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EFFICACY OF EARLY MITICIDES APPLIED EARLY TO CONTROL SPIDER MITES IN CORN, TRIAL #1, 2003

by

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SUMMARY

Spider mite populations increased to 1,385 mites per 2 plants at 37 days post treatment and caused severe leaf damage by the middle of September, killing an average 7 leaves per plant. Comite treatments gave some early control, but little season total control. Corn treated with Comite suffered leaf damage similar to that of the untreated control, and Comite treatments at late-whorl and tassel added only 11.3 and 13.0 Bu/A, respectively, to grain yield. The three late-whorl Onager treatments gave excellent control, 90 to 91% season-total spider mite control, but the tassel-stage treatments failed to give good control. Corn treated with Onager suffered little leaf damage, and Onager treatments added 44.5 to 63 Bu/A grain yield. The high rate of the experimental miticide, GWN1187, gave excellent, 86 to 90%, season-total, spider mite control, even when applied at tassel or dough stage. Corn receiving these treatments suffered little leaf damage and the treatments added 54.0 to 85.6 Bu/A grain yield. Predator mite populations increased during the trial, but did not seem to affect spider mite populations until August. Thrip populations were high during the whorl stage, and mite populations seemed to increase as thrip populations declined. Predator mite and thrip populations were not affected by the miticide treatments.

PROCEDURES

Field corn, DKC60-10 (RR/YGCB) (110-day maturity), was planted May 5 with a John Deere MaxEmerge 6 row planter at a rate of 36,000 seeds/acre in a furrow-irrigated field (Finnup #8) at the Southwest Research-Extension Center, Finney County, Kansas. A test with 10 treatments was set up in a randomized complete block design with four replications. Plots were four rows (10 ft) wide and 50 ft long with a 4-row (10-ft) border of untreated corn on each side and a 10-ft alley at each end. Treatments #2 through 5 were applied July 5, when the corn was in late-whorl stage (4 ft). Treatments #6 through 9 were applied July 16, when the corn was just starting to tassel. The last treatment, #10, was applied July 28, when the corn was in the soft-dough stage. The treatments were applied with a high-clearance sprayer using a 10-ft boom with two nozzles directed at each row (one nozzle on each side of the row on a 16-inch drop hose). The nozzles were directed up into the plant for the first treatment and at the ear zone for the other applications. The sprayer was calibrated to deliver 14 gal/acre at 2 mph and 40 psi.

Banks grass mites infested the plots naturally from an adjacent wheat field to the west. In May, spider mites were sampled by collecting 3 row-ft of wheat from 6 locations around the experimental field. Then spider mites were sampled in corn during the summer by collecting half the leaves from 4 plants (4 half plants = 2 plants) from the two center rows in each plot. The plant material was placed in large paper bags and transported to the laboratory, where it was placed in 76-liter Berlese funnels. A light bulb was used to dry the vegetation and to drive arthropods down into a collecting jar containing 70% methanol. The alcohol samples were filtered on ruled white filter paper, and spider mites, predator mites, and thrips were counted under a binocular microscope. A subsample of spider mites (about 20) was mounted on a microscope slide for each plot. The slides were examined to determine the proportion of Banks grass mites and twospotted spider mites in the population from each plot. Pre-treatment spider mite samples were collected June 27 from 20 areas across the field (before the plots were established), and post-treatment samples were collected July 7, 14, 21, and 28, and August 4 and 11. Spider-mite counts were transformed according to Taylor's power transformation for statistical analysis and were converted to mites per 4 half-plants for presentation. On September 12. the plots were rated for number of green leaves still present. Corn receiving the best treatments still had green leaves down to the ear or lower (10 or more leaves), whereas the check plots had very few green

leaves. Grain yield was collected by machine harvesting two rows from each plot. Because the field was furrow irrigated from one end of the field, there was a significant gradient in the yield going down the field. Therefore, we calculated the "field yield trend" by calculating the average yield across 6 plots at each position down the field. The position means were smoothed by using rolling averages. Then this "field yield trend" was used as the covariate in the ANOVA of grain yield and number of green leaves.

RESULTS AND DISCUSSION

In May, spider-mite populations averaged 0.4 mites per square foot. Spider-mite populations averaged 2.7 mites per 2 plants on June 27. The mite populations increased to an average of 1,385 mites per 2 plants by August 11, and some individual samples were as high as 3,819 per 2 plants. The spider mite populations were 100% Banks grass mites during the pretreatment samples, but by August 11, the twospotted spider-mite populations had increased to 26.4% in some treatments (Table 3). The weather changed in mid-August, and seemed to cause a further shift toward twospotted spider mites. In this region, the species complex is often observed to shift from Banks grass mites early in the season to twospotted spider mites later in the season (Sloderbeck et al. 1987). We were unable to take further samples after August 11 to verify that this shift continued, but it can be inferred from the leaf damage recorded in September and from the grain yields recorded at harvest. By September 12, the mites had killed an average of 7 leaves more per plant in the untreated control, compared with the best treatment (Table 3). There was also 85.6 Bu/A of grain yield lost in the untreated control relative to the best treatment (Table 3).

The standard early-season miticide, Comite, applied at the whorl stage, gave as much as 79% control at 9 days post-treatment, but averaged only 38% season-total spider-mite control (Tables 1 & 2). Corn treated with Comite had one of the highest percentages of twospotted spider mites (Table 3). This may explain the lack of control later in the season. Comite applied at the tassel stage gave as much as 85% control early, but averaged only 57% season-total spider-mite control because of the large early mite populations. Leaf damage at the end of the season was severe for corn from both treatments, however, and the number of green leaves did not differ from the control (Table 1). This damage seemed to be caused by the late-season twospotted spider mites. Comite treatments increased grain yield only 13.0 and 11.3 Bu/A relative to the untreated control. These treatments did not seem to suppress the late-season twospotted spider mite populations.

The three rates of Onager applied at whorl stage gave remarkably good, 90 to 91%, season-total control (Tables 1 & 2). In addition, leaf damage for corn from these treatments was minimal at the end of the season, 9.5 weeks later, and the number of green leaves was not significantly different from the best treatment, but significantly different from the control (Table 3). Onager applied at the tassel stage took 4 weeks to give 61% control. But leaf damage for corn from these treatments was minimal at the end of the season, 8 weeks later, and the number of green leaves was not significantly different from the best treatment, but was significantly different from the untreated control (Table 3). Onager treatments increased grain yield 44.5 to 63 Bu/A relative to the untreated control (Table 3). These treatments seemed to suppress the late season twospotted spider-mite populations (Table 3).

The high rate of the experimental miticide, GWN1187, applied at the whorl stage or at the tassel stage, gave excellent, 90 to 96%, control soon after application, and averaged 86 to 90% season-total control (Tables 1 & 2). Corn receiving the whorl-stage treatment had one of the highest percentages of twospotted spider mites, but this was probably because of the effectiveness of this treatment, and only small numbers of mites remained, mostly twospotted spider mites (or the late-season twospotted spider-mite populations may have reinvaded the plots) (Table 2). Leaf damage at the end of the season was minimal for corn receiving the three GWN1187 treatments, and the number of green leaves remaining was the best of any treatment in the experiment (Table 3). The GWN1187 treatments seemed to give good knock-down, and also good season-total, twospotted spider-mite control.

Predator mite populations in wheat in May averaged 0.47 mites per row foot. On June 27, they averaged 0.05 mites per 2 plants, and remained at these small populations until August 11, when numbers increased to 8.5 mites per 2 plants (Table 4). It was not clear that the miticide treatments affected the predator mite populations except in reducing their food supply. The predator mite numbers were too small to suppress spider-mite populations until mid-August. Predator mite numbers were less in most of the miticide treatments, but this was probably correlated with availability of spider mite prey populations (Table 1 & 4).

Thrip populations averaged 23 thrips per 2 plants at pretreatment. Populations increased to 24 to 59 thrips per 2 plants on July 7, and then decreased rapidly as the plants reached tassel stage (Table 4). It was not clear that the miticide treatments affected the predator mite populations. The thrips seemed to be important early-season facultative predators of the spider mites. The spider-mite populations increased rapidly when the thrip populations declined during the corn reproductive stage.

Henderson, C.F., and W. Tilton. 1955. Tests with Acaricides against the Brown Wheat Mite. Journal of Economic Entomology 48: 157-161.

Sloderbeck, P.E., W.P. Morrison, C.D. Patrick, and L.L. Buschman. 1988. Seasonal shift in species composition of spider mites (Tetranychidae) in corn. Southwestern Entomologist 13: 63-68.

Table 1. Spider mites per 4 half plants (=2 plants) and late-season green leaves on plants in plots treated with miticides, SWREC, Garden City, Kansas. Miticide Trial # 1, 2003.

	Treatment Chemical	Rate per acre	Timing	Spider Mites per 2 plants [1] 6/27 Pre-treat	7/7 2 d PT	7/14 9 d PT	7/21 16 d PT	7/28 23 d PT	8/4 30 d PT	8/11 37 d PT	Season Total
1	Check	—	—	**2.7**	**8**	**48 a**	**43 a**	**154 ab**	**544 a**	**1385 a**	**2618 a**
2	Comite II 6EC	2.0 pt	Whorl		**11**	**10 ab**	**47 a**	**195 a**	**195 ab**	**775 a**	**1442 ab**
3	Onager 1E	10 oz	Whorl		**16**	**0 c**	**0 cd**	**7 c**	**22 cd**	**143 b**	**215 d**
4	Onager 1E	12 oz	Whorl		**3**	**0 c**	**7 bcd**	**8 c**	**5 d**	**189 b**	**232 cd**
5	Onager 1E	16 oz	Whorl		**3**	**1 bc**	**0 d**	**10 c**	**37 bcd**	**150 b**	**226 d**
6	GWN1187	1.5 pt	Tassel		10	15 ab	**7 abc**	**11 c**	**55 bcd**	**181 b**	**315 cd**
7	GWN1187	2.0 pt	Tassel		34	68 a	**5 abcd**	**21 c**	**28 bcd**	**140 b**	**329 cd**
8	Comite II 6EC	2.0 pt	Tassel		11	61 a	**26 a**	**160 ab**	**103 bc**	**692 a**	**1208 ab**
9	Onager 1E	16 oz	Tassel		34	14 ab	**21 ab**	**38 bc**	**82 bc**	**152 b**	**528 bcd**
10	GWN1187	2.0 pt	Dough		13	16 ab	48 a	371 a	**113 bc**	**160 b**	**801 bc**
	F-test-Prob.				0.354	0.0007	0.0036	0.0001	0.0111	0.0004	0.0005
	CV %				36	38	47	27	33	19	18

[1] Means within a column that are followed by the same letter are not significantly different ($P \leq 0.05$, LSD)
Treatments 2 through 5 were applied July 5, when corn was in late-whorl (4-ft) stage. Treatments 6 through 9 were applied July 16, when corn was beginning to tassel. Treatment 9 was applied July 28, when the corn was in the soft dough stage. Post-treatment counts are in bold. Leaf ratings were made September 12.

Table 2. Spider mite percentage control in plots treated with miticides, SWREC, Garden City, Kansas. Miticide Trial #1, 2003.

	Treatment Chemical	Rate per acre	Timing	Spider Mite Percentage Control [1] 6/27 Pre-Treat	7/7 2 d PT	7/14 9 d PT	7/21 16 d PT	7/28 23 d PT	8/4 30 d PT	8/11 37 d PT	Season Total
1	Check	—	—	—	—	—	—	—	—	—	—
2	Comite II 6EC	2 pt	Whorl	—	**-50**	**79**	**-8**	**-27**	**64**	**44**	**38**
3	Onager 1E	10 oz	Whorl	—	**-115**	**100**	**99**	**95**	**96**	**90**	**91**
4	Onager 1E	12 oz	Whorl	—	**60**	**100**	**98**	**95**	**99**	**86**	**90**
5	Onager 1E	16 oz	Whorl	—	**65**	**97**	**100**	**93**	**93**	**89**	**90**
6	GWN1187	1.5 pt	Tassel			—	**50**	**77**	**68**	**59**	**57**
7	GWN1187	2.0 pt	Tassel			—	**93**	**90**	**96**	**93**	**90**
8	Comite II 6EC	2.0 pt	Tassel			—	**53**	**-17**	**85**	**60**	**57**
9	Onager 1E	16 oz	Tassel			—	**-75**	**-13**	**47**	**61**	**19**
10	GWN1187	2.0 pt	Dough					—	**91**	**95**	**86**

[1] Percentage control calculated according to the method of Henderson & Tilton (1955).

Table 3. Summary of spider mite data in plots treated with miticides during the season together with end-of-season observations on the plants, SWREC, Garden City, Kansas. Miticide Trial #1, 2003.

	Treatment Chemical	Rate per acre	Timing	Season Total Spider Mites per 2 plants	% Control [1] season total	% TSM [2] 8/11	No. Green [3] Leaves/plant 9/12	Yield [3] bu/acre
1	Check	—	—	**2618 a**	**—**	**1.1**	**1.7 b**	**98.3 c**
2	Comite II 6EC	2.0 pt	Whorl	**1442 ab**	**38**	**26.0**	**1.5 b**	**111.3 c**
3	Onager 1E	10 oz	Whorl	**215 d**	**91**	**6.3**	**6.3 a**	**161.3 ab**
4	Onager 1E	12 oz	Whorl	**232 cd**	**90**	**14.7**	**6.3 a**	**142.8 b**
5	Onager 1E	16 oz	Whorl	**226 d**	**90**	**9.9**	**7.0 a**	**157.0 ab**
6	GWN1187	1.5 pt	Tassel	**315 cd**	**57**	**7.0**	**7.1 a**	**183.9 a**
7	GWN1187	2.0 pt	Tassel	**329 cd**	**90**	**26.4**	**6.7 a**	**157.2 ab**
8	Comite II 6EC	2.0 pt	Tassel	**1208 ab**	**57**	**6.8**	**2.4 b**	**109.6 b**
9	Onager 1E	16 oz	Tassel	**528 bcd**	**19**	**10.4**	**7.7 a**	**149.6 b**
10	GWN1187	2.0 pt	Dough	**801 bc**	**86**	**11.4**	**8.4 a**	**152.3 b**
	F-test-Prob.			0.0005	—	0.1124	<0.0001	0.0001
	CV %			18%	—	5%	26%	14%

[1] Percentage control calculated according to the method of Henderson & Tilton (1955).
[2] Percentage twospotted spider mites.
[3] Means within a column that are followed by the same letter are not significantly different ($P \leq 0.05$, LSD)

Table 4. Numbers of thrips and predator mites per 4 half plants (=2 plants) in plots treated with miticides, SWREC, Garden City, Kansas. Miticide Trial #1, 2003.

				Thrips per 2 plants							Predator
	Treatment Chemical	Rate per acre	Timing	6/27 Pre-Treat	7/7 2 d PT	7/14 9 d PT	7/21 16 d PT	7/28 23 d PT	8/4 30 d PT	8/11 37 d PT	Mites/2 pl 8/11
1	Check	—	—	**23**	**29**	**15**	**3**	**3**	**4**	**1**	**8.5**
2	Comite II 6EC	2.0 pt	Whorl		**31**	**12**	**7**	**3**	**4**	**0**	**2.0**
3	Onager 1E	10 oz	Whorl		**56**	**13**	**3**	**2**	**4**	**1**	**0.0**
4	Onager 1E	12 oz	Whorl		**20**	**7**	**5**	**2**	**4**	**1**	**0.0**
5	Onager 1E	16 oz	Whorl		**55**	**13**	**4**	**2**	**2**	**1**	**0.5**
6	GWN1187	1.5 pt	Tassel		51	18	**2**	**2**	**2**	**1**	**0.5**
7	GWN1187	2.0 pt	Tassel		59	12	**3**	**2**	**2**	**1**	**0.8**
8	Comite II 6EC	2.0 pt	Tassel		52	19	**5**	**3**	**2**	**5**	**2.0**
9	Onager 1E	16 oz	Tassel		28	8	**7**	**3**	**3**	**0**	**1.3**
10	GWN1187	2.0 pt	Dough		24	10	3	2	**2**	**2**	**3.3**
	F-test-Prob.				0.0116	0.285	0.384	0.913	0.607	0.376	0.427
	CV %				43	55	93	84	88	201	265

Treatments 2 through 5 were applied July 5,when corn was in late-whorl (4-ft) stage. Treatments 6 through 9 were applied July 16, when corn was beginning to tassel. Treatment 9 was applied July 28, when the corn was in the soft dough stage. Post-treatment counts are in bold.

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