HILL-DROP APPLICATION OF ALDICARB TO ENHANCE EFFICIENCY OF THRIPS MANAGEMENT IN COTTON

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Abstract

A field study was conducted to evaluate the effectiveness of precision placed aldicarb treatments in comparison with traditional in-furrow applications for the control of thrips in cotton. Early season sampling showed that precision placed aldicarb (Temik®) was as effective in reducing thrips totals as in-furrow applications. No significant differences were found in yield. Residual analysis of plants showed that precision placement plots had significantly more aldicarb and aldicarb metabolites present within the plant than did in-furrow treatments. Precision placement of aldicarb at planting may be an efficient and cost effective method of managing thrips populations in cotton.

Introduction

One of the most important concerns facing agriculture today is the struggle to control pests in a manner that is both effective and environmentally sound. Several environmentally toxic pesticides such as Temik® are under EPA review and may become unavailable, or their uses greatly reduced, in the future. These pesticides are environmentally hazardous, but as of yet no cost effective alternatives have been found for controlling their target pests.

Current farming technology allows for the placement of seed in-furrow in exact, specific locations. This idea of precision placement can also be applied to insecticide use. Placing the insecticide along with the seed in a specific location would be a more efficient technique of applying planting time insecticides. This type of insecticide use would decrease the cost and amount of insecticide needed as well as decreasing environmental risks.

Important to understanding the control potential of precision placed insecticides is the knowledge of what is happening to the insecticide throughout the growing season of the plant. Residual analysis reveals how much of the insecticide reaches the growing plant and also shows how long it remains within the plant.

In an effort to evaluate the efficacy of precision placed aldicarb compared with traditional in-furrow treatments and to determine residual levels of Temik® present within cotton at specific points during the growing season, the following study was conducted.

Materials and Methods

Experiments were conducted at the Coastal Plains Experiment Station, Tifton, GA. Varying rates of Temik® were applied to the two middle rows of 50-ft-long, 4 row plots in a randomized complete block design with 4 replications. One untreated check was included in each replication. Seed was planted in a hill method on May 4, 2000 using a Monesem pneumatic planter. Hills were spaced 1 ft apart in 38-inch rows with 3 seeds per hill. Rows that were to receive precision placed insecticide treatments were planted with an open furrow with the seed visible. Granular Temik® was applied at planting using two methods; placement of the insecticide along the entire furrow with the seed, or precision placement of the insecticide directly on top of the seed in each hill with a "bazooka" type applicator that was constructed to apply specified amounts of granules for each hill. All insecticide rates are specified as lb product/acre based on 38-inch rows. Open furrows were closed with a garden hoe.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1114-1116 (2001)
National Cotton Council, Memphis TN

Thrips Sampling

Cotton plants were sampled for thrips on May 15, May 24, and June 5, 2000, approximately 10, 20, 30, and 50 days after planting. Plants were sampled by randomly collecting 5 plants from the treated row of each plot and immersing the entire plant into a specimen cup containing alcohol. Samples were then brought back to the laboratory where thrips were identified and counted using a dissecting scope.

Residual Analysis

Plants to be used for residual analysis were collected at approximately 10, 20, 30, and 50 days. Ten whole plants were randomly selected from the two treated rows, bagged, and frozen until analysis. 20g samples of plants from each plot were extracted and run on a GC against analytical standards for aldicarb and aldicarb metabolites to determine the amount of insecticide residual present in the plants from each plot.

Yield

On Oct. 3, 2000 the two treated rows of each plot were mechanically harvested. Seed cotton was weighed in the field to determine yield.

Statistical Analysis

Means for thrips sampling, seed cotton yield, and residual levels of aldicarb and aldicarb metabolites were analyzed using a Tukey's Studentized Range Test (SAS Institute 2000).

Results and Discussion

Thrips Sampling

Over 90% of the adult thrips sampled and counted were tobacco thrips, *Frankliniella fusca* (Hinds). A few western flower thrips, *F. occidentalis* (Pergande), and flower thrips, *F. tritici* (Fitch) were present.

On May 15, 2000, cotyledon stage plants had significantly reduced numbers of tobacco thrips in all Temik® treatments as compared to the untreated check (Table 1). Precision placed Temik® at 0.64 and 2.56 lbs product/acre showed the most significant reduction in thrips totals. When plants were in the two-leaf stage on May 24, 2000 all of the treatments were significantly different from the untreated check with precision placed Temik® at 5.12, 2.56, and 1.28 lbs product/acre showing the most reduction in thrips totals. On June 5, 2000, when plants had four leaves, no significant differences were observed for any treatments when compared to the untreated check.

Yield

No significant differences in yield were found for any of the treatments when compared to the untreated check (Table 2).

Residue Analysis

Within the cotton plant, aldicarb is broken down into its metabolites, rapidly to sufone and then more slowly to sulfoxide (Coppedge et al. 1967). These metabolites are responsible for the insecticidal properties of aldicarb (Montgomery 1993).

On day 10, all treatments had significantly more aldicarb and sulfone present compared to the check with precision placed 5.12, 1.28, 2.56, and 0.64 lbs product/acre having the highest levels (Table 3). Precision placed 5.12, 1.28, 2.56, and 0.64 lbs product/acre had significantly more sulfoxide present than did the other treatments.

All treatments had significantly more aldicarb and sulfone present compared to the untreated check on day 20, with precision placed 5.12, 1.28, and 2.56 lbs product/acre having the highest levels (Table 4). Precision place 0.64, 1.28, and 5.12 lbs product/acre had significantly more sulfoxide present than did the other treatments.

On day 30 no significant differences were found for aldicarb compared with the untreated check (Table. 5). All treatments had significantly more sulfone present than did the check. Precision placed 5.12, 2.56, 1.28, and 0.64 lbs product/acre had significantly more sulfone present than did any other treatments. Significantly more sulfoxide was found in plants that were precision treated with 5.12 and 2.56 lbs product/acre.

No significant differences were found for aldicarb compared with the untreated check on day 50 (Table 6). Precision placed 5.12 and 2.56 lbs product/acre had significantly more sulfone present compared to the other treatments. In-furrow 1.0 and precision placed 5.12 lbs product/acre had the most significant levels of sulfoxide present compared to the other treatments.

Conclusions

From the thrips counts and the residual analysis of plants in this study, we are able to get a clearer picture of what is happening in the field during both in-furrow and precision placement of Temik®. It would appear that precision placed Temik® may be as effective in controlling tobacco thrips as traditional in-furrow treatments. On the first and second thrips sampling dates, many of the precision placed treatments were as effective as the standard in-furrow 3.5 lb product/acre rate. Precision placement uses less insecticide per acre with more of the product actually reaching the seed. Using less insecticide means a reduction in costs for the grower as well as fewer environmental risks. Residual analysis also showed that Temik® metabolite levels were significantly higher in plants treated by precision placement. Precision placement may enhance the efficiency of using high-risk pesticides such as Temik® at levels that are environmentally sound.

References

Coppedge, J.R.. D.A. Lindquist, D.L. Bull, and H.W. Dorough. 1967. Fate of 2-Methyl-2-(methylthio)priopionaldehyde *O*-(Methylcarbamoyl) oxime (Temik) in Cotton Pants and Soil. J. Agric. Food Chem., 15(5):902-910.

Montgomery, J.H. 1993. Agrochemicals Desk Reference. Environmental Data. Lewis Publishers. Chelsea MI. 10-13.

SAS Institute. 2000. SAS/STAT User's Guide. SAS Institute. Cary, NC.

Table 1. Mean number of thrips sampled per plot.

Rate/Application Method	Thrips totals		
lbs product/acre	15 May	24 May	5 June
0.16 precision placed	26.0ab	41.0ab	4.8a
0.64 precision placed	4.3b	25.3ab	26.8a
1.28 precision placed	5.3b	13.3b	12.5a
2.56 precision placed	2.3b	14.5b	20.0a
5.12 precision placed	5.5b	15.0b	12.0a
0.25 in-furrow	15.0ab	56.0ab	13.3a
0.50 in-furrow	12.3ab	42.0ab	18.0a
1.0 in-furrow	10.5b	41.3ab	13.8a
3.5 in-furrow	4.3b	18.8ab	18.8a
check	34.8a	80.5a	11.8a

Means in a column followed by the same letter are not significantly different (*P*=0.05, Tukey HSD).

Table 2. Yield.

Rate/Application Method	Yield
lbs product/acre	lbs/acre
0.16 precision placed	2169.1a
0.64 precision placed	2244.3a
1.28 precision placed	1986.7a
2.56 precision placed	2209.5a
5.12 precision placed	2057.3a
0.25 in-furrow	2074.7a
0.50 in-furrow	2107.7a
1.0 in-furrow	2144.4a
3.5 in-furrow	2214.1a
check	1750.2a

Means in a column followed by the same letter are not significantly different (*P*=0.05, Tukey HSD).

Table 3. Residue Analysis: Day 10.

Rate/Application Method	Residue levels in ppm		
lbs product/acre	Aldicarb	Sulfone	Sulfoxide
0.16 precision placed	1.23ab	11.12bc	2.11b
0.64 precision placed	20.57ab	60.75abc	45.34ab
1.28 precision placed	29.39ab	66.91ab	60.49ab
2.56 precision placed	20.60ab	102.55a	54.91ab
5.12 precision placed	57.51a	116.67a	122.16a
0.25 in-furrow	1.29ab	14.29bc	2.40b
0.50 in-furrow	1.18ab	11.66bc	1.11b
1.0 in-furrow	1.76ab	28.20bc	4.78b
3.5 in-furrow	1.36ab	34.11bc	16.41b
check	0.39b	0.88c	0.10b

Means in a column followed by the same letter are not significantly different (*P*=0.05, Tukey HSD).

Table 4. Residue Analysis: Day 20.

Rate/Application Method	Residue levels in ppm		
lbs product/acre	Aldicarb	Sulfone	Sulfoxide
0.16 precision placed	0.00b	4.26bcd	2.80bc
0.64 precision placed	0.10b	6.08abcd	29.93a
1.28 precision placed	0.25ab	7.70ab	27.04a
2.56 precision placed	0.16ab	6.81abc	20.78ab
5.12 precision placed	0.63a	10.50a	25.24a
0.25 in-furrow	0.00b	3.11bcd	0.00c
0.50 in-furrow	0.00b	2.42bcd	1.16bc
1.0 in-furrow	0.00b	1.81cd	2.48bc
3.5 in-furrow	0.02b	5.06abcd	23.83a
check	0.00b	0.40d	0.00c

Means in a column followed by the same letter are not significantly different (*P*=0.05, Tukey HSD).

Table 5. Residue Analysis: Day 30.

Rate/Application Method	Residue levels in ppm		
lbs product/acre	Aldicarb	Sulfone	Sulfoxide
0.16 precision placed	0.07a	0.64cd	1.05b
0.64 precision placed	0.14a	2.34abc	3.36b
1.28 precision placed	0.18a	3.44ab	2.18b
2.56 precision placed	0.10a	3.47ab	4.98ab
5.12 precision placed	0.08a	4.10a	8.02a
0.25 in-furrow	0.45a	1.01cd	2.27b
0.50 in-furrow	0.07a	0.35cd	1.22b
1.0 in-furrow	0.06a	0.72cd	1.25b
3.5 in-furrow	0.09a	1.37bcd	1.21b
check	0.06a	0.01d	1.62b

Means in a column followed by the same letter are not significantly different (*P*=0.05, Tukey HSD).

Table 6. Residue Analysis: Day 50.

Rate/Application Method	Residue levels in ppm		
lbs product/acre	Aldicarb	Sulfone	Sulfoxide
0.16 precision placed	0.10a	0.11b	1.54bc
0.64 precision placed	0.37a	0.16b	1.33c
1.28 precision placed	0.20a	0.31b	2.02b
2.56 precision placed	0.11a	0.53ab	1.53bc
5.12 precision placed	0.13a	1.04a	2.05b
0.25 in-furrow	0.44a	0.14b	1.27c
0.50 in-furrow	0.65a	0.14b	1.72bc
1.0 in-furrow	0.11a	0.22b	2.72a
3.5 in-furrow	0.12a	0.44b	1.86bc
check	0.21a	0.12b	1.79bc

Means in a column followed by the same letter are not significantly different (P=0.05, Tukey HSD)