

Chemical Control/New Products

CONTROL OF SPIDER MITES IN APPLE AND TART CHERRY WITH ACARICIDES

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Abstract: The efficacy of Acramite (bifenazate) was compared with Pyramite (pyridaben) and Agri-Mek (abamectin) for control of twospotted and European red mite in apple and tart cherry. The toxicity of the acaricides to two predaceous mites, *Galendromus occidentalis* and *Zetzellia mali*, was also evaluated. Treatments were applied on 19 July to single-tree replicates with a handgun sprayer (400 gpa). Spider mite densities were reduced by all acaricides as compared to untreated trees on 7 and 14 days after treatment (DAT). However, spider mite densities in all acaricide treatments rebounded by 21 or 22 DAT, and cumulative mite days for the 42-day study period were not different among treatments, with the exception of lower mite days in Pyramite than untreated trees in the apple study. Pyramite was more effective in reducing densities of European red mite than twospotted spider mite. All acaricide treatments initially lowered predaceous mite densities (7-14 DAT) below those in untreated trees, but predator populations generally recovered and were no different than in untreated trees by 21 or 22 DAT.

Materials and Methods

Both trials were conducted at the Utah State University research farm in Kaysville, UT, during July and August 2001. Treatments were applied on July 19, 2001. Miticides were applied to drip with a multi-tank sprayer and handgun at 80 psi and a rate of 400 gpa.

Apples

Single-tree plots were placed in two rows of an approximately 1-acre 'Liberty' apple orchard. The experimental design was a randomized complete block with five treatments and four replications (20 plots). Tree spacing was 12 ft x 23 ft. The insecticide Provado (imidacloprid) was applied to all trees on August 2 (14 days after treatment (DAT)) for control of green apple aphid.

Treatments:

1. Untreated
2. Acramite 50W @ 0.75 lb/acre + Silwett L-77 @ 1.2 ml/gal
3. Acramite 50W @ 1.0 lb/acre + Silwett L-77 @ 1.2 ml/gal
4. Pyramite 60W @ 10 oz/acre + Silwett L-77 @ 1.2 ml/gal
5. Agri-Mek 0.15EC @ 16 oz/acre +0.25% horticultural oil

Cherries

Single-tree plots were placed in two rows of a 2.2 acre 'Montmorency' tart cherry orchard. The experimental design was a randomized complete block with four treatments and four replications (16 plots). Tree spacing was 12 ft x 20 ft.

Treatments:

1. Untreated
2. Acramite 50W @ 0.75 lb/acre + Silwett L-77 @ 1.2 ml/gal
3. Acramite 50W @ 1.0 lb/acre + Silwett L-77 @ 1.2 ml/gal
4. Pyramite 60W @ 10 oz/acre + Silwett L-77 @ 1.2 ml/gal

At 0, 7, 14, 21 (22 for cherries), 28, and 42 days after treatment (DAT), 10 leaves were randomly selected from each tree, placed in paper bags and transported to the lab in a cooler with blue ice. The numbers of all life stages of twospotted spider mite, European red mite, *Galendromus occidentalis* and *Zetzellia mali* were counted and recorded per 10 leaves. Only motile life stages (adult and immature) are presented in this report due to highly variable egg populations. The mean density of motile mites per 10 leaves was determined and compared among treatments with analysis of variance (Proc GLM; SAS). Cumulative mite days (# mites X # days between sample dates) were calculated and also compared. All data were square root + 1 transformed before analysis. When significantly different, treatment means were separated using Tukey's studentized range test ($P \leq 0.05$).

Results

Twospotted spider mite (*Tetranychus urticae*) and European red mite (*Panonychus ulmi*) were the most common phytophagous mites found in study orchards. European red mite dominated in the apple study, whereas twospotted spider mite dominated in the cherry study. A few brown mites were also observed in both sites. The only predaceous mites detected were the Phytoseiid, *Galendromus occidentalis*, and the Stigmaeid, *Zetzellia mali*. *Zetzellia* specializes on preying on European red mite and rust mites while *Galendromus* is more of a generalist, although seems to prefer twospotted over European red mite. Predaceous mite densities were moderate to high in the apple study and both species were equally abundant. Predaceous mite densities were lower in the cherry study and predominated by *Galendromus*.

Apples

Spider mite densities throughout the study were well below an economic threshold of 5-10 motile stages per leaf (50-100 per 10 leaves) (Fig. 1). All miticide treatments significantly reduced motile spider mite densities below that on untreated trees on 7 and 14 DAT (Table 1 and Fig. 1). Spider mite densities rebounded on 21 DAT and were not different among treatments through 42 DAT. Cumulative mite days for the study period (July 19 – August 30) were significantly lower in the Pyramite treatment than in untreated plots, whereas the Acramite and Agri-Mek treatments were not different from untreated or Pyramite treatments (Table 3).

All miticide treatments caused a decline in predaceous mite densities by 7 DAT (Table 2 and Fig. 2), however, predator densities also declined in untreated trees from pre-treatment to 14 DAT. Predaceous mite densities were significantly less in all miticide treatments than in untreated trees on 7 DAT and again on 42 DAT (except for Pyramite) (Table 2). There was a

slight rebound in predator densities on 21 DAT in all treatments (Fig. 2). The insecticide Provado (imidacloprid) was applied to all trees on 14 DAT for control of apple aphids. There were no obvious effects of the Provado treatment on mite densities. I have observed the neonicotinoid insecticides (Provado and Calypso) increase spider mite densities following repeated applications in other studies. The increases could not be attributed to toxicity to predators but were more likely caused by stimulation of spider mite activity and reproduction (hormoligosis).

Cherries

Spider mite densities exceeded an economic threshold of 5-10 motile mites per leaf (50-100 per 10 leaves) on numerous dates during the study (Fig. 3). On 7 DAT, all miticide treatments significantly lowered spider mite densities below that in the untreated trees (Table 4 and Fig. 1), but spider mite densities began rebounding by 14 DAT. While spider mite densities remained relatively similar in untreated trees throughout the study with some fluctuations up and down, densities in all miticide treatments increased to similar or greater levels than in untreated plots on 22 and 28 DAT. On 28 DAT, densities in Pyramite trees were significantly greater than in all other treatments (Table 4 and Fig. 3). Cumulative mite days for the study period (July 19 – August 30) were much greater than in the apple trial but were not different among treatments (Table 6).

Densities of predaceous mites were generally low in all treatments throughout the study but were significantly less in all miticide treatments than in untreated trees on 7 DAT (Table 5 and Fig. 4). From 14 through 42 DAT, predator mite densities fluctuated but were similar among all treatments (Fig. 4). It appears that their densities recovered quickly but were still generally low.

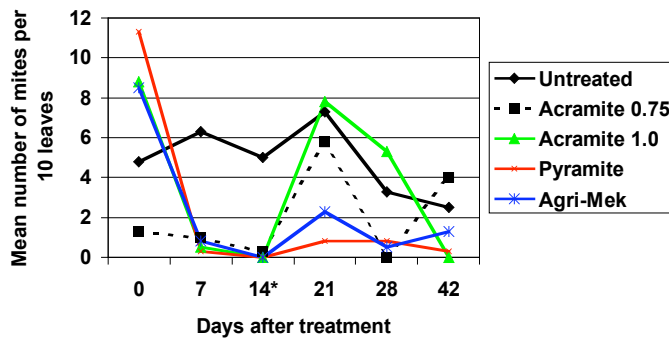
Conclusions

Spider mite densities were reduced by all miticides evaluated as compared to untreated trees for 7 to 14 DAT. Both rates of Acramite, Pyramite and Agri-Mek reduced spider mite densities to equally low levels. However, spider mite densities in all miticide treatments rebounded by 21 or 22 DAT, and cumulative mite days for the 42-day study period were not different among treatments, with the exception of lower mite days in the Pyramite treatment than in untreated trees in the apple study. The reduction in spider mite densities lasted longer in the apple trial (14 DAT) than in the cherry trial (7 DAT), most likely because initial spider mite densities were higher in the cherries. European red mite was also the predominant spider mite species in the apple trial and may be more susceptible to the miticides than twospotted spider mite.

Pyramite performed differently between the apple and cherry trials. The predominant species of spider mite present and mite densities at trial initiation likely had an effect. In the apple trial, Pyramite performed well and kept spider mite densities below a mean of one mite per 10 leaves for the entire post-treatment period. In contrast, in the cherry trial, spider mite densities in the Pyramite treatment increased after the initial knockdown at 7 DAT to over 126 mites per 10 leaves by 28 DAT.

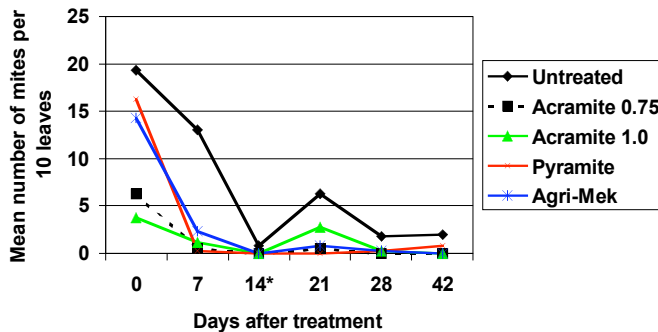
All miticide treatments initially lowered predaceous mite densities, but predator populations generally recovered and were no different than in untreated trees by 21 or 22 DAT (with the exception of lower predator densities in Acramite and Agri-Mek treatments than in untreated on 42 DAT in the apple study). There were no differences among miticides in their initial toxicity to predaceous mites or in the rate of recovery of predator populations.

Figure 1. Mean number of motile life stages of **phytophagous mites** (two spotted spider mite + European red mite) per 10 leaves at pre-treatment and 7, 14, 21, 28 and 42 days after treatment (DAT) in the Kaysville **apple** mite control trial, 2001.



*Provado (imidacloprid) applied for apple aphid control.

Figure 2. Mean number of motile life stages of **predaceous mites** (*Galendromus* + *Zetzellia*) per 10 leaves at pre-treatment and 7, 14, 21, 28 and 42 days after treatment (DAT) in the Kaysville **apple** mite control trial, 2001.



*Provado (imidacloprid) applied for apple aphid control.

Figure 3. Mean number of motile life stages of **phytophagous mites** (two spotted spider mite + European red mite) per 10 leaves at pre-treatment and 7, 14, 22, 28 and 42 days after treatment (DAT) in the Kaysville tart cherry mite control trial, 2001.

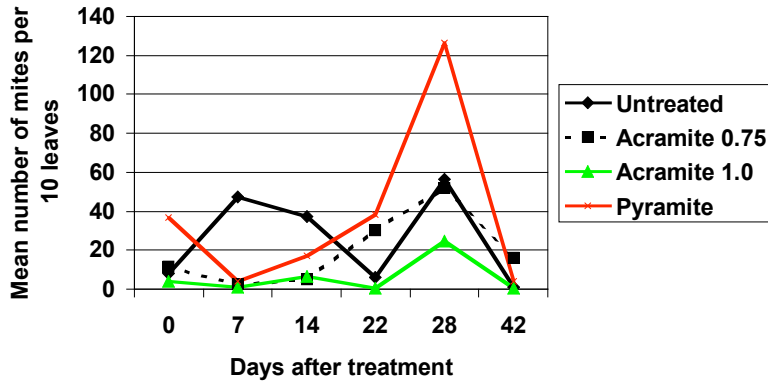


Figure 4. Mean number of motile life stages of **predaceous mites** (*Galendromus* + *Zetzellia*) per 10 leaves at pre-treatment and 7, 14, 22, 28 and 42 days after treatment (DAT) in the Kaysville tart cherry mite control trial, 2001.

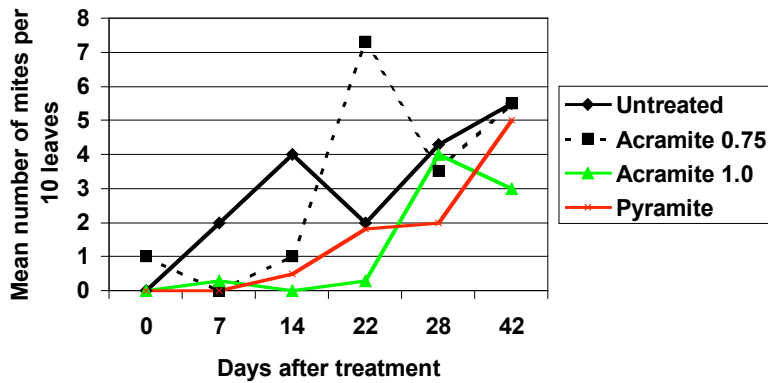


Table 1. Mean number of motile life stages of **twospotted spider mite and European red mite** per 10 leaves at pre-treatment and 7, 14, 21, 28 and 42 days after treatment (DAT) in the Kaysville **apple** mite control trial, 2001

Treatment	Pre-treatment	7 DAT	14 DAT	21 DAT	28 DAT	42 DAT
Untreated	4.8	6.3 a	5.0 a	7.3	3.3	2.5
Acramite 0.75 lb	1.3	1.0 b	0.3 b	5.8	0	4.0
Acramite 1.0 lb	8.8	0.5 b	0 b	7.8	5.3	0
Pyramite	11.3	0.3 b	0 b	0.8	0.8	0.3
Agri-Mek	8.5	0.8 b	0 b	2.3	0.5	1.3
<i>P>F</i>	0.6761*	0.0073	0.0110	0.4119	0.7269	0.1513

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.

Table 2. Mean number of motile life stages of **Galendromus and Zetzellia predaceous mites** per 10 leaves at pre-treatment and 7, 14, 21, 28 and 42 days after treatment (DAT) in the Kaysville **apple** mite control trial, 2001

Treatment	Pre-treatment	7 DAT	14 DAT	21 DAT	28 DAT	42 DAT
Untreated	19.3	13.0 a	0.8	6.3	1.8	2.0 a
Acramite 0.75 lb	6.3	0.5 b	0	0.5	0	0 b
Acramite 1.0 lb	3.8	1.2 b	0	2.8	0.3	0 b
Pyramite	16.3	0.3 b	0	0	0.3	0.8 ab
Agri-Mek	14.3	2.3 b	0	0.8	0.3	0 b
<i>P>F</i>	0.4197*	0.0075	0.0895	0.0559	0.2671	0.0075

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.

Table 3. Mean number of **cumulative mite days** for twospotted spider mite and European red mite during the experimental period (July 19-August 30, 2001)

Treatment	Cum. Mite Days
Untreated	152.3 a
Acramite 0.75 lb	105.0 ab
Acramite 1.0 lb	94.5 ab
Pyramite	15.8 b
Agri-Mek	42.0 ab
<i>P>F</i>	0.0501*

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.

Table 4. Mean number of motile life stages of **twospotted spider mite and European red mite** per 10 leaves at pre-treatment and 7, 14, 22, 28 and 42 days after treatment (DAT) in the Kaysville **tart cherry** mite control trial, 2001

Treatment	Pre-treatment	7 DAT	14 DAT	22 DAT	28 DAT	42 DAT
Untreated	8.0	47.3 a	37.5	6.0	56.3 b	1.0
Acramite 0.75 lb	11.5	2.3 b	4.8	30.3	52.0 b	16.3
Acramite 1.0 lb	3.8	0.8 b	6.5	0.3	24.8 b	0.3
Pyramite	37.0	3.8 b	17.3	38.5	126.3 a	4.0
<i>P</i> > <i>F</i>	0.4827*	0.0006	0.1408	0.1810	0.0127	0.4055

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.

Table 5. Mean number of motile life stages of *Galendromus* and *Zetzellia predaceous* mites per 10 leaves at pre-treatment and 7, 14, 22, 28 and 42 days after treatment (DAT) in the Kaysville **tart cherry** mite control trial, 2001

Treatment	Pre-treatment	7 DAT	14 DAT	22 DAT	28 DAT	42 DAT
Untreated	0	2.0 a	4.0	2.0	4.3	5.5
Acramite 0.75 lb	1.0	0 b	1.0	7.3	3.5	5.5
Acramite 1.0 lb	0	0.3 b	0	0.3	4.0	3.0
Pyramite	0	0 b	0.5	1.8	2.0	5.0
<i>P</i> > <i>F</i>	0.4363*	0.0120	0.4639	0.6525	0.7930	0.7468

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.

Table 6. Mean number of **cumulative mite days** for twospotted spider mite and European red mite during the experimental period (July 19-August 30, 2001)

Treatment	Cum. Mite Days
Untreated	992.8
Acramite 0.75 lb	830.5
Acramite 1.0 lb	204.8
Pyramite	1268.5
<i>P</i> > <i>F</i>	0.1164*

*Means were compared with Proc GLM (SAS) and separated using Tukey's studentized range test ($P \leq 0.05$). Means followed by the same letter within a column are not significantly different. Data were square root + 1 transformed before analysis.