Northern New York Agricultural Development Program
2019 Project Final Report

Establishing New Commercial Fruit Crops for Northern NY

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Collaborators:

- Cornell University Professor Marvin Pritts, Horticulture Section of the Cornell School of Integrative Plant Science, Ithaca, NY

Cooperating Producers:

- Dani Baker, Cross Island Farms, Jefferson County, NY
- Mark Kimball, Essex Farm, Essex County, NY
- Jenna Mulberry, Northern Orchards, Clinton County, NY
- John Bonaparte, Strong Roots Community Farm, Franklin County, NY
- Loren and Chris Bush, Bush Gardens, Jefferson County, NY
- Andrew and Dorothy Kramer, Cedar Knoll Farm, Lewis County, NY
- Mahlon Clements, Iroquois Farm, St. Lawrence County, NY

Background:

Our goal is to increase the number of specialty fruit crops available to Northern New York (NNY) market farms by evaluating varieties and production practices for three high value fruits: Juneberries, *Aronia* berries, and Honeyberries. The high value of these fruits is in terms of both their antioxidant value and their income potential value for NNY growers.

JUNEBERRY (*Amelanchier* spp.)

Juneberry with its sweet flavor and "superfruit" antioxidant content has the potential to be a major novel fruit crop in Northern New York. These small, multi-stemmed shrubs or

trees are native to every U.S. state except Hawaii, and wild-harvested Juneberry fruit were a favored food and medicine for Native American cultures and early European settlers.

Since the inception of this Northern New York Agricultural Development Program (NNYADP)-funded Juneberry research, our objectives have been to:

1. Develop a Juneberry nursery – a living collection of Juneberry plants that includes wild-collected novel lines native to the Northeast and that have commercial fruit production potential, along with all current commercially available fruit-producing cultivars;
2. Evaluate the performance of commercially available cultivars and promising wild lines in replicated field trials; and
3. Test Juneberry plantings on fresh market farms in Northern NY.

HONEYBERRY (*Lonicera caerulea*)

The blue Honeyberry (*Lonicera caerulae*) is a perennial, fruit-producing shrub that is a member of the honeysuckle family and is native to cool temperate forests of western North America, Asia, and Europe. Domesticated subspecies of *Lonicera caerulea* have been cultivated in northern Japan for hundreds of years, and the Japanese refer to the fruit as "the elixir of longevity." The current surge in commercial production of Honeyberry in North America has been facilitated by breeders in Oregon and at the University of Saskatchewan that have produced numerous cultivars with large, exceptionally flavorful fruit.

Honeyberry is well adapted to cold climates, has few pests or diseases, produces the first mature fruit of the season (earlier than strawberries), and can therefore offer NNY growers an exciting new specialty fruit for fresh market sales.

2019 research objectives included:

1. Establish and manage a field trial of promising commercial Honeyberry cultivars on the Cornell Willsboro Research Farm, and
2. Work with NNY farmers to establish two on-farm commercial Honeyberry cultivar plantings. On-farm trials will provide growers with some exposure to this new fruit crop, while also providing information on cultivar performance across a range of NNY growing conditions.

ARONIA

Aronia is a genus in the Rose family that includes three species of multi-stemmed, deciduous shrubs native to the eastern United States. Aronia fruit cultivars have been grown commercially in Russia and Eastern Europe since the mid-twentieth century. Commercial fruit cultivation of Aronia in the United States began in 2007 in Iowa. Numerous scientific studies have documented exceedingly high antioxidant and other beneficial phytonutrient levels in Aronia, leading to the fruit being labeled a "superfood." As a result, fruit production in North America has grown rapidly and has blossomed into a multi-million dollar industry that includes more than 60 unique value-added products.

Aronia cultivars are well adapted to cold climates, have few pests or diseases, and are capable of producing fruit throughout the growing season. These benefits, in addition to the burgeoning value-added market, make Aronia an exciting new specialty fruit crop for NNY growers.

2019 research objectives included:

1. To manage the Willsboro Research Farm trial of commercially-available Aronia cultivars that was established in 2017, and
2. To establish Aronia variety demonstration plots on commercial produce farms in Northern NY.

2019 Willsboro Farm Results:

Juneberry Nursery

Nursery plantings at the Juneberry nursery established with NNYADP funding in 2013 were weeded, fertilized, irrigated as needed, and monitored for disease and insect issues during the growing season.

Juneberry Variety Trials

Flowering Dates (Table 1): 2019 spring weather conditions were unusually wet and cold, and flowering dates in both the commercial fruit variety trial (A1601) and the ornamental variety trial (A1602) were slightly later than in 2018 (2018 also had a cold, damp spring), and eight to thirteen days later than in 2017. As in previous years, the three arborescent ornamental varieties: *Autumn Brilliance*, *Princess Dianna*, and *Prince William* flowered a few days earlier than the commercial fruit-producing varieties. 2019 flowering dates for the wild collected lines were identical to or slightly earlier than 2018 dates. The wild collected *Hudson* line did not produce any flowers for the second year in a row, and the *Greenhouse Morph*, which did not flower in 2018, flowered in two of the four trial plots in 2019. These lines may just be slower to flower than the other wild-collected entries.

Plant Growth: Plants in all three trials continue to put on solid growth as exhibited by increased heights (Figs. 1-3). In the commercial fruit-producing trial it is notable that plant growth and vigor are greater in the first two experimental blocks relative to the third and fourth blocks (Fig. 4). A randomized complete block experimental design was employed for this study with the blocks laid out along the contour of a south sloping field. The soils are wetter in the lower sections of the field where experimental blocks 3 and 4 are located. Decreased plant vigor in these blocks highlights the potential sensitivity of Juneberry cultivars to wet soil conditions.

Fruit Production:

Overall per-plant fruit production was down in the commercial variety trial (A1601) as many of the varieties produced markedly less fruit in 2019 than they did in 2018 (Table 2). Two notable exceptions were *Thiessen* and *Martin*. 2019 fruit yields for these two varieties were almost triple what they were in 2018, and they moved from the bottom half of the yield rankings in 2018 to the top of the 2019 list. It may be that the plants are alternating a heavier fruiting year with a lighter fruiting year. *Northline* also yielded comparatively well in 2019 with the third highest fruit yield. *Thiessen*, *Martin* and

Northline produce some of the largest (Table 3) and best tasting fruits in the trial. It will be interesting to see how all the plants in this trial perform in future seasons.

As in past years, the ornamental varieties all flowered, but did not produce any fruit. The three arborescent cultivars are all very tall and healthy looking, and it may be they are favoring vegetative growth over fruit production at this stage of their development.

Seven of the nine wild-collected lines in trial A1702 produced fruit in 2019, and yields were mostly higher than in 2018 (Table 2). The *Hudson* and *Greenhouse Morph* lines did not produce any fruit in 2018 or 2019. The wild-collected trial plants are all young and further evaluations are needed to adequately assess their potential, but it is notable that the fruit sizes for these lines are generally small compared to some of the commercial varieties.

Pest Control: Juneberry plants at the Willsboro Research Farm have been plagued by Rose Chafers and Japanese Beetles. The Rose Chafers typically emerge in the middle of June and are only active for a couple of weeks, but the Japanese beetles are present for much of the growing season. In an effort to biologically control the Japanese Beetle population in the Willsboro Farm fruit trials, entomopathogenic nematodes were purchased from Cornell University Professor Elson Shields* laboratory and applied to the grass alleyways between the Juneberry beds on September 23, 2019. As a more immediate control measure, four Japanese Beetle pheromone traps were set up in the trial in an attempt to reduce beetle pressure.

*With long-term funding from the NNYADP, Dr. Shields pioneered the use of biocontrol nematodes for managing alfalfa snout beetle and subsequent NNYADP-funded field trials proved the biocontrol nematodes efficacy at controlling berry pests as well. The Shields' protocol developed in NNY is being tested in crops across New York State and in multiple crops in multiple U.S. states.

Honeyberry Trial

A Honeyberry variety trial (H1801) designed to evaluate 15 commercially-available cultivars was planted at the Cornell Willsboro Research Farm in the spring of 2018. Entries include: *Boreal Beauty*, *Boreal Beast*, *Honeybee*, *Boreal Blizzard*, *Tundra*, *Indigo*, *Borealis*, *Aurora*, *Blue Belle*, *Blue Hokkaido*, *Blue Lightening*, *Blue Moon*, *Berry Blue*, *Blue Pacific*, and *Blue Bird*. In 2019 the growth of the young honeyberry plants was monitored (Fig. 5), and flowering dates were recorded for those plants that produced flowers.

Aronia Trial

The Willsboro Research Farm *Aronia* spp. variety trial includes four fruit-producing varieties *Nero*, *Select*, *Viking*, and *Galicjanka*, plus two ornamental varieties *McKenzie* and *Autumn Magic*. Aronia plant growth was good in 2019 (Fig. 6), and all of the plots produced a harvestable fruit yield (Table 4). Surprisingly, *McKenzie*, one of the two varieties that are generally considered ornamentals, produced the highest yields. It will be interesting to see if this pattern holds in future years. The trial experienced little to no disease or pest pressure in 2019.

On-Farm Test Plots:
Test plantings were established on two additional market farms in 2019: Bush Gardens in Jefferson County, and Cedar Knoll Farm in Lewis County. Additionally, preliminary arrangements were made to establish a planting at Iroquois Farm in St. Lawrence County. We continued to monitor previously established test sites during the 2019 field season.

Bush Gardens
Dormant Juneberry and Honeyberry plants were transplanted into black plastic mulched beds at Bush Gardens on November 10, 2019. The collaborative effort included owners Loren and Chris Bush as well as CCE Sustainable Agriculture Educator Mellissa Spence. Sixteen Honeyberry plants including two *Blue Moon*, four *Blue Velvet*, four *Honeybee*, and four *Blue Pacific* were established in one bed, and 19 Juneberry plants including three *Northline*, three *Martin*, five *Thiessen*, three *JB30*, and five *Smoky* were set in the second bed.

Cedar Knoll Farm
With help from owners Andrew and Dorothy Kramer, 12 Juneberry and 12 Honeyberry plants were transplanted into four garden beds at Cedar Knoll Farm on November 27, 2019. Juneberry varieties included *JB 30*, *Martin*, *Northline*, and *Thiessen*.
The five honeyberry varieties were *Czech 17* (a universal pollinator also called *Berry Blue*), *Aurora*, *Tundra*, *Indigo Gem*, and *Indigo Treat.*

Essex Farm
The Essex Farm demonstration plot is located on fertile loamy soil with subsurface tile drainage. Eleven Juneberry varieties including *JB30*, *Martin*, *Thiessen*, *Honeywood*, *Smokey*, *Northline, Regent*, *Nelson*, *Parkhill*, *Lee#8*, and *Gaspensis* were transplanted into the plot in 2017. Twenty-eight Honeyberry plants representing thirteen different varieties were added to the planting on June 1, 2018. Honeyberry varieties included *Blue Moon*, *Tundra*, *Honeybee*, *Berry Blue*, *Indigo*, *Blue Pacific*, *Blue Bird*, *Borealis*, *Aurora*, *Boreal Blizzard*, *Boreal Beauty*, *Boreal Beast*, and *Hoikkado*. The new fruit planting was accidentally grazed by cows during the 2019 field season, and we will continue to monitor the plants' response to the grazing.

Cross Island Farms
The Cross Island Farms' planting includes 12 Honeyberry varieties (*Blue Moon*, *Tundra*, *Honeybee*, *Berry Blue*, *Indigo*, *Blue Pacific*, *Blue Bird*, *Borealis*, *Aurora*, *Boreal Blizzard*, *Boreal Beauty*, and *Boreal Beast*), seven Juneberry varieties (*Northline*, *JB30*, *Smokey*, *Thiessen*, *Honeywood*, *Hudson* and *Gaspensis*), and five *Aronia* varieties (*Nero*, *Viking*, *Galicjanka*, *McKenzie,* and *Autumn Magic*). All the plants were incorporated into Dani Baker's permaculture style forest garden, and it has been impressive to see how the plants have progressed. This was our first on-farm test site and Dani was able to record some of the first on-farm *Aronia* fruit yields in 2019.

Strong Roots Community Farm
A planting of four Juneberry varieties: *Martin*, *JB30*, *Smoky*, and *Honeywood*, and five Honeyberry varieties: *Boreal Blizzard*, *Boreal Beast*, *Boreal Beauty*, *Blue Pacific*, and *Blue Moon* was established at the Strong Roots Community Farm gardens in

Hogansburg, NY, in November 2018. A total of 26 plants were transplanted into the raised beds constructed by the farm manager John Bonaparte.

Northern Orchards
In collaboration with farm owner Jenna Mulberry, 17 dormant Honeyberry plants were transplanted into some test beds at Northern Orchards in Peru, NY, on November 13, 2018. Varieties included *Boreal Blizzard*, *Boreal Beast*, *Boreal Beauty*, *Borealis*, and *Aurora*.

Next Steps:

1. Monitor and evaluate field trials and demonstration plantings of Juneberry and Honeyberry varieties on commercial farms in Northern New York.
2. Continue to maintain established research trials and collect performance data, including growth habit, flowering and fruiting times, disease incidence and susceptibility, and fruit yield to aid growers in selecting varieties well suited to NNY.
3. Evaluate in-row mulch material options.
4. Experiment with potential companion groundcovers.
5. Update and advance the resource information that growers need to successfully establish, manage, harvest, and market these specialty fruits.

Outreach:

These NNYADP New Fruit Trials were featured at the Willsboro Farm Open House/Field Day on July 10, 2019; at the Adirondack Council Annual Meeting on July 13, 2019 (photo); and at grower meetings at the Willsboro Farm on August 27 and November 13, 2019. Articles featuring our collaborative work with Dani Baker at Cross Island Farms were published as follows: July 6, 2019 Watertown Daily Times front page, NNY Business Magazine July 2019 issue, Dec. 12, 2019 New York Ag Connection, Dec. 23 NNYADP website news, NOFA-NY Facebook, Dec. 29, 2019 Morning Ag Clips, Dec. 30, 2019 Country Folks newspaper, Jan. 1, 2020 Thousand Islands Sun, and January 2020 issue of Country Folks Grower magazine. Grower Dani Baker made presentations at the NY and Massachusetts NOFA meetings in 2020 and included mention of this research.

Acknowledgments:

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For More Information:

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Table 1. 2017, 2018, and 2019 mean flowering dates for commercial, ornamental, and wild-collected Juneberry varieties, Willsboro Research Farm Juneberry trials, Willsboro, NY, NNYADP.

Table 1. 2017, 2018 & 2019 Mean Flowering Dates			
Trial A1601	**Commercial Varieties**		
Variety	2017	2018	2019
Honeywood	May 5	May 14	May 17
JB30	May 4	May 14	May 14
Lee #8	May 5	May 14	May 17
Martin	May 6	May 13	May 14
Nelson	May 8	May 14	May 17
Northline	May 8	May 15	May 16
Parkhill	May 2	May 11	May 12
Pembina	May 6	May 13	May 15
Regent	May 4	May 15	May 17
Smoky	May 7	May 14	May 15
Thiessen	May 4	May 13	May 14
Trial A1602	**Ornamental Varieties**		
Variety	2017	2018	2019
Autumn Brilliance	May 2	May 10	May 12
Princess Dianna	May 2	May 10	May 12
Prince William	May 2	May 10	May12
Fergie	May 6	May 15	May 20
Trial A1702	**Wild Collections**		
Collection ID		2018	2019
13-451		May 10	May 10
13-Burgess		May 10	May 10
13-Laevis		May 10	May 8
13-449		May 10	May 10
Hudson		No flowers	No flowers
13-472		May 10	May 8
Greenhouse morph		No flowers	May 10
13-473		May 12	May 12
Gaspensis		May 10	May 10

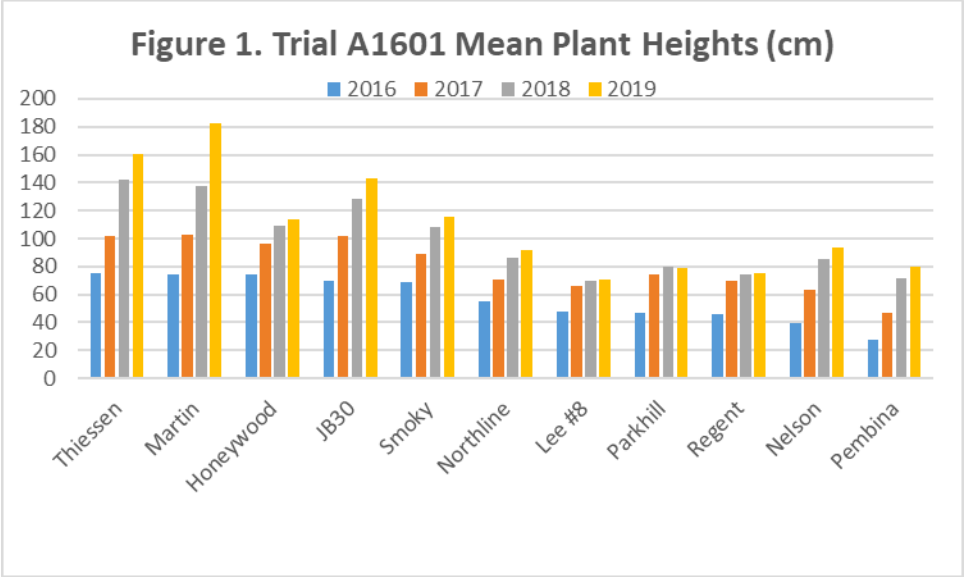

Figure 1. Trial A1601 Mean Plant Heights (cm) for 11 commercial fruit-producing varieties of Juneberry, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

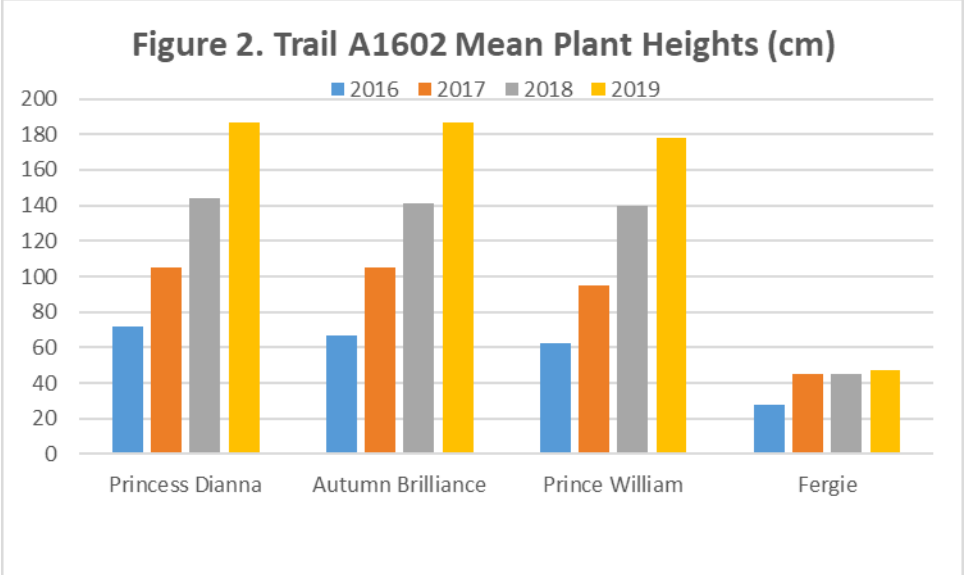

Figure 2. Trial A1602 Mean Plant Heights (cm) for 4 ornamental varieties of Juneberry, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

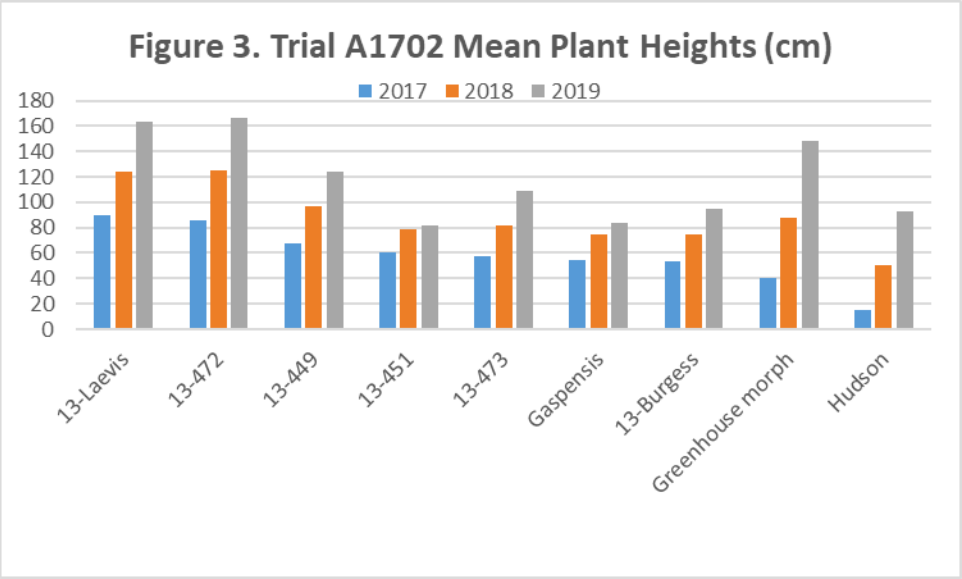

Figure 3. Trial A1702 Mean Plant Heights (cm) for 9 wild-collected varieties of Juneberry, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

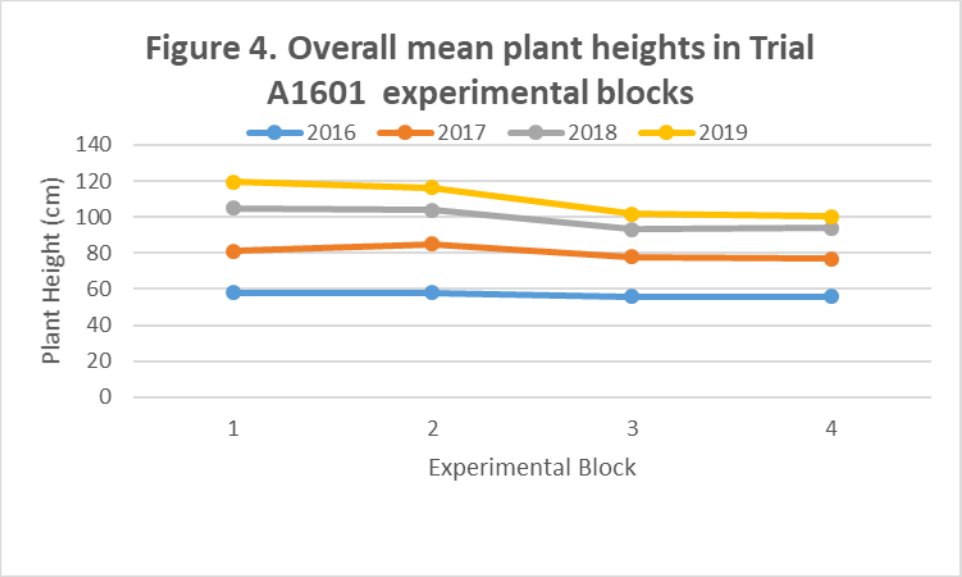

Figure 4. Trial A1601 Mean Plant Heights (cm) for each of the four experimental blocks of commercial fruit-producing Juneberry varieties at the Willsboro Research Farm, Willsboro, NY, NNYADP, 2019.

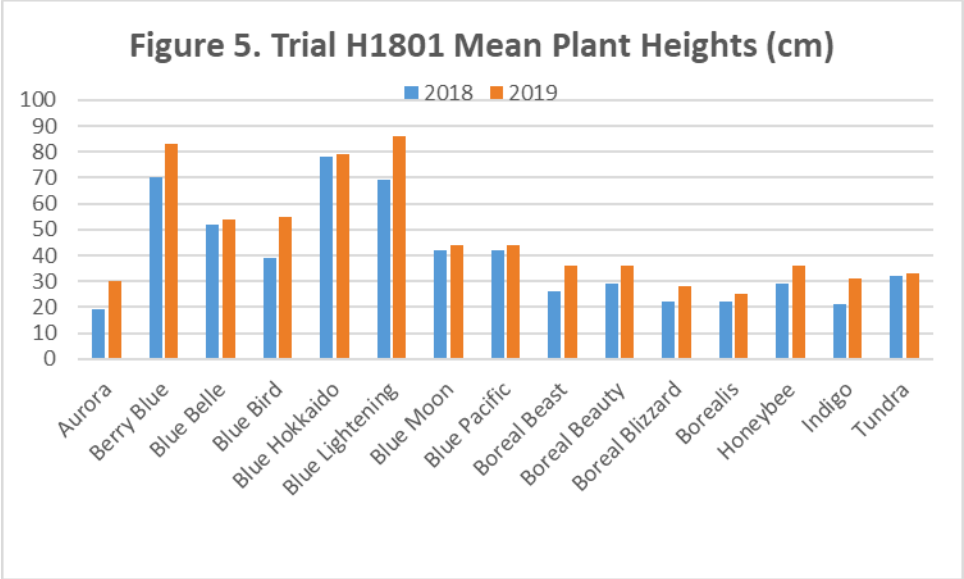

Figure 5. Trial H1801 Mean Plant Heights (cm) for 15 Honeyberry Varieties, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

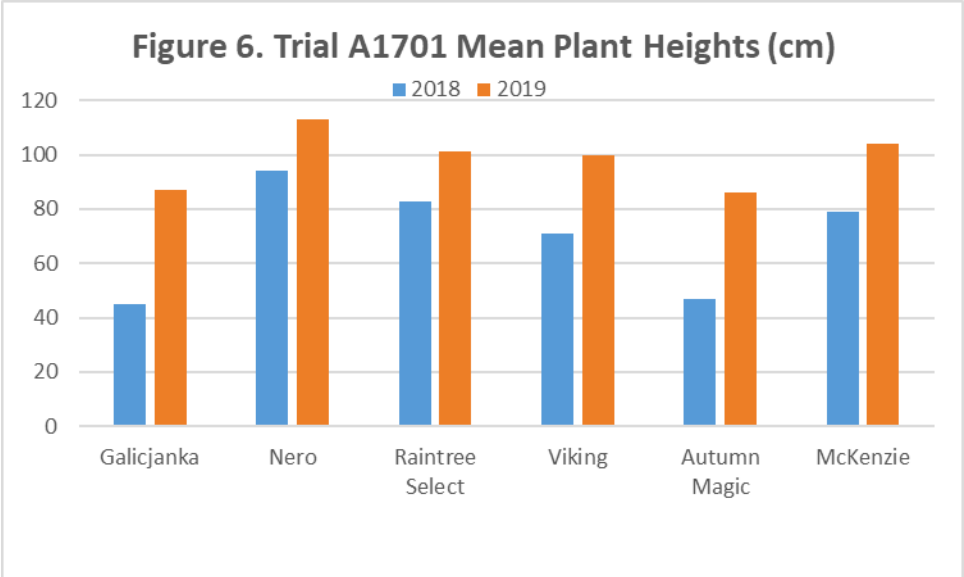

Figure 6. Trial A1701 Mean Plant Heights (cm) for 6 *Aronia* Varieties, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

Table 2. 2018 and 2019 per plant mean fruit yields for commercial and wild-collected varieties of Juneberry, Willsboro Research Farm trials, Willsboro, NY, NNYADP, 2019.

Table 2. 2018 & 2019 Per Plant Mean Fruit Yields (g)				
Trial A1601	**Commercial Varieties**			
	2018		2019	
Variety	Yield	Rank	Yield	Rank
Honeywood	693	1	216	4
Smoky	434	2	130	6
Nelson	412	3	167	5
Parkhill	322	4	75	9
Northline	307	5	237	3
JB30	237	6	78	8
Regent	122	7	101	7
Thiessen	117	8	319	2
Martin	117	9	334	1
Pembina	63	10	32	11
Lee#8	44	11	66	10
Trial A1702	**Wild-collected Lines**			
	2018		2019	
Collection ID	Yield		Yield	
13-449	53		71	
13-451	54		38	
13-472	Did not fruit		57	
13-473	42		57	
13-Burgess	54		102	
13-Laevis	8		15	
Gaspensis	30		46	
Greenhouse morph	Did not fruit		Did not fruit	
Hudson	Did not fruit		Did not fruit	

Table 3. 2018 and 2019 mean weight of 15 fruits for commercial and wild-collected varieties of Juneberry, Willsboro Research Farm trials, Willsboro, NY, NNYADP, 2019.

Table 3. 2018 & 2019 Mean Weight of 15 fruits				
Trial A1601	**Commercial Varieties**			
	2018		2019	
Variety	Weight (g)	Rank	Weight (g)	Rank
Honeywood	18	3	13	4
Smoky	13	6	10	7
Nelson	15	5	11	6
Parkhill	10	7	11	6
Northline	16	4	17	3
JB30	22	1	24	2
Regent	9	8	12	5
Thiessen	22	1	27	1
Martin	21	2	27	1
Pembina	8	9	11	6
Lee#8	9	8	10	7
Trial A1702	**Wild-collected Lines**			
	2018		2019	
Collection ID	Weight (g)		Weight (g)	
13-449	NA		9	
13-451	NA		6.5	
13-472	NA		9	
13-473	NA		5	
13-Burgess	NA		12	
13-Laevis	NA		5	
Gaspensis	NA		8	
Greenhouse morph	NA		Did not fruit	
Hudson	NA		Did not fruit	

Table 4. 2019 per plant mean fruit yields for six *Aronia* varieties, Willsboro Research Farm Trials, Willsboro, NY, NNYADP, 2019.

Table 4. Trial A1701 2019 Per Plant Mean Fruit Yields (g)	
Variety	Yield
Galicjanka	130
Nero	331
Raintree Select	148
Viking	254
Autumn Magic	275
McKenzie	466