Horticulture Program & Activities 2018-2019

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Sunburn Management

This trial was initiated in 2015 and since then we have tested several different approaches to combat sunburn damages on tall spindle "Honey Crisp" trees. For three consecutive years, spray products Surround and ScreenDuo, with kaolin as an active ingredient, have been compared to Purshade, a calcium carbonite-based product. In the last two years, we have included Drape Net system in black and white color to the trial.

Figure 1 shows the daily temperature maximum and precipitation during the growing season. At the experimental orchard, we recorded 42 and 26 days of maximum temperature reaching above 30°C in 2018 and 2019, respectively. When the apples are exposed to direct sunlight and the air temperature rises above 30°C, the probability that sunburn damages will occur is increasing.

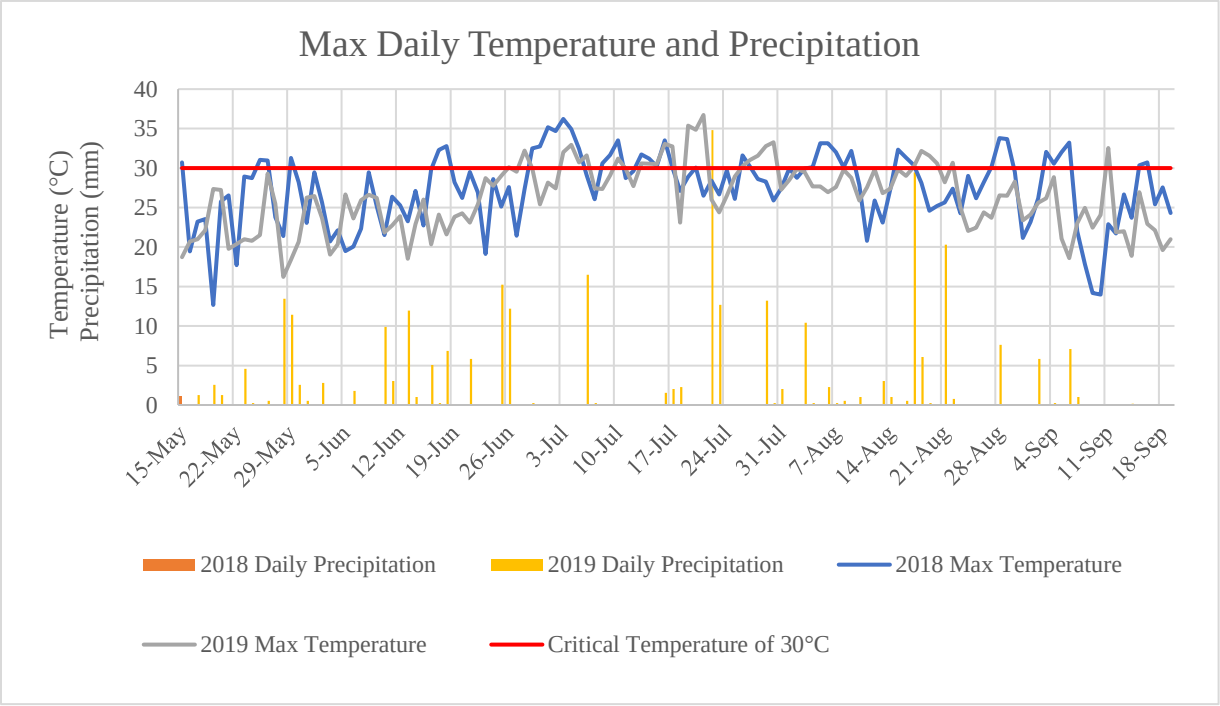

Figure 1. Maximum daily temperature and precipitation for May – September

Rate and application dates are shown in Table 1. All sprays were applied before the heat event and scheduled on biweekly basis or more frequently depending on the amount of rain. Drape Net was installed in the week following of fruit set. Rapidly growing young fruitlets, covered with sunburn protectants and nets were pictured after the first sunburn spray application and shown in Figure 2.

Table 1. Products used for sunburn control with application rate and date.

Product	Rate	Application/installation date in 2018							
		21-May	**25-May**	**7-Jun**	**21-Jun**	**3-Jul**	**18-Jul**	**31-Jul**	**14-Aug**
ScreenDuo	10lbs/100 gal		x	x	x	x	x	x	x
Surround	50lbs/100 gal		x	x	x	x	x	x	x
Purshade	2 gal/A		x	x	x	x	x	x	x
White DrapeNet		x							
Black DrapeNet		x							

		Application/installation date in 2019					
Product	**Rate**	**25-May**	**26-Jun**	**10-Jul**	**19-Jul**	**25-Jul**	**8-Aug**
ScreenDuo	10lbs/100 gal		x	x	x	x	x
Surround	50lbs/100 gal		x	x	x	x	x
Purshade	2 gal/A		x	x	x	x	x
White DrapeNet		x					
Black DrapeNet		x					

Figure 2. The first application of ScreenDuo, Suround, and Purshade, and trees covered with white and black Drape Net (from left to right).

As a direct predictor of the sunburn damage we measured fruit surface temperature (FST) in 2019. For that purpose, we used IR Video Thermometer on fully sun exposed fruits on East and West side of the canopy. The measurement took place on July 20, when the maximum daily temperature reached 35°C. The highest FST value of 38.4°C was detected on the West side of UTC, followed by Purshade and Drape Net White, where we recorded 37.5 and 36.5°C respectively. Fruits on the West side of the Black Drape Net trees developed surface temperature that were comparable to the current ambient temperature. There were no differences of the FST across the treatments on the East side and the temperature of the East side did not diverge more than 1°C from the ambient temperature.

Trees were harvested on September 19th and 9th in 2018 and 2019, respectively, when we recorded yield per tree, fruit count and fruit drop. In 2019 trees sprayed with Purshade and grown under the Black Drape Net had lower yield per tree comparing to the control. This very low number of fruits per tree of Black Drape Net treatment might be related to excessive June drop caused with additional shading the net had imposed on trees. Consistently within the two years, the harvest readings showed prominent fruit drop in White Drape Net. This could be explained by the advanced maturity of the fruits located in the upper portion of the canopy and driven by higher the temperature measured in that part of the canopy.

Figure 4. "Honey Crisp" covered with Purshade, ScreenDuo, Surround, Drape Net White and Black (from left to right) before harvest.

Sampled fruit was analyzed for soluble solids content (SSC), and titratable acidity (TA), fruit firmness (FF) and skin color (a*/b* and Hue) separately for each side of the fruit (B, sun-exposed side; NB, shaded side). Blush was defined as a percentage of red color of the fruit surface.

Treatments made impact on sugar accumulation in the fruit, with Surround and Black Drape Net resulting in the lowest Brix level. We noticed the treatment effect on fruit color, particularly in 2018 on the apples grown under Black Drape Net. Interestingly, the color difference among treatments was not that prominent in 2019. Only shade side of apple grown under Black Drape Net developed brighter color.

The evaluation of sunburn was expressed as the incidence of the three types of sunburn symptoms: sunburn necrosis (SN), sunburn browning (SB) and photooxidative sunburn (PS). SN was a leading type of sunburn damage in 2018, while SB took over that position in 2019. Purshade with Drape Nets suppressed the incidence of SN in 2018. However, Surround and White Drape Net reduced the SB incidence in 2019. Overall sunburn incidence was effectively controlled only by Black Drape Net in 2018.

Figure 6. Sunburn symptoms on "Honey Crisp" - sunburn browning SB-1 and SB-2; sunburn necrosis; and photooxidative sunburn (from left to right).

Drape Net Influence on 5 Apple Cultivars Grown in Eastern NY

Fruit quality

Tall spindle "Gala", "NY1", "NY2", "Empire", and "Fuji – Sun Rise" trees planted in 2010, spaced at 3 ft x 14 ft, grown in the experimental orchards in Highland, NY, were used in this experiment. Fruit set of all cultivars occurred during the second and third week of May and nets were installed on May 25th, a day before first heat event (temperature > 30°C) was expected. Treatments included: (1) untreated control (UTC), (2) White Drape Net, and (3) Black Drape Net. "Gala", "NY1", "Fuji – Sun Rise", "Empire", and "NY2" were harvested Sep. 4th, 20th, 24th, 27th, and Oct 8th, respectively. Nets were removed on the harvest date and yield per tree, fruit count and fruit drop were recorded.

Fruit quality parameters were rated twice- first time within a first month after the harvest and second time 2 months later. Fruit firmness (FF), soluble solids content (SSC), titratable acidity (TA) and the skin color based on CIELAB coordinates (L, a, b, Chroma and Hue) were analyzed separately for each of four sides of the fruit (B or sun-exposed side, B-side + 90°, NB or shaded side, and NB-side + 90°). Blush was expressed as percentage of red color on the fruit surface. Sunburn and insect damage were calculated as an incidence of affected apples in the sample of 15 apples per rep per rating time.

"Gala" - The Black and White Drape Net influenced yield by reducing the number of fruits per tree on this early ripening variety. Additionally, Black DN lower sugar accumulation and color development of the fruit (Figure 1). Similarly, the White DN had an influence on the color but to a lesser extent, reducing the hue on the sun exposed side of the fruit. This is a cultivar sensitive to sunburn damage and our results showed that 15% of fruits were affected by this defect. In the trial, Black DN had positive effect in the sunburn incidence reduction.

Figure 1. "Gala" - before and after Drape Net removal

"NY1" - Known as "SnapDragon", this cultivar has green/yellow background that turns into deep red if exposed to sunlight (Figure 2). In the trial, we noticed that Black DN negatively influenced red color development. Besides that, Black DN reduced fruit weigh and sugar accumulation, suggesting that this color of DN might hinder fruit development and delay fruit maturation. In contrast, White DN did not have any negative impact on fruit quality of 'NY1'.

Figure 2. "NY1" - UTC, White Drape Net and Black Drape Net (from left to right).

"Fuji-Sun Rise" - This late ripening apple has pink flash over the light background (Figure 3). We noticed that this cultivar did not respond well to either of Drape Net colors, resulting in poor color development and low sugar accumulation.

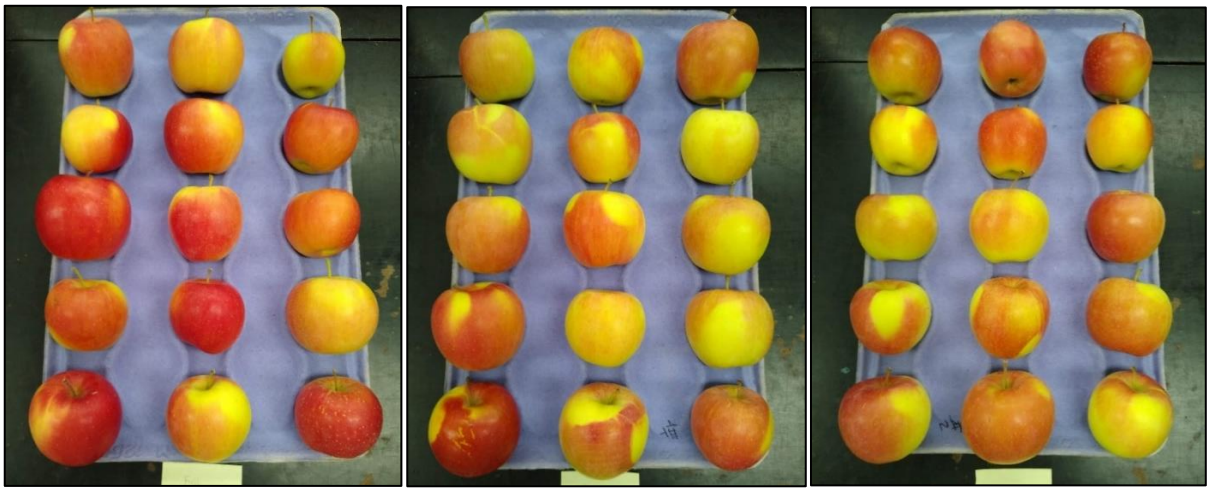

Figure 3. "Fuji-Sun Rise" - UTC, White Drape Net and Black Drape Net (from left to right).

"Empire" - The results showed that Black DN negatively impacted sugar accumulation and color development of this red-purple cultivar. In contrast, we have not noticed any negative effect of White DN on 'Empire' fruit quality.

Figure 4. "Empire" - UTC, White Drape Net and Black Drape Net (from left to right).

"NY2" - This cultivar is known as "Ruby Frost" (Figure 5). We noticed that the yield of Black DN was low due to a small number of fruits per tree harvested. This led to larger size fruit, but the differences were not significant. In addition to that, we observed the effect on fruit chemistry, primarily on TA. The "NY2" apple has a deep red color with a green/yellow background. Our results showed that Black and White DN had generally negative effect on color development of "NY2" apple.

Figure 5. "NY2" - UTC, White Drape Net and Black Drape Net (from left to right).

Spray Deposition

In June 2018 and August 2019, we placed water sensitive cards in the canopy of trees covered with Drape Net to test fungicides penetration through the nets and their deposition of the leaves. The fungicides were applied with Eco Tower Boom sprayer, non-air assist, using pressure at the nozzle only to move the material into the tree canopy, traveling at 2.1 mph and delivering 100 gal/A. The coverage of the Drape Net covered trees was compared to the UTC.

Combined 2018 and 2019 data sets revealed constantly lower spray coverage on the plants which canopy was enclosed in nets, with the significant difference detected in the lower portion of the canopy (Figure 6). For orchards covered with Drape Net, we recommend using water sensitive cards to check spray deposition. If the deposition is lower than expected, adjusting toward speed, fan speed, air volume and/or direction are highly advised.

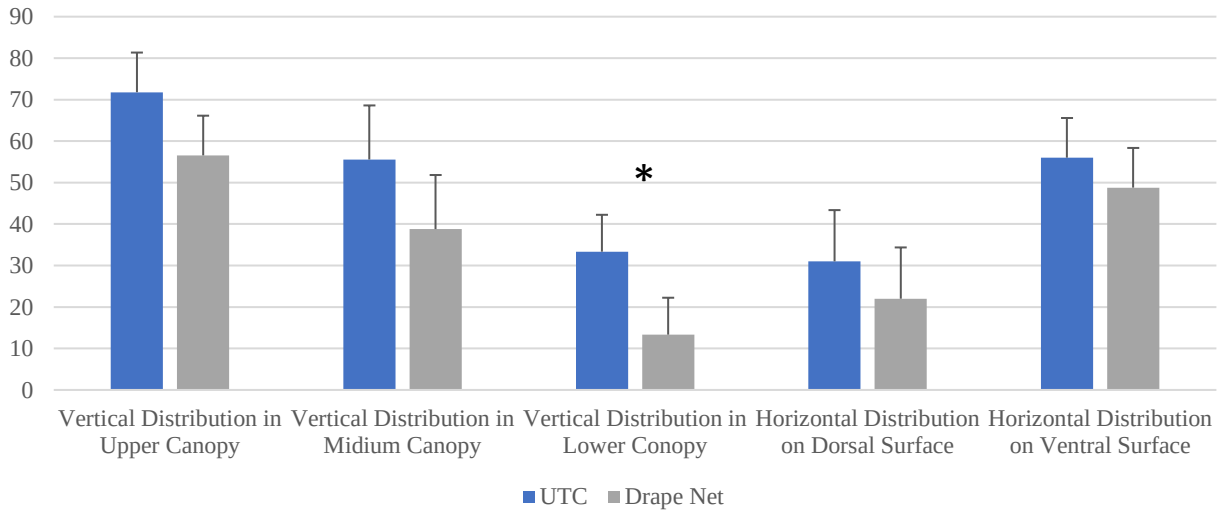

Figure 6. Spray Coverage analyzed for two seasons. Significant difference between treatments detected with Wilcoxon Test is marked with asterisk (*) at α=0.05.

Canopy Microclimate

To evaluate the temperature difference between our tall spindle trees protected with nets of two different colors and the UTC, we recorded the temperature fluctuation during the last half of June in the upper, medium, and lower canopy. Maximum daily temperatures (MDT) were measured in the period from 12pm to 3pm.

The level of intercepted photosynthetically active radiation (PAR) was measured on August 2nd from 12pm to 1pm on the trees covered with black and white nets and the UTC. A maximum PAR was measured in the open space and the recorded value was used as a reference for the calculation of percentage of PAR intercepted by the canopy.

The lowest MDT was detected in the lower and medium canopy of Black Drape Net, while for 2°C higher temperature was found in the upper portion of the canopy covered with White Drape Net (Figure 7). Black Drape Net had a similar vertical distribution of the MDT to the UTC.

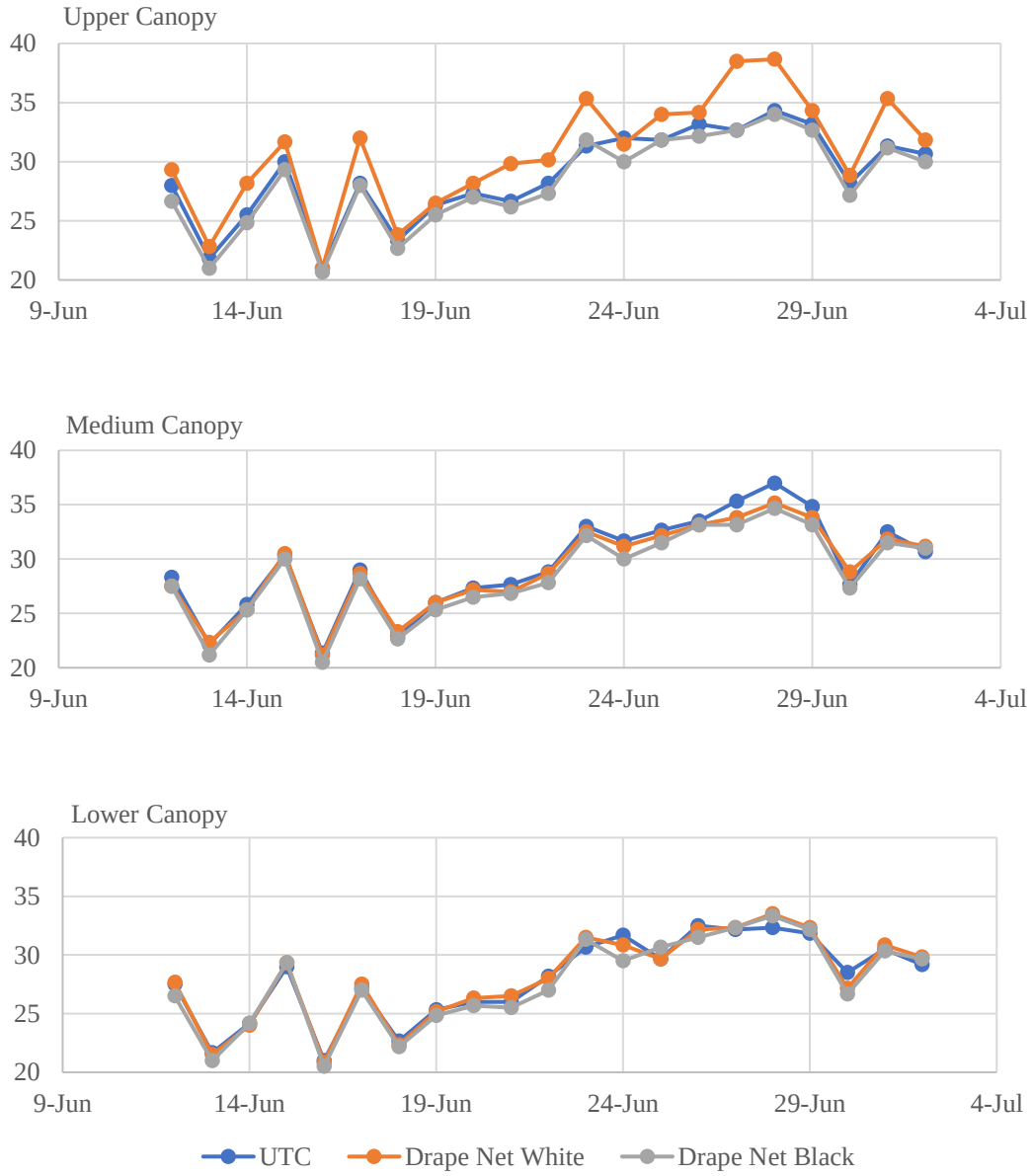

Figure 7. Maximum Daily Temperature (°C) of the Tall Spindle Canopy Recorded from June 12th to July 2nd

Trees covered with white and black nets received 12.6 and 14.6% less PAR than the UTC. The largest difference was observed in the medium portion of the canopy, where black and white nets reduced the PAR for 22 and 17%, respectively.

Honey Crisp Bitter Pit Control

Honey Crisp is a variety highly appreciate among consumers for its unique crispy texture and its price on market is higher compared to other standard apple varieties. However, production cost of this variety is also higher due to the high susceptibility to bitter pit, a physiological disorder, which is related to Ca deficiency. Although many factors that can affect the bitter pit symptoms impairing them or mitigating them have been known, the biochemical and physiological background of the disorder have not been well explained.

Having known that timing of the calcium application, correct form of calcium and application rate have essential impact on better pit prevention, we established a small trial, testing a recently released product, Nano Cal by AquaYield. This product contains advanced form of calcium designed for enhanced foliar uptake. In the trial we have tested application timing and rate starting foliar spray one month after bloom and continued throughout the season with the last application been sprayed 40 days before harvest. The rates of the products and application dates are shown in Table 1.

Table 1. Treatments with rate and application dates in 2018.

Treatment	**Spray Date**								
	June11	June 19	June26	July 03	July10	July 18	July 24	July 31	August 07
Nano Cal @ 4 fl/A	x	x	x	x	x	x	x	x	x
Nano Cal @ 4 fl/A	x		x		x			x	
Cor-Clear @ 2 Ibs/100 gal	x		x		x			x	

On August 23rd, leaf samples were collected and shipped to Cornell Nutrient Analysis Laboratory (CNAL) protocol for wet ash and sap analyses. However, no treatment effect was detected on macronutrient concentration in leaves and apple peel.

Honeycrisp was harvested on September 19th. Fruits were preconditioned at 50°F for 5 days, and after that stored at 36°F for 60 days prior to bitter pit rating. Yield, fruit weight and crop load data were collected on harvest day.

The evaluation of bitter pit symptoms was done on samples of 150 apples per treatment and expressed as the incidence and severity. We also evaluated fruit color, flesh firmness (FF) and soluble solids content (SSC). The results indicate that none of the spray products at different spray schedules had managed to efficiently control biter pit occurrence.

Research Support for T. Robinson lab

The HVL Horticulture has developed a continuous collaboration with Robinson lab, assisting on projects and trials located in the Hudson Valley. In 2018 and 2019, the lab helped with experimental setup, treatment assignment and applications, summer and fall data collection and sampling in following trials: precision irrigation, precision thinning, and precision pruning.

Irrigation Trial

The purpose of the trial is to develop irrigation schedule for apple orchards that will fit the production goals by using automating irrigation systems and interpreted information about soil water status, plant water use and stress, and weather. Irrigation systems has becoming an inevitable necessity in every orchard due to the climate change and extreme weather conditions that have shown tremendously negative impact on crops. For example, in a January farm survey by Cornell, due to the record breaking 2016 drought, fruit tree growers across New York without irrigation reported an average 46-percent crop loss, while even growers with irrigation saw 6 percent losses.

Irrigation trials were conducted in Geneva, Hudson Valley, Champlain Valley, Wayne County and Orleans County. The experimental orchard in HV, located at Minard's farm, Clintondale, received irrigation treatment in which water requirement was weekly calculated using the Cornell model made by Robinson and Lakso 2013. During the 2018 season, data were collected on tree status and growth, yield, and fruit quality.

Precision Pruning

This type of pruning is a part of precision crop load management strategy and it is used to reduce the initial flower bud number by removing excess fruit buds for optimum crop load at which the crop value reaches the highest price.

The experiment was conducted at Crist Brothers Coy Farm in Clintondale, NY. Five-year-old "Honey Crisp" and "Snap Dragon" were selected for the trial and were pruned to six different bud loads at tight cluster stage. The six bud loads treatments were 1 bud : 1 final desired fruit number per tree or 1.5buds:1final fruit, 2.0:1, 2.5:1, 3.0:1 or 3.5:1. To achieve the desired bud loads, first, standard tall spindle pruning was done by removing 1-3 whole large branches(>3/4inch diameter), second, each of the remaining branches was simplified by removing secondary lateral branches, third, pendant branches which had small diameter distal ends were shortened back to the point where the branch was about pencil size and fourth, if more pruning was needed individual spurs were removed (Figure 1). After pruning, half the trees of each treatment were hand thinned at full bloom to a single flower per cluster while the other half were chemically thinned with a series of three to four thinning sprays. At harvest, number of the fruit per tree and yield were recorded and sample of 20 fruits were taken for fruit quality testing.

Figure 1. Flower bud counting and pruning (Photo by Robinson, Francescatto & Lordan)

Precision Thinning

To determine the effect of carbohydrate balance and nozzle pattern on fruit thinning of "Gala" a trial was set up at Minard's farm, Clintondale, NY. The experimental was organized as RCBD with five treatments. Spray timing, plant growth regulators, rate adjustment to tree/row volume or according the carbohydrate model recommendation, and nozzle pattern are presented in Table 1. At harvest, we recorded fruit number and yield for top and bottom of a tree, we sampled 15 fruits for fruit size and color analysis and measured trunk cross sectional area in the late fall.

Table 1. Precision thinning treatment description

Spray	Bloom (70% open flower)	Petal fall	10-12mm	15-18mm (if needed)
1.	10ppm NAA (whole tree and TRV not adjusted)	100 ppm 6BA + 7.5 ppm NAA (whole tree and TRV not adjusted)	100 ppm 6BA + 1pt Sevin (whole tree and TRV not adjusted)	100 ppm 6BA + 1pt Sevin + 1pt oil (whole tree and TRV not adjusted)
2.	10ppm NAA (whole tree/TRV)	100 ppm 6BA + 7.5ppm NAA (whole tree/TRV + carb model)	100 ppm 6BA + 1pt Sevin (whole tree/TRV + carb model)	100 ppm 6BA + 1pt Sevin + 1pt oil (whole tree/TRV + carb model)
3.	10ppm NAA (whole tree/TRV)	100 ppm 6BA + 7.5 ppm NAA (whole tree/TRV + carb model)	100 ppm 6BA + 1pt Sevin (top/TRV – not adjusting up the rate + carb model)	100 ppm 6BA + 1pt Sevin + 1pt oil (top/TRV – not adjusting up the rate + carb model)
4.	10ppm NAA (whole tree/TRV)	100 ppm 6BA + 7.5ppm NAA (whole tree/TRV+ carb model)	100 ppm 6BA + 1pt Sevin (top/TRV – adjusting up the rate + carb model)	100 ppm 6BA + 1pt Sevin + 1pt oil (top/TRV – adjusting up the rate+ carb model)
5.	Grower Standard	Grower Standard	Grower Standard	Grower Standard

To support the development of the apple carbohydrate thinning model developed by T. Robinson and help making fruit thinning recommendation, Horticulture lab at HVL collects data every year on “Gala” from bloom to harvest. We recorded number of flower bud per selected tree, fruitlets size before and after PGR applications and collect yield and fruit number at harvest (Figure 2).

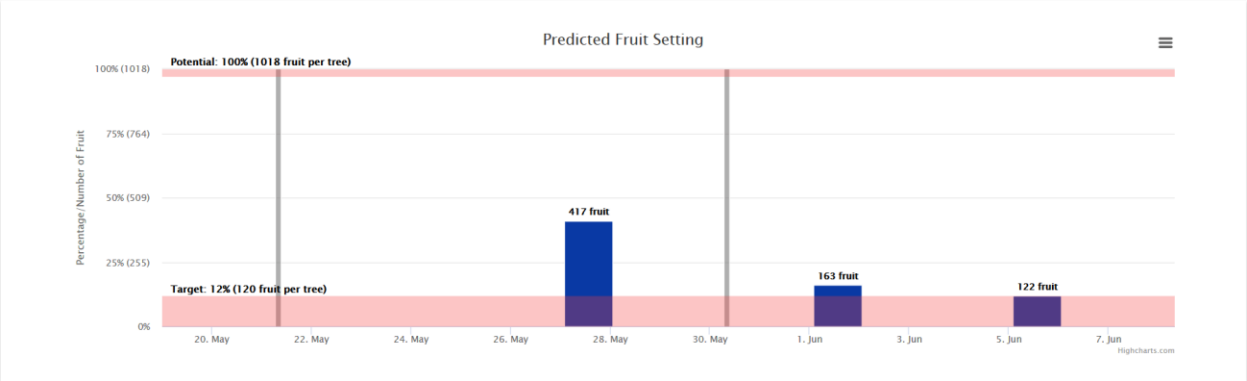

Figure 2. Apple Carbohydrate Thinning Model for Highland HVL 2

Sweet Cherry Planting Systems and Rootstocks

The NC140 regional research project on sweet cherry systems and rootstock was established at Crist Farms in Walden, NY in 2010 (Figure 2). The purpose of the trial is to study the influence of training system, rootstock vigor, and growing conditions (site) on annual fruiting unit growth, yield, and fruit quality. At the Crist Farms site, a cherry variety "Regina" is trained to four high density training systems: Slander Spindle Axe (SSA), Upright Fruiting Offshoots (UFO), Tall Spindle Axe (TSA), and Kym Green Bush (KGB). The cherry trees were grafted to Gisela rootstocks series: Gi.3 (dwarfing, 30-45% of standard), Gi.5 (semi-dwarfing, 50-65% of standard) and Gi.6 (semi-vigorous, 75-90% of standard).

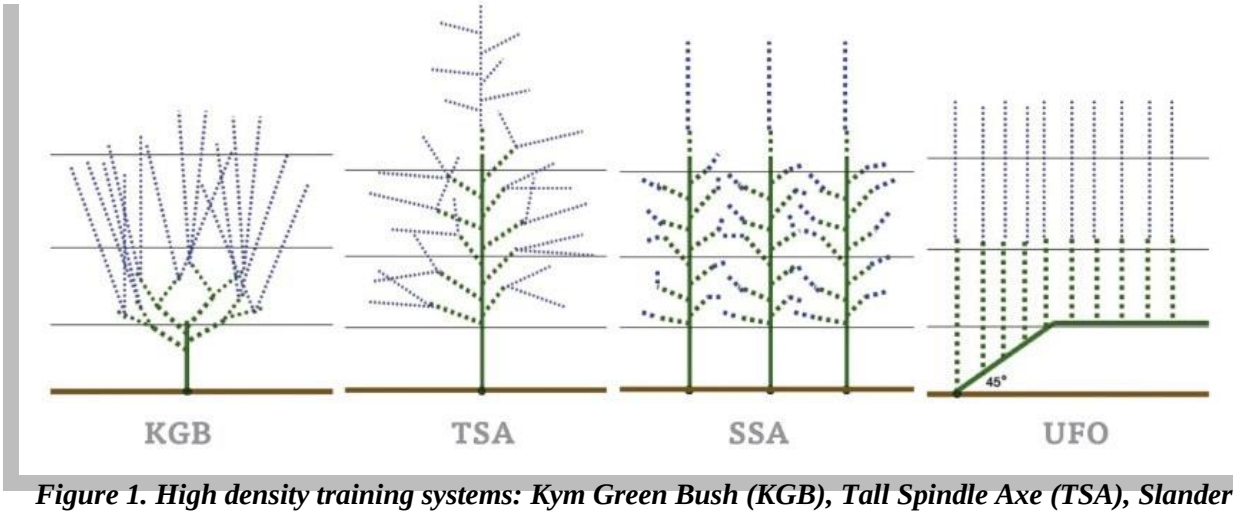

Figure 1. High density training systems: Kym Green Bush (KGB), Tall Spindle Axe (TSA), Slander Spindle Axe (SSA), and Upright Fruiting Offshoots (UFO).

The objectives of the trial are:

- changing the acrotonic growth habit of sweet cherry, and thus improving light distribution lower in the canopy.
- inducing precocity and improving early yield potential.
- developing a minimal permanent trunk.
- performing annual renewal of a portion of the fruiting wood, which is one of the keys to producing high quality fruit over several decades.
- allowing orchard work to be conducted from the ground.

Figure 2.

Harvest and fruit sampling 2018 at Crist Farm Walden, NY.

The trees have started bearing fruits for the first time in 2015. The evaluation of yields and fruit quality in that year has shown an expected low fruit production (< 1.0 kg/tree), with TSA having the highest yields on all three rootstocks, followed by UFO, KGB and SSA.

In 2017, TSA has continued to produce the highest yield and have bigger TCSA. None of the rootstocks had an impact on yield. However, Gi.6 has increased trunk size and fruit weight.

In 2018, trees grafted to Gi.6 had higher yield. KBG and Rootstock Gi.5 influenced the bigger fruit size and diameter in the same year. In 2019, system and rootstock made an impact on crop size, with TSA and Gi.6 resulting again in the highest yield per tree. Also, cherries grown on Gi.5 were heavier and bigger in diameter.

We have recorded number and type of natural defects (fruit with cracking and double fruits) and the observed low level of fruit with defects was consistent over the years.

During the bloom 2016 we have performed a "whole tree renewal", which comprised of removing the most vigorous (largest diameter) fruiting branches by stubbing them back to the lowest possible visible basal bud. For this purpose, only one out of three trees per rep was selected and the related data were used to investigate the effect of tree renewal pruning practice on yield, fruit quality and vegetative growth.

In the following season after the whole tree renewal had been applied, the sets of trees encompassed by this strategy had born very low yield, up to 1.5 kg per tree. However, two seasons later, 2018, the yield per tree were at the comparable level to the trees on which renewal has not been performed (approximately 3 kg per tree) with the highest yield observed in TSA. The same training system showed the highest number of flowering spurs in spring 2018.

Promoting Increase of Sweet Cherries Fruit Size and Resistance to Splitting

The trial has been initiated in 2017 to test the effect of a new compound, Splendor, registered in CA for the promotion of berry fruit growth and prevention of berry splitting after rain. Splendor's active ingredient, forchlorfenuron or CPPU is a synthetic cytokinin-like plant regulator that at low

concentration promotes berry development and increase fruit size. In the trial, this product has been applied alone or in the combination with ReTain, a plant growth regulator that has been shown to extend flower viability in cherries by reducing ethylene production in flowers and delaying flower and stigmatic senescence. Due to this effect, flowers that last longer have a higher likelihood to be successfully pollinated, and increased pollination results in a higher yield.

To test the effect of the products on yield and fruit size, ReTain spray was applied at bloom (May 4th), with rate of 50g/acre, while Splendor with the rate of 6g a.i./acre was sprayed at fruit set (May 15th) in 2018. The experiment counted in following varieties: "Black Pearle", "Burgundy Pearle", "Ebony Pearl", "Blackgold", "Regina", and "Van".

Data present in Figure 1. show the treatment influence on yield per tree, fruit size and fruit quality. Treatments had no significant effect on yield and fruit quality. However, we noticed that Retain applied in the combination with Splendor had promoted yield per tree, but reduced fruit size for two consecutive years. Splendor alone slightly increased berry weight and diameter in 2018.

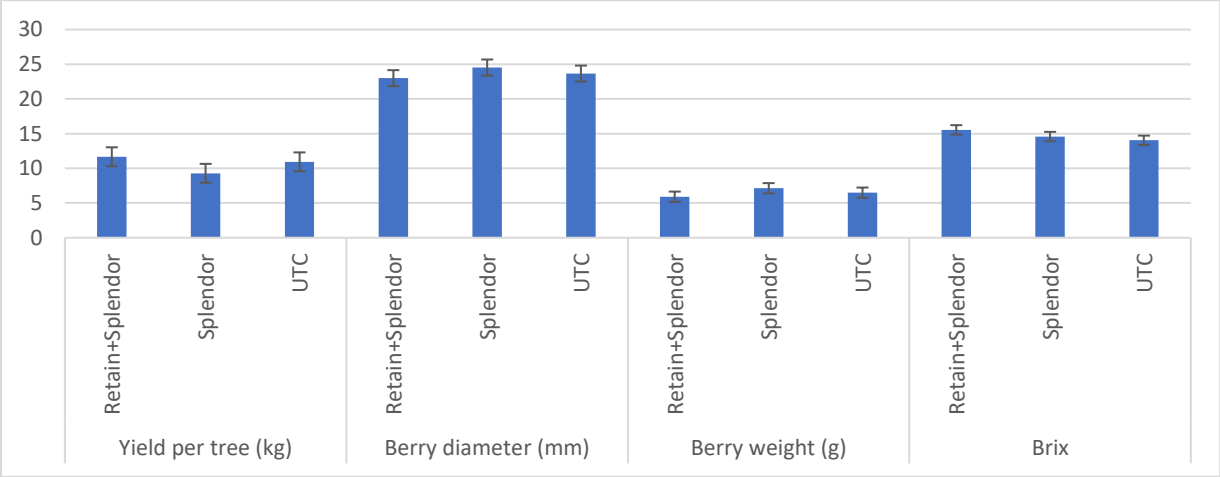

Figure 1. Treatment impact on yield per tree, berry size and fruit quality.

A potential impact of Splendor on resistance to fruit splitting was test by spraying this product at color break (Jun 14, 2018) and compared to UTC. The cherry varieties included in this splitting trial were "Attika", "Danube", "Regina", "Ulster" and "Whitegold".

A rainy week preceded the harvest resulted in almost 45% of UTC fruits with some type of cracking. In this trial we recorded all 4 types of cherry splitting (Figure 2). The transversal and half-moon cracks, which are directly correlated with rapid absorption of water by the roots and contact between fruit, occurred more often in UTC (13.2%) than on cherries sprayed with Splendor (10.3%).

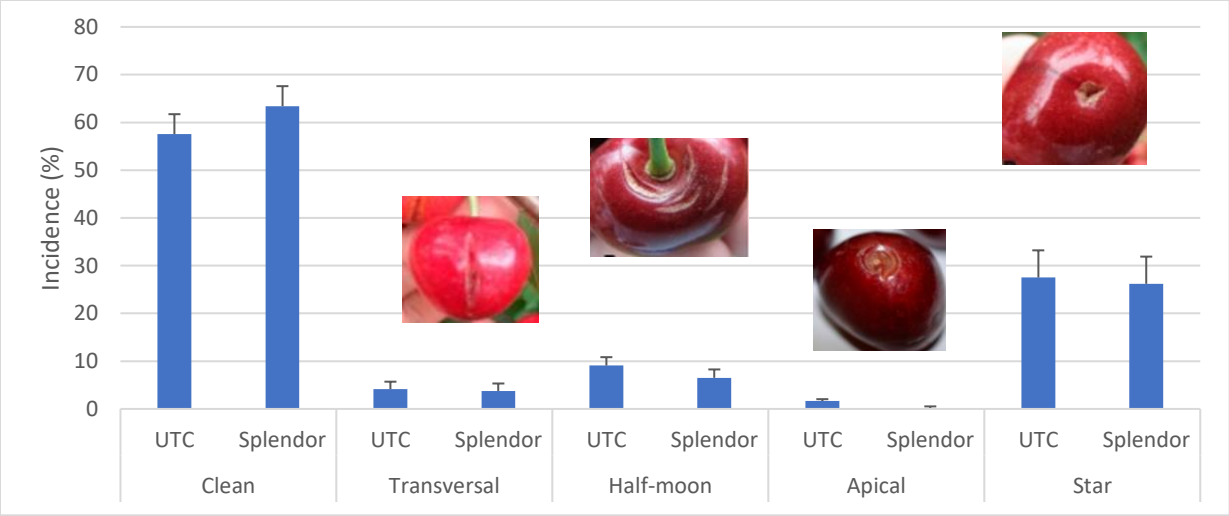

Figure 2. Splendor effect on promotion of resistance to berry splitting.

Grape Cold Hardiness Testing

Since 2009 we have been testing grape buds at the lab for sensitivity to winter cold using a "Differential Thermal Analyzer". The data were used to predict the level of bud mortality at a low temperature and to adjust spring pruning accordingly. The screening of the grapes grown at commercial and Cornell vineyards in the Lake Erie, Finger Lakes, and Hudson Valley regions has been funded by Viticulture Consortium-East, the Lake Erie Regional Grape Program, Inc., and the New York Wine and Grape Foundation.

The HVL Horticulture reported data on Riesling, Cabernet Franc, Seyval, and Pinot Noir as representative varieties exhibiting a broad range of bud hardiness under NY conditions. Vineyards are sampled every two weeks from December 1st through March. Most recent LT50 (Median Bud Freezing Temperature) values for each region are listed in separate tables on the <grapesandwine.cals.cornell.edu> website. Clicking on a variety name will bring up individual graphs of minimum/maximum temperatures and seasonal change in bud freezing temperatures (Figure 1).

Hudson Valley

DATE	LOCATION	VARIETY	LT10	LT50	LT90	BUD MORTALITY %
3/26/2018	Hudson Valley	Cab Franc	0.6	-3.2	-6.9	
		Pinot Noir	-0.9	-3.5	-5.8	
		Seyval	4.1	-1.8	-8.6	
		Riesling	0.2	-4.3	-7.9	

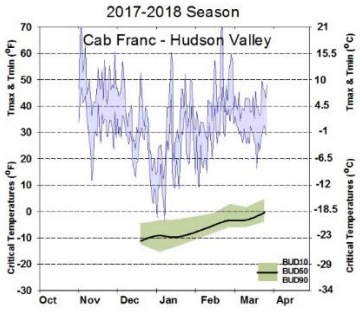

Figure 1. Cold hardiness report of "Cab Franc", "Pinot Noir", "Seyval" and "Riesling" grown in Hudson Valley.

“Cabernet Franc” Clone and Rootstock Selection Suitable for Hudson Valley AVA and Viticultural Techniques for Superior Fruit Quality

To develop regional branding for The Hudson River Appellation, the selection of a single varietal wine was agreed upon in the spring of 2016 by the Hudson Valley Wine and Grape Association, choosing “Cabernet Franc” as their signature variety. Afterwards formed Cab Franc Coalition proposed the development of a research vineyard comprised of compatible rootstocks, grafted to desirable clones of “Cabernet Franc” to define, and solve specific production issues of this variety in the region.

In partnership with HVL and supported by the NYWGF the experimental vineyard was established in 2018 to elicit characteristics of unique clone of “Cabernet Franc” on rootstocks while augmenting cultural practices of vine management to develop juice attributes producing the most desirable traits for this regional selection of grape. The vineyard includes clones of “Cabernet Franc”: clone 1, FPS11, FPS13.1, all of which were grafted on rootstocks: 3309C, 101-14, and Riparia Gloire. Clones are selected for suitability of the cool climate of the Hudson Valley region, demonstrating successful production of premium wine in grape growing regions of the world with similar growing seasons to the Hudson Valley.

Figure 1. Post pounding in 2018, vine watering in spring and young “Cabernet Franc” vines at shoots 10 cm long in 2019.

Assessment of the most successful approach for controlling MPs has been carried out in 2 commercial vineyards: Glorie's Farm in Marlboro, and Millbrook Winery in Millbrook, NY (Figure 2). For that purpose, the treatments were organized in 5 blocks CRBD with 3 repetition per treatment. Yield was manipulated in the crop load (CL) treatments with retention of 1/3 additional buds comparing to the UTC and leaf pulling (LP) treatment. Removing of 4 basal leaves were performed on LP vines 14 days after full bloom.

This trial was originally set up in three commercial "Cabernet Franc" vineyards in 2017 including Whitecliff Vineyard & Winery in Gardiner besides above mentioned two other locations. However, Whitecliff Vineyard experienced extreme winter frost event during 2018 and lost the entire experimental plot over there, so we could not repeat the experiment for the second year at this location.

Figure 2. Vines pruned at Glorie's Farm in March: control, crop load and leaf pulling treatments (top row, from left to right). Vines in bloom at Millbrook vineyard: control, crop load and leaf pulling treatments (bottom row, from left to right).

At Glorie's farm, we observed an increase in yield and cluster number of vines on which LR has been applied. Crop load manipulation and leaving more buds per vine did not significantly result in more clusters or higher yield per vine overall. Using this technique, the increase of 42% in cluster number and 24% in yield were noticed at the Glories' farm only.

Bunch rot incidence did not differ among treatments and was much higher in comparison to the previous season, reaching to approximately 45% of affected clusters due to extremely rainy season.

To prevent damaging effect of bunch rot incidence on fruit quality, grapes were harvested before forecasted rainy period had occurred at brix level of 17.6. Treatments influence on berry size, fruit chemistry and color were not noticed overal. However, looking at the individual site, CL and LP significantly reduced berry size in Glorie vineyard. Generally, smaller berries have bigger surface to volume ratio, and thus higher anthocyanins concentration, since anthocyanins are primarily localized in the outer hypodermis or berry skin. This is exactly what we found in LP treatments.

Additionally, better light exposure could be as well contribution to the higher anthocyanins content of LP treated vines.

The whole berry samples were shipped to Cool Climate Oenology and Viticulture Institute at Brock University, Ontario, to analyze the 3-isopropyl-2-methoxypyrazine (IPMP), 3-sec-butyl-2-methoxypyrazine (SBMP) and 3-isobutyl-2-methoxypyrazine (IBMP) for us, using headspace SPME GC-MS and a stable isotope dilution assay.

Crop load treatment caused the reduction in IPMP concentration at Glorie's Farm. Very little variation was observed in the concentration of other two MPs. Our trial found that crop load play more important role in MP accumulation than leaf removal per se. The absence of treatment effect at Millbrook vineyard can be explained by the site specificity, which was also confirmed in the previously published research pertaining to this subject.

Publications and Extension/Outreach by Dana Acimovic

Relevant Extension/Outreach Publications:

Acimovic, D. & Jentsch, P. (2020). Strategies for Sunburn Prevention on "HoneyCrisp" and Management of the Apple Insect Complex Employing Complete Exclusion Protective Netting in the Hudson Valley of NY State. Fruit Quarterly 28 (1), 14-19.

Refereed Journals Publications:

Tommaso, T., Acimovic, D., Tombesi, S., Sivilotti, P., Palliotti, A., Poni, S., Sabbatini, P. (2018). Changes in Within-Shoot Carbon Partitioning in Pinot Noir Grapevines Subjected to Early Basal Leaf Removal. Frontiers in Plant Science 9. https://doi.org/10.3389/fpls.2018.01122.

Frioni, T., Acimovic, D., Vanderweide, J., Tombesi, S., Palliotti, A., Gatti, M., Poni, S., Sabbatini, P. (2019). Whole-Canopy Source-Sink Balance at Bloom Dictates Fruit Set in cv. Pinot noir Subjected to Early Leaf Removal. Am. J. Enol. Vitic. 70(4), 411-419.

Wise, J. C. Miles, L. A., Acimovic D., Vandervoort C., Isaacs R, Miles, T.D., Schilder, A. M. C. (2020). Sprayer Type and Water Volume Influence Spatial Patterns of Pesticide Deposition and Control of Diseases and Insect Pests of Highbush Blueberries. International Journal of Fruit Science. DOI: 10.1080/15538362.2020.1834895

Reig, G., Lordan, J., Hoying, S., Fargione, M., Francescatto, P., Acimovic, D., Fazio, G., Robinson, T. (2020). Long-term Performance of 'Delicious' Apple Trees Grafted on Geneva Rootstocks and Trained to Four High-density Systems under New York State Climatic Conditions. HortScience. 55(10), 1538 -1550.

Technical Reports:

Acimovic D (2018). Report on Drape Net Effectiveness in Sunburn Prevention on "HoneyCrisp".

Acimovic D, & Leffelman, C. (2019). Report on Drape Net Influence on 6 Apple Cultivars Grown in Eastern NY.

In-State Presentations at fruit grower meetings and other meetings:

The Annual Hudson Valley Cab Franc Coalition Meeting, Benmarl Winery, Marlboro, NY (March 14, 2018). The Research Findings on Viticultural Techniques for MPs Control and Updates on the Cab Franc Vineyard.

The Annual HVRL Industry Meeting, HVRL, Highland, NY (September 7, 2018). Introducing New Cab Franc Clone and Rootstock Trial at HVRL.

Growers and Industry Reporting Session, HVRL, Highland, NY (September 9, 2018). Sunburn Management Strategies in 2018.

2019 Hudson Valley Cabernet Franc Barrel + New Release Tasting, Nostrano Vineyards, Milton, NY (May 30, 2019).

Growers and Industry Reporting Session, HVRL, Highland, NY (September 5, 2019). Progress Report on New Cab Franc Clone and Rootstock Trial.

Growers and Industry Reporting Session, HVRL, Highland, NY (September 5, 2019). Horticulturing programing for the Eastern NY Tree Fruit Industry in 2019.

Research Orchard and Laboratory Field Tour at the HVRL for Arctic Apple Representatives, HVRL, Highland, NY (October 4, 2019). Effect of Drape Net on Fruit Quality.

ARDP Annual Reporting Session, Barton Lab Room A137, Geneva, NY (November 22, 2019). Horticulturing programing for the Eastern NY Tree Fruit Industry in 2019.

2019 Cornell Recent Advances in Viticulture and Enology, Plant Sciences 233, Cornell Campus, Ithaca, NY (December 11, 2019). Cabernet Franc Clone and Rootstock Selection Suitable for Hudson Valley AVA and Viticultural Techniques for Superior Fruit Quality.

2019 Apple Forum, HVRL Highland, NY (December 17, 2019). Progress Report on New Cab Franc Clone and Rootstock Trial.

2019 Apple Forum, HVRL Highland, NY (December 17, 2019). Horticulturing programing for the Eastern NY Tree Fruit Industry in 2019.

39th Long Island Ag Forum (January 8, 2020). 2019 Sunburn Trial at HVRL. Presented by Peter Jentsch.

LERGP and NYWGF Reporting Session, Cornell Lake Erie Research & Extension Lab, Main Meeting Room, Portland, NY (February 13, 2020). Cabernet Franc Clone and Rootstock Selection Suitable for Hudson Valley AVA and Viticultural Techniques for Superior Fruit Quality. Hosted by Lake Erie Regional Grape Research and Extension Program and New York Wine & Grape Foundation

Tour of the HVRL for Foreign Government Officials from Bangladesh, HVRL, Highland, NY (February 18, 2020). HVRL Horticulture Program.

The 2020 Cornell Cooperative Extension Eastern NY Fruit & Vegetable Conference, The Desmond Hotel and Conference Center, 660 Albany Shaker Road, Albany NY (February 25, 2020). The influence of Drape Net on Fruit Quality of Six Apple Varieties Grown in Hudson Valley.

Webinars:

Hudson Valley Zoom Petal Fall and Thinning Meeting (May 14, 2020). Sunburn Management.

Capital Region Virtual Petal Fall Meeting (May 20, 2020). Sunburn Management.

Champlain Valley Petal Fall Meeting (May 26, 2020). Sunburn Management.

Newspaper, digital new releases:

The Horticulture program, current projects and results can be accessed via HVRL Horticulture – Cornell Blog Service: https://blogs.cornell.edu/hvrlhorticulture/

35 blog posts since April 2018

Strong Roots (August 2019). Hudson Valley Wine Magazine by Brian PJ Cronin. https://hvwinemag.com/strong-roots/