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TERMINATION OF COTTON STALKS WITH HERBICIDES IN THE LOWER RIO GRANDE VALLEY OF TEXAS-2002

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Abstract

Thorough cotton stalk destruction is critical and state mandated in Texas as a tool to aid in the reduction of boll weevils. Adverse weather conditions and conservation tillage often prevent immediate and complete stalk destruction. The herbicide 2,4-D amine applied at one pound formulation per acre on shredded stalks, twice during a 30 day period, was proven to be 100% effective in terminating stalks.

Introduction

Cotton stalk destruction is a prime tool for the IPM approach for boll weevil, silverleaf whitefly and pink bollworm management in the LRGV. Without complete stalk destruction following each season's cotton crop, pest insects such as those listed above can become overwhelming yield inhibiting pests of the new cotton crop. Until recently, the only approach which was deemed appropriate for stalk destruction was plowing the stalks to prevent further regrowth of the plant which provides pests a safe haven food and reproductive site. With the advent of conservation tillage practices, plowing of fields is not suggested since the practice tends to compact the soil, reduces water retention of the soil and allows for soil erosion when the fields are left without previous crop residue. A new method of stalk destruction had to be found that would render the cotton plant incapable of producing new fruit on which the pests could depend for food and reproduction.

Materials and Methods

Experiment 1: USDA-ARS Semi-Greenhouse Study

Cotton plants (DPL-50) were grown in 2.5 gallon pots with 4 to 5 plants per pot in the greenhouse until they contained opened bolls. Then plants were cut off at 15-20 cm from the soil line with a weed eater with a metal blade. There were 7 treatments: 1.)Untreated control; 2,4-D amine (Savage brand) (1.0 lb formulated product/ac), sprayed immediately after cotton was shredded; 2.) dicamba (Clarity brand) (1.0 pt/ac), sprayed immediately after cotton was shredded; 2,4-D, sprayed 7 days after cotton was shredded; dicamba, sprayed 7 days after cotton was shredded; 2,4-D sprayed 14 days after cotton was shredded; dicamba, sprayed 14 days after cotton was shredded. The 7 treatments were replicated 3 times. Pots assigned to each treatment were aligned and treated as a row of cotton with a CO_2 pressurized (40 PSI) backpack sprayer with three TX10 hollow cone nozzles per row (one over the top and one on each side on a drop) in a total volume of 10 gallons per acre. After the treatments the plants were held outdoors, and they were watered twice per week. At 1 and 2 months after treatment, leaves per plant, average plant height, and fruit forms per plant were recorded. Data were analyzed with ANOVA and means separations conducted with Tukey HSD multiple comparisons.

Experiment 2: USDA-ARS

The field test was conducted at the Ansul, SARC ARS-USDA experiment station plots, Weslaco Texas, 2002. The test field consisted of 180 rows (40'') 45-m long. The mean height of the cotton plants was 43.0±0.9 cm and the number of nodes per plant - 11.4±0.3 before shredding. There were 10 treatments: control; 2,4-D amine (1.0 qt/ac + 0.5% v/v surfactant), sprayed immediately after cotton was shredded; dicamba (1.0 pt/ac), sprayed immediately after cotton was shredded; Valor (1.0 oz./ac + Roundup, 1.0 qt/ac), sprayed immediately after cotton was shredded; 2,4-D, sprayed 7 days after cotton was shredded; dicamba, sprayed 7 days after cotton was shredded; Valor, sprayed 7 days after cotton was shredded; 2,4-D, sprayed 14 days after cotton was shredded; dicamba, sprayed 14 days after cotton was shredded; Valor, sprayed 14 days after cotton was shredded. The ten treatments were replicated 3 times, in a randomized block design. There were 30 plots laid out in blocks of 10 plots each. Each plot consisted of 6 rows. All 6 rows of a plot received the same chemical treatment, but the outside 2 rows were considered buffer rows and were not sampled. Rows were numbered 1-6 from west to east. One treatment was applied at a time across each of the 3 blocks. The field was shredded July 25 and sprayed July 26, August 2, and August 9 with a calibrated Spider Track sprayer. Chemicals were applied to 6-rows at a time, with 2 drops and 1 nozzle (Turbo TeeJet-11002) over the top of each row (12 gal/ac).

Plots were visually rated on a weekly basis until it was necessary to terminate each test. Plots were rated on a 1 to 5 scale as follows (intermediate ratings numbers were used):

1 = no live plants
2 = some plants alive, but had evidence of herbicide injury
3 = most plants alive, but had evidence of herbicide injury
4 = some apparently health plants
5 = most plants appear healthy

Before the plants were destroyed on August 29, 2002, we checked root mortality on August 27, 2002, and number of fruiting plants per treatment on August 28, 2002. Root mortality evaluations were made by pulling out cotton plants for 1 meter from each plot, cleaning the skin of the roots and determining whether roots were dead or alive. Those with brown color and dry were considered to be dead. About 100-150 randomized, selected plants per treatment were estimated for presence of fruit.

Experiment 3: Texas Cooperative Extension Small Plot Study

A cotton field on the Texas Agricultural Research and Extension Center's "Hiler" Annex Farm near Weslaco was selected to conduct the test. The cotton variety was Stoneville 4892 BR planted on February 20, 2002. Average plant height at the time of herbicide application was 45 inches. Plot size was 4 rows by 50 feet, 4 replications in a randomized complete block design. All plots were shredded with a two row rotary shredder. Two rows of untreated, nonshredded stalks were left along the edges of each plot to provide a potential drift barrier between plots. A two row, Spyder sprayer, applying 10 gallons per acre total volume, was used to apply herbicides. Two herbicides, 2,4-D amine (Savage brand) and dicamba (Clarity brand) were selected for the test. Each herbicide was tested at one rate; 2,4-D at 1 lb. formulation/acre and Dicamba at 1 pint formulation/acre. Both herbicides were applied in 10 gallons water per acre. There were 4 application timings for each herbicide: less than 24 hours post shredding (0 DPS), 3 days post shredding(3DPS), 1 week(7DPS) and 2(14DPS) weeks post shredding. Harvest and shredding of the cotton crop was on July 22. The herbicide application dates were on July 23 (approximately 14 hours post shredding), July 25, July 29 and August 05. A second application of herbicide was applied to all plots (including dicamba treatments) on August 20 with 2,4-D applied at 1.0 pounds of formulation per acre plus Round Up herbicide at 1.5 pints per acre and Herbimax crop oil at 1 quart formulation per acre. Untreated stalks (untreated checks) were destroyed on August 30, 2002 to comply with state stalk destruction regulations. The same visual rating scale used in Experiment 2 was used in this trial, also. Root mortality evaluations were made by pulling plants from a three foot section from the middle of each plot. The roots were cleaned and if the root surface tissue was dry or loose, the root was considered to be dead. All data was statistically analyzed using Statistix 7, means separation, LSD.

Results

Experiment 1

Spraying with dicamba and 2,4 D immediately, 7 d and 14 d after cotton was shredded did not impact plant growth, although the number of leaves per plant at one and two months after treatment was lower and height - shorter than in the untreated control. Only spraying with 2,4-D immediately and 7 d after cotton was shredded prevented fruiting at one and two months after treatment (Table 1).

Experiment 2

One month after the experiment was initiated, most plants appeared healthy in the untreated control and in the Valor (0 d) +RroundUp treatments. In the other treatments the visual rating was between some plants alive but appear sick (2) and most plant alive but appear sick (3) and significantly lower (Table 2).

The highest percentage of root mortality, we observed was in the dicamba (0 d) treatment (55.4%). When 2,4-D, dicamba, and Valor+RoundUp were sprayed one week after cotton was shredded, the percent root mortality was 42.8, 37.8, and 44.8, respectively. Root mortality was low when plots were sprayed with 2,4-D (0 d) - 18.6% mortality and Valor+RoundUp (0 d) - 15.0% compared with untreated control at14.7% root mortality (Table 3).

Experiment 3

2,4-D applied @ 1.0 formulation per acre twice at 27 day intervals on shredded cotton stalks was 100% effective(Table 4). dicamba applied at 1 pint per acre at 7 and 14DPS followed by 2,4-D 27 days after cotton stalk shredding was 100% effective in killing the stalks. All treatments following initial application and through the first 10 days following the second application of 2,4-D had some regrowth (Table 4). Field plot visual observations (Table 4) and root mortality measurements (Table 5) on 9/25 and 9/26, respectively, showed that two Dicamba treatments had live plants/less than 100% root mortality following the second

application of 2,4-D. The second 2,4-D treatment effectively destroyed regrowth on all but Dicamba applied @ less than 1 and 3 DPS. dicamba at 3 DPS was statistically equal to all visual ratings of 2,4-D treatments at the final inspection date of 9/26.

Cotton stalk root kill was 100 % in all 2,4-D treatments 33 days after 2nd 2,4-D treatment. 0 and 3 days post shredding dicamba treatments still had live stalks and initiated fruiting following 2nd 2,4-D treatment

Conclusions

There were a number differences among the experiments, yet the trends of the results were the same. The major difference among the experiments was that in experiment 3, a second application of 2,4-D was applied to all treatments, except the untreated check. The results prior to the second application were very similar. Thus we conclude that cotton stalks were destroyed more effectively with 2,4-D than other products based on these three tests. It was obvious from experiment 3 that a subsequent application of 2,4-D provided the best of all control of live cotton stalks. Experiments during the 2001 season (Sparks, et al, 2001) provided similar results.

It should be mentioned that we observed a delay in reaction of the second application of 2,4-D on the cotton from the time of treatment until the final evaluation in late September. Growers should be prepared to give the second application of 2,4-D time to react before retreating or using a plow to destroy the stalks.

While treatments of 2,4-D applied as a second treatment across all plots in experiment 3 was effective on the previously treated 2,4-D plots, the dicamba treatments responded by losing most of their regrowth, but the plants were not killed. In fact, two of the dicamba treatments (dicamba @ 0 and 3 DPS) had new regrowth by the end of the final evaluation on September 26 and the dicamba @ 0 DPS had some squares. Thus, it would appear that Dicamba, if used in the treatment regime in this test, would best be applied at 7 or 14 days after shredding and then followed by a 2,4-D application about 30 days after initial shredding.

References

Sparks, A.N., Jr., J.W. Norman, Jr., Cotton Stalk Destruction with Selected Herbicides And Effects of Application Methodology. Beltwide Cotton Proceedings, 2002.

Table 1. Plant growth parameters of regrowth cotton in pots at one and two months after treatment with 2,4-D and dicamba, Weslaco, Texas, 2002.

	1 month after treatment			2 months after treatment		
Treatment	#Leaves per plant	Plant height, cm	Fruit form per plant	#Leaves per plant	Plant height, cm	Fruit forms per plant
Control	19.4a	27.3a	1.0a (1/0)	27.6a	38.4a	5.0a (3.2/1.8)
2,4-D (0 d)	3.4bc	19.7b	0b	7.0bc	23.0bc	0c
dicamba (0 d)	14.3b	22.3b	0b	24.9ab	28.9b	3.9b (3.3/0.6)
2,4-D (7 d)	5.1bc	22.8b	0b	5.0bcd	21.7bc	0c
dicamba (7 d)	7.5bc	24.0b	0b	20.8ab	24.1bc	0.8b (0.6/0.2)
2,4-D (14 d)	12.9b	22.3b	0b	13.0bc	24.8bc	0.44b (0.4/0.04)
dicamba (14 d)	14.0b	24.8ab	0b	18.0ab	26.5bc	0.7 (0.5/0.2)

Means within a column and followed by the same letter do not differ significantly at P = 0.05.

Table 2. Cotton plant rating in response to herbicides in Chemical Stalk Termination trial, Ansul, SARC ARS-USDA experimental plots, Weslaco Texas, 2002.

	Dates and Ratings			
Treatment	**8.05**	**8.12**	**8.19**	**8.26**
Control	5.0±0.0a	5.0 ±0.0a	5.0±0.0a	5.0±0.0a
2,4-D (0 d)	2.7±0.2b	3.0±0.4b	2.0±0.01b	2.7±0.2b
dicamba (0 d)	2.3±0.2b	2.3±0.2b	2.8±0.2b	2.3±0.2bd
Valor (0 d)	5.0±0.0a	5.0±0.0a	5.0±0.0a	5.0±0.0a
2,4-D (7 d)	-	2.8±0.2b	2.7±0.2b	2.8±0.2b
dicamba (7 d)	-	3.2±0.3b	3.0±0.01b	2.7±0.2b
Valor (7 d)	-	2.8±0.2b	2.8±0.2b	2.5±0.2b
2,4-D (14 d)	-	-	3.0±0.02b	2.8±0.2b
dicamba (14 d)	-	-	5.0±0.0a	3.3±0.2bc
Valor (14 d)	-	-	2.7±0.2b	2.9±0.1b

Means within a column and followed by the same letter do not differ significantly at P = 0.05.

Table 3. Percent root mortality from Chemical Cotton Stalk Termination trial, Ansul, SARC ARS-USDA experimental plots, Weslaco Texas, 2002.

Treatment	8.27.02
Control	14.7±8.7
2,4-D (0 d)	18.6±12.1
dicamba (0 d)	55.4±20.6
Valor (0 d)	15.0±15.0
2,4-D (7 d)	42.8±6.2
dicamba (7 d)	37.8±3.7
Valor (7 d)	44.8±11.4
2,4-D (14 d)	24.6±4.8
dicamba (14 d)	24.0±13.6
Valor (14 d)	35.3±5.2

Table 4. Cotton plant ratings in response to herbicides in Chemical Stalk Termination trial, TAES "Hiler" Annex Farm, Weslaco, Texas 2002.

	Dates and Ratings					
Treatment	**8/06**	**8/13**	**8/19**	**8/27**	**8/30**	**9/25**
dicamba @ 0 DPS	4.25 c	4.38 a	4.75 a	3.00 c	3.38 c	2.25 a
2,4-D @ 0 DPS	2.38 g	1.75 g	2.13 g	1.38 g	1.13 i	1.00 c
dicamba @ 3 DPS	2.50 ef	2.38 c-e	2.00 g	2.13 e	2.38 e	2.00 a
2,4-D @ 3 DPS	2.63 ef	2.25 ef	2.38 ef	1.50 g	1.63 gh	1.00 c
dicamba @ 7 DPS	3.13 e	2.88 cd	2.88 cd	2.00 e	2.13 ef	1.00c
2,4-D @ 7 DPS	2.63 ef	2.75 cd	2.38 ef	1.50 g	1.75 g	1.00 c
dicamba @ 14 DPS	3.13 e	3.00 c	3.13 c	3.00 c	3.00 c	1.00 c
2,4-D @ 14 DPS	3.13 e	2.50 cd	2.38 ef	1.50 g	1.75 g	1.00 c
Untreated Check	5.00 a	5.00 a	5.00 a	5.00 a	5.00 a	----------

Means within a column and followed by the same letter do not differ significantly at P = 0.05.
*DPS = Days Post Shredding

Table 5. Percent root mortality from Chemical Cotton Stalk termination trial, TAES "Hiler" Annex Farm, Weslaco, Texas, 2002.

Treatment	8/29	9/26
dicamba @ 0 DPS	20.03 ab	60.28 c
2,4-D @ 0 DPS	19.60 ab	100.00 a
dicamba @ 3 DPS	43.33 a	85.73 a
2,4-D @ 3 DPS	26.43 ab	100.00 a
dicamba @ 7 DPS	30.48 ab	100.00 a
2,4-D @ 7 DPS	41.28 a	100.00 a
dicamba @ 14 DPS	35.20 a	100.00 a
2,4-D @ 14 DPS	45.15 a	100.00 a
Untreated Check	0.00 c	---------

Means within a column and followed by the same letter do not differ significantly at P = 0.05.
*DPS = Days Post Shredding