

# Johnsongrass

Control in Corn With and Without Preplant Tillage

**MAFES**

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## Introduction

Johnsongrass can be a serious weed in many southeastern states, including Mississippi, and it is listed as one of the 10 worst weeds in the world (3). Johnsongrass control in cotton and soybeans has improved recently with the introduction of several over-the-top herbicides to complement the preplant soil-incorporated products that have been available for a number of years. Research by Dale and Chandler (1) demonstrated that a light infestation of johnsongrass in corn resulted in johnsongrass becoming the predominant weed with continuous cropping. Effective johnsongrass control in cotton reduced johnsongrass populations in corn with a cotton-corn rotation.

In Mississippi, johnsongrass infestations severely limit corn production, and there is an increased interest among some producers in crop rotations that include corn. However, 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 only give fair to good control of seedling plants and limited control of plants from rhizomes. The use of preplant incorporated herbicides and cultivation also eliminates no-till corn production systems.

Availability of effective over-the-top herbicides for johnsongrass control in corn should result in improved corn yields while allowing increased flexibility for using corn in rotation with other crops.

This publication reports on the control of seedling and rhizome johnsongrass in corn grown with and without preplant tillage and without in-season cultivation.

## Materials and Methods

An experiment was conducted from 1989 through 1991 at the Delta Branch Experiment Station, Stoneville, Mississippi. A naturally-infested johnsongrass area was selected where the soil was a Bosket silt loam (28% sand, 52% silt, 29% clay) with 1.35% organic matter and pH 5.6. Initial treatments were made in mid-September 1988. Whole-plot treatments were 16, 40-inch rows 40 feet long and consisted of either (a) corn grown without preplant tillage or (b) corn grown with preplant tillage. Subplot treatments of four rows each were (1) Roundup 4E® (glyphosate) at 1.5

lb ai/acre applied in the fall; (2) Roundup applied as described for (1) followed by Accent 75DF® (DPX-V9360, nicosulfuron) at 0.031 lb ai/A over-the-top in May; (3) Accent 75DF at 0.031 lb/A over-the-top in May; and (4) no herbicides. All treatments were made to the same areas each year. A split-plot arrangement of treatments with four replications was used. Table 1 lists the overall operations that were specific to the experiment.

Roundup and Accent were applied broadcast with a tractor-mounted boom sprayer delivering the desired spray volume of 10 gallons per acre for Roundup and 20 gallons per acre for Accent and all other herbicides. Johnsongrass plants were 12-24 inches tall in 1988, 3-10 inches (occasional plants to 20 inches) in 1989, and 10-28 inches tall in 1990 when Roundup was applied. In May 1989, 1990, and 1991, respective-

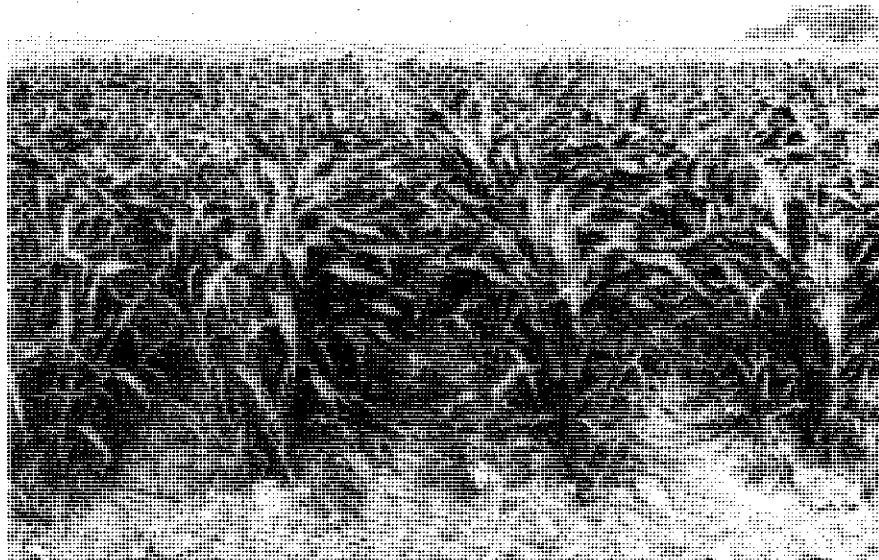


Figure 1. Weedy check, May 31, 1989.

ly, johnsongrass was 8-12 inches (4-8 leaves), 6-14 inches (5-6 leaves), and 3-10 inches (3-5 leaves) tall when Accent was applied. The respective corn heights in 1989, 1990, and 1991 were 5-7 inches (6-7 leaves), 5 inches (6 leaves), and 4-7 inches (5-6 leaves).

**Table 1. Operations used to conduct an experiment on johnsongrass control in corn. MAFES Delta Branch Experiment Station, Stoneville, MS, 1989-1991.**

Operation and Date(s)
<i>Entire Area</i>
Combine harvest 8/16/88, 8/30/89, 9/10/90
Rotary Mow 9/29/88, 9/21/89, 9/17/90
Hip rows 10/13/88
Plant—Funks' brand 'G4666' 4/11/89, 4/23/90, 4/17/91
Preemergence Herbicide Lasso/atrazine 4F® 3.2 lb/A, 4/11/89; Lariat 4I® 4.0 lb/A + Prime Oil 1%, 4/23/90; and Lasso 4E® 2.5 lb/A + Riverside® atrazine 1.5 lb/A + Gramoxone Extra® 0.625 lb/A + X-77® 0.25%, 4/17/91
Fertilizer Liquid urea-ammonium nitrate: 150 lb N/A, 4/18/89; 200 lb N/A 3/14/90; and 3/26/91 (knifed in 10 in. to each side of row 4 in. deep)
Cultivation None
Irrigation None
Insect Control Furadan 15G® in-furrow at 6.5 lb/A product
<i>Main Plot a - No Preplant Tillage</i>
"Burn-down" 4/3/89, Roundup 4E 0.5 lb/A + Triton AG98® 0.5%; 3/20/90, Gramoxone Extra 0.94 lb/A + AAtrex 4L® 0.25 lb/A + Triton AG 98 0.5%; 3/8/91, Gramoxone Extra 0.94 lb/A + AAtrex 4L 0.5 lb/A + X-77 0.5%
<i>Main Plot b - Preplant Tillage</i>
Subsoil in row middle 9/30/88, 10/25/89
Hip rows 11/3/89, 10/19/90
Re-hip rows 4/10/89, 4/20/90, 3/12/91
Bed conditioner 4/10/89, 4/20/90, 3/19/91

Seedling johnsongrass plants were determined in May 1989 and May 1990 (prior to Accent application) by counting the plants from a 1-foot by 3-foot area at three random locations in each subplot centered on a preselected row. Rhizome johnsongrass plants were determined by counting the plants between the middle two rows of each plot in May and from an area of 40 inches by 20 feet in the center of each plot in late-season in 1989, 1990, and 1991. Counts of johnsongrass in September and November 1988 were made from an area 79 inches by 79 inches in the center of each plot. All count data are presented as thousands of plants per acre.

Corn stand was determined by counting the plants on a predeter-

mined row in each plot. Corn was harvested at maturity by combining the two center rows of each plot 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% level of probability.

## Results

There were no differences in seedling johnsongrass plant counts on May 21, 1989 (Table 2). A tillage-by-herbicide interaction occurred with seedling plant counts on May 15, 1990. The seedling

**Table 2. Seedling johnsongrass as affected by preplant tillage and herbicides, MAFES Delta Branch Experiment Station, Stoneville, MS, 1989-1990.**

Treatment	Broadcast rate/acre (lb a.i.)	When applied (Mo.)	Seedling johnsongrass plants/acre <sup>1,2</sup>	
			5/21/89 (1,000's)	5/15/90
<i>No preplant tillage</i>				
Roundup 4E	1.5	Sept.	106.5	20.0 bA
Roundup 4E fb <sup>3</sup>	1.5	Sept.		
Accent 75DF	0.031	May	96.8	11.4 bA
Accent 75DF	0.031	May	142.8	8.9 bA
None	—	—	128.4	35.3 aA
<i>Preplant tillage</i>				
Roundup 4E	1.5	Sept.	110.2	14.3 aA
Roundup 4E fb	1.5	Sept.		
Accent 75DF	0.031	May	142.8	4.2 aA
Accent 75DF	0.031	May	88.4	5.2 aA
None	—	—	150.2	20.3 aB
<i>Main Plot Averages<sup>2</sup></i>				
No preplant tillage			118.6	19.0
Preplant tillage			123.0	11.1
<i>Subplot Averages<sup>2</sup></i>				
Roundup 4E			108.4	17.3
Roundup 4E fb				
Accent 75DF			119.8	7.9
Accent 75DF			115.6	6.9
None			139.3	27.9

<sup>1</sup> A common lower case letter indicates that means are not different for subplot treatments within tillage systems and a common capital letter indicates values are not different for tillage systems compared within subplot treatment according to DMRT at P = 0.05.

<sup>2</sup> No letter indicates no difference according to DMRT at P = 0.05.

<sup>3</sup> fb = followed by.

johnsongrass count for the no-herbicide treatments was lower with preplant tillage than with no preplant tillage. Other treatment comparisons between preplant and no preplant tillage were not different. There were no differences among subplot treatments with preplant tillage. Without preplant tillage, all herbicide treatments provided better control than the no-herbicide treatment. Seedling johnsongrass in 1990 may have been lower in the preplant tillage plots due to the hipping operation November 3, which was followed by unusually low temperature in December. No count of johnsongrass seedlings was made in 1991. Rhizome johnsongrass plant numbers were from 54,000 to 227,000 plants per acre on September 27, 1988, which was 2 days before rotary mowing (Table 3). On November 17, plant counts

were greatly reduced overall and the greater reduction with Roundup applied September 14 demonstrated its effectiveness. Rhizome plant counts on May 8, 1989, continued to demonstrate the control obtained from fall Roundup application. Early johnsongrass control with this treatment was not apparent on May 15, 1990, but control on May 21, 1991, was better than with the no-herbicide treatment. Fall-applied Roundup alone was not sufficient to provide full season johnsongrass control in any year.

Compared to the no-herbicide treatments, rhizome johnsongrass plants were reduced with Accent by an average of 55% in September 1989; 87% in August 1990; and >99% in July 1991 (Table 3). This late-season control was the same in both preplant tillage treatments and was not increased when an ad-

ditional Roundup application was made the preceding fall.

Corn yield was not different among treatments in 1989 (Table 4). Overall yield was high due to the excellent rainfall that occurred during the growing season. In 1990, a tillage-by-herbicide interaction occurred (Table 4). This was probably influenced by the time of fall hipping in 1989 followed by low temperatures, which subjected rhizome johnsongrass to unusual conditions. These conditions resulted in greater johnsongrass control with preplant tillage, particularly with subplot treatments of Roundup alone and no herbicide. Fall-applied Roundup followed by Accent in May without preplant tillage resulted in equal yield as compared with the same treatment with preplant tillage (Table 4). The Roundup followed by Accent treatment resulted in higher yield than

Table 3. Rhizome johnsongrass as affected by preplant tillage and herbicides, MAFES Delta Branch Experiment Station, Stoneville, MS, 1989-1991.

Treatment	Broadcast rate/acre	When applied	Rhizome johnsongrass (plants/acre)							
			1988		1989 <sup>2</sup>		1990 <sup>1</sup>		1991 <sup>2</sup>	
			9/27 <sup>2</sup>	11/17 <sup>1</sup>	5/8	9/13	5/15	8/7	5/21	7/24
	(lb a.i.)	(Mo.)	----- (1,000's) -----							
<i>No preplant tillage</i>										
Roundup 4E	1.5	Sept.	66.4	2.0 bA	8.4	101.0	34.3 aA	72.1 aA	27.1	57.4
Roundup 4E fb <sup>3</sup>	1.5	Sept.								
Accent 75DF	0.031	May	54.3	1.7 bA	9.4	45.2	17.3 bcA	3.2 bA	0.0	6.4
Accent 75DF	0.031	May	188.0	24.5 aA	26.9	58.5	3.2 cA	7.9 bA	3.5	2.7
None	-	-	148.4	33.6 aA	26.2	123.7	19.5 abA	60.0 aA	49.9	70.3
<i>Preplant tillage</i>										
Roundup 4E	1.5	Sept.	67.9	0.2 cA	7.9	82.7	2.7 aB	32.1 aB	10.2	55.0
Roundup 4E fb	1.5	Sept.								
Accent 75DF	0.031	May	97.6	1.0 cA	4.2	53.4	0.0 aB	4.2 bA	0.0	3.4
Accent 75DF	0.031	May	226.7	63.2 aA	33.6	65.7	0.2 aA	6.4 bA	3.2	4.1
None	-	-	181.8	33.3 bA	26.9	121.0	3.0 aB	22.2 aB	31.4	65.8
<i>Main Plot Averages<sup>2</sup></i>										
No preplant tillage			114.4	15.6	20.0	82.0	18.5	35.8	20.1	34.2
Preplant tillage			143.5	24.5	18.3	80.5	3.0	16.3	11.2	32.1
<i>Subplot Averages<sup>2</sup></i>										
Roundup 4E			67.2 b	1.2	8.2 b	91.9 ab	18.5	52.1	18.7 b	112.4 a
Roundup 4E fb										
Accent 75DF			75.8 b	1.5	6.9 b	49.2 c	8.6	3.7	0.0 c	4.9 b
Accent 75DF			207.5 a	44.0	30.4 a	62.2 bc	1.7	7.2	3.3 c	3.4 b
None			165.2 a	33.6	31.1 a	122.5 a	11.4	41.0	40.6 a	136.1 a

<sup>1</sup> A common lower case letter indicates that means are not different for subplot treatments within tillage systems and a common capital letter indicates values are not different for tillage systems compared within subplot treatment according to DMRT at P = 0.05.

<sup>2</sup> A common letter or no letter indicates means are not different according to DMRT at P = 0.05.

<sup>3</sup> = followed by.



**Figure 2. Photo taken May 21, 1989, 7 days after applying Accent, with preplant tillage.**



**Figure 3. Photo taken May 21, 1989, 7 days after applying Accent, with no preplant tillage.**

Accent alone without preplant tillage, whereas these subplot treatments gave equal yield with preplant tillage. In 1991, the preplant tillage corn yield was higher than the yield without preplant tillage when averaged over subplot treatments. Subplot treatments averaged over tillage treatments resulted in highest yield with Roundup followed by Accent (Table 4). This treatment was better than Accent alone, which was better than Roundup alone. The no-herbicide treatment was lower than all the other subplot treatments.

## Conclusions

Johnsongrass was effectively controlled in corn with fall-applied Roundup followed by Accent and with Accent alone over-the-top of corn with or without preplant tillage.

Fall-applied Roundup alone was not sufficient for full season johnsongrass control.

**Table 4. The effect on corn yield from johnsongrass control with preplant tillage and herbicides, MAFES Delta Branch Experiment Station, Stoneville, MS, 1989-1991.**

Treatment	Broadcast rate/acre (lb a.i.)	When applied (Mo.)	Combine yield @ 13%		
			1989 <sup>2</sup>	1990 <sup>1</sup>	1991 <sup>2</sup>
			----- (bu/A) -----		
<i>No preplant tillage</i>					
Roundup 4E	1.5	Sept.	113.2	38.8 cB	25.2
Roundup 4E fb <sup>3</sup>	1.5	Sept.			
Accent 75DF	0.031	May	134.1	110.7 aA	88.1
Accent 75DF	0.031	May	114.5	100.1 bB	67.6
None	—	—	118.5	37.2 cB	8.8
<i>Preplant tillage</i>					
Roundup 4E	1.5	Sept.	123.2	101.7 aA	50.5
Roundup 4E fb	1.5	Sept.			
Accent 75DF	0.031	May	135.4	112.3 aA	100.2
Accent 75DF	0.031	May	128.1	115.6 aA	91.1
None	—	—	118.5	92.0 bA	13.0
<i>Main Plot Averages<sup>2</sup></i>					
No preplant tillage			120.1	71.7	47.4 b
Preplant tillage			126.3	105.4	63.7 a
<i>Subplot Averages<sup>2</sup></i>					
Roundup 4E			118.2	70.2	37.8 c
Roundup 4E fb					
Accent 75DF			134.8	111.5	94.2 a
Accent 75DF			121.3	107.8	79.4 b
None			118.5	64.6	10.9 d

<sup>1</sup> A common lower case letter indicates that means are not different for subplot treatments within tillage systems and a common capital letter indicates values are not different for tillage systems compared within subplot treatment according to DMRT at P = 0.05.

<sup>2</sup> A common letter or no letter indicates means are not different according to DMRT at P = 0.05.

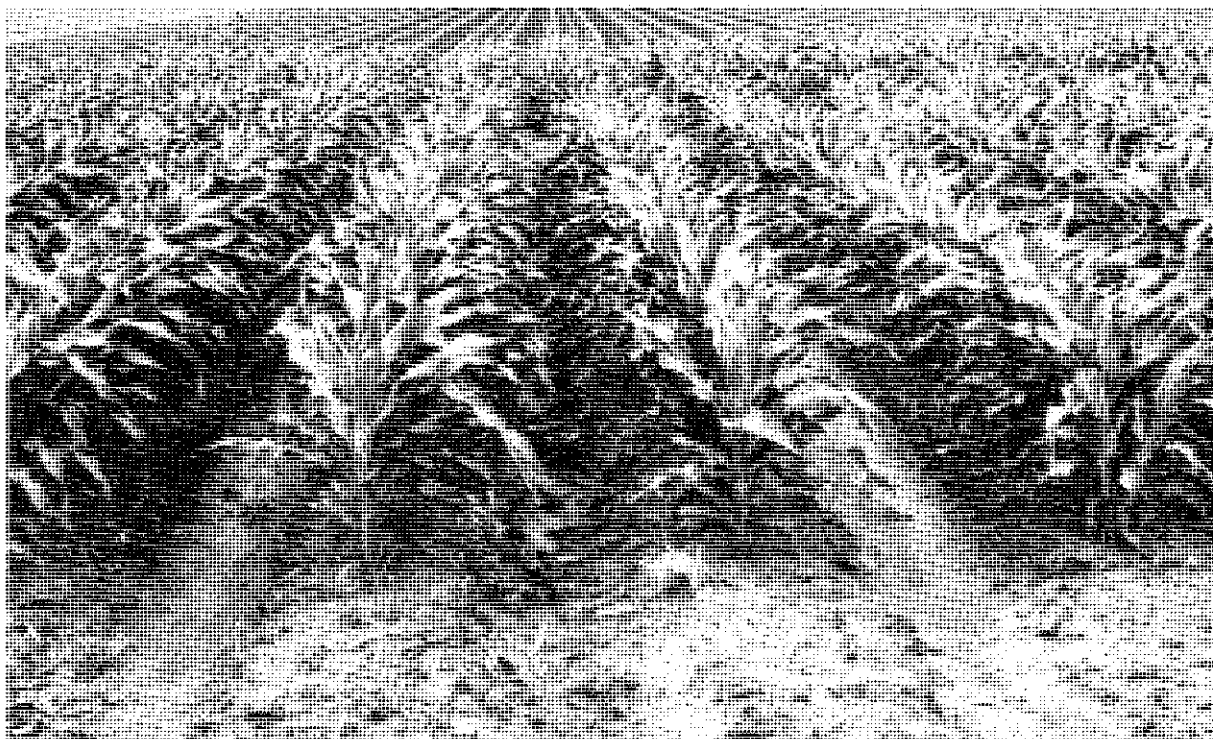
<sup>3</sup> fb = followed by.



**Figure 4. This shows the height of both corn and johnsongrass at the time of Accent application May 14, 1989.**



**Figure 5. Weedy check, June 1, 1990.**



**Figure 6. Photo taken June 1, 1990; field had fall applications of Roundup 4E in 1988 and 1989 followed by application of Accent in May 1989 and May 1990 with preplant tillage.**

Fall tillage was beneficial for johnsongrass control when extended low temperature prevail during the winter. However, this advantage was not apparent with effective herbicide programs for johnsongrass control.

Corn yields were highest with treatments that gave the best johnsongrass control. Under excellent rainfall, corn yield in 1989 was not affected by johnsongrass populations ranging from 45,000 to 123,000 plants per acre when determined at harvest.

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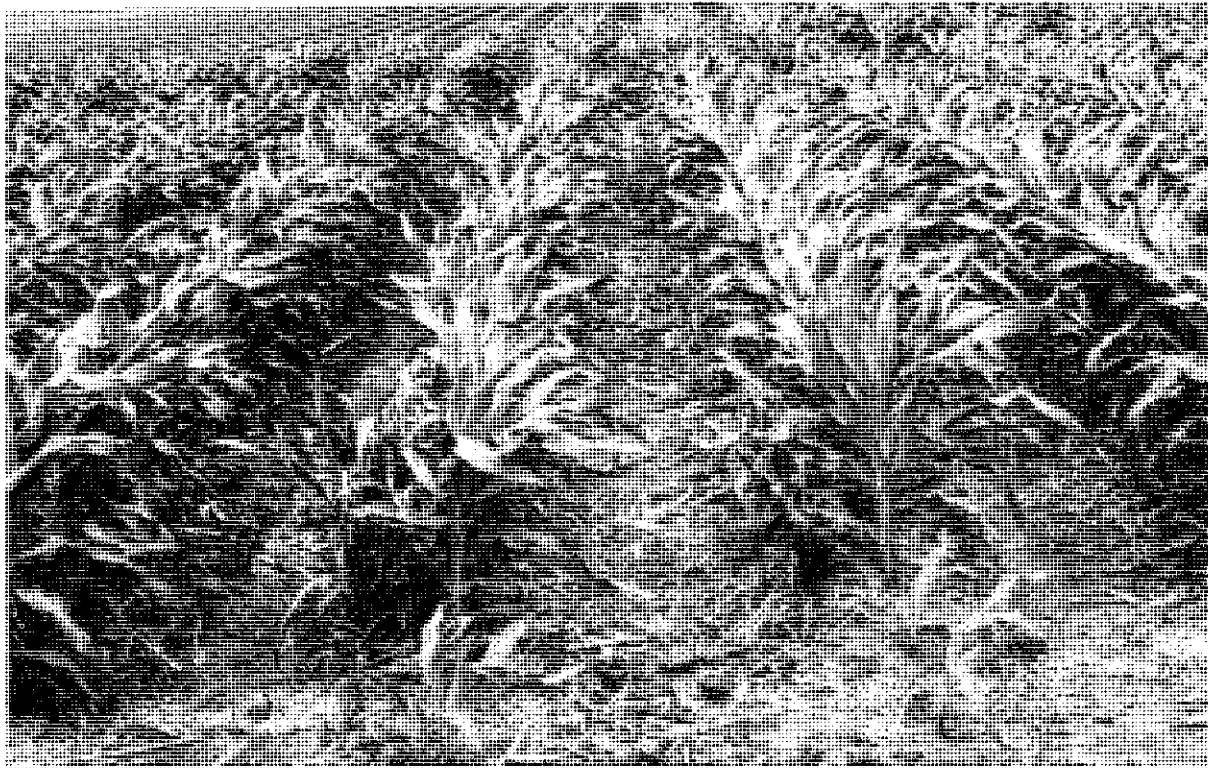
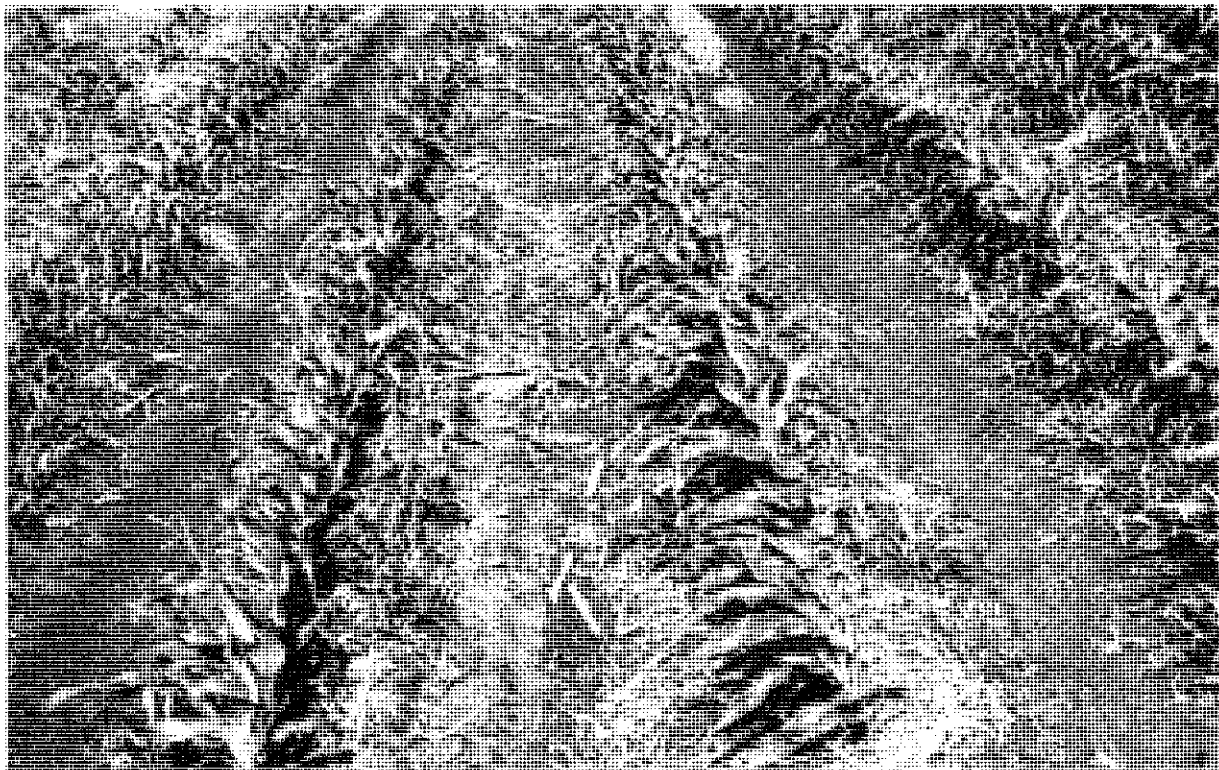


Figure 7. Photo taken June 1, 1990; field had applications of Accent in May 1989 and 1990 without preplant tillage.





**Figure 8. Weedy check, May 22, 1990.**



**Figure 9. Field had applications of Accent in May 1989 and May 1990 with no preplant tillage. Photo was taken May 22, 1990, 6 days after treatment.**



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