European red mite management trial in Ohio apples, 2008

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Introduction: This trial was done to evaluate control of European red mite and survival of its natural predators under several miticide programs, in comparison with untreated plots. Nexter (pyridaben) was used as a standard, and compared with Abba (abamectin) and Apollo (clofentezine).

Materials & Methods

The trial was conducted in a block of 6-year old Scarlet Spur Red Delicious apple trees at Ohio State University's Waterman Laboratory in Columbus, Franklin County, Ohio. There were four treatments, each with four replicates in a randomized complete block design, with three adjacent trees per plot. There was a guard row of Golden Delicious, Gala, and Fuji between adjacent treatment rows. Miticides were applied on 5/30, when the first summer eggs of European red mite were beginning to hatch. Miticide products applied were Nexter 75WP at 6.6 oz/A; Abba 0.15EC at 12.8 fl oz/A plus oil 0.25%; and Apollo 1SC at 6 fl oz/A. All plots including the untreated check were treated with pyriproxyfen (Esteem 35WP, 4 oz/A) plus oil (PureSpray, 2%) at half-inch green on 4/10 for control of San Jose scale, with chlorpyrifos (Lorsban 75WG, 1.3 lb/A) at early pink on 4/18 for control of rosy apple aphid, with indoxacarb (Avaunt 30WDG, 6 oz/A) at petal-fall on 5/5 for control of plum curculio, and with phosmet (Imidan 70WP, 3 lb/A) on 5/28 for codling moth control. Insecticides and miticides were applied in a dilute volume of 150 gallons of water per acre by a handgun sprayer operated at pressure of 100 psi, with a D6 ConeTip nozzle tip. For disease control on all trees, including checks, Captan was applied on 4/10 (half-inch green), 4/18 (early pink), and 4/24 (bloom); Dithane and Nova on 5/15; Captan on 5/27, 6/10, 6/24, 7/10, and 7/25; and Topsin-M was applied on 7/14 and 7/25. Fungicides were applied by an AgTech 4002 airblast sprayer operated at pressure of 20 psi, with TeeJet 6510 and 6520 nozzle tips.

Mite populations were sampled at 7- to 14-day intervals from early May until mid-August. A sample of 25 randomly selected leaves was taken from one tree at the center of each plot. Leaves were brushed with a mite-brushing machine, and mites were counted in sub-samples to determine the average number of European red mite and predatory mites per leaf. The density of apple rust mite was rated as low (<5 mites per leaf), moderate (5 to 50 mites per leaf), or high (>50 mites per leaf) for each sample. Cumulative mite-days were calculated by plot using the number of days in the interval between counts. The threshold of cumulative mite-days was calculated from a theoretical population that remained just below standard thresholds for the duration of the sampling period. Data were subjected to analysis of variance (ANOVA) and mean comparisons by least significant difference (LSD) tests in the SAS 9.1 microcomputer statistics program.

Results & Discussion:

European red mite populations in untreated plots increased during June, peaked on 6/18, and accumulated 258 mite-days by mid-August (Table 1). The mite population increased more slowly than normal in June, most likely due to an application of oil to the entire orchard at the half-inch green stage. A heavy rain of nearly 3 inches in a 2-hour period on 6/26 is a likely reason that populations decreased in late June. All treatments including the untreated check remained below the theoretical threshold of 502 cumulative mite-days. All three miticide treatments resulted in significantly few mites than the untreated check on two dates, 6/18 and 7/2; on these dates, mite density did not differ significantly among the Abba, Apollo, and Nexter treatments (Table 1). Mite density in the Abba, Apollo, and Nexter treatments reached a peak in mid-August, but was still below the late-season threshold of 7.5 mites per leaf. Trends in density of European red mite eggs (Table 2) were similar to those of motiles (Table 1), but peak egg density was in mid-August. There was a significant difference among treatments on 6/11 and 6/18, when all three miticides resulted in fewer eggs than the untreated check (Table 2).

Stigmaeid predatory mites were present in all treatments but at lower than normal density. Stigmaeids reached peak density in late July (Table 3). There were significant differences among treatments in density of stigmaeids on five dates and in cumulative mite-days (Table 3); there were significantly more stigmaeid predator mite-days in the untreated check than in the three miticide treatments on most of these dates. Phytoseiid predatory mites were nearly absent in all treatments in May and June but present at low density in all treatments by mid-July. Phytoseiids reached peak density in early August (Table 4). There were no significant differences among treatments in density of phytoseiids on any date or in cumulative mite-days (Table 4). Apple rust mite, which is an alternate food source for predatory mites, reached peak density in July (Table 5). Apple rust mite density differed significantly among treatments on five dates but trends in which treatments were higher varied by date (Table 5). There was a trend of the lowest density of apple rust mite in the Abba treatment. No phytotoxicity was observed in any treatment. In conclusion, Abba, Apollo, and Nexter applied in late May, following a pre-bloom oil treatment, provided season-long control of European red mite without eliminating predatory mites.

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Table 1. European red mite (ERM) density on Delicious apple leaves in 2008, Columbus, Ohio.

Treatment	*Number[a] of motile ERM per leaf on 12 sampling dates*												*Cumulative Mite Days*
	5/6	*5/13*	*5/20*	*5/27*	*6/3*	*6/11*	*6/18*	*7/2*	*7/15*	*7/28*	*8/7*	*8/21*	
Abba	0.02	0.02	0.06	0.14	0.08	0.14	0.18 B	0.34 B	0.12	0.82	1.14	2.08	49
Apollo	0.08	0.12	0.08	0.06	0.28	0.16	0.08 B	0.16 B	0.02	0.28	1.41	3.08	50
Nexter	0.02	0.04	0.02	0.24	0.04	0.00	0.04 B	0.02 B	0.08	1.04	2.40	2.78	64
untreated	0.10	0.04	0.06	0.34	1.30	1.50	9.10 A	4.68 A	0.16	2.40	2.16	2.74	258
P	*0.29*	*0.42*	*0.76*	*0.30*	*0.11*	*0.07*	*0.034*	*0.05*	*0.11*	*0.32*	*0.74*	*0.83*	*0.09*

[a] Within each column, means followed by the same letter are not significantly different (*P*>0.05), by LSD.

Table 2. European red mite (ERM) egg density on Delicious apple leaves in 2008, Columbus, Ohio.

Treatment	*Number[a] of ERM eggs per leaf on 12 sampling dates*											
	5/6	*5/13*	*5/20*	*5/27*	*6/3*	*6/11*	*6/18*	*7/2*	*7/15*	*7/28*	*8/7*	*8/21*
Abba	0.00	0.06	0.24	0.38	0.00	0.54 B	0.04 B	0.14	0.10	0.10	1.9	5.4
Apollo	0.02	0.08	0.58	0.40	0.26	0.54 B	0.32 B	0.72	0.16	0.10	2.3	15.3
Nexter	0.00	0.08	0.10	0.54	0.16	0.02 B	0.02 B	0.08	0.02	0.54	3.5	12.4
untreated	0.00	0.42	0.68	1.72	1.00	5.76 A	5.21 A	3.26	0.34	0.60	5.2	14.7
P	*0.44*	*0.07*	*0.30*	*0.23*	*0.06*	*0.026*	*0.05*	*0.12*	*0.22*	*0.14*	*0.65*	*0.43*

[a] Within each column, means followed by the same letter are not significantly different (*P*>0.05), by LSD.

Table 3. Stigmaeid predatory mite density on Delicious apple leaves in 2008, Columbus, Ohio.

Treatment	*Number[a] of motile stigmaeids per leaf on 12 sampling dates*												*Cumulative Mite Days*
	5/6	*5/13*	*5/20*	*5/27*	*6/3*	*6/11*	*6/18*	*7/2*	*7/15*	*7/28*	*8/7*	*8/21*	
Abba	0.02	0.02	0.00	0.00 B	0.00	0.00	0.00	0.00 B	0.02 B	0.10	0.10 AB	0.06 B	3.2 B
Apollo	0.08	0.00	0.00	0.02 AB	0.00	0.00	0.00	0.02 B	0.04 B	0.08	0.02 B	0.06 B	2.8 B
Nexter	0.00	0.02	0.00	0.00 B	0.00	0.00	0.00	0.00 B	0.04 B	0.02	0.00 B	0.08 B	1.5 B
untreated	0.02	0.00	0.00	0.06 A	0.00	0.04	0.06	0.26 A	0.58 A	0.22	0.20 A	0.34 A	19.7 A
P	*0.13*	*0.63*	*-*	*0.03*	*-*	*0.09*	*0.13*	*0.006*	*0.002*	*0.13*	*0.040*	*0.004*	*<0.0001*

[a] Within each column, means followed by the same letter are not significantly different (*P*>0.05), by LSD.

Table 4. Phytoseiid predatory mite density on Delicious apple leaves in 2008, Columbus, Ohio.

Treatment	*Number[a] of motile phytoseiids per leaf on 12 sampling dates*												*Cumulative Mite Days*
	5/6	*5/13*	*5/20*	*5/27*	*6/3*	*6/11*	*6/18*	*7/2*	*7/15*	*7/28*	*8/7*	*8/21*	
Abba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.2
Apollo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.08	0.04	1.5
Nexter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	0.10	2.8
untreated	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.04	0.10	0.06	3.2
P	*0.44*	-	-	-	-	-	-	*0.44*	*0.28*	*0.62*	*0.44*	*0.36*	*0.12*

[a] Within each column, means followed by the same letter are not significantly different (*P*>0.05), by LSD.

Table 5. Apple rust mite density rating on Delicious apple leaves in 2008, Columbus, Ohio.

Treatment	*Apple rust mite ratings[a,b] on 12 sampling dates*											
	5/6	*5/13*	*5/20*	*5/27*	*6/3*	*6/11*	*6/18*	*7/2*	*7/15*	*7/28*	*8/7*	*8/21*
Abba	0.0	0.0	0.2	0.2	0.0 B	0.0 B	0.0	0.5 B	0.2	0.2 B	0.0 B	0.2
Apollo	0.0	0.0	0.2	0.2	0.0 B	0.0 B	0.0	0.2 B	0.0	1.2 A	0.0 B	0.2
Nexter	0.0	0.0	0.2	0.2	0.8 A	0.0 B	0.0	0.5 B	0.0	2.0 A	0.8 A	0.5
untreated	0.0	0.0	0.2	0.2	0.0 B	0.8 A	0.5	2.2 A	0.5	1.5 A	0.2 AB	0.2
P	-	-	*1.0*	*1.0*	*0.004*	*0.004*	*0.09*	*0.004*	*0.33*	*0.004*	*0.034*	*0.44*

[a] Density rating scale: 0 = none; 1 = low (<5 per leaf); 2 = moderate (5 to 50 per leaf); 3 = high (>50 per leaf).

[b] Within each column, means followed by the same letter are not significantly different (*P*>0.05), by LSD.