SOIL INCORPORATION EFFECTS ON NEMATICIDAL AND INSECTICIDAL EFFICACY OF DI-SYSTON AND TEMIK

G. L. Sciumbato, D. L. Sudbrink and F. A. Harris
Delta Research and Extension Center, Mississippi State University
Stoneville, MS
T. L. Kirkpatrick
University of Arkansas
Hope, AR
L. D. Young
USDA-ARS
Stoneville, MS

Abstract

The effect of incorporation of Temik (aldicarb)and Di-Syston (disulfoton) insecticidal and nematicidal activity, seedling stand counts, and seed cotton yields was evaluated. No significant trends were observed between incorporated and non-incorporated plots. Plots receiving no Temik or Di-Syston tended to have lower stand counts four weeks after planting. Highest seed cotton yields in the non-incorporated plots were obtained with the 3.5 lb/A product rate of Di-Syston . Highest visual thrips damage was observed in plots receiving no nematicide-insecticide. The numbers of nematodes varied from plot to plot. The plots which were incorporated tended to have a larger Reproductive Index (number of nematodes at sampling date/number of nematodes at planting) over the non-incorporated plots.

Introduction

The reniform nematode (*Rotylenchulus reniformis*) has become a cause of significant cotton yield losses in recent years. There have been no recent surveys conducted to determine the extent of reniform nematode infestation in Mississippi cotton fields. The last survey in 1993 (1) found them in 35 counties with problem levels in 17 counties. In the Mississippi Delta, reniform nematode numbers are estimated to exceed economic thresholds on 40-60% of cotton acreage. Losses to reniform nematode continue to increase dramatically and were estimated to cost Mississippi cotton producers more than 65 million dollars in 1998. (Don Blasingame, Personal communique)

Current economic conditions have discouraged producers from entering into a crop rotation program which would reduce reniform nematode numbers. There are no commercial cotton varieties which are resistant to the reniform nematode. Therefore, most producers with high reniform populations use a nematicide in an attempt to keep populations below economic thresholds.

The most widely used in-furrow applied nematicide and early season insecticide used in Mississippi is Temik (aldicarb). This material is used by many producers at the rate of 3.5 lb of the 15G formulation per acre. This is recognized as the optimum economical rate for early season insect control. At this rate, there is some nematode suppression. Current rates of Temik used to control nematodes are 5-7 lb/A of the 15G formulation. Some producers side dress additional Temik four to six weeks after planting. Several nematologists (1,3,4,5) have reported varying results for the different rates and application methods. The lower rates have been erratic and the higher rates are expensive and can cause cotton seedling damage under certain environmental conditions.

Preliminary research has indicated that incorporation of Temik may enhance nematicidal activity. This research was initiated to determine the affects of soil incorporation on nematicidal and insecticidal activity of Temik and Di-Syston. Di-Syston (disulfoton) was included because it has good insecticidal activity and minimal nematicidal activity.

Materials and Methods

Experimental design was a Randomized Complete Block with factorial arrangement of treatments and four replications. The firstfactor of the trial was incorporation vs non-incorporation of the insecticide-nematicide. The second factor was the following insecticide-nematicide treatments: 1) No nsecticide-nematicide, 2) Temik 15G, 3.5 lb/A, 3) Temik 15G, 7.0 lb/A, 4) Di-Syston 15G, 3.5 lb/A, and 5. Di-Syston 15G, 7.0 lb/A. Nematicides were incorporated by running the planter through the plots without any seed and applying the treatment in the seed furrow. Plots were 26.6 ft. wide x 50 ft. long. Seeding rate was 5 seed per row ft. Treatments were incorporated with a 12" power tiller just prior to planting. Ten soil samples per row were collected between rows 3 and 4, and 5 and 6 from the left of the planter for nematode analysis. Soil samples were sent to the Extension Nematode Laboratory at Mississippi State University and nematode analysis was conducted using a Elutrator. Yield data was collected from rows two and three from the left of the planter. Plots were harvested with a commercial cotton picker adapted for plot harvesting.

Results and Discussion

Results of the seedling stand counts and seed cotton yields are given in Table 1. There were no trends noticed in the incorporated vs non incorporated plots. The plots receiving no nematicide-insecticide treatment tended to have lower stand counts four weeks after planting. Highest seed cotton yield for the plots which were not incorporated was obtained with the 3.5 lb/A rate of Di-Syston and the lowest seed cotton yield with the 7.0 lb/a rate. There were no significant differences between any of the incorporated treatments. The plots which received no insecticide-nematicide yielded the lowest in the incorporated treatments.

The highest thrips counts were obtained in the non-incorporated plots receiving 7.0 lb/A of Di-Syston and the lowest counts were found in the non-incorporated 3.5 lb/A rate of Temik. A complete thrips species composition was not recorded, but western flower thrips, *Frankliniella occidentalis*, were found in several samples and may have been the dominant species. Temik and Di-Syston are not very effective against these thrips. A visual thrips damage rating is given in Table 2. Highest visual thrips damage occurred on the plots receiving no nematicide-insecticide. Non-incorporated Temik treatments had significantly lower visual thrips damage ratings than any other treatment. Visual thrips damage ratings were significantly lower in non-incorporated plots versus incorporated plots among Temik treatments. Damage ratings were also lower in non-incorporated vs. incorporated plots for each Di-Syston treatment level. These results may indicate that the chemicals may not have been taken up as well in plants in the incorporated plots. Nematode counts are given in Table 2. Numbers of nematodes varied from plot to plot. Therefore, the coefficient of variation was very high and there were few significant differences between the treatments. However, the higher nematicide-insecticide rates tended to have fewer nematode numbers on the second and third sample dates. The Reproductive Index (Reproductive index = number of nematodes at planting divided by number of nematodes at a sampling date) for the second through fourth sampling date are given in Table 3. The plots which were incorporated tended to have a larger reproductive index over the non-incorporated plots. The difference was not significant and there were no significant differences in reproductive index on the fourth sampling date.

No significant trends observed in this one year of data. There was a 4- inch rain event the day after planting and this had an effect on nematicide-insecticide performance. The presence of the western flower thrips complicated the collection of thrips control data. Also, 2000 was a

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very hot dry year and, even though the plots were irrigated, they may have been under stress at some times during the growing season.

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Table 1. 2000 Cotton insecticide-nematicide incorporation Trial. Effect of treatment on seeding survival.

			Seeding Survival (weeks after planting)						
			Two			Four			Seed Cotton
Treatment	Rate lb per A	Incorporation	Row 2	Row 3	Ave.	Row 2	Row 3	Ave.	Yield
			Percent			Percent			lb/A
None	None	None	60.3 a[1/]	61.7 ab	61.0 ab[2/]	56.5 c	57.7 b	57.1 d	2142 abc
Temik 15G	3.5	None	62.8 a	67.0 a	64.9 a	66.8 ab	66.9 a	66.9 a	2444 abc
Temik 15G	7.0	None	60.3 a	63.8 ab	62.0 ab	67.0 a	63.6 ab	65.3 ab	2576 ab
Di-Syston 15G	3.5	None	57.9 a	61.9 ab	59.9 b	62.2 a-c	61.3 ab	61.7 bc	2633 a
Di-Syston 15G	7.0	None	62.5 a	64.4 ab	63.5 a	60.3 a-c	62.9 ab	61.6 bc	1774 bc
None	None	Incorporated	60.4 a	60.4 b	60.4 b	56.1 c	56.4 b	56.3 d	1699 c
Temik 15G	3.5	Incorporated	61.8 a	60.3 b	61.0 ab	62.0 a-c	62.4 b	62.2 bc	2022 abc
Temik 15G	7.0	Incorporated	61.6 a	63.2 ab	62.4 ab	60.1 bc	63.4 ab	61.8 bc	2255 abc
Di-Syston 15G	3.5	Incorporated	60.9 a	59.3 b	60.1 b	58.0 c	59.7 ab	58.9 cd	977 abc
Di-Syston 15G	7.0	Incorporated	59.3 a	60.1 b	59.7 b	56.9 c	61.8 ab	59.3 cd	448 abc
MSD			8.80	6.12	4.43	6.91	7.37	3.79	848.55
C.V.			3.46	2.60	2.62	2.26	2.54	2.02	20.96
F Value			1.31	1.60	2.07	3.35	2.03	5.76	2.03

1/ Percent stand of one row. Mean of four replications. Means in the same column followed by the same letter are not significantly different according to Waller-Duncan K ratio t test (K ratio =100).

2/ Percent stand of two rows. Mean of eight replications. Means in same column followed by the same letter are not significantly different according to Waller-Duncan K ratio t test (K ratio = 100).

Table 2. 2000 Cotton insecticide-nematicide incorporation Trial. Effect of treatment on Thrips and nematodes.

Treatment	Rate lb per /A	Incorporation	Thrips Counts[1/] 5-23	Thrips Counts[1/] 5-30	Thrips Damage[3/] (1-5)	Canopy Cover Value[4/] (1-5)	Number of Nematodes per Pint of soil[2/] (weeks after planting) 5/2/00 At plant	6/16/00 6 wk	7/20/00 12 wk	9/12/00 19 wk
None	None	None	16.3 ab	3.5 c	3.88 a	1.00 e	4661 ab	2184 b	2416 a	13999 a
Temik 15G	3.5	None	7.0 b	8.0 ab	2.13 e	3.03 a	4522 ab	3825 ab	2787 a	7123 a
Temik 15G	7.0	None	11.8 ab	8.8 a	1.75 e	2.75 ab	2385 ab	1703 b	4398 a	4924 a
Di-Syston 15G	3.5	None	15.8 ab	8.0 ab	3.00 cd	2.38 abc	4878 ab	1982 b	3484 a	12915 a
Di-Syston 15G	7.0	None	21.0 a	4.8 abc	2.75 d	2.38 abc	2509 ab	3004 ab	7743 a	18149 a
None	None	Incorporated	16.3 ab	5.3 abc	4.13 a	1.05 e	6845 a	3453 ab	3469 a	10128 a
Temik 15G	3.5	Incorporated	16.8 ab	2.8 c	3.19 cd	2.15 bc	2902 ab	3097 ab	3020 a	6566 a
Temik 15G	7.0	Incorporated	13.3 ab	7.8 ab	2.88 d	2.42 abc	1456 b	2664 ab	2199 a	7371 a
Di-Syston 15G	3.5	Incorporated	17.0 ab	3.8 bc	3.75 ab	1.47 de	4383 ab	4847 a	3221 a	7588 a
Di-Syston 15G	7.0	Incorporated	16.3 ab	6.0 abc	3.38 bc	1.92 cd	2447 ab	3051 ab	2354 a	8734 a
MSD			10.62	4.79	0.49	0.70	5379.1	2310.8	6561.2	1953.2
C.V.			2.70	47.19	1.89	23.44	69.54	56.10	80.24	91.96
F Value			2.30	2.47	13.71	8.14	1.46	3.95	1.21	1.21

1/ Number of thirps per 10 plants. Means in the same column followed by the same letter are not significantly different according to Waller-Duncan K ratio t test (K ratio =100).

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

3/ Thrips damage was estimated visually using the " Visual Aid to Damage Assessment of Cotton" provided by Gustafson LLC. On a scale of 1-5, a rating of 1 indicates no damage, while the 5 indicates severe damage.

4/ Canopy cover values on a 1-4 scale (1 = least cover, 4 = most cover).

Table 3. 2000 Cotton insecticide-nematicide incorporation Trial. Effect of treatment on nematode reproductive index.

Treatment	Rate lb per/A	Incorporation	Reproductive Index[1/] 6/16/00 6 week	7/20/00 12 week	9/12/00 19 week
None	None	None	0.535 b[2/]	0.668 b	3.154 a
Temik 15G	3.5	None	1.155 ab	0.828 b	1.662 a
Temik 15G	7.0	None	0.837 b	2.516 a	2.604 a
Di-Syston, 15G	3.5	None	0.722 b	1.592 ab	6.071 a
Di-Syston, 15G	7.0	None	1.288 ab	3.196 a	7.475 a
None	None	Incorporated	0.567 b	0.787 b	1.891 a
Temik 15G	3.5	Incorporated	0.755 b	0.957 b	1.663 a
Temik 15G	7.0	Incorporated	2.005 a	1.817 ab	5.406 a
Di-Syston, 15G	3.5	Incorporated	1.096 a	0.849 b	1.824 a
Di-Syston 15G	7.0	Incorporated	1.190 ab	1.117 b	4.634 a
MSD			0.999	2.072	6.66
C.V			47.19	80.24	91.96
F Value			2.38	2.18	1.60

1/ Reproductive index equals number of nematodes at each counting date divided by number of nematodes at planting.

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