

Spot-treating

JOHNSONGRASS

in Corn

with

Accent

and

Beacon



MAFES

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Spot-Treating Johnsongrass in Corn with Accent[®] and Beacon[®]

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Introduction

Johnsongrass is a serious weed in Mississippi and it is listed as one of the 10 worst weeds in the world (3). The control of johnsongrass in cotton and soybeans has improved recently with the introduction of the over-the-top herbicides used to complement preplant soil incorporated materials, which have been available for a number of years. Dale and Chandler (1) demonstrated that a light infestation of johnsongrass in corn resulted in this plant becoming the predominant weed with continuous cropping. They reported that effective control of johnsongrass in cotton reduced the johnsongrass population in corn in a cotton-corn rotation.

In many Mississippi fields, johnsongrass infestations severely limit corn production. As corn production has increased in the last few years, there has been an increased interest in producing corn and utilizing corn in crop rotations, especially with cotton. For advantageous rotation to corn, johnsongrass must be controlled during corn production. Several preemergence and preplant incorporated herbicides are available for johnsongrass control in corn, but these materials do not give excellent control of plants from rhizomes (11). Use of preplant incorporated herbicides and cultivation also eliminates no-till corn production systems.

Accent[®] (nicosulfuron) and Beacon[®] (primisulfuron) are selective herbicides that have been recommended for over-the-top application for johnsongrass control in corn since 1990. These herbicides have greatly improved johnsongrass control when growing corn continuously or in the corn phase when rotating with other crops.

This bulletin reports on the control of seedling and rhizome johnsongrass in corn when applications are made to johnsongrass utilizing spot-treatments. Spot-treatment applications would be used primarily in situations where johnsongrass was present at a low infestation level or in spot areas of fields.

Materials and Methods

An experiment was conducted from 1991 through 1993 at the Delta Branch Experiment Station, Stoneville, Mississippi. A naturally-infested johnsongrass area was selected where the soil was a

Bosket silt loam (Mollic Hapludalfs) (22% sand, 65% silt, 13% clay) with 1.1% organic matter and pH 5.8. The initial treatments were made in 1991 with the exception of a fall-applied treatment of Roundup[®] (glyphosate) made in October 1990. A split-plot design with three replications was used. Whole-plot treatments were 32, 40-inch rows 40 feet long consisting of either (A) corn grown without preplant tillage or (B) corn grown with preplant tillage.

Table 1 lists the overall operations that were specific to the experiment. Subplot treatments were randomized within each whole plot and consisted of four rows each. Subplot treatments involved applications of Roundup, Accent, Beacon, or no herbicide at the rates and timings listed in Table 2. The treatments were repeated on the same areas during the 3 years of the study.

The Roundup treatment was applied broadcast with a tractor-mounted boom sprayer delivering a spray volume of 10 gallons/acre. Overall preemergence and postemergence directed treatments were made with a tractor-mounted sprayer delivering a broadcast spray volume of 20 gallons per acre. The spot-treatment applications were made by hand with a knapsack sprayer delivering 0.2 to 0.3 gallon per minute when fully charged.

The spot-treatment operator was advised to spray johnsongrass to "cover" the foliage. One row per pass was sprayed (20 inches wide if cultivated, 40 inches wide if not cultivated). The total volume of spray material used was determined for each plot in 1992 and 1993. These data are presented as gallons per acre on a land area basis in Table 3.

The spot-treatment rate was determined by using 50% of the amount of product suggested on the product label for each gallon of spray mixture if the product was to be applied broadcast at 20 gallons per acre. This is presented as percent weight/volume.

Numbers of seedling johnsongrass plants were determined before spot-treatments were made each spring by counting the plants from a 1-foot by 3-foot area at three random locations in 1991 and 1992, and from an area 10 feet by 40 inches in each subplot centered on a preselected row in 1993. Rhizome johnsongrass plants were determined by counting plants from a preselected area between the two center rows of each subplot before and from a preselected area centered on an inside row of each subplot after the spot-treatment applications were made. Count data are presented as numbers of johnsongrass plants per 10 square feet.

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Corn stand was determined by counting the plants on a predetermined row in each subplot. The two center rows of each subplot were harvested at maturity using a plot combine with corn header attachment. Yield is presented as bushels per acre of shelled corn adjusted to 13% moisture.

All data were subjected to an analysis of variance and means were separated using Duncan's multiple range test at the 5% significance level.

Results

Spray volume

Table 3 lists the spray volume used with each spot-treatment. There were no main-plot by subplot treatment interactions for spray volume at any date of application. On May 11, 1993 (data not presented), main-plot treatment A, no preplant tillage, required a greater average spray volume (45.3 gallons per acre)

Table 1. Operations used to conduct an experiment on spot treating johnsongrass in corn. MAFES, Delta Research and Extension Center, Stoneville, MS, 1991-1993.

Operation and Date(s)	<i>Entire Area</i>
Combine Harvest	
8/23/91, 8/31/92, 8/27/93	
Rotary Mow	
10/26/90; 8/26/91, 10/4/91; 9/1/92, 9/30/92	
Plant Funk's/Deltapine Brand G4666	
4/17/91, 3/24/92, 3/19/93	
Burndown	
Roundup D-Pak 0.5 lb ai/A + Latron AG 98 1.0% 3/2/92, Gramoxone Extra 0.94 lb ai/A + Riverside atrazine 90DF 0.5 lb ai/A + Activate Plus 0.5% 3/8/93	
Preemergence Herbicide	
Riverside atrazine 90DF 1.5 lb ai/A + Lasso 4E 2.5 lb ai/A + Gramoxone Extra 0.63 lb ai/A + X-77 0.25% 4/17/91; Caliber 90DF 0.9 lb ai/A 10/10/91; Prowl 4E 1.0 lb ai/A + AAtrex 4L 1.5 lb ai/A 3/24/92; Frontier 7.5E 1.0 lb ai/A + Riverside atrazine 90DF 1.13 lb ai/A 3/19/93	
Postemergence Directed Herbicide (12-inch band centered on row)	
Gramoxone Extra 0.25 lb ai/A + X-77 0.25% 5/24/91, Gramoxone Extra 0.1 lb ai/A + Activate Plus 0.25% 5/14/92	
Fertilizer	
Liquid urea-ammonium nitrate: 200 lb N/A 3/26/91, 4/13/92, 180 lb N/A 4/13/93 (knifed in 10 in. to each side of row 4 in. deep)	
Irrigation	
None	
Insect Control	
Furadan 15G in-furrow 6.5 lb product/A 4/17/91, 3/19/92, Asana XL 10 oz product/A 4/23/92 over-the-top	

Main Plot A — No Preplant Tillage

Burndown	
Gramoxone Extra 0.94 lb ai/A + AAtrex 90DF 0.5 lb ai/A + X-77 0.5% 3/8/91	
Replant	
4/7/93	
Cultivated (undisturbed 12-inch band centered on row)	
5/17/91	

Main Plot B — Preplant Tillage

Hip Rows	
11/7/90, 10/10/91, 10/13/92	
Re-hip Rows	
3/12/91, 10/21/92	
Bed Conditioner	
3/19/91, 3/17/92, 11/18/92	
Cultivated (undisturbed 12-inch band on row)	
5/19/91, 4/17/892, 5/4/92	

than main-plot treatment B, preplant tillage (39.1 gallons per acre). Average spray volume for main-plot treatments were not different on the other dates.

The early spot-treatment with Accent after Roundup required the least spray volume in 1992 and 1993; however, in 1992 it was not different from other treatments except lower than when Beacon was applied one time. In both years, the late spot-treatment application of Accent applied one time required greater spray volume than the amount required for

the first application of treatments made two times. In both 1992 and 1993, the second spot-treatment application with Beacon required greater spray volume than the spot-treatment with Accent.

Johnsongrass

There were no main-plot by subplot interactions of johnsongrass plant counts at any date (Table 4). Seeding johnsongrass plants on April 17, 1991 are to be

Table 2. Subplot treatment herbicides, application dates, and johnsongrass stage with a johnsongrass control experiment in corn. MAFES, Delta Branch Experiment Station, Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration	Application date(s) and johnsongrass height at application					
			1991		1992		1993	
			Date	Height	Date	Height	Date	Height
		(% w/v)	(mo/day)	(in)	(mo/day)	(in)	(mo/day)	(in)
1.	Accent 75DF	0.0125	5/10	6-12	4/23	2-12	5/11	2-12
2.	Accent 75DF	0.0125	5/10	6-12	4/23	2-12	5/11	2-12
	Accent 75DF	0.0125	6/6	6-12	5/20	6-12	6/15	10-20
3.	Accent 75DF	0.0125	5/21	10-24	5/11	3-30	5/26	10-30
4.	Accent 75DF	0.0125	5/21	10-24	5/11	3-30	5/26	10-30
	Accent 75DF	0.0125	6/12	10-24	6/4	6-12	6/23	12-24
5.	No spot-treatment							
6.	Roundup D-Pak ¹ 6.4E		10/20	4-30	9/16	4-30	9/15	4-24
	Accent 75DF	0.0125	5/10	6-12	4/23	2-12	5/11	2-12
7.	Beacon 75DF	0.015	5/10	6-12	4/23	2-12	5/11	2-12
8.	Beacon 75DF	0.015	5/10	6-12	4/23	2-12	5/11	2-12
	Beacon 75DF	0.015	6/6	6-12	5/20	6-12	6/15	10-20

¹ Applied in previous fall on date indicated as a broadcast treatment.

Table 3. Spray material used for spot-treating johnsongrass in corn with Accent and Beacon during 1992 and 1993. Delta Branch Experiment Station, Stoneville, MS.

Trt. no.	Herbicide	Spray concentration	Application dates and spray volume used (land area basis) ¹							
			4/23/92	5/11/92	5/20/92	6/4/92	5/11/93	5/26/93	6/15/93	6/23/93
			(gallons per acre)							
1.	Accent 75DF	0.0125	15.3 ab				46.4 a			
2.	Accent 75DF	0.0125	12.2 b		9.1 b		41.8 a		22.4 b	
	Accent 75DF	0.0125								
3.	Accent 75DF	0.0125		26.8 a				36.5 a		
4.	Accent 75DF	0.0125		12.3 b		21.08		27.9 b		36.2
	Accent 75DF	0.0125								
5.	No spot-treatment									
6.	Roundup D-Pak ² 6.4E									
	Accent 75DF	0.0125	9.6 b				27.7 b			
7.	Beacon 75DF	0.015	18.0 a				48.4 a			
8.	Beacon 75DF	0.015	9.6 b		18.1a		46.7 a		38.4 a	
	Beacon 75DF	0.015								

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

Table 4. Seedling johnsongrass plants in April with spot-treatment applications of herbicides in corn, Delta Branch Experiment Station, Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration (% w/v)	Date		
			4/17/91	4/22/92	4/22/93
———— (plants/10 square feet) ————					
Subplot treatments¹					
1.	Accent 75DF	0.0125	58.7 b	44.5 a	2.9 bc
2.	Accent 75DF	0.0125	151.7 a	44.2 a	2.4 bc
	Accent 75DF	0.0125			
3.	Accent 75DF	0.0125	60.6 b	41.3 a	2.9 bc
4.	Accent 75DF	0.0125	102.4 ab	44.5 a	0.8 c
	Accent 75DF	0.0125			
5.	No spot-treatment		108.0 ab	53.0 a	10.3 a
6.	Roundup D-Pak ² 6.4E				
	Accent 75DF	0.0125	73.1 ab	27.8 a	6.8 ab
7.	Beacon 75DF	0.015	65.6 ab	33.5 a	4.1 bc
8.	Beacon 75DF	0.015	133.7 ab	44.3 a	1.7 c
	Beacon 75DF	0.015			
Main-plot treatments¹					
A. No preplant tillage				17.1 b	5.4 a
B. Preplant tillage				66.4 a	2.6 b

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

Table 5. Rhizome johnsongrass plants before first spot-treatment application of herbicides in corn, Delta Branch Experiment Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration (% w/v)	Rhizome johnsongrass plants Date		
			4/11/91	4/2/92	4/6/93
———— (plants/10 square feet) ————					
Subplot treatments¹					
1.	Accent 75DF	0.0125	4.1 ab	5.0 ab	2.7 a
2.	Accent 75DF	0.0125	9.4 a	3.3 bc	3.0 a
	Accent 75DF	0.0125			
3.	Accent 75DF	0.0125	4.8 ab	6.9 a	2.5 a
4.	Accent 75DF	0.0125	5.9 ab	2.1 c	1.2 b
	Accent 75DF	0.0125			
5.	No spot-treatment		6.9 ab	5.4 ab	3.1 a
6.	Roundup D-Pak ² 6.4E				
	Accent 75DF	0.0125	1.0 b	1.6 c	0.3 c
7.	Beacon 75DF	0.015	3.0 b	3.7 bc	1.6 b
8.	Beacon 75DF	0.015	5.4 ab	3.1 bc	3.2 a
	Beacon 75DF	0.015			
Main-plot treatments¹					
A. No preplant tillage					3.3 a
B. Preplant tillage					1.1 b

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

considered beginning values. With treatment 6 (Roundup applied Oct. 20, 1990), the seedling johnsongrass plant count was not different from other treatments.

On April 22, 1992, seedling johnsongrass plants were reduced 56% overall from 1991. There were no differences among subplot treatments. However, the main-plot treatment B, preplant tillage, resulted in 66.4 seedling johnsongrass plants per 10 square feet, which was greater than subplot treatment A, no preplant tillage (17.1 plants).

Average seedling johnsongrass counts on April 22, 1993, were reduced 95% from 1991 and 90% from 1992. These reductions indicate only marginal, if any, effect on seedling johnsongrass numbers from previous in-season and fall treatments since the no spot-treatment control had a reduction of 94% when compared with 1991. Treatment 4 (Accent May 21, 1991 and May 11, 1992 followed by Accent June 12, 1991 and June 4, 1992) and treatment 8 (Beacon May 10, 1991 and April 23, 1992 followed by Beacon June 6, 1991 and May 20, 1992) resulted in lower seedling johnsongrass numbers on April 22, 1993, when compared with the no spot-treatment control. The main-plot treatment A, no preplant tillage, resulted in more seedling johnsongrass plants per 10 square feet than B, preplant tillage (an average of 5.4 and 2.6 plants, respectively).

The rhizome johnsongrass plant count on April 11, 1991, was not different from the no spot-treatment control for any treatment though treatment 6 (Roundup) had been applied October 20, 1990 (Table 5). However, the fall-applied Roundup treatment had the least numerical count.

In April 1992, the overall rhizome johnsongrass count was reduced 23% from the April 11, 1991 count. The no spot-treatment control count was 22% lower, so the in-season spot-treatments did not lower the rhizome johnsongrass count after one year. Treatment 4 (Accent May 21, 1991 followed by Accent June 12, 1991) and treatment 6 (Roundup Oct. 20, 1990 followed by Accent May 10, 1991) had counts lower than the no spot-treatment control.

The April 6, 1993 counts resulted in a similar rhizome johnsongrass plant count overall and with the no spot-treatment control compared to counts on April 11, 1991. The plant count reduction for both averaged about 56%. The in-season spot-treatments did not result in an average reduction in rhizome plants after 2 years. The lowest April 1993 rhizome johnsongrass count was obtained with spot-treatment 6 (Roundup Oct. 20, 1991 and Sept. 16, 1991 followed by Accent May 10, 1991 and April 23, 1992), which was lower than all other treatments.

Two additional treatments, spot-treatment 4 (Accent May 21, 1991 and May 11, 1992 followed by Accent June 12, 1991 and June 4, 1992) and spot-treatment 7 (Beacon May 10, 1991 and April 23, 1992), had reduced April 1993 rhizome johnsongrass plant counts when compared with the no spot-treatment control.

The main-plot treatment A, no preplant tillage, had more rhizome johnsongrass plants in April 1993 (3.3 plants per 10 square feet) than main-plot B, preplant tillage (1.1 plants per 10 square feet).

When rhizome johnsongrass plants were counted in mid- to late-July, the no spot-treatment control had 12.9, 24.3, and 28.2 plants per 10 square feet for 1991,

Table 6. Rhizome johnsongrass plants after spot-treatment application of herbicides in corn, Delta Branch Experiment Station Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration (% w/v)	Rhizome johnsongrass plants on row ¹ Date			
			7/24/91	7/20/92	6/1/93	7/19/93
1.	Accent 75DF	0.0125	8.3 ab	27.0 a	1.6 c	
2.	Accent 75DF Accent 5DF	0.0125 0.0125	5.5 ab	30.2 a	1.2 c	1.7 bc
3.	Accent 75DF	0.0125	11.6 ab	28.9 a	9.9 b	
4.	Accent 75DF Accent 75DF	0.0125 0.0125	1.5 b	27.8 a	3.7 bc	0.1 c
5.	No spot-treatment		12.9 ab	24.3 a	28.2 a	28.2 a
6.	Roundup D-Pak ² 6.4E Accent 75DF	0.0125	15.4 a	22.2 a	4.6 bc	
7.	Beacon 75DF	0.015	7.2 ab	20.6 a	3.1 c	
8.	Beacon 75DF Beacon 75DF	0.015 0.015	6.5 ab	28.6 a	3.5 bc	4.1 b

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

Table 7. Corn stand with spot-treatment herbicide applications for johnsongrass control, Delta Branch Experiment Station, Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration	Corn plant population ¹		
			Date		
		(% w/v)	5/2/91	4/14/92	5/5/93
			(plants/acre)		
1.	Accent 75DF	0.0125	21,889 a	18,677 ab	13,913 ab
2.	Accent 75DF	0.0125	17,478 b	19,056 ab	15,519 a
	Accent 75DF	0.0125			
3.	Accent 75DF	0.0125	21,236 a	19,112 ab	13,421 ab
4.	Accent 75DF	0.0125	19,765 ab	20,745 a	14,592 ab
	Accent 75DF	0.0125			
5.	No spot-treatment		19,439 ab	16,227 b	14,239 ab
6.	Roundup D-Pak ² 6.4E				
	Accent 75DF	0.0125	20,582 a	19,112 ab	12,524 b
7.	Beacon 75DF	0.015	21,236 a	19,658 ab	14,049 ab
8.	Beacon 75DF	0.015	20,853 a	20,255 ab	13,666 ab
	Beacon 75DF	0.015			

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

Table 8. Corn yield with spot-treatment applications for johnsongrass control, Delta Branch Experiment Station, Stoneville, MS. 1991-1993.

Trt. no.	Herbicide	Spray concentration	Shelled corn yield at 13% moisture ¹		
			Year		
		(% w/v)	1991	1992	1993
			(bushels/acre)		
1.	Accent 75DF	0.0125	100.8 a	62.6 bc	28.6 ab
2.	Accent 75DF	0.0125	98.0 a	89.4 a	32.9 a
	Accent 75DF	0.0125			
3.	Accent 75DF	0.0125	96.6 a	56.2 c	14.8 d
4.	Accent 75DF	0.0125	93.7 a	76.1 ab	28.2 ab
	Accent 75DF	0.0125			
5.	No spot-treatment		76.2 b	29.0 d	5.7 e
6.	Roundup D-Pak ² 6.4E				
	Accent 75DF	0.0125	101.4 a	80.8 ab	30.4 a
7.	Beacon 75DF	0.015	105.0 a	66.8 bc	23.0 bc
8.	Beacon 75DF	0.015	103.5 a	78.7 ab	20.7 cd
	Beacon 75DF	0.015			

¹ A common letter for each date indicates that means are not different according to DMRT at P = 0.05.

² Applied in previous fall on date indicated as a broadcast treatment.

1992, and 1993, respectively (Table 6). The lower count in 1991 probably was caused by the very large rainfall, which resulted in extended soil saturation of field plots in February and again in late April to early May. Spring and summer flooding of soil has been shown to greatly reduce rhizome johnsongrass (6).

Rhizome johnsongrass counts on July 24, 1991, were not different from the no spot-treatment control with any treatment. Treatment 4 (Accent May 21, 1991 followed by Accent June 12, 1991) had the least number of plants per 10 square feet (1.5), which was lower than treatment 6 (Roundup Oct. 20, 1990 followed by Accent May 10, 1991), which had the highest plant count (15.4 plants per 10 square feet). The rhizome johnsongrass plant counts on July 20, 1992 ranged from 20.6 to 30.2 plants per 10 square feet. There were no treatment differences.

On June 1, 1993, rhizome johnsongrass plants with spot-treatments applied one time were lower than the no spot-treatment control. This was also true with counts on July 19 with spot-treatments applied two times.

Corn

The corn plant populations in 1991 and 1992 were adequate for maximum yield without irrigation (Table 7). The 1993 plant population was lower than recommended. Corn plant population was different but inconsistent between subplot spot-treatments in all years. No treatment was different from the no spot-treatment control in 1991 and 1993. In 1992, only spot-treatment 4 (Accent May 21, 1991 followed by Accent June 19, 1991) was different from the no spot-treatment control, being 27% higher. This difference cannot be explained.

In all years, corn yield was greater with all spot-treatments compared with the no spot-treatment control (Table 8). There were no yield differences between the spot-treatments in 1991.

In 1992, greatest corn yield was obtained with treatment 2 (Accent May 10, 1991 and April 23, 1992 followed by Accent June 6, 1991 and May 10, 1992). Corn yield with treatment 2 was not greater than with treatment 6 (Roundup Oct. 10, 1990 and Sept. 16, 1991 followed by Accent May 10, 1991 and April 23, 1992) or treatment 8 (Beacon May 10, 1991 and April 23, 1992 followed by Beacon June 6, 1991 and May 20, 1992). The lowest corn yield in 1992 using spot-treatments occurred with treatment 3 (Accent May 21, 1991 and May 11, 1992), a spot-treatment applied to larger johnsongrass plants one time each year. All corn yields were very low in 1993, the result of less than adequate rainfall and the low plant population. The greatest corn yield in 1993 was obtained with treatment 2 (Accent early followed by Accent late

each year) and treatment 6 (Roundup in previous fall followed by Accent early each year). These treatments were not different from one another or from treatment 4 (Accent late followed by Accent very late each year).

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