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EFFICACY OF MITICIDES APPLIED AT TASSEL STAGE FOR CONTROL OF SPIDER MITES IN CORN, 2005

by
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SUMMARY

Spider mite populations started out low, but reached 785 mites per 2 plants by 30 Aug. (46 days post treatment). The populations were mostly Banks grass mites (BGM) in July, but by the end of the season, nearly 90 percent of the population was twospotted spider mites (TSM). The standard treatment, Comite®, gave some early control, but had little impact on the late-season TSM populations.. The Oberon®, Onager®, and Zeal® treatments seemed to give early-season control of BGM, but had limited impact on TSM populations late in the season. The Agri-Mek® treatment was applied late, due to equipment problems, and gave inconsistent control of the BGM populations, but did seem to provide some control of TSM later in the season. Predator numbers were very low for most of the season, but predator mite populations increased late in the season, when spider mite populations were high. No differences in predator mite populations were observed among treatments. Grain yields were highest in some of the Onager® and Oberon® treatments, but they were not significantly different from the Check, probably as a result of soil variability in the field.

PROCEDURES

Field corn, N73-F7 (GT/LL/YGCB) (112-day maturity), was planted April 26 with a John Deere MaxEmerge 6 row planter at a rate of 35,000 seeds/acre in wheat stubble under a center-pivot irrigation system (Field N34) 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. The field received 170 lb of N as anhydrous ammonia and was irrigated 16 times, receiving 14.5 inches of water. The plots were manually infested with Banks grass mites (BGM) July 12 by tying on mite-infested leaves collected from a cornfield in Stevens County. We infested 6 plants in each plot, 3 for each of the two center rows. Treatments (except #6) were applied July 15, when the corn was late whorl stage to tassel stage (6 ft). The sprayer broke down, so treatment #6 could not be applied with the other treatments. Treatment #6 was applied August 1, when the corn was in the soft dough stage, with other post-tassel treatments in the adjacent plots (see companion report). The treatments were applied with a high-clearance sprayer using a 10-ft boom with two nozzles directed at each row (one on each side of the row on an 18-inch drop hose). The nozzles were directed up into the plant. The sprayer was calibrated to deliver 14 gal/acre at 2 mph and 40 psi.

Spider mites were sampled by collecting half the leaves from 4 plants (4 half plants = 2 plants) from the two center rows in each plot. Early in the season, we sampled plants next to the infested plants. The plant material from each plot was placed in separate large paper bags and transported to the laboratory, where the plant materialwas placed in separate, large 76-liter Berlese funnels. A 100-watt light bulb was used to dry the vegetation and 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. The slides were examined to determine the proportion of BGM and TSM in the populations from each plot. Pre-treatment spider mite samples were collected July 14, and post-treatment samples were collected July 18, 22, 29, and August 5, 12, and 30. Spider mite counts were transformed with Taylor's power transformation for statistical analysis, and were back-transformed to mites per 4 half-plants for presentation. Grain yield was collected by machine harvesting two rows from

each plot. There was considerable variation in the plant height and a gradient in the yield going down the field, so we calculated the "field yield trend" by calculating the average yield across 6 rows of plots going 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. The F-value for the covariate was 3.5717; that for treatment was 2.3672.

RESULTS AND DISCUSSION

Banks grass mite and TSM populations averaged 12 mites per 2 plants on July 14. The Banks grass mite populations in the untreated control increased to 126 mites per 2 plants by August 5, and then declined to 38 mites per 2 plants by August 12 (Table 1). The TSM populations in the untreated control were present at very low numbers during July, but they increased rapidly in August, from 6% on August 5 to 89% on August 30. By this time, the TSM population averaged 694 mites per 2 plants in the untreated plots (Tables 3 and 4). There was a period of wet weather in early August that seemed to be associated with the collapse of the BGM populations was followed by increasing TSM populations. This confirms previous observations in this region that the species composition often shifts from mostly BGM early in the season to TSM later in the season.

The standard early-season miticide, Comite®, gave good early control (up to 100%) of BGM (Table 2), but it did not seem to affect the late-season populations of tTSM (Table 3 and 4). The season-total control of both spider mites was only 20% (Table 5). The percentage of TSM in the population did not differ meaningfully between the Comite® treatment and the control (Table 4).

The three rates of Onager® gave excellent BGM control, 72 to 98% from 7 to 21 days after treatment (DAT) (Table 2). The season-total BGM control was 41 to 78% (Table 2). These treatments seemed to have little impact on the late-season TSM, season-total control of TSM was 1 to 28% (Table 4). The season-total control for both spider mites was only 32 to 57% (Table 5). There seemed to be a significant increase in the percentage of TSM in the Onager® plots 21 DAT (Table 4), probably as a result of the significant impact of these treatments on the BGM during this period. There was no clear indication of a rate response among the three rates of Onager® tested, and the highest rate was the treatment that seemed to break down first.

The two formulations of Oberon® also gave excellent BGM control, 50 to 97% out to 21 DAT (Table 2). The season-total BGM control was 61 to 64% (Table 2). The impact of these treatments on the

Table 1. Banks grass mites per 4 half plants (=2 plants) in plots treated with miticides*. Southwest Research -Extension Center, Garden City, Kansas, 2005.

No.	Treatment	Rate	BGM/4 half-plants [a] July 14 Pre-treat.	July 18 3 days	July 22 7 days	July 29 14 days	Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days
1	Check	—	19	29	79 a	14 ab	126 a	38	81
2	Comite II 6EC	2.25 pt	8	11	0 d	8 bc	41 ab	20	141
3	Onager 1E	6 oz	9	16	8 bc	2 c	4 c	30	11
4	Onager 1E	8 oz	7	18	8 bc	1 c	2 d	4	7
5	Onager 1E	12 oz	3	11	15 bc	1 c	5 cd	9	84
6 [b]	AgriMek 0.15 EC	8 oz	3	12	19 ab	47 a	43 ab	38	5
7	Oberon 240EC	8.5 oz	9	5	3 bcd	2 c	3 cd	37	21
8	Oberon 480EC	4.25 oz	9	12	2 cd	3 bc	15 bcd	20	60
9	Zeal	0.66 oz	14	11	9 bc	3 bc	22 bcd	25	65
10	Zeal	1.0 oz	2	27	9 bc	6 bc	23 bcd	10	24
	F-test P value		0.7394	0.3248	0.0023	0.0016	0.0024	0.3382	0.2496

*Treatments made July 15, 2005, when the corn was just starting to tassel.

[a] Means followed by the same letter are not significantly different ($P < 0.05$, LSD)

[b] Treatment 6 was not applied until August 1, so it was a Check until the August 5 sample.

Table 2. Percentage of control of Banks grass mites in plots treated with miticides*, Southwest Research -Extension Center, Garden City, Kansas, 2005.

No.	Treatment	Rate	Percentage control for BGM July 18 3 days	July 22 7 days	July 29 14 days	Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days	Season Total
1	Check	—	—	—	—	—	—	—	—
2	Comite II 6EC	2.25 pt	56	**100**	33	**60**	35	0	16
3	Onager 1E	6 oz	34	**88**	**86**	**96**	6	**84**	**68**
4	Onager 1E	8 oz	21	**88**	**88**	**98**	**86**	**90**	**78**
5	Onager 1E	12 oz	43	**72**	**90**	**94**	**63**	0	41
6 [a]	AgriMek 0.15 EC	8 oz				49	0	**91**	21
7	Oberon 240EC	8.5 oz	**81**	**96**	**84**	**97**	0	**69**	**64**
8	Oberon 480EC	4.25 oz	50	**98**	**78**	**86**	37	13	**61**
9	Zeal	0.66 oz	**60**	**88**	**81**	**81**	30	14	51
10	Zeal	1.0 oz	0	**80**	28	**70**	55	52	46

*Treatments made July 15, 2005, when the corn was just starting to tassel.
[a] Treatment 6 was not applied until August 1, so it was a Check until the August 5 sample.

Table 3. Twospotted spider mites per 4 half plants (=2 plants) in plots treated with miticides*, Southwest Research-Extension Center, Garden City, Kansas, 2005.

No.	Treatment	Rate	TSM/4 half-plants [a] July 14 Pre-treat.	July 18 3 days	July 22 7 days	July 29 14 days	Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days
1	Check	—	0.0	0.0	0.0	4	4	34	694
2	Comite II 6EC	2.25 pt	0.0	0.0	0.0	1	7	11	673
3	Onager 1E	6 oz	0.0	0.0	0.0	0	1	25	696
4	Onager 1E	8 oz	0.0	0.0	0.0	1	3	9	511
5	Onager 1E	12 oz	0.0	0.0	0.0	0	5	15	587
6 [b]	AgriMek 0.15 EC	8 oz	0.0	0.0	0.0	7	2	15	403
7	Oberon 240EC	8.5 oz	0.0	0.0	0.0	0	2	16	726
8	Oberon 480EC	4.25 oz	0.0	0.0	0.0	2	4	15	424
9	Zeal	0.66 oz	0.0	0.0	0.0	1	4	19	613
10	Zeal	1.0 oz	0.0	0.0	0.0	2	5	11	496
	F-test P value		—	—	—	0.1729	0.8792	0.9452	0.8824

*Treatments made July 15, 2005, when the corn was just starting to tassel.
[a] Means followed by the same letter are not significantly different (P < 0.05, LSD)
[b] Treatment 6 was not applied until August 1, so it was a Check until the August 5 sample.

late-season TSM varied from 0 to 59% on the samples 21 to 46 DAT (Table 4). The season-total control for both spider mites was only 31 to 60% (Table 5). There was no clear indication of a difference in performance of the two Oberon® formulations.

The BGM populations in the Agri-Mek® treatment were similar to the untreated check until August 5, 4 days after the treatment. The Agri-Mek® treatment gave inconsistent control of BGM populations (49 and 91% control on August 5 and 30, respectively, but control was 0% on August 12 (Table 2)). The season-total BGM control was only 21% (Table 2), but this treatment seemed to impact the late-season TSM populations (42 to 55% control 21 to 46 days after treatment (Table 4)). The season-total control for both spider mites was 52% (Table 5). The 8-oz rate of Agri-Mek® used here did not work as well as the 16-oz rate used in 2003, but the 16-oz rate is estimated to cost $64 an acre.

The two rates of Zeal® gave fair to excellent BGM control, 28 to 88% 7 to 21 DAT (Table 2). The season total BGM control was 46 to 51% (Table 2),

Table 4. Percentage of control of twospotted spider mites in plots treated with miticides*, Southwest Research-Extension Center, Garden City, Kansas, 2005.

No.	Treatment	Rate	Percentage population TSM [a] Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days	Percentage control for TSM Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days	Season total
1	Check	—	6 b	48	89	—	—	—	—
2	Comite II 6EC	2.25 pt	18 ab	37	79	0	**69**	3	8
3	Onager 1E	6 oz	**43 a**	46	97	**68**	27	0	1
4	Onager 1E	8 oz	**48 a**	64	95	30	**72**	26	28
5	Onager 1E	12 oz	**45 a**	57	87	0	56	15	19
6	AgriMek 0.15 EC	8 oz	6 b	32	88	53	55	42	41
7	Oberon 240EC	8.5 oz	31 ab	35	93	59	52	0	1
8	Oberon 480EC	4.25 oz	23 ab	32	85	7	56	39	40
9	Zeal	0.66 oz	21 ab	42	90	10	44	12	12
10	Zeal	1.0 oz	23 ab	52	89	0	**68**	29	31
	F-test P value		0.0832	0.5697	0.4082	—	—	—	—

*Treatments made July 15, 2005, when the corn was just starting to tassel.
[a] Means followed by the same letter are not significantly different (P < 0.05, LSD)

but these treatments seemed to have less impact on the late-season TSM, with season-total control of 12 to 31% (Table 4). The season-total control for both spider mites was only 33 to 53% (Table 5). There was no clear indication of a rate response among the two rates of Zeal® tested.

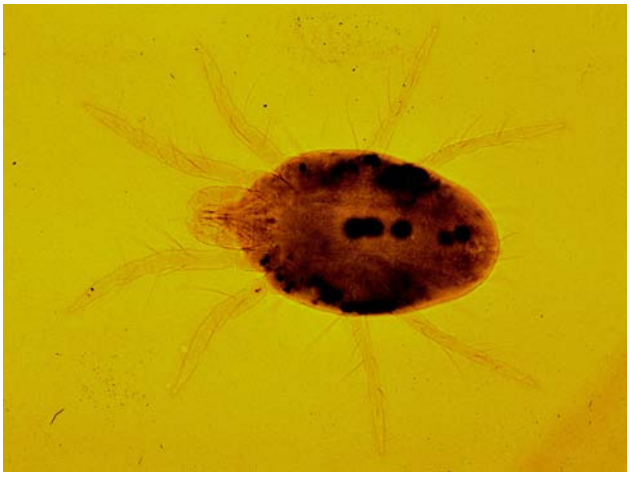
During the early part of the season, July 14 and August 5, predator mite populations were low, 0.35 to 0.9 per 2 plants, because spider mite populations were also low, <50 mites per plant (Tables 1 and 3). In late August, however, when the mite populations increased from <50 to >1190 mites per 2 plants, the predator mite populations increased from 0.9 to 116.3 mites per 2 plants. (Table 5). This was the only predator population that seemed to increase as spider mite populations increased. The late-season predator mite numbers were not significantly different across the miticide treatments (Table 5). Thrips populations, *Frankliniella* spp., decreased from 3.0 to 0.9 per 2 plants during the sampling period. They were sampled during the post-tassel period, when thrips numbers are usually smaller than they are during the early to mid-whorl stages. In the past, these thrips seemed to be important early-season facultative predators of spider mites. The spider mite populations generally increase rapidly during the corn reproductive stage, when the thrips populations are low. Sixspotted thrips, *Scolothrip* spp., were present, but populations were low during the sampling period, 0.06 to 0.25 thrips per 2 plants. These thrips are reported to be important predators of the spider mites, but we have recorded them only infrequently. Predator populations were too low early in the season, when treatments were applied, to determine if there were differences in their responses to the miticide treatments.

Although there were some significant differences in yields among treatments, and the coefficient of variation (CV) was only 7.9%, interpretation is difficult. The highest yields were in the Oberon® 480EC and 8 oz. Onager® 1E treatments, which had the highest season-total percentage of control, but they were not significantly different from the untreated check. The treatments were good enough to protect enough yield to be clearly identified in this trial.

Table 5. Numbers of predator mites, season-total numbers of spider mites, and grain yield for plots treated with miticides*, Southwest Research-Extension Center, Garden City, Kansas, 2005.

No.	Treatment	Rate	Predator mites/4 half-plants [a] Aug. 5 21 days	Aug. 12 28 days	Aug. 30 46 days	Spider mites /4 half-plants [a] Season totals BGM	TSM	Sum	% Control	Grain yield [a] bu/acre
1	Check	—	1.5	9.8	109	434 a	756	1190		162.2 ab
2	Comite II 6EC	2.25 pt	2.0	9.3	152	295 ab	699	994	20	166.2 ab
3	Onager 1E	6 oz	0.5	20.5	158	118 cd	749	867	32	155.8 b
4	Onager 1E	8 oz	1.5	2.3	159	77 d	542	619	57	174.6 a
5	Onager 1E	12 oz	0.8	13.0	119	172 bcd	615	787	41	169.8 ab
6 [b]	AgriMek 0.15 EC	8 oz	0.3	6.3	67	232 abc	444	674	52	154.5 b
7	Oberon 240EC	8.5 oz	0.0	18.3	119	130 cd	749	880	31	164.8 ab
8	Oberon 480EC	4.25 oz	1.5	2.8	107	146 bcd	452	597	60	178.6 a
9	Zeal	0.66 oz	0.5	4.8	75	199 bc	663	862	33	175.2 a
10	Zeal	1.0 oz	0.5	6.0	100	142 bcd	519	661	53	155.6 b
	F-test P value		0.0787	0.1102	0.6397	0.0139	0.8682	—	—	0.0430

[a] Means followed by the same letter are not significantly different (P < 0.05, LSD)
[b] Treatment 6 was not applied until August 1, so it was a Check until the August 5 sample.



BGM female.

BGM male.

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