Northern New York Agricultural Development Program
2015 Project Report

Precision Crop Load, Irrigation and Harvest Management to Optimize Fruit Size and Quality of NNY Apples

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Cooperating Producers in Northern New York:

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Background:

The income apple farmers realize per acre varies widely among growers and is affected by yield level, fruit size and fruit quality. Small fruit size apples and/or poor quality fruit can greatly reduce potential income per acre. Through better management practices growers achieve much higher returns per acre for the same variety of apple.

For each variety and orchard there is an optimum number of fruits per tree at which yield, fruit size and fruit quality are optimized. This project seeks to help apple growers optimize yield, fruit size and fruit quality by implementing a suite of management practices we have named precision orchard management.

We have developed three improved management strategies to help NNY apple growers ensure they produce the most profitable fruit size and quality. These strategies involve more precise ways to control crop load (fruit thinning), irrigation, and harvest to help a fruit grower maximize the crop value of each orchard block by increasing the percentage of the crop in the highest price categories of fruit size and fruit color and to reduce the variability of fruit quality within each block and between years.

The goal of this project is to further develop and then promote the precision orchard management strategies to NNY apple growers. Three Northern New York apple growers participated in this project through the use of on-farm research plots.

Methods:

In order to increase orchard income, we divided this project into our three main focus areas: (1) precision thinning; (2) precision irrigation (3) precision harvest.

(1) Precision Thinning:

Growers from Northern New York's Champlain Valley region were advised to follow a sequence of thinning sprays to achieve their desired target crop load beginning with a spray at bloom, followed by a spray at petal fall, then if needed another spray at 10-12mm fruit size and/or at 18mm fruit size. The target crop load is defined by each grower according to their experience, variety, tree vigor and age and desired fruit size.

The growers were advised to use the apple carbohydrate model on the Cornell Network Environment and Weather Applications website to assist management decisions on whether or not to spray, how to adjust the application rate, and what days to avoid application.

The fruit growth rate model requires more effort. It requires growers to go out and tag some spurs, and then measure the diameter of the little fruitlets in each spur twice – one exactly three days after application and secondly eight days after application. With those two measurements this model can estimate how many of those fruitlets are still growing and how many are not growing. Those that are not growing are categorized as being the ones that will fall off in about one week. Those that are still growing fast are categorized as ones that will persist and continue to grow. With this process the growers can have confidence if he is going to get close to the target fruit number.

At each location the cooperating grower counted the number of flower buds on 5 representative trees at pink and then calculated the target number of fruits per tree needed to achieve a desired high yield. The cooperators then tagged 17 representative spurs per tree on the 5 test trees. At petal fall each fruit in each cluster was marked with a number or dot to identify its position in the cluster. After the petal fall spray the fruit diameter of

each fruit in the 17 tagged clusters on each of the 5 trees (425 fruits) was measured 3 days after spraying and then again 7 or 8 days after spraying to clearly differentiate abscising versus retained fruit. These diameter data were sent electronically to Cornell

University Horticulture Professor Terence Robinson who analyzed the data with the fruit growth rate model, developed by Duane Greene from University of Massachusetts. Within 24 hours the results were sent to the growers with Dr. Robinson's recommendation for the next spray. The cooperators then sprayed the test blocks sequentially with one of two spray protocols (bloom + PT +12mm +18mm sprays or PF +12mm+18mm sprays). After each spray the cooperators measured fruit diameters at 3 and 7 days after spraying and the data was again analyzed by Terence Robinson and a new recommendation was sent back to the cooperators.

Anna Wallis with the Cornell Cooperative Extension ENY Commercial Horticulture Program, which serves growers in NNY, assisted growers on how to set up the protocol on their farm, how to use the models, how to take the measurements, and how to interpret the results.

(2) Precision Irrigation:

In 2015 we conducted an irrigation management trial on four apple farms (one each in Ulster, Orleans, Wayne and Clinton counties) and one at the NYS Agricultural Experiment Station (NYSAES) in Geneva, NY, by using the Cornell Apple Irrigation Model.

The orchards were set up as follows:

- Geneva (NYSAES): Empire/B9 orchard, planted in 2011 at 1,156 trees/acre,
- Hudson (Ulster County): Gala/M9 orchard, planted in 2011 at 1,117 trees per acre,
- Orleans County: Plumac/B9 orchard, planted in 2015 at 1,980 trees/acre,
- Wayne County: Gala/B9 orchard, planted in 2009 at 838 trees/acre, and
- Champlain Valley (NNY: Clinton County): NY1/B9 orchard, planted in 2010 at 1,037 trees/acre.

At each site we managed soil water level according to the Cornell Apple Irrigation Model to minimize tree water stress. To assess the value of the model, some trees were left unirrigated so growers could compare and visually access the benefit of the irrigation. We assessed tree growth, tree stress, and crop yield, fruit size and fruit quality (flesh firmness and sugars) with irrigation and no irrigation.

(3) Precision Harvest:

The "precision harvest" program with the Honeycrisp apple was conducted at Forrence Orchards, Chazy Orchards, and Everett Orchards in Clinton County and at Indian Ladder in Albany County.

Fruit were sampled weekly until the end of harvest. Fruit sampled right before harvest were evaluated for dry matter content and fruit mineral content of macro and micronutrients. Through harvest, apples from each orchard were harvested and fruit red color, flesh firmness, starch index, sugar content and DA meter (a tool for evaluating fruit maturity) readings were evaluated.

Half of the fruits from each sample were treated with MCP (methylcyclopropene) or left untreated and stored until early February at 0°C in air and evaluated for fruit quality: flesh firmness and sugar content, external and internal apple disorders and appearance, and taste by an untrained panel.

An assessment of potential fruit storability for each block has been made based on fruit dry matter content and fruit N, Ca and N/Ca ratio. The results after storage were correlated to pre-harvest measures to determine if we could predict fruit quality and storability at harvest to assist farmers in segregating fruit for long and short-term storage. With the data from this study we expect to develop guidelines for the precision harvest management of Honeycrisp apples.