Northern NY Agricultural Development Program
2016-2017 Project Report

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

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Cooperating Producers:

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Background:

The income that 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 can 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. In addition, irrigation is essential to preventing water stress and small fruit size of apples in dry summers, even in humid climates like New York State. This project sought 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 and improved management strategies to help NNY apple growers increase the percentage of crop harvested in the highest price categories based on fruit size and quality. These strategies include more precise ways to control crop load (fruit thinning) and irrigation. These precision management strategies also can help to reduce the variability of fruit quality within each block and between years.

One of the long-term major outcomes of this project will be to facilitate the development of practical guidelines for NNY apple growers to optimize crop load and water management. We have been doing this through on-farm experiments, demonstration projects, and workshops. The project involves growers through the use of on-farm research plots. These grower-based plots lead to broad grower involvement through field days and workshops and winter fruit schools.

Growers from other regions within New York state also volunteered to participate in the Precision management project. Most of the precision farming techniques demonstrated in this report have already been efficiently adopted by some growers in Western and Eastern NY. For validation of the models, trials were also conducted at the Geneva site and were partly funded by the Apple Research and Development Program (ARDP) and partly self-funded.

Methods:

The project's two main focus areas were (1) precision thinning and (2) precision irrigation.

(1) Precision Thinning:

In 2017, we helped three growers in Northern New York (NNY), among 20 growers located in New York State, to manage chemical thinning of their Gala and Honeycrisp apple crops more precisely.

The precision chemical thinning protocol recommended to apple growers in 2017 was very similar to the 2016 protocol and incorporated two precision thinning models:

- the carbohydrate model developed by Alan Lasko, Cornell University, and
- the fruit growth rate model (FGR) developed by Duane Greene, University of Massachusetts.

The 3 growers in Northern New York's Champlain Valley region were advised to follow several simple steps to accomplish both models. The first step is to establish a target fruit number (target crop load). The target crop load was defined by each grower according to experience, variety, tree vigor and age, and desired fruit size.

The protocol includes a sequence of thinning sprays growers choose from to achieve desired target crop load, beginning with a spray at bloom, followed by a spray at petal fall, then, if needed, another spray at 10-12 mm fruit size and/or at 18 mm fruit size.

Before starting the thinning sprays, growers were instructed 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 FGR model requires more effort from growers: to tag some spurs in the orchard, and measure the diameter of the little fruitlets in each spur twice: once exactly three days after application and again eight days after application. With those two measurements this model estimates how many of those fruitlets were still growing and how many were not growing. Those fruitlets not growing were categorized as ones that would fall off in approximately one week. Those were still growing fast were categorized as ones that would persist and continue to grow. With this process the growers can have confidence they can get close to their target fruit number.

At each location the cooperating grower counted the number of flower buds on 5 representative trees at pink and calculated the target number of fruits per tree needed to achieve a desired high yield. The cooperators then targeted 15 representative spurs per tree on the 5 test trees. After the petal fall spray, the fruit diameter of each fruit in the 15 tagged clusters on each of the 5 trees (375 fruits) were measured 3 days after spraying and again 7 or 8 days after spraying to clearly differentiate abscising versus retained fruit.

The diameter data were sent electronically to the Cornell University Horticulture Department for analysis by post-doctoral associate Poliana Francescatto using the FGR model. Within 24 hours the results were sent to growers with the recommendation for the next spray. The cooperators then had to, or not, depending on the number of fruit on the trees, spray 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 had to measure fruit diameters as mentioned above at 3 and 7 days after spraying and data was again analyzed and a new recommendation sent back to the cooperators.

Anna Wallis with the Cornell Cooperative Extension ENY Commercial Horticulture Program, which serves growers in eastern 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.

A parallel trial was conducted at the Cornell Agricultural Experimental Station in Geneva, NY, to serve as a reference test model for comparison with the orchards hosting trials in NNY.

(2) Precision Irrigation

In 2017 we continued our irrigation management trial that started in 2015 on three apple farms: one each in Ulster (eastern NY), Orleans (Lake Ontario region), and Clinton (northeastern NY) counties) and one at the experimental station in Geneva by using the Cornell Apple irrigation model.

The orchards are composed as follows:

- Ulster County: Hudson, Gala/M9 orchard, planted in 2011, 1,117 trees/acre;
- Orleans County: Plumac/B9 orchard, planted in 2015, 1,980 trees/acre, used for 2015-16 trial; Gala/M9 orchard planted in 2010, 1,210trees/acre, 2017 trial;
- Clinton: NY1/B9 orchard was planted in 2010 at 1,037 trees/acre;
- Geneva, NY: Empire/B9 orchard planted in 2011, 1,156 trees/acre,

At each site, we managed soil water level according to the irrigation model to minimize water stress while other trees were left unirrigated. We assessed tree growth and tree stress, and crop yield, fruit size, and fruit quality (flesh firmness and sugars) with irrigation and no irrigation.

See separate posting at www.nnyagdev.org: Horticulture for Results; and Conclusions and Next Steps.