Cornell University
Cooperative Extension

Lake Ontario Fruit Program
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"*Fruit Facts*" – Friday, May 3rd, 2024

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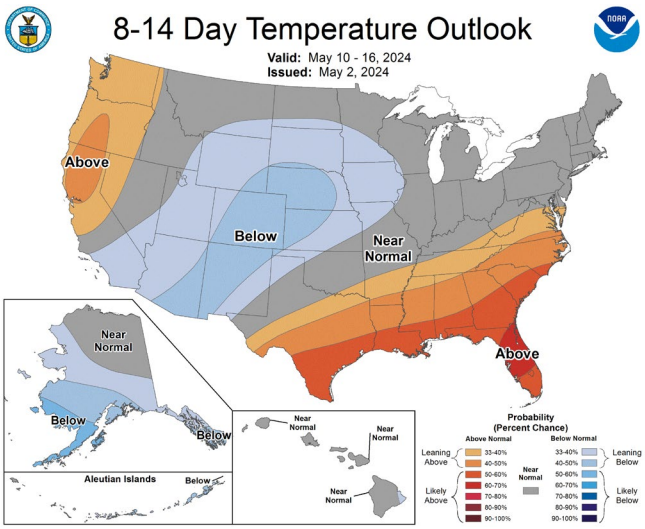
CCE LOF Fruit Facts Special Edition

"Assessing Cold Damage and What to Do Now after Two Consecutive Frost/Freeze Events Occurred in the Lake Ontario Fruit Region Last Week'

Weather Forecast

See below the graphic that was provided last night (Thursday May 2) by Cornell climatologist Samantha G. Borisoff from NOAA, Northeast Regional Climate Center at Cornell University.

NOAA's Climate Prediction Center (CPC) 8-14 day temperature outlook suggests near-normal temperatures are expected for the May 10-16 period. Normal highs for this time of year are generally in the mid to upper 60s, while normal lows are generally in the low to mid 40s.



Cold Damage Notes

First cold damage assessment and some special considerations after two consecutive cold night events experienced late last week.

Mario Miranda Sazo, Brian Lawrence, Craig Kahlke, Janet van Zoeren, Elizabeth Tee and Terence Robinson

Low temperatures registered last Thursday and Friday nights resulted in several cultivars suffering blossom damage across the entire LOF region and at Cornell Agritech in Geneva. As expected, the most advanced early cultivars (Fuji, Pink Lady, Zestar, NY-2, Idared, Crispin, etc.) located at the lowest spots and without the protective effect of wind machines had the most damage. Floral clusters that were still at tight cluster were more protected from the cold air

and did better. We started seeing the first symptoms of the damage in a Pink Lady site (50-60% bud loss) located inland in Orleans and without a wind machine last Friday in the afternoon. The Cornell fruit team started assessing the cold damage on Monday and Tuesday and waited until this Wednesday May 1 to conduct a more detailed viability evaluation of kings and laterals (see below Table 1).

By the end of this week, we feel more confident that there is still a good crop waiting to be pollinated despite the cold damage reported by growers, consultants, and our own extension team in inland and lake sites. Honeycrisp, Gala, and Fuji growers that did not suffer big losses (got good protection with the use of wind machines, and/or had blocks in better sites with good air drainage) should consider the use of blossom thinning sprays this Sunday or early next week. Producers of high value apple cultivars that were still at tight cluster/early pink last Friday and are not sure about the viability of floral clusters should consider the use of Promalin as a frost rescue treatment now (see below more details for promalin use).

Use of wind machines: Wind machines were started around 8-9pm (@ 36-37°F) and run the entire night until early the following day. There were a few Wayne growers that even used helicopters. Wind machines with higher temperature settings were more effective this year than last year. Machines provided good protection up to 500-600ft from the wind machine.

Testing the use of trickle irrigation (under the tree) the night before a cold event to mitigate cold damage in the LOF region: This year a very interesting mitigation strategy that was trialed by a few LOF growers at a large scale (at both sides of the city) was the use of trickle irrigation prior to the cold event on Fuji blocks that were more advanced by Friday or for other high value cultivars located at lower elevation sites without the protection of wind machines. At these sites, irrigation was started at approximately the same time as the wind machines and the total amount of water applied averaged around one to one and a quarter inches/acre. There is anecdotal information at one of these sites where an entire set of tree rows did not receive trickle irrigation that more bud damage was observed in these unirrigated rows when compared to the trees that received one irrigation cycle the night before the cold events. To understand some of the science of this practice, I made a few phone calls to WA fruit growers, consultants, and fruit extension specialists this week and learned that that the trickle irrigation practice (under the tree) is commonly used by WA growers for additional frost protection. Growers mentioned that for every gallon of water that freezes it releases around 144 BTU per lb. but growers need to keep watering to keep releasing that heat during the cold event. Under tree microsprinklers are much more effective than trickle irrigation. Western US growers indicated that watering the ground also improves soil conductivity and thermal mass. However, in WNY state the soil was quite wet from April rains so we would expect much less benefit from trickle irrigation; thus the anecdotal benefit this year is a surprise. Western US growers emphasized that while under tree irrigation can be effective, overhead irrigation is more effective if there is enough water available for freeze protection during the entire length of the freeze event. Western US growers lobby very heavily to have early and enough water rights when temperature weather forecasts predict early frost events in the Pacific Northwest.

Cold damage evaluations: Percentage of viable king flowers were higher for 'Honeycrisp' (ranged from 20 to 43%) than for 'Gala' (ranged from 13 to 43%) at the inland sites in Orleans County (review Table 1). Percentage of viable flowers was close to 50% or higher for both cultivars in Orleans. At Cornell Agritech, an orchard of 'Gala' atop a small hill with slope had 25% better bloom survival rate than 'Gala' planted at lower elevation without slope, while 'Honeycrisp' had twice as many viable blooms on the hill compared to the lower elevation. The early blooming 'Zestar' cultivar planted at a lower, flat location had nearly 100% bloom loss. In general, there is a significant amount of damage with several missing kings and laterals. A careful assessment of cold damage patterns on your farm is required to produce cold damage maps for coming chemical thinning decisions later (please see below the suggestion to produce 'cold damage distribution maps' after completing your own evaluations).

Table 1. Cold damage evaluation conducted for several cultivars located at two inland sites in Orleans County and at several research plots at Cornell Agritech, Geneva on Wednesday May 1st, 2024.

Location/orchard condition	Cultivar	% Viable flowers	% Viable king flowers
Orleans (inland 1)	Gala	58	13
Orleans (inland 1)	Honeycrisp	46	20
Orleans (inland 2)	Gala	52	43
Orleans (inland 2)	Honeycrisp	84	43
Cornell Agritech/elevated location and/or with slope	Gala	76	33
	Honeycrisp	69	37
	Sunrise Fuji	71	56
	Minneiska	94	67
Cornell Agritech/low elevation and flat	Gala	50	30
	Honeycrisp	31	10
	Zestar	10	0

What can you do now if you are not sure about the extent of your cold damage?

- **First of all, you need to determine the injury threshold!** It's up to you to determine if there are enough damaged flowers on the trees that may result in reduced fruit set and crop loss. Remember, you don't need every flower to set. In most cases, the goal is for only one of the five flowers on a spur to develop into a fruit. It's also important to have an adequate number of non-fruiting spurs for next year's crop. Don't panic if there is modest flower injury. Consider it your first thinning application…
- **Decide**: If your damage assessment suggests that crop loss is likely then you can make the choice to spray Promalin on the trees to increase fruit set. Apply one **pint of Promalin/Acre**, timing the application to first flower/early bloom stage. Applications made later than early flowering have been shown to be ineffective in situations where flower injury occurred from freeze events at tight cluster through pink. Use sufficient water volume ~100 gal/Acre to ensure good coverage and apply under slow drying conditions if at all possible.

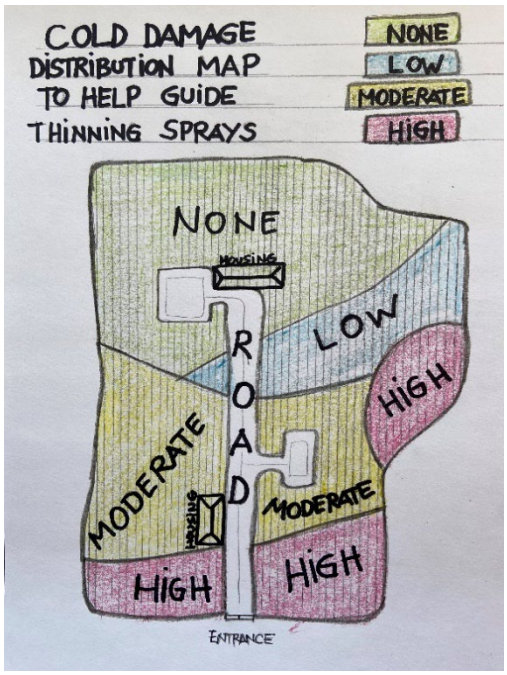
It's important to understand how Promalin works and what its limitations are:

1) **Promalin IS NOT an anti-freeze type product.** It will not lower the freezing point of the plant tissue if applied ahead of a frost event.
2) **Promalin WILL NOT revive, resuscitate or repair plant/flower tissue that is damaged by freezing temperatures.**
3) **Promalin is basically equivalent to hormone replacement therapy in humans.** In the normal pollination process, fertilized ovules begin to develop in to seeds that produce hormones including cytokinins and gibberellins. These hormonal signals tell the tree there is viable seed in the apple. The seed is essentially the offspring, and the tree will continue to nourish the developing seed with carbohydrates and nutrients. However, if fertilization does not happen due to reproductive flower injury or poor pollination weather, then no viable seed will develop. In that scenario, the tree is much more likely to shed the fruit and put it's energy in to those apples that have the potential to produce progeny. That's where Promalin comes in. Promalin applied to sterile flowers provides the hormonal signal that would normally come from the developing seed. That's why it's important to synchronize the application of Promalin with the trees natural phenology - slightly ahead of or during the early pollination window. Trees don't receive hormonal signals from developing seeds from tight cluster through pink, so why apply Promalin then? The cytokinin and gibberellins will be long gone by the time bloom comes around. Coincide the application to the same stage

the tree is expecting to receive those signals instead. The fruit that develops after Promalin application will have low seed count or no seeds at all, but it will develop to normal size as research studies have shown.

Finally, you can still develop and use practical 'Cold Damage Distribution Maps' to guide your coming thinning spray decisions (see below sketched cold damage map):

- By now growers should have a better idea of the extend of cold damage at their farms. This information can be hand-drawn and colored by cold damage levels as shown in the drawing.
- Hopefully, several growers will carefully assess their blocks (bottoms and tops with the use of ladders) and won't find too much damage and the crop will need to be thinned with full/normal rates.
- For those growers with a **whole range of damage levels** (none, low, moderate, high) with some blocks showing no damage and others showing massive damage, we suggest the use of **cold damage distribution maps** to guide your future thinning sprays.



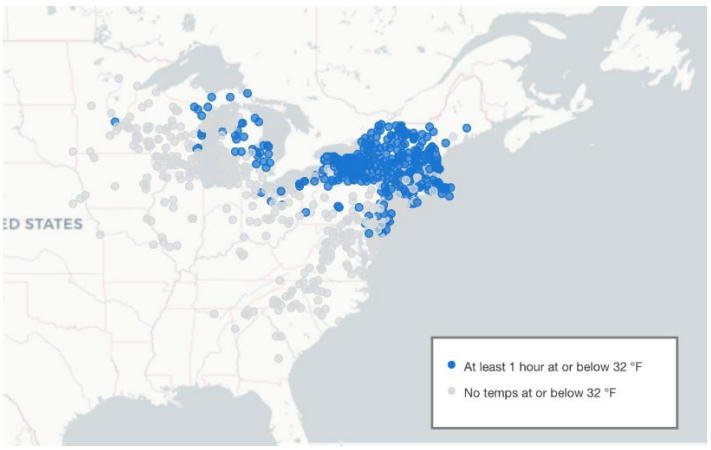
Same dead king flower before and after a cold damage evaluation on May 1, 2024

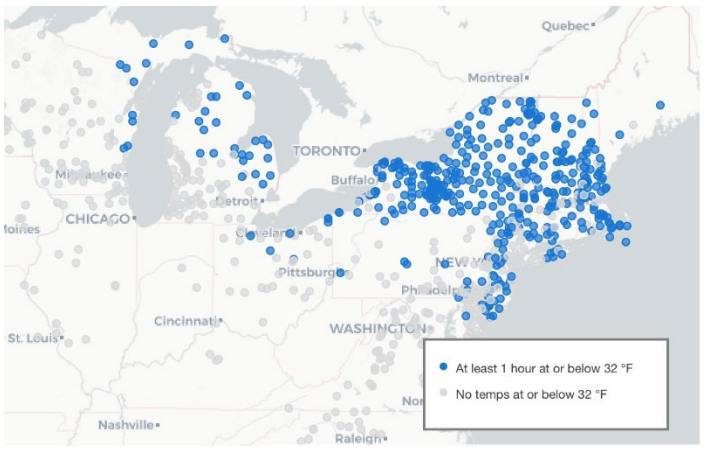
Good to Know

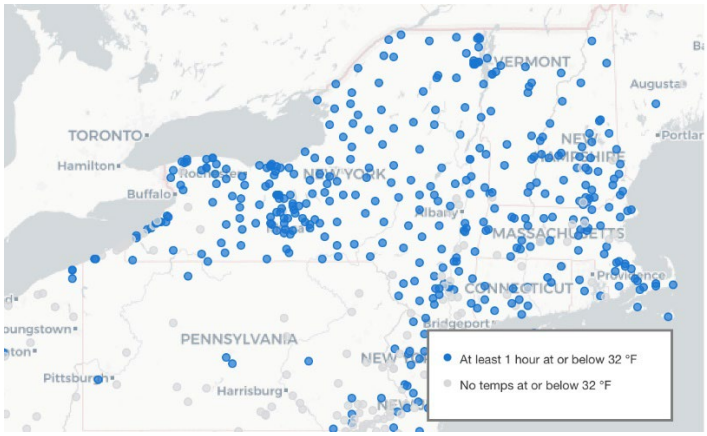
Summary of April 25 and 26, 2024, Two consecutive Frost/Freeze Events in the Lake Ontario fruit region, Northeast (weather data set analyzed/graphics produced by Dan Olmstead, Digital Outreach and Development Coordinator of NYSIPM, CCE, Cornell AgriTech, Cornell CALS): Dan wanted to reach out and share the below graphics to interested NY fruit growers who might need this information for crop insurance purposes. This is an excellent resource to visualize the extend of the freeze/frost events occurred last Thursday and Friday.

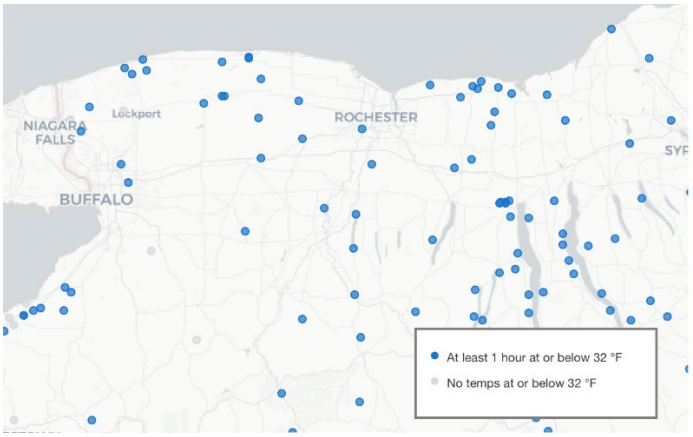
Blue markers (see below the selected graphics for only the night of Friday April 26) indicate at least one hour at or below freezing. Hours <= 32°F are reported, along with minimum temperature. If freezing temperatures were recorded, mean dewpoint, relative humidity, and temperature during those freezing hours are also provided in the CSV download link that is available below, with coordinates removed for privacy purposes.

The entire resource for all interested NY fruit growers can be found at the following link:
NEWA | Regional Weather Events https://newa.cornell.edu/regional-weather-events.









Early this week a commercial grower from Ohio, south of Columbus, was asking about the reasons of why short stems started to be seen on the king fruit of Gala and Fuji. The grower was not sure if it was due to a frost and was wondering if the fruits will thin off. Also, the grower was wondering what caused the short stems. He/she sprayed copper before bud break, sprayed calcium regularly, and was following a regular spray program.

- **Cornell Emeritus Professor Dr. Dave Rosenberger replied to the Ohio grower and provided the below link:** I've seen similar short stems on king bloom on Mac, Cortland, and other cultivars in the Champlain Valley of New York (across from Vermont) in many different years. I believe that this phenomenon usually results from cold injury sometime after bud swell but before one would normally be concerned about spring frosts that affect bloom. Perhaps rapid transitions to low temperatures in other parts of winter can also be a factor. Frank McNicholas and Dr. C.G. Forshey wrote an extension publication about winter damage in the Champlain Valley (https://ecommons.cornell.edu/server/api/core/bitstreams/0f8c85a5-accc-4c5b-986f-4504753048a7/content). Their publication has two photos (#9 and #10) that show short stems resulting from cold injury. In most years where I have seen short-stemmed king flowers, the damage has been much less severe than shown in the McNicholas/Forshey publication. I can't recall if the short-stemmed king flowers set fruit. If they do, they are weaker and are generally thinned off with chemical thinners. The more distressing problem is that with king flowers weakened, the clusters are often left with 3 to 5 equally strong side flowers, and getting those to thin down to single fruits per cluster is more difficult than when a strong king flower is present.
- **Cornell Professor Dr. Terence Robinson also replied to the same Ohio grower and provided more useful information:** For forty years, before giving thinning recommendations at grower meetings, I have visited numerous commercial orchards each year. One of the things I look for is shortened stems of the king flower. There have been many years we have observed this phenomenon on many different varieties. We have always attributed it to cold damage as the buds begin to open sometime between green tip and tight cluster. When we have observed this problem, we usually caution to be more conservative in chemical thinning since the damaged king flowers will almost always thin off as well as the lateral flowers. Where growers have decided not to use chemical thinners, the damaged flowers do set fruit and can grow to maturity. We often see fruits with very short stems at harvest in years with this problem.