Effects of Multiple Pyrethroid Insecticide Applications on Secondary Mite Outbreaks

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Pyrethroid insecticides are known to cause or contribute to mite problems in certain situations. Our results showed that flaring of mite populations by Asana was greatly dependent upon the degree of early-season mite control. Asana and Guthion applications suppressed *Typhlodromus pyri* in some trials, but this effect alone did not cause significant flaring - suggesting that other factors contribute to the phenomena.

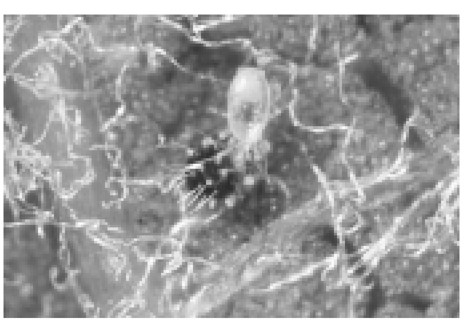
Organophosphate(OP) insecticides have long been essential to northeastern apple growers for the management of many insects, primarily for plum curculio and apple maggot. Because these two pests oviposit directly into the fruit, protection by insecticides is provided by toxicity to the adult prior to or during oviposition. The OP's have been well suited and popular for this purpose because they generally act quickly, yet have good persistence, and are effective against both Coleoptera and Diptera. Implementation of the Food Quality Protection Act (FQPA), and the resulting restrictions on OP usage, has affected apple pest management programs in the Northeast. At the onset of the FQPA, we were concerned that all OP usage would be eliminated, and therefore thought it likely that this pest control void would be filled by pyrethroids. For the purposes of this research, we chose the worst-case hypothesis that all OP uses would be revoked.

It is commonly thought that because of detrimental effects on phytosied predators, applications of pyrethroid insecticides contribute to secondary outbreaks of European red mite (ERM), *Panonychus ulmi* (Koch) and to two-spotted mite (TSM), *Tetranychus urticae* Koch. It was undetermined however, the extent to which such outbreaks might be mediated by the residues of three currently registered efficacious miticides, ie. Apollo, Savey and AgriMek. Within the context of a larger project, one of our objectives was to assess the relationship of multiple pyrethroid applications to secondary mite outbreaks.

Within three commercial orchards (one each in Eastern NY[ENY] and two each in Western NY[WNY]) during 1998 and 1999, we established the following treatments in a split-plot design to assess the relationships among miticides, multiple Asana and Guthion sprays and the seasonal buildup of phytophagous mites:

1) prebloom Apollo + multiple Guthion
2) prebloom Apollo + multiple Asana
3) petal fall AgriMek + multiple Guthion
4) petal fall AgriMek + multiple Asana
5) either no miticide or prebloom oil + multiple Asana
6) either no miticide or prebloom oil + multiple Guthion
7) various untreated situations

Treatments were replicated 4 times. Insecticide applications started at petal fall and continued as regular covers through the apple maggot oviposition period (≈Aug 15). Prebloom and petal fall miticide treatments were prophylactic; summer miticide treatments, where necessary, were applied at the NY IPM threshold. Phytophagous and predacious (*Typhlodromus pyri*) mite populations were assessed by standard methodology. Cumulative mite days per leaf (CMD's) were calculated by: $[0.5(mpl_1 + mpl_2]*d_{1-2}$, where mpl_1 is the number of mites per leaf at time 1, mpl_2 is the number of mites per leaf at time 2, and



A *T. pyri* predator mite attacking a European red mite.

Twospotted spider mite, a sporadic but potentially serious pest in New York orchards.

d_{1-2} is the number of days elapsed between the two counts. Simply described, the CMD model utilizes frequent assessment of mite numbers to measure the accumulative effects over time, rather than at a single point in time. For the purposes of these experiments, treatments allowing greater than 100 CMD's are considered to be poor from the perspective of mite management.

1998 Experiments

Western NY: Identical trials were performed in two commercial orchards. Moderate to high mite (ERM) populations were present at these sites. These trials included oil treatments applied at the same timing as Apollo (tight cluster). Pyramite alone was applied at IPM threshold and is considered as the untreated control. Results of these experiments, which are presented in Table 1, show the following:

- In the untreated plots at both sites, ERM populations developed early and Pyramite rescue treatments were necessary before the trial ended.
- In the tight cluster oil treatment at both sites, populations exceeded threshold by mid-June, regardless of the insecticide used.
- At both sites, the tight cluster Apollo treatments yielded very acceptable CMD's regardless of the insecticide used.
- Between sites, AgriMek applied at petal fall provided inconsistent results – Asana yielded high CMD's at site #1; while conversely, Guthion yielded high CMD's at site #2.

Eastern NY: Low mite populations (ERM+ TSM) were present at this site. Leaf condition was compromised by severe apple scab infections. Results of this experiment, which are also presented in Table 1, show the following:

- Significant flaring of mites did not occur regardless of the miticide used or the insecticide schedule.
- Based on CMD's, the Asana schedules tended to produce more mites, but in no instance did the effects approach seriousness.

1999 Experiments

Western NY: Identical trials were performed in two commercial orchards, representing two distinct mite (ERM) pressure situations. Results of these experiments, which are presented in Table 2, show the following:

- Infestation pressure at site #1was initially low and all miticides, regardless of seasonal insecticide program, allowed low CMD's throughout the season.
- By early July however, populations at site #1 were significantly over threshold in both tight cluster oil treatments, regardless of insecticide used.
- Infestation pressure was considerably higher at site #2. Both tight cluster oil treatments needed rescue miticide applications after the trial was concluded.
- Within the tight cluster Apollo treatments, rescue treatments were required regardless of the seasonal insecticide schedule employed.
- AgriMek treatments maintained ERM well below threshold for the entire season, regardless of the seasonal insecticide schedule employed.
- Generally, Asana reduced *T. pyri* predator numbers to a greater extent than did Guthion. Relative to the untreated trees however, all treatment combinations reduced *T. pyri* CMD's.

Eastern NY: High mite (ERM+TSM) populations were present at this site. Results of this experiment, which are presented in Table 2, show the following:

- Treatments that utilized Asana or Guthion but no miticide, yielded very high CMD's, without an apparent relationship to the insecticide used.
- Similar to WNY-site #2, tight cluster Apollo applications allowed high CMD's, with no relationship to the insecticide used.
- AgriMek allowed very low CMD's, regardless of the seasonal insecticide

TABLE 1

Effects seasonal insecticide applications on phytophagous mite pests of apple in Western and Eastern New York orchards, 1998.

Treatment	Miticide timing	Cumulative mite days per leaf WNY[1]site 1	WNY[1]site 2	ENY[2]
Oil + Guthion	TC	176.3[a]	247.5[b]	-
Oil + Asana	TC	164.9[a]	181.1[b]	-
Apollo + Guthion	TC	34.9	39.9	18.3
Apollo + Asana	TC	47.9[a]	23.3	49.8
AgriMek + Guthion	PF	38.1	132.0	58.7
AgriMek + Asana	PF	125.4	28.5	72.2
Pyramite check		291.9[a]	283.5[c]	-
No miticide + Guthion	-	-	-	93.3
No miticide +Asana	-	-	-	34.6

[1] ERM only; Guthion applied 5 times, starting at PF; Asana applied 6 times, starting at pink. Numbers in bold represent a significant degree of flaring of mite populations by Asana.
[2] ERM + TSM; Guthion applied 4 times, starting at PF; Asana applied 5 times, starting at pink. Note: severe apple scab infection affected leaf quality and subsequent mite infestations.
[a] Rescue treatments applied after data completed.
[b] Rescue treatments applied on 1 July before data completed.
[c] Rescue treatment applied 10 June before data completed.

TABLE 2

Effects seasonal insecticide applications on phytophagous mite pests of apple and a predator in Western and Eastern New York orchards, 1999.

		Cumulative mite days per leaf				
	Miticide	WNY[2] site 1		WNY[2] site 2		ENY[3]
Treatment[1]	timing	pest	predators	pest	predators	pest
Oil + Guthion[4]	TC	61[6/28]	1.3	104[6/28]	3.6	398[7/22]
Oil + Asana[4]	TC	131[7/13]	0.7	327[8/6]	3.7	277[7/22]
Apollo + Guthion	TC	25	4.3	171[8/15]	4.7	342
Apollo + Asana	TC	51	1.4	358[8/15]	1.5	313
AgriMek + Guthion	PF	4	4.2	42	1.6	88
AgriMek + Asana	PF	6	1	3	2.3	54
Untreated	-	26	12.6	386	10.4	473

[1] At all locations, Guthion applied 5 times, starting at PF; Asana applied 6 times, starting at pink.
[2] ERM only; predator primarily *Typhlodromus pyri.* Numbers in bold represent a significant degree of flaring of mite populations by Asana. Dates in brackets are threshold or rescue treatments with Pyramite.
[3] ERM + TSM; dates in brackets are threshold or rescue treatments with Pyramite.
[4] Dormant oil applications in WNY only; ENY received insecticide only.

schedule employed.

Our results show that either Asana or Guthion can cause flaring of mite populations. Within only four of twenty-one total paired comparisons (19 percent) between Asana and Guthion did the pyrethroid promote higher mite populations. Moreover, if effective and persistent miticides (AgriMek in particular) were employed against early-season mite populations, CMD's were not exacerbated by the use of either insecticide. It was apparent that flaring of mites was more likely to happen with either insecticide when early-season mite populations were high, or were not adequately controlled by an early miticide application. Our evidence suggests that Asana could be substituted for an OP without causing outbreaks of phytophagous mites, provided that current (and future miticides) remain efficacious and are applied early in the season. Analyses of predatory mite populations within Asana and Guthion treatment scenarios showed that both insecticides had suppressive effects on *T. pyri* , but this effect alone did not cause significant flaring of phytophagous mites.

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