Northern NY Agricultural Development Program
2021 Project Report

Utilizing Computer Models and Additional Thinning Materials for Precise Crop Load Management in Northern NY Apple Orchards

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Collaborators:

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Grower Collaborators:

- Northern Orchard, Peru, NY
- Forrence Orchards, Peru, NY

Background:

Apple crop load management is the single most important management practice affecting an orchard's crop value. Growers must balance reducing crop load (yield) sufficiently in order to achieve optimum fruit size and obtain good levels of return bloom in the following season. For each variety of apple, there is an optimum number of fruit per tree where yield, fruit size, and fruit quality are balanced to bring the greatest economic return to the grower.

In Northern NY, most crop load management is performed by thinning trees when fruit are between 10-12mm in size following the petal fall period. Thinning at this timing relies on the use of hormone-based plant growth regulator materials, such as NAA and 6-BA, and carbaryl, an insecticide that also acts as a mild fruit thinner. While NAA and 6-BA materials are currently industry standards, their efficacies are highly temperature-sensitive. The optimal temperature for the application of these hormone-based materials is generally in the mid 70's. Below 70°F efficacy is greatly reduced, leaving too many fruit on the tree. At the same time, temperatures in the mid-80's can remove all the fruit from a tree. In Northern New York, these narrow temperature windows are sometimes difficult to achieve, making crop load management with these hormone-based materials relatively ineffective in some years.

An alternative method for crop load management is to begin thinning earlier at bloom. This method uses different materials, like ammonium thiosulfate (ATS, a common row crop fertilizer) and lime sulfur (LS, an organic fungicide product) to inhibit flower fertilization. These materials have the potential to take more fruit off the trees beginning at bloom. **Trees thinned earlier at bloom may produce larger fruit at harvest, and have greater return bloom the following spring, reducing orchard biennial bearing (many fruit on the trees one year, few the following). This would be particularly valuable in Northern New York apple production, as growers across the region had poor thinning results with some hormone-based thinners in 2018, 2019, and 2020, and had poor return bloom in 2019 and 2021 on their Honeycrisp crop, one of Northern New York's most valuable apple varieties.**

While bloom thinning is a promising approach for crop load management, and is being used extensively in Washington State, it remains difficult to perform locally, as it requires precise timing of the applications to inhibit the correct number of blossoms. When materials are applied at the incorrect timing, trees are likely to be over-thinned or under-thinned. To better time these applications, some Northern NY growers have begun to use the pollen tube growth model (PTGM).

The pollen tube growth model was developed through a decade of research at Virginia Tech. This model estimates the amount of time between pollination and fertilization of the apple flowers, allowing growers to better time their bloom thinning materials. Growth rate models have been developed for Honeycrisp, Gala, Golden Delicious, Fuji, Cripps Pink (Pink Lady), Granny Smith, and Red Delicious.

By beginning the thinning process at bloom, growers have multiple opportunities to thin their trees, and can gauge how trees are responding to each thinner application. This response can be quantified using the fruit growth rate model, developed at Cornell University. In this model, fruitlet growth is monitored after each thinning application to determine how many fruitlets will be removed by the previous thinning spray, allowing growers to more precisely reach their target crop load.

In this 2021 NNYADP Precision Apple Orchard Management project, our primary objective was to further test and validate the efficacy of these alternative bloom thinning materials, at their currently recommended spray rates, precisely timed with the pollen tube growth model. Our secondary objective was to utilize the fruit growth rate model on the same orchard blocks to precisely reduce the crop load to the growers' target crop density through additional thinner applications, and to further validate the utility of the fruit growth rate model. We anticipate that combining the fruit growth rate model with an effective bloom thinning protocol with applications of ATS or LS will bolster the profitability of Northern NY apple growers by making thinning applications in our region more reliable, allowing fruit growers to achieve optimum crop loads to maximize their fruit yield and quality, while reducing biennial bearing in Honeycrisp.

Methods:

We established two field trials in commercial orchards in Northern New York, one in Gala (Northern Orchard), and one in Honeycrisp (Forrence Orchards).

Northern Orchard: Gala Variety Trial

Our Gala experiment at Northern Orchard in Peru consisted of a block of Brookfield Gala, planted in 2012 at 4x12-foot spacing. We selected 15 trees in April 2021 (five replications of three trees) within the orchard to receive the experimental ammonium thiosulfate (ATS) applications (Treatment 1), and 15 trees to receive the grower's standard thinning applications (Treatment 2), giving us 30 trees total within the experiment.

Working with the grower, we determined the target crop load for the block was 90 fruit per tree. At the pink bud growth stage, the number of flower buds were counted on ten trees within the experiment, and trees were subsequently pruned to reduce some of the crop load. Following pruning, 15 flower clusters on five representative trees (75 clusters total) within Treatment 1 were flagged and numbered, so we could run the fruit growth rate model on the trees to track the estimated crop load following each thinning application (Figure 1: see Photos section).

As bloom began, 30 king flowers were collected from trees within the experiment block at random (Figure 2). Flower styles were measured in the field (Figure 3), and the average style length from these flowers was added to the pollen tube growth model (PTGM; freely available to growers at ptgm.newa.cornell.edu.) As more flowers opened, we monitored the block closely to estimate that the targeted 90 king flowers per tree opened in the block on May 8, 2021, allowing us to "start" the PTGM. The first application of 2.5% ATS was made to Treatment 1 on May 12, when the PTGM estimated that pollen tube length reached 60% of the style length.

A second application of 2.5% ATS was made to Treatment 1 on May 15, when the model once again reached 60%, and a third application was made on May 17, again when the model reached 60%. Treatment 2 received an application of Fruitone (an NAA product) at the rate of 4 oz. per 100 gallons dilute tree row volume (TRV) on May 14.

All of the bloom treatments were then followed with a petal fall thinning application of 3 oz. Fruitone per 100 gallon dilute TRV + 1 pt Sevin per 100 gallons on May 22.

Following the petal fall application, fruitlet growth was measured on the clusters we had flagged at the pink bud stage (Figure 4). Measurements were made on May 25, and again on May 30. Following the petal fall application, the fruit growth rate model predicted there were still 527 fruit per tree remaining, so a 12 mm thinning application of 64 oz Maxcel per 100 gallon dilute TRV + 1 pt Sevin per 100 gallon was made on June 1. We measured fruitlet growth again on June 4 and June 7, and the model predicted 222 fruit per tree remained. On June 9, we made a final thinning application of 64 oz Maxcel per 100 gallons dilute TRV + 1 pt Sevin per 100 gallons. For this application, the bottom 4 nozzles were shut off on each side of the sprayer, so more of the thinner could be directed to the more-difficult-to-thin upper portion of the tree canopy. Fruitlets were measured again on June 16, at which point the model predicted 94 fruit per tree remained.

Fruit were harvested on September 10, 2021. As fruit were harvested, we recorded the total fruit count and fruit weight per tree. From these measurements, average fruit size per tree was also tabulated. A subsample of 60 fruit per treatment was shipped to Dr. Terence Robinson at Cornell AgriTech in Geneva, New York, and were sorted over a color and size grader. Fruit were also examined for their level of fruit russeting. These data were then used to tabulate total crop value per acre of each treatment.

Forrence Orchards: Honeycrisp Trial
This site consisted of Honeycrisp trees, planted in 2012 at a 3x14-foot spacing. We selected 15 trees (5 replications of 3 trees) to receive the experimental bloom thinning ATS applications (Treatment 1), 15 trees to receive the experimental bloom thinning LS applications (Treatment 2), and 15 trees to receive the grower's standard thinning applications (Treatment 3), giving us 45 trees total within the experiment. Working with the grower, we determined the target crop load for the block was 85 fruit per tree. At the pink bud growth stage, the number of flower buds were counted on five trees within the experiment to help us determine our starting bud load. We flagged and numbered 15 flower clusters on five representative trees (75 clusters total) within Treatment 1, so we could run the fruit growth rate model on the trees to track the estimated crop load following each thinning application.

As bloom started, 30 king flowers were collected from trees within the experiment at random. Flower styles were measured, and the average style length from these flowers was added to the PTGM. As more flowers opened, we monitored the block closely to estimate that the targeted 85 king flowers per tree had opened in the block on May 9, allowing us to "start" the PTGM. The first application of 2.5% ATS was made to Treatment 1 on May 13, when the pollen tube model was at 60%. The second application was made at 75% on May 15. For Treatment 2, the first application of 2% LS and 1% mineral oil went on at 100% pollen tube growth on May 14, and the second went on at 60% on May 15. For Treatment 3, an application of 4 oz NAA per 100 gallons dilute TRV was applied on May 15.

A petal fall application of 3 oz NAA + 1 pt Sevin per 100 gallons dilute TRV was applied on May 24.

Following the petal fall application, fruitlet growth was measured on the clusters we had flagged at the pink bud stage. Measurements were made on May 27, and again on May 30. Following the petal fall application, the fruit growth rate model predicted there were still 1054 fruit per tree remaining, so a 12 mm thinning application of 3 oz NAA per 100 gallons dilute TRV + 1 pt Sevin per 100 gallons was made on June 1. We measured fruitlet growth again on June 4 and June 7, and the model predicted 309 fruit per tree remained. On June 9, we made a final thinning application of 48 oz Maxcel per 100 gallons dilute TRV + 1 pt Sevin + 1 pt LI-700 (a surfactant material) per 100 gallons. For this application, the bottom half of the sprayer nozzles were shut off on each side of the sprayer, so more of the thinner could be directed to the more-difficult-to-thin upper portion of the tree canopy. Fruitlets were measured again on June 16, at which point the model predicted 91 fruit per tree remained.

Fruit were harvested on September 16, September 22, September 29, and October 8. As fruit were harvested, total fruit count and weight were recorded per tree. Following the September 22 harvest, fruit from the first three replicates were accidentally harvested by a picking crew, so only the final 2 reps had harvest data collected on September 29 and October 8. From these measurements, average fruit size per tree was also tabulated. A subsample of 60 fruit per treatment was shipped to Dr. Terence Robinson at Cornell AgriTech in Geneva, New York, and were sorted over a color and size grader. Fruit were also examined for their level of fruit russeting. These data were then used to tabulate total crop value per acre for each treatment.

Statistical Analysis:
From the Northern and Forrence orchards' field trials, treatment differences in number of fruit per tree, yield per tree (kg), yield per acre, fruit size (oz.), and crop value were analyzed using a

Standard Leased Squares with Restricted Maximum Likelihood (SLS REML) model through the Fit Model function in JMP® statistical software. Russeting data from the Forrence orchards site was analyzed using SLS REML through the fit model in JMP statistical software. Where significant differences existed within the model, treatment differences were then compared using Tukey's HSD (Honestly Significant Difference) Test.

Results:

Northern Orchard: Gala

Trees in both the experimental bloom thinning and the grower standard thinning treatments did not achieve the desired level of thinning in 2021. While our target crop load for this block was 90 fruit per tree, our bloom ATS treatment (Treatment 1) averaged 168 fruit per tree, and the bloom NAA treatment (Treatment 2) averaged 183 fruit per tree. Yield per tree averaged 27.42 kg in Treatment 1, and 29.57 kg in Treatment 2. This would equate to an average yield of approximately 1307 bushels per acre, and 1409 bushels per acre, respectively. Average fruit size averaged 0.17 kg in Treatment 1, and 0.16 kg in Treatment 2, representing fruit sizes of about 116 and 118 fruit per bushel, respectively. Russeting was minimal on both treatments, only one apple in the ATS treated samples had a minimal amount of russeting.

Taking into account the yield and fruit quality data, we estimated the value of the crop in Treatment 1 as $14,586 per acre, and the value for Treatment 2 as $15,248 per acre. None of the differences in any values were statistically significant between the two treatments (Table 1).

2021 Gala							
Bloom Thinning Material	Fruit Per Tree	Yield Per Tree (kg)	Estimated Bushels Per Acre	Fruit Size (kg)	Fruit Count Per Bushel	Fruit Color (% Red)	Crop Value Per Acre
ATS	168	27.42	1307	0.17	116	81.2	$14,586
NAA	183	29.57	1409	0.16	118	78.9	$15,248
P-value	**0.415**	**0.370**		**0.4937**	**0.6061**	**0.52**	**0.400**

Table 1. Harvest and crop value data from the Northern Orchard Gala trial.

The fruit growth rate model predicted that trees started with an initial crop load of 1170 fruit per tree. Following the bloom and petal fall applications, the model predicted there were 527 fruit remaining per tree. This prediction suggests that three applications of 2.5% ATS alone at bloom would have been inadequate for reaching the target crop load.

The fruit growth rate model predicted a final crop load of 94 fruit per tree. Our actual average fruit per tree at harvest was 168 in the ATS treatment, suggesting that the fruit growth rate model was not very accurate in this block, as it under-predicted the amount of fruit remaining on the trees by 74 fruit (44%).

Forrence Orchards: Honeycrisp

Trees in both the experimental bloom thinning and the grower standard thinning treatments were close to the desired level of thinning in 2021. Our target crop load per tree for this experiment was 85. Average fruit per tree in the ATS bloom treatment (Treatment 1) was 108. The average fruit per tree in the LS treatment (Treatment 2) was 87, and there were 105 fruit per tree in the NAA bloom treatment (Treatment 3). The average yield per tree was 22.3 kg in Treatment 1, 19.07 kg in Treatment 2, and 20.28 kg in Treatment 3. This equates to an average per acre yield of approximately 1214 bushels per acre, 1038 bushels per acre, and 1104 bushels per acre, respectively. Fruit size was 0.21 kg in Treatment 1, 0.22 kg in Treatment 2, and 0.19 kg in

Treatment 3. These correspond to fruit sizes of 92 fruit per bushel, 87 fruit per bushel, and 99 fruit per bushel, respectively.

The percentage of fruit without russeting was 91% in the ATS-treated fruit, 83% in the lime sulfur-treated fruit, and 99% in the NAA-treated fruit.

Taking into account the yields and fruit quality data, we estimate the value of the crop in Treatment 1 was $28,857 per acre, the value for Treatment 2 was $23,818 per acre, and Treatment 3 was $23,255 per acre. The only values that were statistically significant between treatments were the percentage of red color: lower in Treatment 3 compared to Treatments 1 and 2, and the amount of russet-free fruit: lowest in Treatment 2 and highest in Treatment 3 (Table 2). Although not statistically significant, the ATS-treated Honeycrisp fruit were worth $5,602 more per acre than the grower's standard NAA at full bloom treatment.

2021 Honeycrisp Bloom Thinning Trial								
Bloom Thinning Material	**Fruit Per Tree**	**Yield Per Tree (kg)**	**Estimated Bushels Per Acre**	**Fruit Size (kg)**	**Fruit Count Per Bushel**	**Fruit Color (% Red)**	**Percent Russet-Free Fruit**	**Crop Value Per Acre**
ATS	108	22.30	1214	0.21	92	46.6A	91B	$28,857
LS	87	19.07	1038	0.22	87	46.8A	83C	$23,818
NAA	105	20.28	1104	0.19	99	39.8B	99A	$23,255
Log P-Value	**0.4583**	**0.7706**		**0.1525**		**0.04**	**0.001**	**0.33**

Table 2. Harvest and crop value data from the Forrence Orchards Honeycrisp trial. Differing letters shows statistically significant differences between treatments at p value < .05.

The fruit growth rate model predicted that trees started with an initial crop load of 1817 fruit per tree. Following the bloom and petal fall applications, the model predicted there were 1054 fruit remaining per tree. This prediction suggests that two applications of 2.5% ATS alone at bloom would have been inadequate for reaching the target crop load.

The fruit growth rate model predicted a final crop load of 91 fruit per tree. Our actual average fruit per tree at harvest was 108 in the ATS treatment, suggesting that the fruit growth rate model was quite accurate in this block, under-predicting by only 17 fruit (about 15%).

Discussion:

At both sites, all bloom thinning materials gave similar levels of thinning when applied with the same follow-up applications post-bloom, as we found no statistically significant differences in the total number of fruit per tree, yield per tree, or fruit size per tree between the two Gala treatments, or the three Honeycrisp treatments.

Fruit color did not differ in the Gala trial, but was improved by the ATS and LS treatments in the Honeycrisp trial. However, ATS-treated and LS-treated fruit also had higher levels of russeting in that trial, and no significant differences in final crop value were demonstrated in either study.

These results suggest that bloom thinning materials timed with the PTGM provide comparable levels of thinning as traditional NAA bloom thinning. These findings further validate that adequate levels of thinning can be achieved with these alternative thinning materials, and provide Northern New York fruit growers more choices in which products they choose to thin with at bloom.

Economics

When comparing the costs between the two bloom treatments, we estimate two applications of ATS cost our cooperators approximately $29.60 per acre in materials and spray labor. In our Gala experiment, three applications of ATS would cost $44.40. The cost of one bloom application of NAA was estimated at $24.63 per acre. We estimate two applications of lime sulfur and oil cost our cooperators approximately $107.60 per acre in materials and spray labor. These numbers do not account for the added labor expense associated with collecting, measuring, and observing the opening of the flowers to implement the PTGM. When we add in the material costs against the fruit returns, in these particular situations this year, it appeared more economical to use NAA at bloom on the basis of input costs and crop value alone in our Gala trial, and more economical to use ATS on Honeycrisp due to the increased crop value per acre (Table 3).

Economics Per Acre			
Gala Trial			
Bloom Thinning Material	**Crop Value**	**Per Acre Costs**	**Total Returns**
ATS	$14,586	$44.40	$14,541.60
NAA	$15,248	$24.65	$15,223.35
Honeycrisp Trial			
Bloom Thinning Material	**Crop Value**	**Per Acre Costs**	**Total Returns**
ATS	$28,857	$29.60	$28,827.40
LS	$23,818	$107.60	$23,710.40
NAA	$23,225	$24.65	$23,200.35

Table 3. Crop value data and per-acre costs of each bloom thinning treatment from Gala and Honeycrisp trials. These returns do not account for all other expenses occurred by the grower to produce the fruit, this is simply the costs associated with each bloom thinning treatment.

Russeting

Russeting can be a concern with lime sulfur and ATS applications, and the results from our Honeycrisp trial suggest that lime sulfur at 2% with oil at 1%, and ATS at 2.5%, can lead to some minor fruit russeting in our Northern New York conditions. Russeting decreased the overall value of the lime sulfur-treated fruit, however, the extra size and color gain from the lime sulfur led to similar overall returns to the grower with either the lime sulfur or NAA treatment. Russeting was less severe in the ATS-treated fruits and with the extra color gain made the ATS treatment the most profitable. Russeting was minimal on all the Gala treatments, and therefore had a negligible impact on fruit quality.

Other studies have found an increased risk of russeting from using lime sulfur and ammonium thiosulfate for bloom thinning (Peck et al., 2017; Marchioretto et al., 2018). While the exact reasoning for this russeting is not always clear (Allen et al., 2021), the standard guidance has been to use reduced rates of the materials or to avoid using these materials under slow drying conditions. We did not have particularly slow drying conditions this season, so this suggests russeting risk with lime sulfur might be particularly high at these concentrations, so growers should weigh these risks when weighing the perceived benefits from using these materials.

Weather Impacts

Weather was moderately conducive to good hormonal thinning during our petal fall applications in 2021, but was not conducive to good thinning at our 12mm applications. The weather during bloom was also not ideal for bloom thinning this year. The first application of bloom thinning materials were applied when the weather was relatively cool, with a high of 61ºF for the Gala trial, and a high of 67ºF for the Honeycrisp trial. It is possible that the weather was slightly too cool for these materials to reach their full levels of efficacy. The second and third applications went on in the 70ºs. We expect we would see higher levels of thinning efficacy when materials are applied under warm, humid conditions, as efficacy is increased under slow drying conditions (Janoudi and Flore, 2005).

Thinning at Bloom Alone?
Our fruit growth rate model results from the Northern Orchard Gala trial site suggests that three applications of 2.5% ATS alone would have been insufficient to adequately reduce crop load. Kon et al. (2018) found that two applications of 2.0% ATS at bloom did not reduce final crop load sufficiently. We may attribute some of this reduced efficacy to the mild weather prevalent at bloom during our applications. Given our results, bloom applications of ATS may require additional thinner applications at later fruit growth stages, or may necessitate using a higher concentration of ATS at bloom when quick drying conditions and cooler weather are prevalent. Commercial recommendations suggest concentrations of ATS between 2% and 4% for bloom thinning. In our estimation, a higher concentration may be necessary in Northern New York in dry years to achieve more effective early crop load reduction. However, higher concentrations may cause unacceptable levels of leaf damage and russeting of the fruit surface, reducing the crop value, so further research on the most appropriate concentration relative to weather conditions during the application window is warranted.

Return Bloom Consideration
Other accounts have suggested an additional benefit of treating trees with ATS at bloom may be an improved return bloom in biennial varieties such as Honeycrisp (Robinson, 2020). We evaluated return bloom in May 2021 from our 2020 trials, and found no significant increase in return bloom in either our Honeycrisp or Gala trial. We note that return bloom was very low in many Northern NY Honeycrisp blocks in 2021, which could have contributed to ATS being less effective at improving return bloom. We plan to evaluate return bloom for our 2021 trials in spring 2022 to better understand the effects of thinning on return bloom.

Under- and Over-Prediction Variability
The fruit growth rate model under-predicted the amount of fruit remaining on the trees this season at both sites. The model under-predicted by 44% at our Gala site, but by only 15% at our Honeycrisp site. The Gala trees we tagged had many additional fruits at the tops of the trees at harvest, whereas the clusters we had tagged were more uniformly distributed throughout the canopy. This might explain the large under-prediction we observed in Gala this season. In contrast to this season, in 2020 the model over-predicted remaining fruit by 10% in our Gala experiment, and by 160% in our Honeycrisp experiment. Earlier experiments have found that the model tends to slightly overestimate in trials by about 10% (Robinson, 2020). These two years of results indicate that the fruit growth rate model can be a valuable tool in roughly estimating the amount of fruit left on the tree to help growers to determine when to stop thinning, but it may under-estimate or over-estimate in any given year.

Moving Forward
Given that our target crop loads were met at only one of our two trial sites, we believe further research is required to refine the use of these models in commercial settings, and to determine

the best rates and timings of these materials to incorporate them into an integrated thinning program in Northern New York.

Conclusions:

The bloom thinning of apples has great potential to increase fruit size and promote return bloom the following season. In our trials, bloom thinning with 2.5% ATS or 2% LS + 1% mineral oil with the PTGM did not provide additional benefits compared to the standard practice of using NAA at bloom in terms of yield, fruit size, fruit quality, or crop value at our Gala orchard field site when followed with the same thinning protocols at petal fall, 12mm, and 15mm+. At our Honeycrisp field site, fruit red color and the percent of russeting were significantly increased with LS and ATS relative to NAA. While not statistically different, ATS-treated trees increased crop value in our Honeycrisp trials by $5,627 per acre compared to NAA-treated trees. We did not observe increases in return bloom from our 2020 trials. We will still need to evaluate the return bloom in our Honeycrisp field site in the spring of 2022 to determine if the ATS and LS treatments enhance return bloom. Two applications of 2.5% ATS at bloom were not effective in reducing crop load to acceptable levels alone in Gala or Honeycrisp, as documented by the fruit growth rate model results, and would necessitate followup applications of hormone-based thinners to achieve the targeted crop load.

The fruit growth rate model provided a reasonable estimate of the amount of fruit remaining on the trees in our trials; however, the model under-predicted the number of fruit at both sites.

Before we can confidently make recommendations for growers to implement bloom thinning based on use of the PTGM and the fruit growth rate model on commercial orchard-scale under Northern New York conditions, we will need to repeat these trials to evaluate additional thinner rates and timings in both Gala and Honeycrisp and continue to monitor the impact of weather.

Education and Outreach:

2021 Cornell Tree Fruit Conference, February 2-4, 2021, Virtual.
A grower panel on bloom thinning with the pollen tube growth model was presented on the second day of the meeting. This meeting was attended by more than 250 fruit growers.

2021 Statewide Bloom Thinning Webinar, May 3, 2021, Virtual.
Speakers included this project's Dr. Gregory Peck. This meeting had more than 80 attendees. A recording of the meeting is online on the Lake Ontario Fruit Program YouTube page.

Virtual Thinning Meetings, May-June 2021
Three weekly thinning meetings were held online for Northern New York growers. Dr. Robinson and project leader Mike Basedow discussed thinning conditions and recommendations for thinning each week. Weekly attendance fluctuated between 11 and 28 growers. Recordings of these meetings are posted on the ENYCHP YouTube page.

E-mail Alerts
Following each virtual thinning meeting, growers were emailed a recap of the discussed thinning recommendations, along with additional details from model outputs from our test sites in Peru, NY, reaching an audience of 678 Eastern/Northeastern New York fruit growers.

Champlain Valley Field Tour, Chazy, NY, August 19, 2021

One stop on the tour included a presentation by Dr. Terence Robinson and Michael Basedow on bloom thinning with the pollen tube growth model. The tour was attended by 35 orchard employees from across the Northern NY region and Vermont.

One-on-One Outreach
Growers participating in the thinning projects received frequent personalized emails, text messages, phone calls, and farm visits to discuss the models, and were given thinning advice based on these model recommendations.

Next Steps:

Grower outreach events in 2021 were well received and will continue through 2022, including a pre-bloom thinning webinar to be held on March 18, 2022.

In spring 2022, we will evaluate the return bloom at our orchard sites by counting the amount of floral and vegetative buds on three limbs of each tree within the trial to determine if the ATS bloom treatments significantly increased return bloom.

Since we did not see the full level of thinning as we generally expect with these bloom thinning products, we believe additional research is necessary to fully understand how to best incorporate the use of these two models into an integrated thinning program in Northern New York. We intend to continue running bloom thinning experiments in 2022. Northern New York apple producers were optimistic about the continued use of ATS and LS in their thinning programs; however, we believe additional work needs to be done to find the most effective concentration of ATS and LS to use at bloom on these varieties relative to the weather conditions on the day of application.

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For More Information:

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https://nnyagdev.org/index.php/horticulture/nny-horticultural-research

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Photos:

Left: Figure 1. A tree at Northern Orchard that has been pruned, counted, and clusters tagged for Fruit Growth Rate Model measurements. Photo by: Michael Basedow.

Right: Figure 2. Collecting king flower blossoms to measure flower style length. NNYADP. Photo by: Andy Galimberti

Left: Figure 3. Measuring flower style lengths in the field. NNYADP. Photo by: Andy Galimberti

Right: Figure 4. Measuring apple fruitlets to enter into the Fruit Growth Rate Model, NNYADP. Photo by Andy Galimberti.