

## Arthropod Pest Pressure Among Several Disease-Resistant Apple Cultivars

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### Introduction

Commercial production of disease-resistant (or scab-resistant) apple cultivars hold the potential of significantly reducing early season fungicide use, while producing high quality fruit. Since growers apply both insecticides and fungicides in tank mix cover sprays, a further benefit could be realized if certain cultivars were resistant to those arthropod targets. Conversely, new apple cultivars may also present obstacles if they are more susceptible to some arthropod pests than are traditional cultivars. This investigation focuses on pest incidence considerations in scab resistant apples for integrated pest management programs.

### Methods

Two plantings were established in 1990. A Mark rootstock planting consists of the cvs. 'Liberty,' 'Co-op 29,' 'Co-op 30' (Enterprise) and 'Empire' used as a standard disease susceptible cultivar. An M.7 planting consists of the cvs. 'Empire,' 'NY75441-67,' 'Co-op 30,' 'Liberty,' 'Nova Easygro' and 'Freedom.'

Both blocks received minimal pesticide schedules in 1991 and 1992. In 1992 both plantings were treated in a split plot design where half the blocks received fungicide treatments starting 6/26 through 9/14. All blocks were treated with insecticide starting at petal fall through late July during both years.

Pest and beneficial insects and mites were sampled every two weeks in each planting on alternating weeks between plantings (seasonal sampling.) Sampling units were as follows: apple/

spirea aphid-% of terminals infested, white apple leafhopper-number of nymphs and/or adults per leaf; spotted tentiform leafminer-number of mines per leaf; San Jose scale, plum curculio, plant bugs and European apple sawfly-number of injured fruit. Leaf samples were brushed for European red mites and predacious mites (20 leaf sample/4 trees in M.7 and 10 leaf samples/tree in Mark). *Stethorus punctum* was counted where present. All fruit were examined after harvest and rated for the percent pest injury.

### Results

There were significant differences (1991) in mite day (MD) accumulations among cultivars. In the M.7 planting, 'Empire' and 'Freedom' had more MDs than did 'Liberty,' 'Nova Easygro,' 'NY 75441-67' and 'Co-op 30,' which had the lowest accumulation. In the Mark planting, 'Co-op 29' had the fewest MDs, followed by 'Co-op 30,' 'Liberty' and 'Empire.' In 1992, end of August spotted tentiform leafminer mines were at

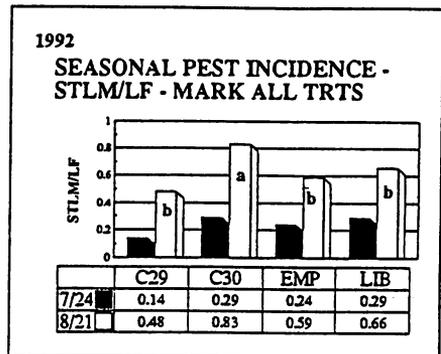


Figure 1. Tentiform leafminer populations on Mark trees in 1992.

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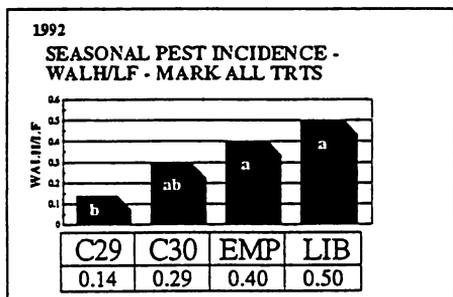


Figure 2. Second generation white apple leafhopper populations at the end of August on Mark trees, 1992.

higher levels in 'Empire' (Mark), with few differences seen in the M.7 plant-

ing, although fewer mines were present in 'Freedom' and 'Nova.'

'Co-op 29' showed the lowest leafhopper populations on Mark, while 'Freedom' and 'Nova' had the highest levels on M.7. Fruit samples during 1992 showed no differences except in plum curculio injury, which was greatest on 'Liberty.'

### Conclusions

The tested cultivars did show varying degrees of pest susceptibility. 'Liberty' seems particularly susceptible to plum curculio, while 'Co-op 29' seems least susceptible to leafhoppers and leafminers.

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## Developing Scab-Resistant Apple Cultivars with Increased Quality and Ability to Store

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The Rutgers apple breeding program is working in collaboration with Purdue University and the University of Illinois (the PRI breeding program) to develop new disease resistant cultivars with superior quality and storage potential. Selections which store for several months and produce much lower levels of ethylene have been identified. Storage studies were conducted to examine factors controlling ethylene production in these unusual selections and to determine if there is a relationship between ethylene evolution at room temperature (20C) and the ability of the fruit to store. DR101-T110 and PAR14T238, both low ethylene producing selections, readily converted ACC to ethylene. Although ethylene induces ripening, there were no significant relationships between ethylene evolution and respiration or the other quality parameters measured.

DR101T110, which produced less than 10  $\mu\text{L} \cdot \text{kg}^{-1} \cdot \text{hr}^{-1}$  even after five months in refrigerated storage, had one of the highest respiration rates and softened rapidly. Alternatively, 'Liberty', the variety with the highest ethylene evolution rate, stored for up to 5 months and softened at half the rate of DR101T110. Clearly, respiration and ethylene evolution rates are inadequate predictors of the ability of a variety to store. Of the scab-resistant varieties evaluated in these studies, PAR14T238 was one of the most interesting. This selection maintained its firmness with a crisp texture for the duration of this study. The ground color of this selection also changed from a yellow-green to a bright yellow. Although this apple is somewhat bland and lacks sweetness, it should make an outstanding parent in future crosses.

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