TWO-SPOTTED SPIDER MITE MANAGEMENT IN COTTON

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Abstract

The two-spotted spider mite, *Tetranychus urticae*, is an economic threat to cotton acreage in Arkansas. Damage from this pest will likely increase with the implementation of the Boll Weevil Eradication Program in Southeast Arkansas. Frequent evaluation of the performance of commercial miticides is necessary for two-spotted spider mite suppression. Based on data from 1999 and 2000, Capture (0.06 lb ai/ac), Lorsban (1 lb ai/ac), and Zephyr (0.0093 lb ai/ac) provided the most consistent and timely suppression of spider mites over the test period. Selective use of these miticides can prevent resistance and result in effective management of the two-spotted spider mite.

Introduction

Damage caused by the two-spotted spider mite, *Tetranychus urticae*, can result in significant economic damage to cotton in Arkansas as well as the entire U.S. Cotton Belt. In 1999, spider mites caused yield losses greater than 1,000 bales in Arkansas and 30,000 bales nationwide (Williams, 1999). Hot, dry conditions across the mid-South during the past few growing seasons created a favorable environment for this pest. Although some cultural practices help in preventing infestation in cotton, chemical control with miticides remains the most effective.

Spider mites usually feed on the underside of leaves, removing vital chloropyll that causes a reduction in photosynthetic activity (Univ. of AR Coop. Ext. Service). This reduction in photosynthesis causes yellow speckling on the leaves that may turn red in color with increasing levels of infestation. Spider mite infestations usually begin on field borders and can increase with insecticide applications due to the removal of natural enemies (Gonzales et al., 1982). Some weed species serve as hosts to spider mites (Steinkraus and Zawislak, 1999); therefore, control of other pests in cotton can be effective in suppressing spider mite populations.

The implementation of the Boll Weevil Eradication Program in Southeast Arkansas will result in programmed insecticide applications throughout the area. This could increase the occurrence of spider mite infestations in cotton (Gonzales et al., 1982). It is necessary to frequently monitor the performance of miticides in controlling the two-spotted spider mite as it becomes a potentially greater threat to Arkansas cotton production.

Experiments were conducted in Lonoke County, AR, and Lincoln County, AR, in 1999 and 2000, respectively, to evaluate the performance of currently available miticides for two-spotted spider mite management in cotton.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1125-1127 (2001)
National Cotton Council, Memphis TN

Methods

The 1999 experiment was conducted on the James Ray Farm in Lonoke County. The cotton variety BXN 47 was conventionally sown in 38-in rows on 11 May. Plot size was eight 38-inch rows 75 ft in length. Treatments were arranged in a randomized complete block design with four replications. Insecticide treatments were initiated based upon state recommendations of 50% spider mite infestation. A John Deere 6000 hi-cycle sprayer equipped with a compressed air delivery system was used for treatment application. Total volume was 12 gal/acre at 45 psi using conejet TX6 nozzles with 20-inch spacing. The treatments listed in Table 1 were applied on 28 July. The center two rows of each plot were evaluated for spider mite infestation on 30 July (2DAT) and 2 August (5DAT). Ten leaves were randomly chosen from each plot and spider mites were counted in a 1 in^2-area.

The Randy Eagle Farm in Lincoln County was the location of the 2000 experiment. The field was located within the boll weevil eradication zone and received programmed applications of ULV malathion throughout the growing season, which may have attributed to the spider mite infestation. BXN 47 was conventionally sown in 38-in rows on 22 April. Plot size was eight rows 50 ft in length with a treatment design identical to the 1999 test. Application was similar to 1999 except a volume of 8.6 gal/acre was used. The treatments tested in 2000 were different from those tested in 1999 (Table 2). The application date was 13 July and spider mite populations were evaluated on 17 July (4DAT), 20 July (7DAT), and 28 July (15DAT). Methods used to evaluate spider mites in 1999 were used in 2000. Egg populations were evaluated in the same matter as live spider mites. Percentage spider mite control was determined from the number of spider mites present in the control treatment for the respective replication. Cotton yields were not evaluated in either year. Data were processed using Agriculture Research Manager Ver. 6.01. Means from both years were subjected to analysis of variance and 5% significance was determined using the Student-Newman-Keuls Test (1999) and Duncan's New Multiple Range Test (2000).

Results and Discussion

No statistical differences occurred among any treatments in 1999 for either evaluation date (Table 1). However, mean values indicate that there were differences in spider mite populations on a numeric basis only. Trends in the data for both evaluation dates indicated miticides that resulted in the best overall control for the testing period. For example, Capture (0.06 lb ai/ac) decreased mite populations to five per square inch on both evaluation dates. The Decis treatment (0.02 lb ai/ac), on the other hand, had mite populations of 86 and 72 per square inch 2 and 5 DAT, respectively. On a numerical basis only, Capture (0.06 lb ai/ac), Lorsban (1 lb ai/ac), Curacron (1 lb ai/ac), and Zephyr (0.0093 lb ai/ac) were the most effective miticides in reducing spider mite populations.

In 2000, pre-treatment evaluation of the test area was implemented to determine the initial spider mite population. The overall average egg population was 156 per 10 leaves in addition to 65 live spider mites. Of the miticides tested, Lorsban, Zephyr, Capture, Capture + Ovasyn, Comite, and Denim significantly reduced egg populations below that of the untreated check 4 and 7DAT (Table 2). Only the Comite treatment had an increase in population of 33.3 eggs 15 DAT. All other treatments were significantly below this level. The Kelthane and Ovasyn treatments did not reduce spider mite egg populations in a timely manner.

Based on live spider mite counts, Capture, Lorsban, and Capture + Ovasyn provided the best initial suppression of mites (Table 3). However, these were not significantly higher than the Denim, Ovasyn, Zephyr, or Kelthane (1 lb ai/ac) treatments. Only the untreated check and Kelthane (0.75 lb ai/ac) did not reduce mite numbers lower than the 65 pre-treatment count.

Fewer treatment differences were observed by 7 DAT. Only the Kelthane (1 lb ai/ac), Zephyr, and Comite treatments had significantly less spider mites than the control. All treatments maintained mite populations lower than the initial 65 per 10 leaves, indicating there was no rebound in spider mite population. By 15 DAT there were no treatment differences with respect to spider mite population. The life cycle of the spider mite usually lasts 10 to 15 days; therefore, the lack of difference could be attributed to a natural population decline. The percentage of spider mite control based upon live counts is displayed in Table 4. Capture provided the highest percent control 4 DAT with 77.8%; however, this level was only significantly different from the untreated check and Kelthane (0.75 lb ai/ac) treatments. All treatments with the exception of Kelthane and Zephyr provided significantly higher control (>50%) than the untreated check 4 DAT. The addition of Ovasyn to Capture did not increase spider mite control. All treatments, with the exception of Capture + Ovasyn, provided significantly greater spider mite control than the untreated check at 7 DAT. By 15 DAT, no differences among treatments with respect to spider mite control were observed.

Based upon the data collected from both studies, Capture (0.06 lb ai/ac), Lorsban (1 lb ai/ac), and Zephyr (0.0093 lb ai/ac) provided the most consistent and timely suppression of spider mites over the test period. Although it was not included in the 2000 experiment, Curacron (1 lb ai/ac) provided favorable spider mite control in 1999.

Summary

As the two-spotted spider mite becomes an increasing threat to Arkansas cotton production, miticides will be implemented in integrated pest management programs. Two years of data showed Capture, Lorsban, and Zephyr to be effective miticides. Curacron, Comite, and Ovasyn provided reasonable suppression. Selective use of these miticides can prevent the development of resistance in areas where spider mite infestations are common on a yearly basis.

Acknowledgements

The authors would like to thank Mr. James Ray, Mr. Randy Eagle, AgrEvo, Bayer Corporation, Dow AgroSciences, FMC Corporation, Helena Chemical, Novartis Crop Protection, Uniroyal Chemical Company, Zeneca, and Rohm and Haas for providing the resources necessary to conduct this research.

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Table 1. Two Spotted Spider Mite Management in Cotton, 1999.

Treatment	Rate (lbs. ai/ac)	Total mites / 10-1in^2 samples 2 DAT	5 DAT
1 Denim	0.01	18 a*	69 a
2 Capture	0.06	5 a	5 a
3 Karate	0.028	49 a	41 a
4 Baythroid	0.03	82 a	43 a
5 Decis	0.02	86 a	72 a
6 Lorsban	1.0	15 a	16 a
7 Curacron	1.0	5 a	10 a
8 Comite	1.5	60 a	44 a
9 Zephyr	0.0093	27 a	18 a
10 Zephyr	0.005	49 a	57 a
11 Dimethoate	1.0	64 a	66 a
12 Dimethoate	0.5	100 a	64 a
13 Untreated		72 a	60 a

*Means followed by the same letter do not significantly differ (P=.05, Student-Newman-Keuls).

Table 2. Two-Spotted Spider Mite Egg Suppression in Cotton, 2000.

Treatment	Rate (lbs. ai/ac)	Eggs / 10-1in^2 Leaf Samples 4DAT	7DAT	15DAT
1 Kelthane MF	0.75	95.8 a*	44.0 a	1.0 b
2 Kelthane MF	1.0	82.0 ab	40.5 ab	1.5 b
3 Lorsban 4E	1.0	7.5 c	5.3 d	5.0 b
4 Zephyr 0.15EC	0.0093	12.8 c	4.5 d	3.3 b
5 Capture 2EC	0.06	4.0 c	6.0 cd	4.5 b
6 Capture 2EC + Ovasyn 1.5EC	0.06 + 0.125	10.3 c	4.0 d	12.0 ab
7 Ovasyn 1.5EC	0.5	57.8 abc	5.8 d	1.3 b
8 Comite 6.55EC	1.6375	10.3 c	5.8 d	33.3 a
9 Denim 0.16EC	0.01	18.8 bc	5.8 d	2.5 b
10 Untreated		94.0 a	24.5 bc	3.0 b

*Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)

Table 3. Two-Spotted Spider Mite Suppression in Cotton, 2000.

Treatment	Rate (lbs. ai/ac)	Mites / 10-1in^2 Leaf Samples 4DAT	7DAT	15DAT
1 Kelthane MF	0.75	78.5 a*	10.5 ab	1.0 a
2 Kelthane MF	1.0	39.3 abc	6.0 b	2.3 a
3 Lorsban 4E	1.0	14.3 c	10.0 ab	2.5 a
4 Zephyr 0.15EC	0.0093	28.0 bc	3.0 b	3.3 a
5 Capture 2EC	0.06	7.8 c	14.5 ab	2.3 a
6 Capture 2EC + Ovasyn 1.5EC	0.06 + 0.125	18.0 bc	15.3 ab	4.3 a
7 Ovasyn 1.5EC	0.5	23.8 bc	11.5 ab	2.3 a
8 Comite 6.55EC	1.6375	17.0 c	5.5 b	2.8 a
9 Denim 0.16EC	0.01	25.3 bc	14.8 ab	3.0 a
10 Untreated		62.3 ab	27.8 a	2.3 a

*Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT).

Table 4. Percentage Two-Spotted Spider Mite Control in Cotton, 2000.

Treatment	Rate (lbs. ai/ac)	Percent Control[1] 4DAT	7DAT	15DAT
1 Kelthane MF	0.75	17.3 bc[2]	48.5 a	33.3 a
2 Kelthane MF	1.0	37.2 abc	69.5 a	25.0 a
3 Lorsban 4E	1.0	53.0 ab	68.7 a	50.0 a
4 Zephyr 0.15EC	0.0093	37.4 abc	81.0 a	25.0 a
5 Capture 2EC	0.06	77.8 a	65.1 a	41.7 a
6 Capture 2EC + Ovasyn 1.5EC	0.06 + 0.125	66.7 a	3z6.5 ab	25.0 a
7 Ovasyn 1.5EC	0.5	60.0 ab	57.0 a	41.7 a
8 Comite 6.55EC	1.6375	69.9 a	69.6 a	30.0 a
9 Denim 0.16EC	0.01	50.6 ab	57.8 a	25.0 a

[1]Control calculated as percentage of live mites in untreated check.
[2]Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT).