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

Abstract
Producing apples in the Midwest requires intensive, chemically based pest management systems to bring high-quality, fresh market apples to consumers. A combination of rising costs, pest resistance, and new legislation has caused existing systems of apple pest management to become ineffective or to fall out of favor with growers. Because of this, new methods of pest control were developed to combat the ever present problems in apple production. These new methods must meet a number of criteria: sufficient pest control must be achieved, the innovative tactics must be safer for applicators, the environment, and consumers, and must also be economically feasible or they are not likely to be adopted by growers.

Keywords
Plant Pathology

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

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Introduction

Producing apples in the Midwest requires intensive, chemically based pest management systems to bring high-quality, fresh market apples to consumers. A combination of rising costs, pest resistance, and new legislation has caused existing systems of apple pest management to become ineffective or to fall out of favor with growers. Because of this, new methods of pest control were developed to combat the ever present problems in apple production. These new methods must meet a number of criteria: sufficient pest control must be achieved, the innovative tactics must be safer for applicators, the environment, and consumers, and must also be economically feasible or they are not likely to be adopted by growers.

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/subplot.

1) *Calendar-based* using conventional pesticides.
2) *Current IPM* using delayed and degree-day based pesticide sprays.
3) *New IPM A* using a leaf wetness based disease warning system, and alternative, calendar-based, pest specific insecticide applications.
4) *New IPM B* using a relative humidity based disease warning system 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

There were very few differences in marketable or cull number and weight of apples among treatments, and there were very few differences among treatments for insect and disease incidence (Table 1). No apple scab appeared. No SBFS signs appeared on early cultivar Redfree and few signs were observed on later harvested cultivars. Treatments using SBFS warning systems had slightly more SBFS signs than conventional treatments, but still had $\leq$1% incidence on fruit. Very little codling moth damage occurred (Table 1). Treatment 4 required the fewest pesticide sprays to manage pests and diseases (Table 2). Treatment 3 required weekly Cyd-X applications throughout the growing season and spray numbers were higher than any other treatment. Several of the new IPM options explored in this study controlled apple pests as well as conventional strategies and showed potential for reducing orchard management costs while minimizing pesticide exposure to humans and the environment.

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Table 1. Summary of fruit yield and mean incidence (5 fruit) of disease/pest damage means by cultivar and treatment in 2008.

	Weight (lb)		Number		Disease/Pest			
Treatment	Marketable	Cull	Marketable	Cull	Codling Moth	SBFS	Plum curculio	Apple scab
Redfree								
1	20.4 a[z]	0.2 a	72.0 a	0.8 a	0.1	0.0	0.0	0.0
2	17.2 a	0.3 a	63.3 a	1.3 a	0.0	0.0	0.0	0.0
3	19.3 a	0.3 a	69.1 a	1.4 a	0.2	0.0	0.0	0.0
4	20.7 a	0.3 a	69.6 a	1.3 a	0.0	0.0	0.0	0.0
Liberty								
1	22.2 a	1.0 b	74.0 a	4.0 b	0.0	0.4 a[y]	0.2 a	0.0
2	20.2 a	1.1 b	73.0 a	4.1 b	0.0	0.8 a	0.0 b	0.0
3	21.3 a	2.0 a	79.1 a	7.0 a	0.0	1.7 b	0.1 ab	0.0
4	21.9 a	1.4 ab	74.7 a	5.1 ab	0.0	0.9 a	0.1 ab	0.0
Goldrush								
1	42.6 a	0.3 a	113.2 a	1.2 a	0.0	0.1 b	0.0	0.0
2	31.1 b	0.4 a	99.1 a	1.7 a	0.0	0.0 b	0.0	0.0
3	37.7 ab	0.3 a	113.0 a	1.2 a	0.0	0.4 ab	0.0	0.0
4	40.6 a	0.6 a	125.1 a	2.1 a	0.0	0.9 a	0.0	0.0

[z]Means followed by the same letters are not different (P = 0.05).

Table 2. Summary of sprays by cultivar and treatment 2008.

	Treatment			
Cultivar	1	2	3	4
Redfree				
Insecticide	9	4	13	8
Fungicide	10	9	4	4
Total number of sprays[y]	19	13	17	12
Total number of trips[z]	10	11	14	8
Liberty				
Insecticide	10	4	17	8
Fungicide	12	11	6	6
Total number of sprays	22	15	23	14
Total number of trips	12	13	18	10
Goldrush				
Insecticide	11	4	19	8
Fungicide	13	12	7	7
Total number of sprays	24	16	26	15
Total number of trips	13	14	20	11

[y]Does not include dormant oil, bactericide, or miticide sprays applied to all treatments.

[z]Combines insecticide and fungicide sprays that were applied at the same time as a tank mix.