Northern NY Agricultural Development Program
2015-2016 Project Report

Advancing Vegetable Production in NNY

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Background:

It is well known that the use of cover crops can address a variety of soil issues. But growers with smaller acreage struggle to find space to set aside for cover crops and all growers are curious to see the newer mixtures first hand in the field. A summer demonstration planting shows growers options for fitting warm weather cover crops into their crop rotations.

Tomatoes grown in high tunnels are a profitable crop and growers across Northern NY are adding tunnels to their farms each year. Cornell Cooperative Extension has guidelines for managing determinate (bush-style) and indeterminate (vining) tomatoes, but the increasingly popular cherry-type tomatoes have not been well studied and challenge growers with a rampant growth pattern. Growers struggling with keeping these popular plants under control question whether the time they spend pruning this vigorous type of tomato is worth the effort.

Additional challenges for growers include the problem of one of the most popular varieties of cherry tomatoes with consumers, *Sungold*, being prone to splitting. Many cherry-type tomatoes produce attractive fruit but some have little to no flavor while others are very tasty. In addition, leaf mold (*Passalora fulva*) is a disease particular to high tunnels and studied in previous years on slicing tomatoes. Most of the cherry-type tomatoes, including *Sun Gold,* are susceptible to leaf mold so grower evaluation of the newer, resistant varieties is needed.

This project focused on two main areas:

1) **Cover Crops:** Comparing the establishment, weed suppression, and vigor of several cover crops planted under summer growing conditions.
2) **High tunnel cherry tomato production:**
   a) A trial to determine which method is the most cost- and labor-effective for pruning cherry tomatoes in high tunnels.
   b) A trial comparing disease-resistant varieties of cherry type tomatoes in high tunnels.

COVER CROPS METHODS

Two fields with different soil types were plowed and fitted in preparation for the cover crop demonstration plot plantings at the Cornell Willsboro Research Farm. The "sand" site soil was a Stafford Fine Sandy Loam, while the "clay" site had a Kingsbury Clay soil. Seed for eight individual cover crops and five cover crop mixes were obtained from King's Agriseeds (Table 1). Five-foot-wide by 40-foot long demonstration plots were planted at both sites on July 1, 2016 with a 5-foot Great Plains 3-point hitch seed drill. Cover crop seeding rates are listed in Table 1.

All plots were scored for weed suppression on September 2, 2016 (Table 2), and cover crop and weed shoot biomass samples (Figure 1) were collected on September 9, 2016.

Additionally, individual cover crops were planted in the top of 4-foot long, 4-inch diameter white PVC pipes filled with potting soil and placed on a stand that kept them in a vertical orientation (Appendix D. Photos). The pipes were opened during cover crop summer field meetings to illustrate the different root architectures associated with the cover crops.

Cover Crop Results, Performance Notes:

- *Sun Hemp*: Stand establishment was spotty and inconsistent in both sites. Weed suppression was fair, even in sections with solid stands of sun hemp.
- *Cowpea*: Established well in both sites, and the stands did a nice job of suppressing weeds.
- *SSX AS 5201(Sorghum Sudangrass)*: Established well on both sites, produced high shoot biomass dry matter, and exhibited excellent weed suppression.
- *Buckwheat*: Failed to establish on either site.
- *Soybean 3884N*: Failed to establish on either site.
- *Tillage Radish*: Plants established better on the sand than on the clay. The short-statured plants appeared to do a decent job of suppressing weeds on the sand site where stands were good. Weeds were not suppressed on the clay site where the tillage radish stands were sparse.
- *Crimson Clover*: Some stand establishment on the sand site, but failed to establish on the clay. Exhibited little to no weed suppression.

- *Corvallis Teff*: Short-statured plants. The dense stands that established on the sand site appeared to do a good job of suppressing weeds. Teff failed to establish on the clay.
- *3-way Clover Mix*: Established poorly on the sand, and failed to establish on the clay. Little to no weed suppression.
- *Summer Feast Mix*: Wonderleaf millet was the dominant component of this mix, produced large amounts of shoot biomass, and did an excellent job of suppressing weeds.
- *Summer Pollinator Mix*: Buckwheat was the dominant component of this mix; cowpeas and sunflowers were intermediate; hemp was very sparse. This mix was more productive on the sand than on the clay, and weed suppression was generally good to excellent.
- *Ray's Crazy Fall Mix*: The grass components dominated this mix, and weed suppression was good to excellent at both sites.
- *Soil Builder Plus Mix*: Shorter than the other multispecies mixes. Weed suppression was good on the sand, but poor on the clay.

Cover Drops Demonstration Conclusions/Outcomes/Impacts:

- The warm season grasses, sorghum sudangrass and millet, produced the most shoot biomass and did a great job of suppressing weeds.
- Cowpeas were the only legume to perform well on both the sand and clay sites in the summer production window.
- White and crimson clover did not establish well under the warm, dry conditions of summer. These are more typically planted in spring or fall.
- Where the brassicas did establish they did an excellent job of suppressing weeds.
- Using the PVC pipes to grow cover crops provided excellent teaching tools at summer field meetings. Growers were fascinated to see the differences in the root structures of the different crops as we opened each pipe and allowed them to see and feel the differences. The pipes are portable and reusable. We plan to continue using them in future years.

CHERRY TOMATO PRUNING TRIAL METHODS (Figures in Appendix B)

Research Question: How much time does it take to train, prune, and harvest under 3 different treatments, and what are yield differences between the 3 treatments? Which pruning method provides the greatest economic return to labor investment?

We used the variety Supersweet 100 and established 3 different pruning treatments, each replicated 4 times in a randomized block pattern, each block 11 feet long. The plants were started from seed indoors on March 25 and transplanted to 4-inch pots on May 1 using a peat based potting medium and fertilized weekly. They were transplanted on May 25 into the high tunnel with drip irrigation/fertigation and no mulch.

The treatments represented 3 different intensities of pruning:

- A: Single Leader Treatment.The most intensive labor investment, pruning each plant to a single leader and removing all suckers. Plants were 12 inches apart in a single row, with 9 plants per row.
- B: Double Leader Treatment.Moderately labor intensive, pruning each plant to a double leader. Plants were 18 inches apart in a single row, with 5 plants per row.
- C: 4-Leader Treatment. Intended to be the least labor intensive. We started by pruning the plants to 4 leaders and then transitioned to minimal pruning. Plants were 18 inches apart in a single row with 5 plants per row.

For each treatment, we tracked the labor in minutes it took to train and prune (Figure 3), to harvest (Figures 4 and 5), plus the total hours for pruning and harvest by treatment (Figure 6), marketable yield by weight of each treatment (Figure 7), marketable harvest over time (Figure 8), and net revenue by treatment. We harvested 3 times per week from July 13 – September 10. We monitored fertility levels with bi-weekly foliar testing and fertigated 3 times per week at a rate to provide 5 lbs N/acre/week.

Cherry Tomato Pruning Trial Results

- Throughout the trial, the single leader treatment took the least time to prune and harvest even though it had 4 more plants per treatment at 12-inch spacing. The 4 leader treatment, with 5 plants at 18-inch spacing, took the most time to prune, train and harvest due to the dense tangle of growth.
- These results show that what we called the most intensive pruning method (the single leader) actually took the least amount of time to prune and harvest. The 4-leader treatment was meant to be the least intensive method but it ended up taking the most time to prune and harvest because the tangle of unpruned stems was slower to work in.
- In terms of yield, the 4 leader system yielded the most by weight but not statistically more than the double leader system. The single leader system did yield less than the other two treatments.
- Even though the 4-leader system yielded the most fruit by weight, when we considered the efficiency of harvesting each treatment we saw a significant difference.
    - The single leader treatment took less time to harvest per minute all season, so that even late in the season, when the tangled 4 leader plants yielded slightly more overall, the efficiency of gathering that harvest was less.
    - This corroborates with the experience and comments from the harvesters as well.

Cherry Tomato Variety Trial Methods (Figures in Appendix C)

Research Question: The variety Sungold is popular with consumers based on flavor, but lacks important disease resistance to the common tunnel disease, Leaf Mold. Is there a difference in yield and consumer preference between the popular variety Sungold and other leaf mold resistant varieties?

We used 4 different varieties of cherry tomatoes, each replicated 4 times in a random block design. Each row was 11 feet long and the plants were spaced 18 inches apart, 5 plants per row, trained to a double leader. Plants were fertigated 3 times per week at the same rate as the above pruning trial.

We harvested 3 times per week from July 13-September 10 and tracked the yield in weight of each variety. The varieties grown were Sungold (susceptible to leaf mold), and 3 resistant varieties: Esterina, Nature's Bites and Sakura.

To study consumer preference for the different varieties we offered taste tests at summer programs and field events asking participants to rate the 4 varieties plus the pruning trial variety on a scale of 1-5 in terms of their overall quality and flavor.

Cherry Tomato Variety Trial Results

- The taste testing produced widely variable results. There was no clear 'winner' from the 60 or so taste testers surveyed. Sungold was very popular, but both Sakura and Esterina were nearly as popular.
- Nature's Bites had the most variable results but we found that it needs to fully ripen on the plant before harvesting to improve its flavor. The other varieties were preferred more consistently by tasters.
- Differences in yield between the varieties were much more clear. (Figures 10 and 11). Of the 4 varieties trialed Sakura averaged 15.3 lbs/plant and Esterina averaged 15.0 lbs/plant producing a higher yield than Nature's Bites at an average 12.1 lbs/plant and Sungold at an average 10.8 lbs/plant.

It is important to note that the study tunnel did not have any leaf mold occurrence. If there had been leaf mold, we would expect Sungold, the susceptible variety, to have had an even lower yield than the resistant varieties that would not have been weakened by the disease.

Cherry Tomato Pruning and Variety Trials Conclusions/Outcomes/Impacts:

- The data show that more intensive pruning takes less time than less intensive pruning and it results in more efficient harvesting, which is an overall labor savings. The double leader treatment had the best combination of overall yield and efficiency of labor.
- One key is to prune regularly, at least once each week especially during the first 6 weeks of growth so the job can be done quickly. Regular pruning allows for quick and simple movements and prevents a tangle of stems from developing.
- Once plants become overgrown it takes much longer to prune them.
- Variety Trial: Consumer preferences for taste and perceived quality vary greatly from person to person. We saw no clear 'winner' in taste or quality from the surveys we conducted.
- Disease resistance is a clear and tangible advantage for growers, saving them money when diseases are present through increased yields without the costs of treatment.

Outreach for Cover Crops and Cherry Tomatoes Projects:

2016 Twilight Field Meetings: Canton, August 3: 16 people; Willsboro, August 4: 12 people with guest speakers: Dr Christine Smart, Cornell University Professor of Plant Pathology, and Judson Reid, Cornell University Vegetable and High Tunnel Specialist; Willsboro, September 21: 7 people. Amy Ivy presented *Pruning for Profitability* that summarized cherry tomato trials at the NYS Producer's Expo, Syracuse, January 2017; Hudson Valley Vegetable School, Kingston, February 2017; Capital District Vegetable School, Albany, February 2017; Northern Vegetable School, Essex, March 2017. Amy Ivy wrote two articles: one on the cover crops demonstration, one on the pruning trial for Produce Pages, the ENY Commercial Horticulture Program monthly newsletter.

Next Steps:

The project team is pleased to have received funding to continue the pruning trial in 2017. We feel another year of data will strengthen and clarify results and subsequent recommendations to growers. The PVC pipes are reusable and we plan to grow cover crops in them each year to include as an engaging part of summer field meetings.

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Reports and/or articles in which results of this project have been published:

- *Summer Options for Cover Crops*, Produce Pages November 2016
- *Pruning for Profitibility* , Produce Pages January 2017

See Appendices A-D posted separately for charts, graphs and photos:
Appendix A. Summer Cover Crop Tables and Figures
Appendix B. Cherry Tomato Pruning Trials
Appendix C. Cherry Tomato Variety Trials
Appendix D. Summer Cover Crops Photos