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Fruit Notes

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Cornell Cooperative Extension
Lake Ontario Fruit Program

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Phenology Update for Tree Fruit

Craig Kahlke

Since last year, we have been modeling green tip (GT) prediction in apples by using growing degree hours (GDH) following chill unit accumulation. Experimental data has shown that about 2000 GDH (base 40°F) are required from the end of rest completion until GT for early breaking varieties such as Idared, RubyFrost, and Zestar™. At about 2200 GDH, most varieties in the normal budbreak window will be at GT. In most winters in NY, the cold temperatures of Jan. and Feb. limit heat unit accumulation so that even though rest has been completed in late December or early January, buds do not begin to develop until warmer temperatures arrive in March and April.

Chill Unit and Heat Unit Accumulation During the Winter of 2022/2023

The winter of 2022/2023 has been quite variable. November was fairly normal, but December and January were among the warmest on record. Things got close to normal for temperatures in February. Thus far as we are into late March, we've had slightly below average temperatures that have hindered bud development this month. Using the chill unit model developed in North Carolina, which is an improved version of the original chill unit model from Utah, I've estimated that for both inland and lake sites, chill units began to be accumulated in late Sept. (22nd). Warmer lake temps moderated the temperatures and these sites reached an accumulation of 1080 chill units on Dec. 29, 2022. For inland sites, rest was not achieved until about 5 days later, on Jan. 3, 2023. It is theorized that warmer lake water temperatures have moderated the lake sites, keeping them warmer, and thus reaching rest earlier. Above average temperatures in late December and early January allowed the lake sites to start accumulating heat units, and they've remained significantly above inland sites. However, we expect the inland sites to catch up, as spring daytime temperatures are usually warmer inland. Thus far, the inland sites have accumulated significantly more GDH than lake sites over the past 3 weeks; however, the lake sites are still far ahead. Again, we expect this to change as we warm up.

Crop consultant Jim Eve has been running GDD (base 4C, BE) at weather stations in Wayne County. His numbers are in line with mine—behind the same sites at the same time last year. He's observing early silver tip at some Idareds, Macs, and Empires. He's observed peaches and pears at bud swell. Tart cherries have a race of bud scale separation, and are at bud swell at another block. Sweet cherries are at bud swell/trace of scale separation.

My calculations of apple GDH in lake sites since the completion of rest have shown that trees have accumulated ~1131 GDH, and only 798-819 GDH for inland sites. All sites are significantly behind where we were at this time last year. At this time last year, lake sites were ~953 GDH, while inland sites were 1099-1303 GDH. The forecast for the next 3 weeks looks to be close to normal regarding daytime high and nighttime low temperatures. If I use the forecasted temperatures, we will still reach GT earlier in lake sites, which I don't believe will happen. **With the latest temperature data, GT dates for earlier sites look to be April 13 (early varieties) and April 15 (all other varieties). For the later sites, GT dates look to be April 15 (early varieties) and April 18 (all other varieties).** So, if we can believe the forecast, green tip could be later than our "new normal" this year. However, if actual temperatures are significantly higher than forecasted, GDH will accumulate quicker and GT could be earlier, but likely not before April 10. Stay tuned for another update by April 7.



Statewide Virtual Apple Conference Recording Available

For those who were unable to attend our March 3 conference (co-hosted with the CCE-ENYCHP), the recordings are available for purchase (\$20) through this link on our website: <https://lof.cce.cornell.edu/event.php?id=1765>
If you pre-registered and were not able to attend, or you attended but want to view the recordings, you will be emailed the free link by Liz Tee soon.

Free “Strep Resistant *Erwinia amylovora*” webinar recording

A lot of excellent material was covered in the March 21 “Strep resistant *Erwinia amylovora*” webinar. In case you missed it, or want to watch it again!, the recording is now available for free on our YouTube channel. Please share widely!
<https://youtu.be/-hi9guUp0Ho>

Last Call for Budwood Collection While Trees are Still Dormant and Be Cautious if Planning to Graft an Old Block to ‘Honeycrisp’ this Season

Mario Miranda Sazo, Terence Robinson, Lailiang Cheng, and Craig Kahlke

Using Craig’s most recent bud break forecast (for more details please read his entire article on page 1 of this issue), we estimate that green tip in apples in early sites will be on **April 13** (early cultivars) and on **April 15** (all other varieties). For the later sites, green tip dates will be on **April 15** (early cultivars) and on **April 18** (all other varieties). Therefore, we are quickly approaching the **end of the window for collection of budwood while it is fully dormant** for any top-, side-, or beaver-grafting project you may plan this coming season. If this is the case, you should collect new growth “one-year wood” from the past season. Avoid the spurry wood! It is undesirable and usually can’t be used. The best wood is located at the ends on the branches or tops of the trees - often near a pruning cut from the prior season. If you look at the terminal growth of a limb, it is the newest growth from above the growth ring where the prior year’s terminal bud was. Wood to the "south" of this growth ring is not desirable as those buds are very dormant, dead or have grown into fruiting spurs. Cut dormant wood about 8-12". Wrap with a damp paper towel or damp newspaper and wrap with plastic to keep it from drying out. You can store budwood in a labor camp refrigerator with the temperature turned all the way down. Freezing temperatures at or just below 32°F will not harm fully dormant wood but will prevent the development of mold.

Creating opportunities via grafting: WNY growers now have

existing modern orchards with less profitable varieties on dwarfing rootstocks that needs to be renewed and at tree densities of 1,000 or more trees/acre which would be very expensive to renew by replanting. Grafting is a viable option since replanting will take a minimum of 2-3 years to prepare the ground and plant and then another 2-3 years to return to partial production. Since there is less site preparation and lower material costs, a grafted “modern” orchard can be producing a high-value crop by year 2 or 3. However, WNY growers should think twice when planning to graft an old block to ‘Honeycrisp’ this season. Grafting to Honeycrisp has been problematic especially in more vigorous rootstocks with very fertile soils. This condition produces an unbalance between the bottom (big root system) and the top (new grafted cultivar). Vigorous re-growth and too much nitrogen of the scion wood can contribute to a delay in early production, fruit quality issues, and bitter pit incidence. Our current research findings indicate that high peel N/Ca ratio (>10) can affect overall fruit quality and a high peel SAP K/Ca ratio (>25) can increase bitter pit. A grafted Honeycrisp block can be a challenge even on a dwarfing stock and for an experienced WNY fruit grower. We recommend to growers the planting of a new Honeycrisp orchard instead of grafting to avoid fruit quality issues and incidence of bitter pit. Please think twice when planning to graft an old block to Honeycrisp in 2023.

Tree Fruit Blog: Early Season Disease Management 2023

Līga Astra Kalniņa & Kerik Cox

Assessing the upcoming 2023 apple scab season.

Winter seemed to come late in early March, and only for a few weeks and with intermittent snow cover at best. Snow cover is effectively non-existent, and while it's still cool in the evenings, we're having considerable bouts of warm temperatures often approaching 60°F. In the Hudson Valley and Long Island, green tip is presently happening or imminent in the near future. The rest of the production areas in NY may still have a week or so before bud break. Fortunately, there are cooler days forecasted for the week for most of NY with temperatures remaining below 60°F, which could slow tree development. Overall, the season will be upon us shortly, and we need to consider early season management for apple scab. In 2022, there was little rainfall from early April to June, which was characterized by sporadic, but hot (>75°F) heavy thunderstorms in July and August. For 2021 and 2022, many regions received less than 5 inches of rainfall during the key periods of apple scab infection and pressure is at a historical low. Eerily, conditions seem to favor apple blotch (syn. Marssonina blotch), which comes in later in the season and defoliates trees in late August and early September. In our orchards at Cornell AgriTech, unmanaged trees of numerous cultivars only had low incidences of apple scab. Unsurprisingly, there were no reports of apple scab control failures in commercial orchards anywhere in NY.

Inoculum reduction recommendations in 2023.

Despite the low levels of apple scab in 2021 and 2022, reduction of overwintering or "primary ascospore inoculum", may allow for easy season long management even if there is considerable rain fall from green tip to petal fall. Reducing this initial inoculum will delay the epidemic, and in theory, if there is little rain early in the season, it could possibly delay the epidemic to a point in the season where it would be too dry and too hot for the apple scab fungus to cause infection. Since it's hard to predict if there will be an early season drought, we should keep suppressing apple scab to keep orchard populations low. In addition to apple scab, reducing orchard floor leaf litter and fruit drops may greatly reduce the inoculum for other foliar diseases like apple blotch and numerous fruit rot diseases including bitter, black, and white rot. As soon as it is possible to safely get a tractor in the orchard, remove any remaining fruit drops and pruned shoots left on the floor from winter pruning as they may contain bitter rot or black rot inoculum. If orchard floor management was practiced in the fall with flail mowing or urea sprays, it won't be necessary to repeat the practices this spring. Research out of the University of New Hampshire has demonstrated that there are diminishing

returns for practicing inoculum reduction in the fall and spring. Even if the planting is in green tip, inoculum reduction may still provide considerable benefit by reducing inoculum pressure by tight cluster or pink, when tissues are most susceptible to scab.

The two best options for inoculum reduction are to apply the urea to leaf litter or use a flail mower to shred the leaves. These practices hasten decomposition of the leaf litter. In the case of flail mowing, leaves should be first swept or raked from underneath the canopy into row middles as most of the apple scab inoculum is present on litter under the trees. Subsequently, go over the row middles with the flail mower set to scalp the sod. If urea is used, apply 40 lbs. of feed grade urea per acre in 100 gallons of water to the herbicide strip (5% solution). Dolomitic lime applied at a rate of 2.5 tons per acre can be used in place of urea. Of the various options, applying urea is the simplest approach, but take care to flush the sprayer pumps with water afterwards since the urea is caustic and can corrode a pump over time. As suggested above, the use of orchard floor urea may also reduce inoculum of other diseases such as apple blotch, bitter rot, and black rot as it hastens decomposition of leaf litter, fruit drops and pruned shoots that harbor the pathogens causing foliar diseases, cankers, and summer fruit rots.

Delayed-Dormant copper for apple scab and fire blight inoculum reduction.

Excessive warm weather after petal fall in the last few years has led to some devastating fire blight epidemics in western NY. Orchards with fire blight in 2022, will likely have an excessive number of cankers this season. Presently, overwintering fire blight cankers are still dormant even in our high inoculum fire blight research orchard in Geneva. As the weather begins to warm (> 60°F) in the coming day/weeks, fire blight cankers could begin to ooze. Now is the time to scout for oozing cankers, especially in the eastern part of the state and New England. It's important to note that cold weather will not kill fire blight bacteria overwintering in cankers; the bacteria will remain inactive, but viable at low (< 32°F) temperatures. To mitigate the threat of oozing cankers and reduce both fire blight inoculum and early season apple scab inoculum, make one to two "delayed dormant" silver-tip applications of a high (>15%) metallic copper equivalent (MCE) copper fungicide (e.g. Badge, Kocide, Cuprofix). It may be hard to get into the orchards at silver tip due to wet fields, and the application can be delayed to 'green tip'. Even at green tip, it is generally still safe to apply high MCE copper products. In the Geneva research orchards, a second application of a high MCE copper fungicide is often made at ¼" green with no consequences.

Ag Water Proposed Rule in the FSMA PSR – Performing an Agricultural Water Assessment

Craig Kahlke

The FDA is proposing to revise certain pre-harvest agricultural water requirements for covered produce (other than sprouts) in Subpart E of the FDA Food Safety Modernization Act (FSMA) Produce Safety Rule. **This proposal, if finalized, would replace the pre-harvest microbial quality criteria and testing requirements for such produce in the Produce Safety Rule with requirements for systems-based pre-harvest agricultural water assessments that covered farms would use for hazard identification and risk management decision-making purposes.** As part of the assessment, the farms would be required to evaluate factors to identify conditions that would be reasonably likely to introduce known or reasonably foreseeable hazards into or onto produce or food contact surfaces.

Please see the full FDA factsheet on their website here:

<https://www.fda.gov/media/154334/download>

In July 2022, the FDA issued a supplemental notice of proposed rulemaking (SNPRM) to the agricultural water proposed rule to extend the compliance dates for the proposed pre-harvest agricultural water provisions. The SNPRM proposes to establish the following compliance dates for the pre-harvest agricultural water requirements for covered produce other than sprouts:

2 years and 9 months after the effective date of a final rule for very small businesses

1 year and 9 months after the effective date of a final rule for small businesses

9 months after the effective date of a final rule for all other businesses

*But what can growers do to prepare for the final rule? **Assess water systems now.***

Growers currently testing their water may continue to do so

If not testing, growers may consider starting to test to better understand their water quality

Follow Good Agricultural Practices (GAPs) to protect and maintain water quality

Develop water management strategies, such as water system surveys, to identify and reduce risks

Questions? Don't hesitate to contact Craig at 585-735-5448, or cjk37@cornell.edu

Share Your Thoughts on Cover Crops in the National Cover Crop Survey!

Share your thoughts on cover crops in an online survey at bit.ly/CoverCrop23. Why do you plant cover crops...or why don't you? What do you want to know about cover crops? Where do you get your information about them? Your insight will help guide research, communications, seed development, and more.

This National Cover Crop Survey is the seventh since 2012 conducted by the USDA-NIFA Sustainable Agriculture Research and Education (SARE) program, Conservation Technology Information Center (CTIC) and the American Seed Trade Association (ASTA), with the help of Informa/Farm Progress.

Please take a few minutes to contribute your voice at bit.ly/CoverCrop23.

The survey will close on March 30, 2023.

After completing the questionnaire, you may enter a drawing for one of three \$100 Visa gift cards.

Scaffolds - revamped audio version began this week!

Many of you probably read Art Agnello's statewide tree fruit updates and recommendations newsletter, "Scaffolds". Dr. Monique Rivera is bringing it back, but in a new audio version. Episode one was recorded this week, and is now available for free online at <https://open.spotify.com/show/5WscL4QHbFJudltdLBRI9?si=6afe7ff5f21c4210>.

End of Intended Enforcement Discretion for Subpart E Requirements for Harvest and Post-Harvest Agricultural Water for Covered Produce Other than Sprouts - Beginning January 26, 2023

Craig Kahlke

For compliance with the Subpart E Requirements for Harvest and Post-Harvest Agricultural Water for Covered Produce Other than Sprouts in the FSMA PSA, the USDA is ending enforcement discretion at:

January, 26, 2023 for all other businesses (>\$500,000 in produce sales)

January 26, 2024, for small businesses (>\$250,000 - \$500,000 in produce sales)

January 26, 2025, for very small businesses (>\$25,000 - \$250,000 in produce sales)

As has been done with other FSMA rules, the FDA plans to take an "educate before and while they regulate" posture as they begin implementing the harvest and post-harvest requirements.

The full details of the requirements, along with definitions, can be found here: <https://www.fda.gov/food/food-safety-modernization-act-fsma/requirements-harvest-and-post-harvest-agricultural-water-subpart-e-covered-produce-other-sprouts>

Questions? Don't hesitate to contact Craig at 585-735-5448, or cjk37@cornell.edu

On Sale Now: 2023 Cornell Pest Management Guidelines for Commercial Tree Fruit Production

The 2023 Cornell Pest Management Guidelines for Commercial Tree Fruit Production is now on sale and is available for purchase at <https://www.cornellstore.com/books/cornell-cooperative-ext-pmep-guidelines>.

The 2022 edition of the guide will be available to view until April 5th, after which it will no longer be accessible.

Results from the 2022 Berry Prices Survey

Kristen Park, Dyson School of Applied Economics and Management

Cornell's Food Industry Management Program, with funding by the NYS Berry Growers Association, has results from the 2022 berry pricing survey for New York commercial berry growers. The survey collected 2022 price information so commercial growers can make pricing decisions for their upcoming season.

We want to thank all the growers who took the time to complete the survey. One hundred thirty-six farms from 45 counties which spread the length and width of the state responded to the survey. The number of returned surveys was higher than the previous study conducted in 2020, and the results are robust. The distribution of respondents according to type of production practice, conventional versus organic (Table 1) was very similar to the 2020 respondents and can be compared with the previous survey results.

Table 1: Number of Survey Respondents, 2012 through 2022

	2012	2018	2020	2022
	<i>% of respondents</i>			
Total growers	117	117	99	136
Conventional	97	87	78	107
Organic	12	30	22	29
Counties represented	37	45	37	45

Prices for the four leading berry crops, blueberries, strawberries, raspberries, and blackberries, sold through the various market channels are displayed in Table 2.

Prices for all berry types increased from 2020 to 2022, rising dramatically during the year that saw high inflation for almost all goods. Price increases ranged from a 7.5% increase for u-pick fall raspberries to a 42.0% increase for retail strawberries-all. The market appeared to hold despite these large increases in berry prices. As a comparison, the USDA Economic Research Service reports food at home inflation in 2022 was 11.4%. Whether under continued high inflation in 2023 or under a recession, berry growers should monitor food at home prices at local supermarkets as well as their customer sentiment when they price their berries for the 2023 season.

Table 2. Average Price per Pound

	2018	2020	2022	2020-2022 % change
Blueberries				
U-pick	2.83	2.89	3.44	19.0
Wholesale	3.44	3.64	4.04	11.0
Retail	5.41	5.19	5.63	8.5
Strawberries-All types				
U-pick	2.68	3.20	3.92	22.5
Wholesale	2.74	3.26	4.00	22.7
Retail	5.11	4.24	6.02	42.0
Strawberries-June-bearing				
U-pick	NA	NA	3.91	-
Wholesale	NA	NA	3.84	-
Retail	NA	NA	5.77	-
Strawberries-Day neutral				
U-pick	NA	NA	4.17	-
Wholesale	NA	NA	5.03	-
Retail	NA	NA	7.52	-

Table 2. Average Price per Pound

	2018	2020	2022	2020-2022 % change
Raspberries-summer				
U-pick	4.14	4.87	6.20	27.4
Wholesale	4.84	5.84	7.95	36.1
Retail	8.11	8.54	10.06	17.8
Raspberries-fall				
U-pick	4.54	4.76	5.12	7.5
Wholesale	5.91	6.60	7.33	11.1
Retail	8.74	7.89	11.15	41.3
Blackberries				
U-pick	4.69	5.36	7.27	35.6
Wholesale	5.72	5.43	6.94	27.8
Retail	7.94	8.05	10.85	34.8

NA=Not available. 2022 was the first year June bearing and day neutral prices by market channel were reported. Previously, they were combined under strawberries.

Conventional versus organic prices

We compared prices of conventional berries to organic berries (Table 3) and see strong price premiums for organic depending on the berry type and market channel. The price premiums for diurnal strawberries, wholesale fall raspberries and blackberries were not available due to the limited number of data points for these.

Table 3. 2022 Price per Pound, Conventional Berries versus Organic Berries

Berry		Conventional	Organic	% Price premium
		\$	\$	%
Blueberries				
	U-pick	3.32	4.10	23.5
	Wholesale	3.93	4.43	12.7
	Retail	5.18	6.82	31.7
Strawberries-June bearing				
	U-pick	3.67	5.40	47.1
	Wholesale	3.58	4.93	37.7
	Retail	5.24	7.07	34.9
Strawberries-diurnal				
	U-pick	NA	NA	-
	Wholesale	5.04	NA	-
	Retail	7.86	NA	-
Summer Raspberries				
	U-pick	5.53	7.60	37.4
	Wholesale	6.56	10.00	52.4
	Retail	8.94	12.00	34.2
Fall Raspberries				
	U-pick	5.70	6.50	14.0
	Wholesale	7.58	NA	-
	Retail	9.94	12.00	20.7
Blackberries				
	U-pick	6.83	8.14	19.2
	Wholesale	6.94	NA	-
	Retail	9.47	15.67	65.5

The price premium is the difference between the organic average price and the conventional average price, divided by the conventional price.

Other berries

Information about sales of "other" berries was also collected; however, the number of responses from those growing these specialty berries was not large enough to report prices for each berry type. Prices were averaged across the specialty berry types and market channel prices are shown in Table 10. In general, prices charged in 2022 for berries in the other category which includes black raspberries, currants, gooseberries, and others, are much higher than for blueberries, raspberries, and strawberries. Prices increased between 8.0 and 40.2 percent from 2020 depending on the market channel used.

Table 4. Price per Pound for Other Berry Types

	2018	2020	2022	2020-2022 % change
		\$		%
Other berries				
U-pick	5.49	4.43	6.21	40.2
Wholesale	-	7.41	8.00	8.0
Retail	4.50	7.69	9.04	17.6

Summary

The total number of growers participating in the 2022 berry pricing survey was up from 2020. Berry farm demographics, such as acreage, berry types, and representation across numerous counties in the state stayed the same.

The survey results indicate that berry prices in New York State increased significantly across all marketing channels for each berry type since 2020. This is important to note as the entire berry season took place under general high inflation across the economy. The CPI for food in 2022 was 11.4%. The price increase for berries was often much higher than the overall CPI for food but was a change over 2 years, since 2020.

Thank you to all NYS Commercial berry growers who responded to the 2022 pricing survey. We hope this information is valuable to you as you calculate your price for the future seasons. Thank you again!

Ag Water - Surface and Well Water Testing – Drop Off Sites Available

Getting water testing for surface and well irrigation sources and wells for post-harvest water tests for GAP audits have been a bit problematic for some growers. Either there are no labs in the area that do the quantitative generic E. coli testing within 8hrs of water samples being taken or limited transportation available (Plain communities).

Below is a list of drop off sites that Lozier Environmental Consulting (lab out of Rochester, NY) has set up to help make getting water testing done a little more easily. They have organized drop off sites for farmers (as well as anyone needing testing) in locations where farmers might be frequenting for supplies etc. The forms, bottles, instructions, and payments can all be done at these sites. Each site has cold storage for the bottles. The samples would have to be dropped off on the same morning as pickup schedules.

Testing for agricultural water quality for surface water sites such as ponds, streams, canals, springs, and lakes, along with wells is a very useful tool for understanding what might be affecting the quality of water for irrigation. Water testing for wells that will be used washing of fruit and vegetables (and drinking) as prescribed for farm food safety practices needs to be done to establish the quality of that water. Water tests need to be completed by a laboratory in under 8hrs of the samples being taken. To make this easier for farms to accomplish, drop off/pick up sites have been set up in a number of locations across the region. For quantitative generic E. coli water testing (farm food safety) use the Enumeration test option.

There are other water tests available for farm and home. Well water tests, chemical, and others. The lists can be found with the forms and bottles at the sites.

Water test sample bottles, forms, and information are available at each site. Water samples must be dropped off the morning of pickup before the listed times for each site.

Site and Location	Due before:
Albion: Albion Hardware 146 South Main Street Albion NY 585-589-1713	Wed 9am
Sodus: The Country Hardware Store 10 West Main Street Sodus NY 315-483-6571	Fri 9am
Fulton: Northern Ace Home Center 2721 State Route 3 Fulton NY (315) 592-2063	Fri 9am
Rochester: Lozier Environmental Consulting 2011 East Main St. Rochester, NY 585-654-9080. M-F 8am-4pm	

This is the company that has set up the sites across the region teaming up with local businesses who are trying to make water testing more accessible for farms. For more information on the program, call Lozier at their Rochester location.

The start date for the service will April 1. The lab will also do water sampling for home wells, livestock water tests etc. For more information about the other tests, contact Lozier at 585-654-9080 x 108 and ask for Victoria.

If farmers are looking for establishing baseline water quality evaluation, 3-4 tests per season per water source is recommended. If anyone needs assistance with interpretation of results, Craig Kahlke can help with that.

Promising Ag-Vision Technologies Highlighted at the CCE Statewide Virtual Apple Fruit Conference 'What Is Possible Today and in the Future'

Mario Miranda Sazo and Michael Basedow

This winter we were interested in the technological capabilities and solutions being offered by three vision system companies for precision crop load management in apples in 2023 and in the future. Our main goal was to learn how these technologies can help NY growers to evaluate their fruit thinning decisions and yield estimations in high density orchards. We were fortunate to conduct a virtual discussion with four Ag-tech entrepreneurs well-versed in digital Ag, who were willing to share their experiences and knowledge during the statewide virtual apple fruit conference on March 3, 2023.

Here we summarize the responses provided by Dr. Dave Brown and Dr. Patrick Plonski, both from **Pometa** (formerly known Farm Vision), Jenny Lemieux from **VIVID Technologies**, and Charles Wu from **Orchard Robotics**. Our article finishes with a brief overview of the main light sensors and imaging technologies available today.

CCE: What are the main applications we can use in 2023? In the next two years?

Pometa: Crop load management (BETA blossom cluster counting, fruitlet counting, growth and predicted abscission, and the Fruit Growth Rate Model); Irrigation (fruit growth rates); Harvest (fruit color, size, and growth, hand scans or ATV mapping (> 1 inch), Harvest forecast by bins/acre and size distribution; Post-harvest (bin scanning); Weather services (frost, heat and dew alerts, station specific forecast).

VIVID Technology: In 2023 blossom counts, fruitlet and fruit sizes, counts to help with thinning and yield prediction, BETA Fruit Growth Rate Model; in 2024-2025 disease detection and pruning insights.

Orchard Robotics: In 2023 bud counting, blossom counting, counting and sizing of early-stage fruitlets all the way up until harvest, the size distribution model for precision thinning; in the future we will be looking at expanding into disease detection and early-warning of fire blight.

CCE: How accurate have your numbers been?

Pometa: Final crop load is as accurate as hand measurements with the fruit growth rate model; yield estimations for harvest have been within +/- 5% (within ~3 weeks of harvest).

VIVID Technology: 90% accuracy, with variation between farms and varieties.

Orchard Robotics: For full block yields we have demonstrated 93% accuracy. For fruitlets, we are within +/- 10% sizing accuracy at the earliest growth stages, and this accuracy improves throughout the season.

CCE: How early can fruitlet size be assessed?

Pometa: 5 mm, 25mm for ATV scans.

VIVID Technology: 10mm.

Orchard Robotics: About 5 mm, accuracy within 10% at 10mm.

CCE: What is the set up and ground-truthing process?

Pometa: Install iPhone app. Must use an iPhone 12, 13, or 14 Pro or Pro Max. To reach the top of trees, mount phone on a 3' to 6' long pole. ATV scans require mounting iPhone ~6 ft off ground on a fixed pole attached to the front of an ATV. We recommend a quad-lock motorcycle mounting. Install plastic markers (~3 inches) on two trellis posts for reference row segments. For common training systems, ground truth data not required. Detailed vertical scans of reference segments are used to predict occlusion for ATV driving (30 to 60 seconds/scan). For an unfamiliar training system, six individual tree high quality ground truth measurements should be collected throughout the season.

VIVID Technology: Our team conducts the initial farm mapping and software set-up. We also provide a mounting system to attach the camera for scanning that can be left on overnight. The amount of ground truthing is dependent on the amount of an orchard scanned. The person operating the camera can do the ground truthing as it takes as long to count a tree and size a sample of what is on the tree. For 2023, Vivid Machines will be helping by providing ground-truthing as much as possible, as part of the service.

Orchard Robotics: A few minutes to mount the camera to a tractor, gator, or UTV. No additional infrastructure is necessary to start scanning. The system requires a one-time setup of your orchard structure for reference (telling it the name, variety, and location of each block). For accurate absolute data, we highly recommend calibration counts to inform our system's occlusion models. Calibration counts are done by the grower, and the time varies depending on the number of calibration counts and blocks, but calibrating a single block should not take more than an hour of counting.

CCE: What is your pricing structure?

Pometa: \$100/acre starting price for a minimum 100 acres (unlimited use for the season, per acre price declines substantially with volume); \$1000/orchard one-time setup cost.

VIVID Technology: \$5000 per year hardware lease and a \$80 per acre subscription fee. Talk to us about our 2023 new customer pricing.

Orchard Robotics: Camera system at-cost for \$10,000, option to lease a system for \$4,000 / year. Free camera upgrades. Software subscription at \$96/acre/year. Risk mitigation pricing strategy for first year users.

CCE: What is the data collection process and how much of the data collection and processing is automated?

Pometa: Scans are uploaded and processed automatically when iPhone connects to wifi. Hand-held scans of reference segments between two marked trellis posts. Growers set up ~10 of these per block. Scanning takes 30-60 seconds depending on fruit size and post distance. Scans are used to measure fruit growth rates, and to build occlusion models for ATV scanning. During the fruitlet phase, growers scan reference segments every 3-4 days in order to predict fruitlet drop. Ideally, growers scan blocks with an ATV mounting after fruit set to provide the first harvest forecast, then again an additional 1-2 times before harvest to dial in that forecast. In bin-scanning mode, post-harvest, growers can pass the iPhone over a bin to obtain size and color distributions for their harvest.

VIVID Technology: The user needs to hit 'start/stop' on the recording. Once the sensor is plugged in – all data upload and visualization is automatic. Camera sensor updates are done automatically.

Orchard Robotics: The entire process is automated. Doing an orchard scan is a simple, two-click process: one click to start the scan, and one click to stop the scan. All of the processing is handled automatically after the conclusion of the scan, and does not require any additional work from a grower (other than plugging the camera in at the end of the day to recharge!) After the couple of hours of processing time, growers can then view the data on either our provided tablet, or on our website. We supply everything you need to start scanning (tablet to control the camera, the camera system itself, and an external battery + charger).

CCE: How long does it take data to be processed into an actionable report?

Pometa: An hour for the reference segment, overnight for ATV full block scans.

VIVID Technology: Immediate data to growers in the orchard on a tablet/phone as soon as they stop recording. The app provides immediate fruit counts, average fruit size/tree, and tree counts. Once the grower connects to the internet, the data gets uploaded to the cloud, and the predictions display on a dashboard by 9am the next morning. This interactive dashboard provides all of the data insights collected to date throughout the season.

Orchard Robotics: We have a very powerful computer inside the camera system that processes all the data on-device, which means that you do not need a fast internet connection to upload tons of data. This also means that data can be returned as an actionable report quickly, usually within 2x the scan time. (i.e. for a 5 hour scan, you will have the data back within 10 hours, and this is something you can leave running overnight).

CCE: Can I integrate your hardware/software over my existing equipment?

Pometa: Yes. iPhone can be mounted on ATV or gator.

VIVID Technology: Yes, we have built a mounting system that can be adapted for different farm equipment allowing our sensor to be attached to a variety of vehicles.

Orchard Robotics: No additional infrastructure is necessary to start scanning.

CCE: How do we view the data?

Pometa: Web application for data display; iPhone app for data collection.

VIVID Technology: We have an app and a dashboard. The app runs on any phone or tablet. The data is aggregated at a row level at the moment, but individual trees can also be selected. The cloud-based dashboard can be viewed in a website browser and allows growers to get a more extensive view of their orchard. You can filter by date, variety, block etc. The dashboard provides information such as growth curves and size and count distribution.

Orchard Robotics: Scans are run on a tablet app we have developed. This tablet interface lets growers start, stop, and view orchard scans + the status of the camera system. We have a mobile/tablet app to view processed data immediately in the field, as well as a cloud-based website where growers can access, interact with, and export data.

CCE: What do you offer in terms of tech support?

Pometa: Remote support for east coast and midwest growers. Targeted in-field training and support for larger Pacific Northwest producers.

VIVID Technology: We provide field staff to scan and collect ground truth points for growers. Field staff are available to email, call, or message for quick answers. More technical support available should product suggestions or more complicated issues arise. Currently, our field staff communicates with the technical team on behalf of growers.

Orchard Robotics: Full on-site support and servicing whenever a grower needs it – just give us a call and we'll be there!

Short Ag-Tech Summary of Main Light Sensors and Imaging Technologies (available as services through several more Ag-tech companies in the United States and Europe today)

Much like any plant growth regulator, insecticide, fungicide, or herbicide, knowing how sensors work or don't work is crucial to using them effectively. Commercially available sensors, most commonly digital and multispectral, are useful in orchards for crop growth stage determination and general crop health and are available as services through several more Ag-tech companies in the U.S. today. The following information is a brief overview of these technologies.

Digital cameras operate within the visible light range (red, green, blue) and serve as 'eye extenders'. They are relatively low-cost, readily available, easy to use, and small. While powerful, they provide limited information. They are best for looking at properties over a wide range: greenness, growth, weeds, pests, and visible disease. They have potential integrated pest management (IPM) uses for tree/vine training, crop/canopy management, and disease management.

Multispectral sensors operate by sensing discrete segments of visible and near infrared (NIR) light and are good for general crop stress detection and indirect problem identification.

They can be imprecise and provide limited information, but are budget-flexible as they are available in a wide price range. They can be used to run the normalized difference vegetation index (NDVI) on the crop being stand, which is a good indicator of general crops stress from multiple causes, such as nutrient deficiency, water stress, weeds, pests and diseases. Potential IPM uses are tree/vine training, crop/canopy management, tree/vine nutrition, irrigation, and disease management.

Hyperspectral sensors operate throughout the light range of continuous visible to shortwave infrared (SWIR) wavelengths. Rather than sensing only a few key wavelengths like multispectral, hyperspectral sensors collect 100's of wavelengths. They have potential applications for direct problem identification and trait quantification. They are currently very expensive, and need more commercial development and require expert interpretation. They can be used for specific biotic and abiotic stress detection and quantification.

Thermal sensors operate using longwave infrared light with applications for temperature monitoring and properties that change plant temperature. They are available at a moderate to high cost. High-resolution technologies are heavy, and data collected can become 'noisy'. Used for properties that change plant temperature, including water content, water stress, and diseases that impact plant vascular activity. Potential IPM uses include soil management, tree/vine nutrition, irrigation, and disease management.

LiDAR (Light Detection and Ranging) operates in a very specific light region, either NIR or SWIR. Applications include laser, plant structure, plant height, and biomass. These technologies can be high cost and are best for use in the sky, rather than on the ground. They can be used for measuring elevation, plant height, leaf volume, and canopy density. Potential IPM uses include site selection, tree/vine training, and crop/canopy management.

Mark Your Calendar

Meeting Title	2023 Respirator Fit Testing Clinic in Orleans county
Date	April 4th and 5th, 2023
Time	PM on April 4th, AM on April 5th
Location	Orleans county CCE 12690 NY 31 Albion NY
Cost	Varies by farm, see flyer on page 6
Contact for Info/Registration	Call 607-547-6023 (Monday-Friday, 7:30 am—4:00 pm) and ask for the Fit Test Clinic scheduler OR E-mail FitTest@bassett.org
Brief Description of Meeting	The New York Center for Agricultural Medicine and Health (NYCAMH) and Cornell Cooperative Extension of Orleans County are pleased to provide respirator fit testing clinics for agricultural businesses in your region on April 4th & 5th. Stay tuned for details on fit testing clinic dates in Wayne county!

Meeting Title	Special Permit Training—Wayne county
Date	April 11th
Time	English: 8:30am check-in, 9am-12:30pm training Spanish: 1pm check-in, 1:30-5pm training
Location	Wayne County Cornell Cooperative Extension 1581 NY-88 Newark, NY
Cost	\$30 if you register by April 4th
Contact for Info/Registration	Register at: https://lof.cce.cornell.edu/event_preregistration_new.php?id=1760
Brief Description of Meeting	Special Permits will only be issued for 8 specific pesticide labels. This will relieve the certified pesticide applicator from "on-site within voice contact" supervision of non-certified pesticide applicators when they are handling federally-restricted-use pesticides for which they hold a Special Permit.

Meeting Title	Special Permit Training—Orleans county
Date	April 12th
Time	English AND Spanish both run: 8:30am check-in, 9am-12:30pm training
Location	Orleans county Cornell Cooperative Extension 12690 NY 31 Albion NY
Cost	\$30 if you register by April 4th
Contact for Info/Registration	Register at: https://lof.cce.cornell.edu/event_preregistration_new.php?id=1756
Brief Description of Meeting	Special Permits will only be issued for 8 specific pesticide labels. This will relieve the certified pesticide applicator from "on-site within voice contact" supervision of non-certified pesticide applicators when they are handling federally-restricted-use pesticides for which they hold a Special Permit.

Meeting Title	Statewide Virtual Pink Meeting (Zoom)
Date	April 19
Time	12:00-1:30PM
Location	Virtual via Zoom
Contact for Info/Registration	Watch for more information including how to register in April!

Meeting Title	2023 LOF Summer Tour
Date	July 28
Location	Wayne County Specific locations TBD
Contact for Info/Registration	Stay tuned for more information.

Cornell Cooperative Extension

Lake Ontario Fruit Program

12690 Rt. 31

Albion, NY 14411

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Phenology Update for Tree Fruit

Statewide Virtual Apple Conference Recording Available

Free "Strep Resistant Erwinia amylovora" webinar recording

Last Call for Budwood Collection While Trees are Still Dormant and Be Cautious if Planning to Graft an Old Block to 'Honeycrisp' this Season

Tree Fruit Blog: Early Season Disease Management 2023

Ag Water Proposed Rule in the FSMA PSR –
Performing an Agricultural Water Assessment

Share Your Thoughts on Cover Crops in the National Cover Crop Survey!

Scaffolds - revamped audio version began this week!

End of Intended Enforcement Discretion for Subpart E Requirements for Harvest and Post-Harvest Agricultural Water for Covered Produce Other than Sprouts
- Beginning January 26, 2023

On Sale Now: 2023 Cornell Pest Management Guidelines for Commercial Tree Fruit Production

Results from the 2022 Berry Prices Survey

Ag Water - Surface and Well Water Testing – Drop Off Sites Available

Promising Ag-Vision Technologies Highlighted at the CCE Statewide Virtual Apple Fruit Conference 'What Is Possible Today and in the Future'

Mark Your Calendar

Contact Us

Fruit Notes

YOUR TRUSTED SOURCE FOR RESEARCH-BASED KNOWLEDGE

Fruit Specialists



Craig Kahlke | 585-735-5448 | cjk37@cornell.edu

Team Leader, Fruit Quality Management

Areas of Interest: Fruit Quality and factors that affect fruit quality before, during, and after storage.

Crops: Blueberries, Raspberries / Blackberries, Strawberries, Apples, Apricots, Cherries, Nectarines, Peaches, Pears, Plums



Mario Miranda Sazo | 315-719-1318 | mrm67@cornell.edu

Cultural Practices

Crops: Blueberries, Raspberries / Blackberries, Strawberries, Apples, Apricots, Asian Pears, Cherries, Currants, Gooseberries, Nectarines, Peaches, Pears, Plums



Janet van Zoeren | 585-797-8368 | jev67@cornell.edu

Integrated Pest Management (IPM)

Areas of Interest: IPM of tree fruit and berry pests, biological control, pollinators.

Crops: Blueberries, Raspberries / Blackberries, Strawberries, Apples, Apricots, Asian Pears, Cherries, Currants,

For more information about our program visit us at lof.cce.cornell.edu