2019 Northern-Hardy Fruit Evaluation Project Update

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In 2019, the Northern Hardy Fruit Evaluation Project at the Carrington Research Extension Center brought fruit-growing information to over 950 people. People accessed information through tours, meetings, video-conference programs and personal phone calls. In 14 years, we have reached approximately 13,300 constituents. This year, we responded to calls from North Dakota, Minnesota, Montana, South Dakota, Illinois and Idaho.

Cooperators: Our 2019 cooperators were Dakota Sun Gardens Winery, Carrington, ND and a group near Fessenden, ND, investigating hard cider production.

Weather: Fall 2018 was very dry and warm with temperatures in the 70s and 80s through mid-September. Plants were drip-irrigated to prepare them for winter. The first week of October saw a day of rain followed by 2-inches of snow and temperatures as low as 22^{o}F. It snowed again the following week with eastern areas of the state receiving nearly 20 inches. This was finally a 'test' winter with high temperatures averaging almost seven degrees below normal. At the end of January 2019, CREC recorded -35 and -40^{o}F. One pear cultivar and one black currant variety were injured by winter conditions and were removed from the project. Spring 2019 was cool and deficient in moisture. In summer, rainfall began to increase and by late October, the orchard precipitation was 6.2 inches ahead of average (including a 4-inch rainfall event Sept 20-21). From October 10-12, CREC experienced an early blizzard with over 20-inches snow. Due to the cool year, the plants were not fully senesced and the weight of the snow broke or flattened some trees and shrubs with leaves. After this, temperatures warmed and the snow completely melted before 'winter' returned. Soils are very wet in the area.

SWD: After a slow-warming spring, the growing season was 4.0^{o}F cooler than normal. Bloom and fruit development were slowed; however, spotted wing Drosophila (SWD) arrival was right on time. Warm, moist conditions in the middle part of the US and North Dakota likely contributed to the onset of intense SWD fruit fly infestations. 2019 was the worst year of infestation we have experienced. The three types of haskap and honeyberry we grow usually escape damage but this year, even the mid-season harvests were ruined. Most of the juneberry and all the cherry crops were lost despite pesticide applications. Early currant crops were damaged although later varieties were less bothered; in late July to August, there are fewer crops to inhabit and hand-sprayed pesticides are more effective. CREC will invest in a tractor-mounted sprayer that will blow pesticides into the plants.

Field Day: This year's event was only an orchard tour with no special speaker invited. At least 55 people toured the orchard. The juneberries were optimally ripe and at the same time, were succumbing to SWD infestation. Visitors were encouraged to return after lunch to pick fruit, which they did.

Mason bees in the Orchard: Over the past three seasons, we have experimented with using mason bees to pollinate the haskaps. They are not natural pollinators of haskaps but will do so if they have few other choices. We did the experiment because we do not have as many bumble bees as we need and wondered if mason bees could be made into an effective replacement. Prior to bloom, we covered half the plants with netting to enclose the mason bees and exclude other bees. The first two years, we bought bee cocoons 'for consistency' but the bees were very small and weak the second year. This year, we used bee cocoons saved from the previous year instead of buying new bees.

Tundra was harvested July 1-2 while 'Borealis' was picked July 8 and 10, with one and one-half days of rain in between. The wild-pollinated 'Borealis' berries were a bit 'wet' the first day due to SWD egg-laying. The remaining mason bee-pollinated berries appeared to be half-fallen and terribly soft when picking resumed on July 10th; therefore, 'Borealis' mason bee data is not correct in 2019.

2019 'Tundra': natural pollination – 7533. Mason bee pollination – 5877g (22.0% less fruit).
2019 'Borealis': natural pollination – 5214g. Mason bee pollination – 2329g (55.3% less fruit).

Our report, based on three years of results, will conclude that wild bumble bees and honey bees are the most effective pollinator, but if there were no other bees, mason bees could be forced to pollinate the crop with 25-55% lower yields expected.

Apples: Bloom did not start until May 28th, with 'Zestar,' and was nearly complete on June 4th. Temperatures just prior to bloom and near the end were mid- to upper-80s. Students thinned fruit in mid-June but much re-thinning had to be done later. In general, there was good fruit set and most of the trees produced 200 pounds of apples per four trees. One of the 'Hazen' trees

was dead in spring and was removed. It was noted in 2018 that this tree did not have much new growth and we were considering fertilizing it. A second 'Hazen' tree had a black rot canker (*left*) killing the uppermost branch. This branch was exposed to summer and winter sunlight from the southwest and may have had some injury over the years; it was pruned out.

'Zestar' and 'Hazen' were picked between September 18-24, about 3 weeks later than normal. The Carrington area experienced 4 inches of rain overnight, September 20-21. We expected the apples to crack, but they generally did not. The three late varieties were left on the trees until October 10th in hopes that they would lose their slight 'green' taste. The orchard was then hit by a 20+-inch blizzard over the next two days. One apple branch broke but otherwise they were fine.

Harvest: 'Zestar' – 200lbs, 'Hazen' – 218lbs, 'Honeycrisp' – 209lbs, 'Sweet 16' – 157lbs
'Haralred' – 181lbs

Aronia: The plants over-cropped in 2018 after the 2017 crop failure. In 2019, they had a smaller but respectable crop. With the increasing moisture over the summer, aronia leaves were attacked by lacebugs. These were sprayed once with spinosad and a second time with pyrethroid to control these leaf-sucking pests. A storm with hail nicked some berries in early September. SWD and cherry fly larvae also affected the integrity of the berries. This is the first time we have seen SWD in the aronia fruit. The hail indentations did not seem to affect fruit quality but we could feel soft fruit from the SWD larvae. The only time the fruit turned brown and dry inside was when cherry fruit worms had developed in the top of the berry. Even the berries with SWD larva did not seem spoiled as the inner flesh was still firm and red. We only found one larva per berry, unlike cherries or strawberries where there are multiple larvae in infested fruit.

A mechanical olive harvester was utilized to pick the aronia this year. It was checked out from a California supplier. Conclusions: It works best with 2 people - one to hold down the branches, one to run the machine; it picks berries quickly; there is a lot more 'trash' in the berries; it took extra time to spread a groundcover and then to fan the berries. I don't know whether we came out ahead or not. I normally fan handpicked berries once but I had to do it three times after using the picker. It felt longer with all the fussing, but I don't think it was.

Canadian Sour Cherries: The older shrubs of 'Carmine Jewel' and 'Crimson Passion' were removed in the spring. Almost all the 'Crimson Passion' shrubs had gummosis, which is when a sticky sap oozes from the branches or trunks due to some infection. They also had 'barren branches,' where a branch never has new leaf or flower buds again. They had not been very productive although they produced big, firm fruit with lower acidity than other cherries. They were a good tart cherry to eat fresh or right out of the freezer. 'Carmine Jewel' was still healthy and productive. Its fruit was smaller, more tart and dark maroon when it could be left to ripen. SWD ruined or hurried every cherry crop since it appeared in 2012 and did not seem to be dissuaded by spraying efforts.

Our two new Canadian cultivars, 'Juliet' and 'Romeo' were planted in 2015 and had their first crop in 2019. Though the season seemed to be about 2-3 weeks delayed, Juliet had some red fruit on July 10th. On the 17th, the fruit was various shades of red, but it was not completely ripe. It was covered with SWD so it was picked and discarded. The trees, 'Bali', were in the same state on July 30th, and were also picked for discard, as was 'Romeo' on July 31. For reference, 'Bali' was usually perfectly ripe 5-7 days after 'Carmine Jewel' and 'Crimson Passion' were picked. 'Juliet' will be the earliest ripening cherry.

Red Currants: Red currants have been removed so that just the better cultivars remain, which are: 'Jhonkeer Van Tets', 'Rovada', 'Rosetta', and the unknown variety we received in place of a white selection. The unknown variety is earliest, followed by 'JVT', 'Rosetta' and 'Rovada'. The

first two are the best tasting. The last two are more vegetal and less sweet. ‘Rosetta’ does not ripen to a very dark red color. ‘Rovada’ has been the most productive cultivar over the years.

Black Currants: Although we initially saved some plants from the original black currant variety trial when it was removed last year, we pulled them out this past spring. It was too much extra work to make sure they were picked and sprayed with the constant threat of SWD.

The variety trial of McGinnis Berry Crop plants, and all currant plants, was managed more closely for currant stem borer these past several years. This entails the normal pruning followed by a second removal of poor canes in May, after flowering and leafing. At that time, it is obvious when a cane is less vigorous and should be removed. All these pruned canes are burned to kill the insects within them.

In 2019, a third pruning was completed in July, as the berries were just coloring. SWD pressure was extremely high and so the plants were thinned of new, small canes and the lower leaves were raised to about 8-inches high to allow for better spray penetration. Many of the varieties in this trial ripen unevenly in North Dakota. This means that the berries on (primarily) the tips of the plants ripen sooner and start to fall off, or more importantly, are attacked by SWD. During the third pruning, the tips of branches that bent and touched the ground were also cut back to prevent shaded areas and to allow spray penetration. We tried to be more proactive by picking the plants twice; we laid down sheets and ‘gently’ (or less aggressively) tapped the plants to remove the early, loose berries. Often these berries were weighed but were not cleaned and frozen because of the difficulty of sorting out the few good berries. About three days later, the rest of the berries were picked and most were ‘good’.

As the season proceeds, there are typically fewer SWD observed. Normally the conditions become drier and there are also fewer berries for SWD propagation. Insecticides are observed to be effective at this time while they seem completely ineffective in early July. This pattern was observed in 2019 although there was more damage for a longer time.

Grapes: In the last several years, the grape plants were reduced to one representative group of four plants for each cultivar. If it was nearby or conveniently sited, other desirable plants were also retained. Despite temperatures of -40 and -35^{o}F in late January 2019, we did not notice much resulting winter injury during the growing season. There were probably fewer clusters on some plants. However, damage came in October, before the leaves froze or fell off. An early

blizzard dropped over 20 inches of snow and pushed or pulled quite a few plants and trunks toward the ground, ruining their vascular systems. They will be evaluated in spring 2020 to determine whether each group of plants should be saved.

Haskaps and Honeyberries: Work continues to grow out and evaluate new selections of Japanese haskaps from Dr. Maxine Thompson's breeding program. From 2017-19, we acquired 57 selections, both of our choosing and of Dr. Thompson's. All have been fully hardy in our climate. Fruit production will begin in 2020 through 2022. Additionally, we have 13 selections from 2012 and six from 2007. We are looking for plants with tasty fruit that hold onto their berries until they are fully ripe and harvested. An upright structure is another positive attribute that will help with mechanical harvest.

One of our lucky haskap berry pickers: a catbird.

We continue to retain most of the original Russian, Canadian and Japanese honeyberry and haskap plants installed in 2007. We no longer harvest them though we sporadically collect data. The early fruit is readily eaten by the birds which eliminates them as an SWD reservoir and allows us to focus on the new Japanese plants.

Juneberries: Juneberry pruning continued for a third year in order to maintain the size of the plants and to encourage new growth. With the extra rain this year, regrowth was very good and perhaps made the plants too tall again.

Juneberry ripening seems quite unaffected by cool temperatures. While other crops were delayed by 2-3 weeks, Juneberries were somewhere between on-time to one week late. SWD began to be noticed about July 8th and this crop was noted as 'not ready' on July 11th. However, with just a couple more days of warmth, the crop was suddenly ready on Sunday, July 14th. Our inexperienced picking crew did their best on Monday, as did some local pickers that we contacted. The fruit was already spoiling and disintegrating despite having been sprayed with insecticide on July 10th. After our Field Day tour the next day, we invited participants to pick juneberries in the afternoon. In the days that followed, we picked the rest of the juneberries and discarded them.

This year, we put up poles for bird netting but never applied it; there were not enough birds taking berries to justify the extra work. In 2018, we thought that the dry weather caused the birds to move on, but this year we realized that a pair of Cooper's hawks had been nesting in the shelterbelt, which discouraged song birds in the orchard. The fruit project manager even saw one at work, catching and taking a small bird! Two or perhaps three young hawks were raised.

The moist summer provided a good environment for *Entomosporium* leaf and berry spot, a fungal disease that affects juneberries everywhere. In most years, two to three applications of fungicide control its emergence through berry harvest, and then the rest of the summer is too dry for it to develop. This year the fungus continued to propagate and infected quite a few leaves. We did not continue spraying and don't anticipate extra problem in 2020.

Pears: Twelve standard pear trees were planted in the orchard in 2015. They were well-branched and of good caliper. We decided to finally plant pears because St. Lawrence Nursery was closing their business and they have always had an excellent selection of hardy trees. (SLN ended up not closing; an employee bought it and is continuing the business.) We selected six cultivars that were noted to be 'extremely' hardy or 'extremely-very' hardy: 'Schroeder Hardy ND, Ayers, Stacey, Patten, Nova and Ely.' 'Ayers' had cold-injured branches for three seasons and was extremely injured in spring 2019; it was removed then. 'Schroeder Hardy ND' is very precocious, having had fruit since 2017. However, we have not figured out how to ripen the fruit yet. The fruit begins to drop as it turns light green and the lenticels turn brown. Typically, this is a good time to pick pears, refrigerate them and then ripen them later at room temperature. So far, the fruit has only spoiled from the inside out during refrigeration or ripening, and has stayed quite tannic. In 2019, we tried to place the just-picked fruit into a 50°F space for a week but they also spoiled. The discoverer, Art Schroeder, thought that the best way to ripen them was on the tree! So in 2020, we will try to leave the fruit on the tree to ripen, even though a lot of it will also fall off.

	2015 Caliper (mm)		2018 Caliper (mm)	2019 Caliper (mm)	Notes
Ayers	apx 13-19		48	removed	Not hardy enough
Ely	apx 13-19		40	50	Nice moderate growth
Nova	apx 13-19		63	72	Tall, lanky growth
Patten	apx 13-19		50	60	Big, lanky growth
Schroeder Hardy ND	apx 13-19		46	62	Big. The 1st to fruit
Stacey	apx 13-19		72	80	Very pyramidal and tall

Pears grow very vigorously and vertically; they are probably a lot for a typical homeowner to manage. Of the trees at CREC, we would recommend 'Ely' for homeowners based on its moderate growth habit, though we do not know anything about its fruiting character yet. There are some ornamental pears which are smaller trees and they would pollinize a single fruiting tree. Or a pear variety that blooms at a similar time could be grafted amongst the branches for its flowers.

A pear tree with a lot of spacers to improve crotch angles.

Hazelnuts: There has been winter damage to several of the oldest Canadian hazelnut plants. This is not unexpected because they are F1 crosses that were made between hardier and more tender varieties. Plants 2, 3 and 6 have had the least cold injury, with plant 6 having none. In October, these older plants were observed for Eastern filbert blight (EFB). Plants number 3 and 5 had stromata on the stems (*as in photo, left*).

With EFB, "the first symptoms to appear on infected trees are elliptical black stromata. They are formed in longitudinal rows on infected branches, and appear only after extended cold periods, usually between May and August. The first stromata to appear erupt from branches 12-18 months after the initial infection." http://plantclinic.cornell.edu/factsheets/efilbertblight.pdf We intend to control the disease by pruning or plant removal.

The new hazelnuts, which are selections provided by Riverbend Hazelnuts in 2014, have grown well these past few years. They have been pruned for standard shrub openness. Only one has had winter injury which is probably because it continues to grow too long in the fall and does not harden off early enough. One shrub produced a good number of nuts this year but the squirrels were unusually perceptive. They have never bothered the older plants before early September, but this year, the squirrels took the nuts from both groups of plants in mid-August while we were distracted with the currant harvest. They even cut whole branches from the new plants and ate the nuts at their leisure. It was quite disappointing, but there is always next year.

Riverbend Hazelnut plants, October 8, 2019: Left plant: not hardy. Center-left plant: fall color