

New Methods of Integrated Pest Management for Apple Orchards in the Midwest

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Introduction

Apple production in the Midwest requires very intensive, chemically-based pest management systems in order to bring quality, fresh market apples to consumers. Current systems of apple pest management have become ineffective and have fallen out of favor with growers, due to a combination of rising costs, pest resistance, and government regulation. New pest control methods must meet several criteria in order to be adopted by growers, such as adequate pest control, applicator safety, minimal environmental impact, and above all, economic viability. In this study, four apple pest management systems were compared for control of codling moth, apple scab, and sooty blotch and flyspeck (SBFS).

Materials and Methods

A conventional apple pest management system was compared with a current integrated pest management (IPM) and two new IPM systems employing a combination of pest control tactics. These included three apple scab-resistant cultivars (Redfree, Liberty, and Gold Rush on M9 rootstock), weather-based disease warning systems, and alternative pesticides.

Four apple pest management treatments were compared in a 3-year-old orchard. All treatments included resistant cultivars. The plot was arranged in a stratified randomized complete block with five blocks for each treatment-cultivar combination and five trees per subplot.

- 1) **Calendar-based** using conventional pesticides.

- 2) **Current IPM** using delayed- and degree-day based pesticide sprays.
- 3) **New IPM 1** using a leaf-wetness-based disease warning-system for SBFS and alternative, calendar-based, pest-specific insecticide applications.
- 4) **New IPM 2** using a relative-humidity-based disease-warning system for SBFS and several alternative insecticides whose applications were based on degree days and insect trap captures.

At harvest, mean percentage of fruit with SBFS, apple scab, codling moth, and damage due to other insects and disease were recorded for each fruit. Marketable and cull apples were also counted and weighed.

Results and Discussion

No apple scab was observed on any fruit, although disease pressure in the area was confirmed by disease presence on nearby crab apples. There was no statistical difference in mean percent damages among treatments for codling moth, however treatments 1 and 2 had less SBFS incidence than treatments 3 and 4 (Table 1) ($P < 0.05$). The percent of damaged apples overall in each treatment was unacceptably high. This may be caused by the freezing conditions and pollination problems which occurred during bloom this year. There were no differences ($P > 0.05$) in weight or number of marketable and cull apples among treatments. Mean marketable weight ranged from 8.93 to 14.96 lb/treatment. Mean marketable number ranged from 29.3 to 48.4 apples/treatment.

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Table 1. Mean percent of damaged apples for each pest management treatment.

Treatment	Codling moth	Mean percent of damaged apples ^a			Total ^d
		SBFS ^b	Plum curculio	Other ^c	
1	3.53a ^e	0.37a	4.43a	0.02ab	18.35a
2	0.57a	1.48a	2.92a	18.69a	23.66a
3	0.32a	6.23b	12.72a	7.34b	26.61a
4	0.67a	5.70b	6.97a	12.01ab	25.35a

^aMean percent of five tree experimental unit average over all replications and all cultivars.

^bSooty blotch and flyspeck.

^cDamage due to unknown biotic and abiotic sources.

^dMean total damage percent for all known and unknown biotic and abiotic sources.

^eMeans in the same row followed by a different letter differ at $P < 0.05$.