Implementation

Reduced-risk pest management programs for MI apple, year 1

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Abstract: The goal of this 4-year Risk Avoidance Mitigation Program (RAMP) is to design and evaluate pest management systems utilizing reduced-risk tactics that are effective, sustainable, economically viable, and lead to enhanced biological control for eastern apple growers. The overall experimental design was a direct comparison of the effectiveness of an organophosphate-free (RAMP) vs. OP-based grower standard pest management program. OP-free programs relied on IGRs, neonicotinoids, oxadiazines, naturalytes, biopesticides, and pheromone based mating disruption. Grower standard programs relied on OPs, carbamates, and pyrethroids as well as some new chemistries. Pheromone mating disruption was excluded from all grower standard programs. Each program was evaluated in 10-20 acre apple blocks in three regions of MI and replicated on three farms within each region. Pest management programs without OPs were 2-3x more expensive than OP standard programs. Fruit injury at harvest caused by codling moth, obliquebanded leafroller and oriental fruitmoth varied in these two programs. Some of the most promising results were obtained in trials evaluating apple maggot and plum curculio control.

Materials and Methods

The overall experimental design was a direct comparison of the effectiveness of an organophosphate-free vs. OP-based grower standard pest management program. Commercial orchards 10-20 acres were managed under the soft vs. standard pest management regime. OP-free programs relied on IGRs, neonicotinoids, oxadiazines, naturalytes, biopesticides, and pheromone mating disruption. Grower standard programs relied on OPs, carbamates, and pyrethroids. Pheromone mating disruption was excluded from all grower standard programs. Each program was evaluated in three regions of MI and replicated on three farms within each region.

Capture of males in pheromone traps, larval densities and levels of fruit injury were used to evaluate the effectiveness of Lepidopteran pest control in test plots. Pheromone traps (2 to 4/species/program block) for OFM, CM, RBLR and OBLR were placed and monitored weekly to assess adult activity. OFM larval densities were estimated by inspecting new shoots on 20 trees for signs of larval feeding twice per season. CM control was evaluated by sampling 600 fruit for injury. LR densities were estimated by inspecting new shoots for signs of larval feeding and the presence of larvae. Twenty shoots on each of 20 trees were examined during peak periods of overwintering and summer generation larval activity. Fruit was evaluated for injury from all fruit feeding pests by collecting and examining 30 fruit per tree on 20 trees within a program block at mid-season and harvest to measure efficacy of each treatment. Pesticide use records were collected and evaluated for each site.

Circle traps baited with fruit essence and grandisoic acid were placed along orchard perimeters adjacent to woodlots to monitor for plum curculio activity. Apple maggot activity was measured using yellow sticky-panel traps and red-ball traps baited with fruit essence. AM traps were distributed along orchard borders and in the orchard interior. Traps were monitored weekly.

Indirect pests including white apple and potato leafhoppers; green, spirea, rosey, and woolly apple aphids; spotted tentiform leafminer, and European, twospotted spider, and rust mites were monitored throughout the season to measure pest densities. Presence of beneficial insects was also measured, including ladybird beetles; syrphid, tachinid and cecidomyiid flies; predacious mites; lacewings, and various wasp parasites.

Results

Fruit injury caused by codling moth, obliquebanded leafroller and oriental fruitmoth was detected in at least one location for each program. Codling moth management was the greatest challenge during the first year of this program. The number of CM males captured at peak activity in the sites with the highest pressure averaged 35 moths per week (Fig. 1). Where CM populations were high, the RAMP programs sustained fruit injury exceeding 8%. However, under moderate to low populations the combination of MD and soft chemistries performed as well as or better than the conventional programs. In comparison, OBLR control was achievable as there are more effective tools targeting leafrollers, including Spintor, Intrepid, and MD. Fruit injury sustained by OBLR was lower in most of the RAMP blocks with an average of less than 0.5%. In contrast, several conventionally managed blocks had greater than 2% injury, with one exceeding 6% (Table 1).

Some of the most promising results were obtained in trials evaluating apple maggot control. Large numbers of AM were captured using the red-ball traps baited with fruit essence, and activity was recorded from mid-July into harvest (Fig. 2). We anticipated that two neonicotinoids (Actara and Assail), when used for control of CM and other pests, would also provide control of AM flies. Indeed, the use of this strategy in RAMP blocks appeared to be an effective approach for preventing AM fruit damage.

Few differences between RAMP and non-RAMP blocks were detected during the first year when assessing populations of indirect pests and beneficial insects. Two exceptions included greater numbers of woolly apple aphids and ladybird beetles in RAMP programs.

The success of the RAMP programs cannot be measured in one year. In some cases, the RAMP pest management programs without OPs were 2-3x more expensive than OP standard programs. Injury to fruit varied but was the same or lower in many of the RAMP sites. Adopting softer pest management programs in apple is an information intensive and dynamic process. It is hoped that successes will be easier to achieve and made cost effective as the project unfolds over the next 3 years.

Table 1. Larval densities and injury to fruit in soft vs. conventionally managed orchards, MI, 2002

		% Foliage Injury				% Fruit Injury			
		1st Gen.		2nd Gen.		Midseason		Pre-harvest	
Location	Treatment	OFM	LRs	OFM	LRs	Internal	External	Internal	External
Ridge 1	RAMP	0	0	0	2.1	0.9	0.5	8.7	1
Ridge 1	COMP	0	0	0	1.4	0	0	3.5	2.7
Ridge 2	RAMP	0	0.5	0	1.7	0.7	0	8.1	0.8
Ridge 2	COMP	0	1.3	0	1	0.4	0	0.5	0.5
Belding	RAMP	0	4.8	0	2	0.2	0	0.3	0.2
Belding	COMP	0	12	0	10.3	0	0	0	1.8
SW 1	RAMP	0.3	1.0	0.0	0.8	0.0	0.5	1.3	1.2
SW 1	COMP	0.5	1.3	0.0	10.8	0.0	2.5	1.3	6.3
SW 2	RAMP	0.0	1.0	0.0	0.3	0.1	0.0	1.2	0.2
SW 2	COMP	0.0	0.0	0.3	0.8	0.0	0.2	0.0	0.2
SW 3	RAMP	0.8	2.3	0.0	1.5	0.0	0.2	0.3	1.3
SW 3	COMP	0.0	3.0	0.3	1.3	0.0	0.0	0.0	0.7
WC 1	RAMP	--	--	--	--	--	--	0.3	0
WC 1	COMP	--	--	--	--	--	--	12.9	0.6
WC 2	RAMP	--	--	--	--	--	--	1.8	0.3
WC 2	COMP	--	--	--	--	--	--	0	0
WC 3	RAMP	--	--	--	--	--	--	0.7	0
WC 3	COMP	--	--	--	--	--	--	1.4	0.2

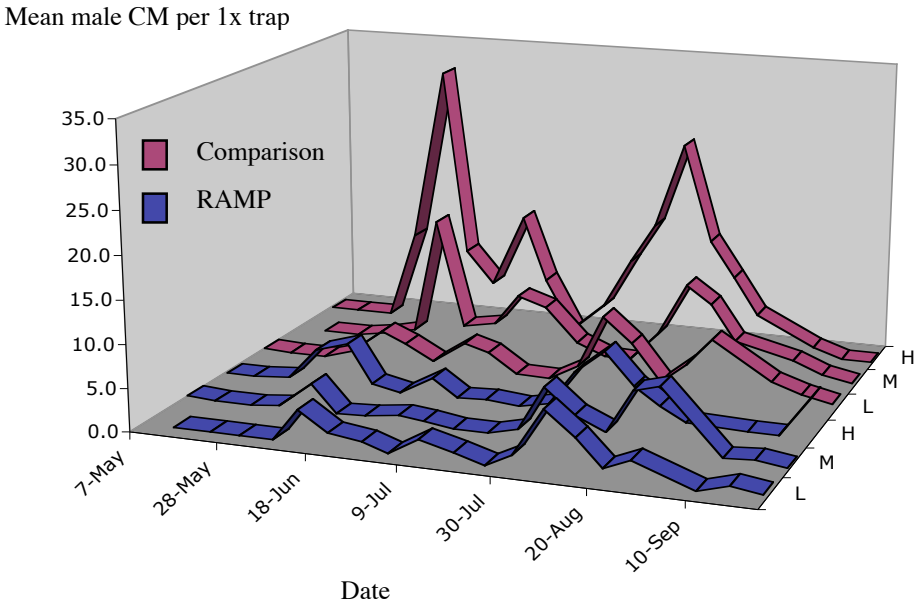

Fig. 1. CM flight activity in high, medium, and low pressure apple orchards, MI, 2002.

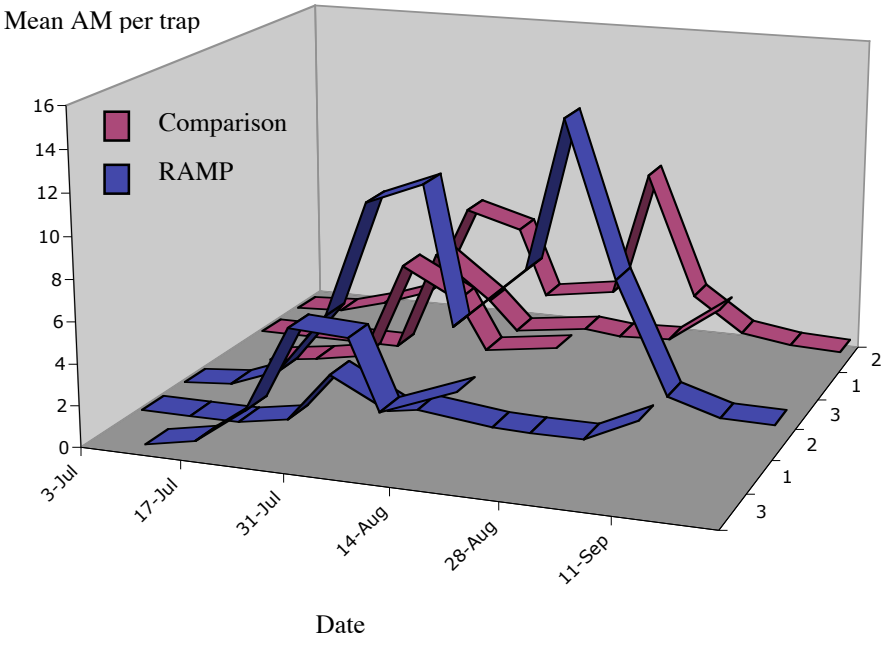

Fig. 2. AM activity in three regions of MI, 2002.