

**REDUCING HERBICIDE-INDUCED COTTON SEEDLING
STRESS BY SUBSTITUTING ROUNDUP FOR
CONVENTIONAL HERBICIDES ON ROUNDUP READY
COTTON AND ADDING HOPPER-BOX OR
IN-FURROW FUNGICIDES**

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Abstract

Four herbicide and three fungicide regimes were evaluated on Roundup Ready cotton. Highest crop injury and seed cotton yield reductions occurred in the herbicide regimes which contained preplant, preemergence, or post emergence herbicides. Treatments which received a hopper-box or in-furrow fungicide in addition to a seed treatment had significantly higher stand counts. However, there was no significant differences in seed cotton yields. The Roundup treatments alone gave comparable control of weeds and were less expensive.

Introduction

Cotton seedling injury and stunting due to conventional soil-applied herbicides has been well documented. Unfavorable weather following planting including cool, wet conditions in combination with soil-applied herbicides almost always results in varying degrees of herbicide injury. Interactions may occur between soil-applied herbicides, nematicides, and insecticides, further increasing injury. Theoretically, this injury could be reduced or eliminated by replacing the soil-applied herbicides with Roundup using the Roundup Ready system.

Genetically engineered cotton varieties are widely available to cotton producers. This include types which are tolerant to the non-selective herbicide Roundup. Roundup has a broad spectrum of activity which includes most of the major weeds infesting cotton fields. Producers may be able to replace all or almost all of the currently used conventional cotton herbicides with Roundup and thereby reduce their herbicide costs. However, Roundup cannot be applied over-the-top after the four leaf stage to cotton without reducing fruit set and there are certain weeds which Roundup may not effectively control.

All of the cotton seed planted in Mississippi is treated with at least one fungicide. Approximately 50-70 percent of the cotton seed planted is also treated with a hopper-box or in-furrow applied fungicide(s). The additional cost of a hopper-box treatment is \$2.50-\$4.50 per acre and the cost of an in-furrow applied treatment is from \$6.50-12.60 per acre. The percent of the seed receiving a hopper-box or in-furrow treatment depends on weather conditions at planting, the price of cotton, condition of the seed bed, what happened last year and several other factors. In-furrow treatment is recommended when cotton is planted early in the season, when seed quality is poor, when certain combinations of soil-applied herbicides and in-furrow applied insecticides or nematicides are used (these combinations can weaken the seedling and make it more susceptible to seedling disease), and when there is a history of severe seedling disease in the field.

The use of Roundup with the Roundup Ready system will eliminate some of the interactions observed between the different conventional herbicides, insecticides, and nematicides. Therefore it is possible that an in-furrow or hopper-box applied fungicide may not be needed under this system. Another benefit from the Roundup Ready system may be an increase in seedling health and vigor.

Materials and Methods

Roundup Ready variety DPL 5415 treated with Baytan 0.50 oz + Thiram 42S, 2.5 oz + Alliegence 0.75 OZ Per CWT was planted in this trial. The trial was inoculated with panicum infested with *Rhizoctonia solani* and *Pythium Sp.* to increase disease pressure. Experimental design was a Randomized Complete Block with Factorial arrangement of treatments. Plots were 13.3 ft. wide x 40 ft. long. Seeding rate was 5 seed per row ft. The treatments were replicated seven times. The first level was the fungicide component which consisted of the following treatments: 1. Seed Treatment only, 2. Seed Treatment + Hopper-Box Treatment (Delta-Coat AD, 11.75 oz/CWT), and 3. Seed Treatment + In-furrow Treatment (Ridomil PC11G, 7 LB/A). The second level was the herbicide component which consisted of the treatments as shown in Table 2.

Hopper-Box Fungicides were applied to the seed prior to planting and in-furrow fungicides were applied at planting. Herbicides were applied as noted above. Seedling stands and heights were determined at two and four weeks after planting. Plots were rated for herbicide injury and weed control. The trial was inoculated with Panicum infested with *Rhizoctonia solani* and *Pythium Sp.* to increase disease pressure. Experimental design was a Randomized Complete Block with Factorial arrangement of treatments. Plots were 13.3 ft. wide x 40 ft. long. Seeding rate was 5 seed per row ft. The treatments were replicated seven times. The first level was the fungicide component which consisted of the following treatments: 1. Seed Treatment only, 2. Seed Treatment + Hopper-Box Treatment (Delta-Coat AD, 11.75 oz/CWT), and 3. Seed Treatment + In-furrow Treatment (Ridomil PC11G, 7 LB/A). The second level was the herbicide component which consisted of the treatments as shown in Table 2.

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Results and Discussion

The analysis across the herbicide treatments is given in Table 1. There were significant differences in seedling stands between the fungicide treatments. The hopper-box treatment was significantly higher than the seed treatment only and the in-furrow treatment was significantly higher than the seed treatment alone and the hopper-box treatment. However, there were no significant differences in seed cotton yield between the treatments. These results are consistent with our other research which has shown stand increases but not yield increases under low disease pressure when hopper-box or in-furrow treatments are used.

The results of the analysis across fungicide treatments is given in Table 2. The hand hoed plots tended to have lower stand counts. The treatments containing a conventional PPI or PE herbicide tended to have lower seed cotton yields. Herbicide regime 1 had significantly lower seed cotton yields over the hand hoed (Regime 4) and two of the Roundup treatments (Regimes 2 and 3).

Roundup (Table 3) effectively controlled most of the weeds in this trial. The hand hoed plots had the highest number of weeds. Weed control tended to be higher in the plots receiving PPI and PE herbicides.

Herbicide regime 1 had significantly lower plant height (Table 4) over the other regimes on June 27. The highest crop injury occurred in regime 1. This injury was correlated with reduction in seed cotton yields (Table 2). There was also significant crop injury in Regime 2. Lowest percent canopy closure was also observed in Regime 1.

All of the conventional herbicide and conventional herbicide treatments + Roundup were more expensive than the Roundup treatments alone. The Roundup treatments alone gave comparable seedling stand counts and seed cotton yields to the other treatments and were less expensive. However, there may be some situations where Roundup tolerant weeds may affect yield and a conventional herbicide may be needed.

In conclusion, under the low disease pressure conditions of this trial, hopper-box and in-furrow treatments increased seedling stands but not seed cotton yields. The Roundup treatments alone gave comparable weed control to the conventional herbicide and conventional herbicide + Roundup treatments.

Significant crop plant height reduction, canopy closure reduction, increases in crop injury, and reduction in seed cotton yields occurred in herbicide Regime 1 which included P.I., PE, and PO herbicides. The most economical treatment was the one containing Roundup treatments only. Seed cotton yields from this treatment were comparable to the other treatments.

Table 1 . 2000 Cotton Seedling Stress Trial, analysis across herbicide treatments. Panicum Inoculum.

Herbicide Treatment	Percent Seeding Survival ¹ (Week after plant)						Yield lb Seed Cotton/A
	Two week			Four week			
	Row 1	Row 2	Ave.	Row 1	Row 2	Ave.	
1. Seed Treated							
No Hopper-Box Treatment							
No In-Furrow Treatment	36.3 c ²	40.2 c	38.3 c	31.9 c	35.3 c	33.6 c	1904.5 a
2. Seed Treated							
Hopper-Box Treatment							
No In-Furrow Treatment	48.6 b	51.4 b	50.0 b	43.1 b	49.1 b	46.1 b	1953.5 a
3. Seed Treated							
No Hopper-Box Treatment							
In-Furrow Treatment	67.9 a	69.3 a	68.6 a	64.0 a	68.9 a	66.5 a	2045.9 a
M.S.D	3.33	3.34	12.76	3.89	3.70	3.22	219.10
C. V.	5.57	14.84	12.55	19.96	17.32	15.73	19.62
F Value	141.49	119.00	6190.10	108.42	128.88	163.75	1.21

1. Percent stand of one row. Mean of forty- two replications.

2. Means in the same column followed by the same letter are not Significantly different according to Waller-Duncan t test (K ratio=100).

Table 2. 2000 Cotton Seedling Stress Trial, analysis across fungicide treatments. Panicum Inoculum.

Fungicide Treatment	Percent Seeding Survival ¹ (week after planting)						Yield lb Seed Cotton/A
	Two week			Four week			
	Row 1	Row 2	Ave.	Row 1	Row 2	Ave.	
1. Treflan 4EC, 1.5 pt Cotoran 4L, 1.5 pt + Staple 85 SP, 0.40 oz Cotoran 4L, 1.0 pt + MSMA 6.0, 1.0 pt Cy-Pro 4L, 0.6 pt + MSMA 6.0, 1.0 pt	50.4 a ²	50.9 a	50.6 a	46.7 ab	49.7 a	48.2 ab	1715.4 b
2. Cotoran 4L,1.5 pt + Staple 85 SP,0.40 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	50.6 a	54.9 a	52.7 a	45.6 ab	51.4 a	48.5 ab	2006.3 a
3. Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	52.1 a	53.2 a	52.6 a	48.5 ab	53.4 a	50.9 a	2089.5 a
4. No P.I. No PE Hand Hoe Hand Hoe	49.8 a	54.3 a	52.1 a	41.6 b	48.2 a	44.9 b	2130.7 a
5. Cotoran 4L, 0.5 pt + Staple 85 SP, 0.20 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	51.8 a	55.0 a	53.4 a	49.3 a	53.0 a	51.1 a	1898.2 ab
6. Treflan 4EC, 1.5 pt + Zorial 80 DF, 15.00 oz Cotoran, 4L, 1.5 pt + Zorial 80 DF, 7.50 oz Cotoran 4L, 1.0 pt + MSMA 6 L, 1.0 pt Cy-Pro 4 L, 0.6 pt + MSMA 6E, 1.0 pt	52.8 a	50.3 a	51.5 a	48.3 ab	52.6 a	50.6 ab	2058.5 a
M.S.D	8.41	6.49	6.67	7.08	7.89	5.97	254.72
C. V.	12.01	14.89	12.80	120.08	17.58	16.09	19.54
F Value	0.40	1.42	0.45	1.96	1.09	1.94	3.35

1. Percent stand of one row. Mean of twenty-one replications.

2. Means in the same column followed by the same letter are not significantly different according to Waller-Duncan t test (K ratio=100).

Table 3. 2000 Cotton Seedling Stress Trial , analysis across fungicide treatments. Weed control Ratings.

Fungicide Treatment, and Rate per Acre	Weeds (percent Visial Control) ¹				
	# Weeds (12" X 10 ")			Broadleaf	Grass
	5-11	6-14	6-28	7-26	7-26
1. Treflan 4EC, 1.5 pt Cotoran 4L, 1.5 pt + Staple 85 SP, 0.40 oz Cotoran 4L, 1.0 pt + MSMA 6.0, 1.0 pt Cy-Pro 4L, 0.6 pt + MSMA 6.0, 1.0 pt	0.10 c ²	100 a	100 a	80.2 d	86.3 b
2. Cotoran 4L,1.5 pt + Staple 85 SP,0.40 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	0.10 c	100 a	100 a	91.6 b	86.4 a
3. Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	12.76 b	100 a	100 a	96.2 a	83.8 b
4. No P.I. No PE Hand Hoe Hand Hoe	70.62 a	79 b	89 a	85.7 c	72.6 c
5. Cotoran 4L, 0.5 pt + Staple 85 SP, 0.20 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	0.52 c	100 a	100 a	93.7 ab	82.3 b
6. Treflan 4EC, 1.5 pt + Zorial 80 DF, 15.00 oz Cotoran, 4L, 1.5 pt + Zorial 80 DF, 7.50 oz Cotoran 4L, 1.0 pt + MSMA 6 L, 1.0 pt Cy-Pro 4 L, 0.6 pt + MSMA 6E, 1.0 pt	0.00 c	100 a	100 a	95.5 ab	94.4 ab
M.S.D	7.55	1.62	0.81	4.65	6.95
C. V.	99.38	3.10	1.52	9.11	14.15
F Value	85.97	171.12	176.01	12.05	7.43

1. Percent weed control. Mean of twenty-one replications.

2. Means in the same column followed by the same letter are not significantly different according to Waller- Duncan test (K ratio = 100).

Table 4. 2000 Cotton Seedling Stress Trial , analysis across fungicide treatments. Vigor and injury ratings.

Fungicide Treatment, and Rate per Acre	Plant Height	NAWF ¹	Visual Injury ²	Canopy Closure
	6-27	7-26	6-1	7-27
1. Treflan 4EC, 1.5 pt Cotoran 4L, 1.5 pt + Staple 85 SP, 0.40 oz Cotoran 4L, 1.0 pt + MSMA 6.0, 1.0 pt Cy-Pro 4L, 0.6 pt + MSMA 6.0, 1.0 pt	40.1 d ³	4.3 a	23.3 a	61.4 c
2. Cotoran 4L,1.5 pt + Staple 85 SP,0.40 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	56.6 a	4.2 ab	16.7 b	72.4 ab
3. Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	58.2 a	3.8 c	2.6 de	78.1 a
4. No P.I. No PE Hand Hoe Hand Hoe	57.0 a	4.3 a	0.7 e	75.7 ab
5. Cotoran 4L, 0.5 pt + Staple 85 SP, 0.20 oz Roundup Ultra 4EC, 1.0 pt PO OT Roundup Ultra 4EC, 1.0 pt PO Dir	55.6 ab	4.4 a	9.8 c	71.9 ab
6. Treflan 4EC, 1.5 pt + Zorial 80 DF, 15.00 oz Cotoran, 4L, 1.5 pt + Zorial 80 DF, 7.50 oz Cotoran 4L, 1.0 pt + MSMA 6 L, 1.0 pt Cy-Pro 4 L, 0.6 pt + MSMA 6E, 1.0 pt	53.2 a	3.9 c	6.7 cd	70.0 b
M.S.D	5.86	0.46	4.32	7.61
C. V.	18.17	17.77	8.84	17.38
F Value	18.60	3.62	25.74	4.50

1. NAWF = Nodes above white flower.

2. Percent Cotton injury. Mean of twenty-one replications.

3. Means in the same column followed by the same letter are not significantly different according to Waller- Duncan t test (K ratio = 100).

Table 5. Estimated Fungicide and Herbicide Costs for the Different Regimes-1999

Fungicides (Planted 14 lb/A)	Estimated Costs (\$ A)
Seed Treatment	4.50
Seed Treatment + Hopper- box (Delta-Coat 11.75 oz /CWT)	4.50 +5.48 = 9.98
Seed Treatment + In-Furrow (Ridomil Gold 11 G, 7 lb /A)	4.50 + 12.60 = 17.10
Herbicides and Application	Total Costs Per Acre
Treatment 1	38.76
Treatment 2	39.36
Treatment 3	25.10
Treatment 4	106.10
Treatment 5	31.20
Treatment 6	49.7