed Sci. Soc. Am., p. 16.
7. Hurst, H.R. and B.L. Arnold. 1982. Multiple practices for control of johnsongrass in cotton (*Gossypium hirsutum*) (L.) Pers.). MAFES Bull. 907, 7 pp.
8. Jordan, T.N., R.S. Baker, and W.L. Barrentine. 1978. Comparative toxicity of several dinitroaniline herbicides. Weed Sci. 26:72-75.
9. Keeley, P.E. and R.J. Thullen. 1981. Control and competitiveness of johnsongrass (*Sorghum halepense*) in cotton (*Gossypium hirsutum*). Weed Sci. 29:356-359.
10. Kurtz, M.E. 1982. Evaluation of seven experimental herbicides for johnsongrass control in cotton. Abstr. Weed Sci. Soc. Am., p. 10.
11. McWhorter, C.G. 1961. Morphology and development of johnsongrass plants from seed and rhizomes. Weeds 9:558-562.
12. McWhorter, C.G. 1970. A recirculating spray system for postemergence weed control in row crops. Weed Sci. 18:285-287.
13. McWhorter, C.G. 1974. Johnsongrass control in soybeans with trifluralin and nitralin. Weed Sci. 22:111-115.
14. McWhorter, C.G. 1977. Johnsongrass control in soybeans with soil-incorporated dinitroaniline herbicides. Weed Sci. 25:264-267.
15. Smith, L.L., Jr., H. Johnston, B.C. Gerwick, and E.A. Egli. 1982. Dowco 453 - A new postemergence herbicide for selective annual and perennial grass control in broadleaved crops. Abstr. Weed Sci. Soc. Am., p. 107.
16. Standifer, L.C. and C.H. Thomas. 1965. Response of johnsongrass to soil incorporated trifluralin. Weeds 13:302-306.
17. Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics - A Biometrical Approach (2nd ed.). McGraw-Hill Book Co., Inc., New York, 633 pp.
18. Terhune, M.E. and R.E. Frans. 1980. Preliminary comparisons of KK-80 and BAS-9052 for overtop control of johnsongrass in cotton and soybeans. Proc. South. Weed Sci. Soc. 33:45.
19. Wills, G.D. and C.G. McWhorter. 1983. Effect of environment on the translocation and toxicity of fluazifop in *Cynodon dactylon* and *Sorghum halepense*. Aspects of Appl. Biol. 4:283-290.