



# New strategies to enhance sustainability of apple orchards

**Abstract:** Three years of experiments were conducted to help increase profit margins for apple growers, cope with new regulations on pesticide use, and deal with increased pesticide resistance by major apple pests and diseases.

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\$35,692 for year three

**Q** Can Iowa apple growers use disease-resistant varieties to sharply reduce pesticide use and cut production costs, and is hard cider production a viable option for Iowa apple growers?

**A** Project field trials showed how Iowa apple growers can take advantage of disease-resistant varieties and mulching to cut back on pesticide use, reduce production costs, and minimize their environmental impact. The lab-scale hard cider results offered apple growers a head start in exploring this value-added production option.

## Background

Commercial apple growers in Iowa face significant challenges that threaten their continued sustainability. Among the issues are declining profits for fresh-market apples, lower profits from sweet cider production, collapse of an integrated pest management (IPM) strategy for apple scab integrated pest management (IPM) strategy, continued problems with codling moth, the search for a disease warning system to manage summer diseases, and concerns with weed management and soil quality. The project evaluated several strategies to help with these challenges. Among them were growing disease-resistant apple varieties, validating sustainable options for codling moth management, organic mulches for groundcover management, advanced management practices, and the potential of hard cider as a new value-added product for Iowa orchards.

## Approach and methods

Three years of field experiments were conducted to evaluate new IPM tactics on disease-resistant apple varieties. Researchers analyzed the profitability and environmental impact of the new alternatives. A segment of the project related to cider production developed production standards and methods for producing high-quality hard cider from Iowa apples, including the newer disease-resistant varieties.

## Results and discussion

In field experiments, one of the two tested IPM strategies worked better than the other, and pest and disease control for both were comparable to conventional treatments. Pesticide active amounts, amounts of pesticide per spray, and frequency of sprays were used to develop an environmental risk rating for each treatment. Mulches were tested for efficiency in suppressing harmful groundcover.

The cider portion of the project covered development of production processes and evaluation of the hard ciders by trained sensory evaluation panels. Due to year-to-year variability in apple quality and varieties processed, however, there were no



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statistically significant differences among apple varieties noted in the three-year summary of results.

## Conclusions

One of the new IPM systems—which combined delaying the first springtime fungicide spray, using a virus-based biological control product against codling moth, and applying a weather-based warning system for timing summer fungicide sprays against the sooty blotch and flyspeck (SBFS) fungal complex—reduced the number of pesticide sprays compared to conventional management, and was less expensive than conventional practices for larger orchards.

In contrast, the other new IPM strategy required more applications and was more costly than the other treatments because it relied on frequent (weekly) sprays of the virus-based biological control product for codling moth.

Pest and disease control in the new IPM treatments was comparable to that in the conventional treatments.

Both of the new IPM treatments substantially lowered environmental risk compared to conventional calendar-based spraying and current IPM practices.

Composted hardwood mulch suppressed weeds when compared to bare soil and required fewer herbicide applications. Soil under the mulch treatment was cooler and moister in summer than in the bare soil treatment, suggesting that mulch could help ward off significant tree stress and insure adequate fruit size during drought years in a typical non-irrigated Iowa orchard.

Several of the hard ciders created by the ISU team were potentially competitive with U.S. commercial brands of hard apple cider, because the ISU ciders had a more pronounced apple flavor.

On-farm demonstration trials showed that the SBFS warning system reduced fungicide use by an average of two sprays per year compared to standard grower practices and controlled SBFS as the conventional schedule.

Spray volume had no discernible impact on the effectiveness of the SBFS warning system in most of the on-farm trials. Growers can be reassured that using a low-volume spray does not add risk to using the warning system, as long as growers take care to spray trees on both sides.

## Impact of results

Project objectives were achieved in part. There was good evidence that the “pesticide umbrella” for apples can be reduced substantially by substituting resistant apple varieties, new IPM techniques and composted organic mulch for some pesticide sprays. One of the new IPM strategies tested was more profitable than conventional or current IPM tactics, and both new strategies sharply reduced the environmental footprint for control of diseases, pests, and weeds in apple orchards. These strategies give apple growers some options for overcoming the problems with scab resistance to fungicides. With the collection of data from 2009, researchers hope to finalize plans for outreach and research publications, on-line and through ISU Extension.

The hard cider portion of the project showed that high-quality hard cider can be produced from Iowa-grown apples, including the scab-resistant cultivars. Findings will be shared with apple growers at a March 2010 workshop and through a research publication.

## Education and outreach

The investigators prepared papers for Agriculture, Ecosystems, and Environment and Journal of Food Science. Several field days were held. In June 2008, Domoto spoke at an Iowa Fruit and Vegetable Growers Association (IFVGA) event in Solon. Gleason presented at an IFVGA field day at Harlan in June 2009, and information was distributed at the “All-Horticulture Field Day” at the ISU Horticulture Farm in August 2009. Preliminary findings from the Horticulture Farm and on-farm trials were published in the ISU Annual Fruit/Vegetable Progress Reports in 2007 and 2008.

## Leveraged funds

The ISU Graduate Program in Sustainable Agriculture provided 50 percent (approximately \$9,000) of the cost of the graduate student stipend in the first year of the project. A \$129,000 North Central Region-Sustainable Agriculture Research and Education grant, built on this project, allowed investigators to complete the 2009 field trials and April 2009 hard cider evaluation trials after the Leopold Center grant ended. This grant also enabled investigators to obtain a \$200,000 USDA Pesticide Management Alternatives Program grant for 2009-2011. This will allow them to field-validate regionally derived versions of the sooty blotch/flyspeck warning system and put the systems online in combination with site-specific weather conditions.

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