Arthropod Management Tests, 2015, 1–3
doi: 10.1093/amt/tsv002
(A2)

APPLE: *Malus domestica* Borkhausen "Empire," "Cortland," "Jonagold," and "Delicious"

Evaluation of Seasonal Insecticide Programs Against New York Apple Pests, 2014*

A. Agnello[1] and D. Combs

Department of Entomology, Cornell University, New York State Agricultural Experiment Station, 630 West North Street, Geneva, NY 14456, Phone: (315) 787-2341, Fax: (315) 788-2326 (ama4@cornell.edu; dbc10@cornell.edu) and [1]Corresponding author, e-mail: ama4@cornell.edu

Subject Editor: Elizabeth H. Beers

Oriental fruit moth (OFM): *Grapholita molesta* (Busck)

Lesser appleworm (LAW): *Grapholita prunivora* (Walsh)

Codling moth (CM): *Cydia pomonella* (L.)

Internal fruit-feeding Lepidoptera (IL): OFM, LAW, CM

Obliquebanded leafroller (OBLR): *Choristoneura rosaceana* (Harris)

Plum curculio (PC): *Conotrachelus nenuphar* (Herbst)

Apple maggot (AM): *Rhagoletis pomonella* (Walsh)

Tarnished plant bug (TPB): *Lygus lineolaris* (Palisot de Beauvois)

San Jose scale (SJS): *Quadraspidiotus perniciosus* (Comstock)

The objective of this test was to determine the effectiveness of seasonal spray programs against a variety of apple pests in a research orchard located at the NYS Agricultural Experiment Station in Geneva, NY. Cultivars in the block were "Empire," "Cortland," "Jonagold," and "Delicious." Treatments, including an untreated check, were replicated three or four times in four-tree blocks arranged in an RCB design. Treatments were applied at various rates and timings from bud stage "tight cluster" (6 May), "pink" (13 May), or "petal fall" (27 May) and then approximately every 14 d depending on weather conditions until 19 August (Table 1). Seasonal insecticide programs were applied with a Durand-Wayland airblast sprayer at 100 gpa. Damage was assessed from foliage or fruit on the tree for OBLR on 19 June and 11 July. Feeding damage from the IL complex of CM, OFM, and LAW was assessed on 27 June, 11 July, and 29 July. PC oviposition scars were assessed on 27 June. Damage from SJS fruit injury was assessed on 27 June and 29 July. Harvest fruit damage samples were taken from 9 September to 14 September, and all data were transformed and subjected to analysis of variance. Means were separated with Student's *t*-test.

Fruit and foliar damage from OBLR was quite low during the 2014 growing season (Table 2). Harvest readings in previous years indicate that small populations are consistently present but rarely exceeded 3.0% fruit injury at harvest. The 2014 harvest data from the untreated check plot indicate that this pest is becoming better established in the test orchard. While most of the treatments were significantly lower in damage compared to the check, those treatments also did not target the summer generation. Applications had either stopped or materials were being used that have little effect on OBLR. Feeding damage from IL also seemed to be below average from the previous years. However, the untreated check plot shows an increase throughout the season, indicating that all treatments were providing some level of control for these sample dates (Table 2). Harvest evaluations suggested that pests were still quite abundant, and all treatments had a significant effect on controlling these pests (Table 3). Some of these treatments were specifically timed for IL, having had no other insecticides applied after second cover. Specific spray timings against these pests were pink, petal fall, first, and second cover. Altacor 35WG was applied as a comparison to two rates of Cyclaniliprole 50SL at IL timings, and there were not any significant differences among these treatments. SJS has become the dominant insect in the test orchard. Populations have reduced tree vigor and growth due to excessive numbers where tree girdling is being observed. Well-timed sprays as crawlers are emerging from

* This research was supported, in part, by industry gift(s) of pesticides and research funding from ISK Biosciences, JMS Flower Farms, Bayer CropScience, Gowan Co., Dow AgroSciences, United Phosphorus Inc., and E.I. DuPont de Nemours and Co.

Table 1.

Trt	Material/ formulation	Rate amt/acre	Application timing	Tight cluster	Pink	Petal fall	1C	2C	3C	4C	5C	6C
1	Sivanto EC+	14.0 oz	Tight cluster	6 May								
	oil	32.0 oz										
	Imidan 70WP	3.0 lbs	Petal fall		27 May							
	Belt 4SC	3.0 oz	Petal fall			27 May						
	Belt 4SC	5.0 oz	1C, 2C				10 June	26 June				
	Movento 2SC+	6.0 oz	2C					26 June				
	LI-700	32.0 oz										
	Imidan 70WP	3.0 lbs	3C						9 July			
	Admire Pro SC	2.8 oz	3C						9 July			
	Assail WP	8.0 oz	4C, 5C							22 July	6 Aug	
	Leverage 360	2.8 oz	6C									19 Aug
2	Cyclaniliprole 50SL	16.4 oz	Pink, petal fall, 1C, 2C		13 May	27 May	10 June	26 June				
	Movento 2SC+	6.0 oz	Petal fall			27 May						
	LI-700											
3	Cyclaniliprole 50SL	22.0 oz	Pink, petal fall, 1C, 2C		13 May	27 May	10 June	26 June				
	Movento 2SC+	6.0 oz	Petal fall			27 May						
	LI-700											
4	Altacor 35WG	4.0 oz	Pink, petal fall, 1C, 2C		13 May	27 May	10 June	26 June				
	Movento 2SC+	6.0 oz	Petal fall			27 May						
	LI-700											
5	Imidan 70WP	3.0 lb	Petal fall thru 6C			27 May	10 June	26 June	9 July	22 July	6 Aug	19 Aug
6	Check	—										

Table 2.

	OBLR	% Fruit damage						
	% Terminal dam.	OBLR	IL			SJS		PC
Trt.	19 June	11 July	27 June	11 July	29 July	27 June	29 July	27 June
1	1.0a	0.7a	0.0a	0.0b	0.0b	0.0b	2.7c	1.0a
2	0.7a	0.7a	0.0a	0.3ab	0.0b	0.0b	1.0c	0.0a
3	0.3a	0.0b	0.0a	0.0b	0.3b	1.7ab	7.7abc	0.0a
4	0.3a	0.0b	0.0a	1.3ab	0.7b	2.3ab	5.3bc	2.0a
5	0.7a	0.0b	10.3a	0.0b	0.0b	1.7ab	8.0abc	0.0a
6	0.7a	0.3ab	1.7a	1.7a	6.3a	10.0a	34.7a	0.0a

Means within a column followed by the same letter are not significantly different (Student's *t*-test, $P \leq 0.05$). Data were transformed arcsine (Sqrt *x*) prior to analysis.

Table 3.

Treatment	% OBLR (summer gen.)	% Internal Lepidoptera	% SJS	% PC	% AM	% TPB	% Clean fruit
1	3.0bcd	1.7cd	2.0c	1.3ab	0.7bc	5.0ab	85.3a
2	5.0bc	11.7b	1.7c	0.3ab	1.3ab	7.0a	72.7abc
3	3.0bcd	4.3bc	3.0c	0.0b	0.7bc	5.7ab	82.3a
4	3.7bcd	6.7b	8.3c	2.3a	1.3ab	3.0ab	73.7abc
5	5.7ab	2.3cd	15.3bc	0.0b	0.3bc	2.0b	77.3ab
6	12.0a	48.7a	60.7a	0.3ab	3.3a	4.0ab	7.7d

Means within a column followed by the same letter are not significantly different (Student's *t*-test, $P \leq 0.05$). Data were transformed arcsine (Sqrt *x*) prior to analysis.

both the first and second generations have proven effective against this pest (Table 2). Movento 240SC exhibited excellent control against SJS. Treatments 1–4 all received an application at either petal fall or second cover causing a significant reduction in damage from the untreated check plot. Regardless of timing, there are no significant differences at harvest among those treatments that received a Movento 240SC application (Table 3). PC populations in the test orchard have been sporadic, making it difficult to rate their effectiveness against this pest (Tables 2 and 3). Several treatments did not receive any insecticides after second cover, so in those cases, control of AM is not likely to have been affected. Those treatments that did receive late season applications controlled AM significantly better than in the untreated control (Table 3). TPB damage was observed in all the treatments. The tight cluster application of Sivanto EC + oil did not control this pest. Imidan 70WP (season-long program, Treatment 5) was the only treatment that had significantly lower damage than the untreated control plot. Treatment 1 also had Imidan 70WP applied at petal fall, at time when TPB are active; however, it did not control this pest. Several factors may contribute to this, including spatial variability of this pest in the test orchard, and the single application of this material. Phytotoxicity was not observed in any of the treated plots.