

Introduction

Beginning in 1997, WSU Mount Vernon NWREC has responded to nursery growers, researchers and hobbyists to investigate fruit kinds that are not commonly grown in western Washington. Some of these fruits were not considered viable in our maritime climate conditions. Other kinds were little known because they originated in eastern Europe, Asia, or Oceania, or were uncultivated native North American plants. Since 2000, the interest in evaluating new and unusual fruits has been reinforced by the search for potential high-return alternative crops by commercial growers. A screening trial of 24 unusual fruit crop species, some as specimen plants and others including several cultivars, was established in 1997, with some new plants being added up until 2003.

Methods

The unusual fruit trial plots presently include 22 unusual fruit species that are being screened for their suitability for either home orchards or commercial production in a cool maritime climate. The plots are non-replicated; some species are represented by several cultivars, others by a single specimen. Observations are made annually of the plants' productivity, growth habit, bloom time, and general health. Fruit characteristics are evaluated on an ad-hoc basis as the need appears. Yield data, juice analysis and other data have been collected for some of the more promising cultivars. Some plants failed to thrive (e.g. pomegranates) and others were discarded as unproductive.

Plots are drip irrigated 2 times per week for 3-4 hours, beginning in late May, and based on soil moisture irrometer readings. No insecticides or fungicides are applied in these plots. Weed control is a soil residual herbicide application targeted to problematic weeds. Shrubs such as currant and aronia, and small trees with a spreading growth habit such as fig and pawpaw, are generally pruned to an open center; upright-growing trees such as shipova are pruned to a central leader. Grape vines and all kiwis are pruned according to standard pruning methods for their respective trellis systems.

A replicated trial of black, white and red currants was conducted from 1999 to 2001. In 2000 an evaluation of leaf damage by insects (primarily currant saw fly) was conducted. In 2001 juice brix was measured, observations on juice quality and extraction recorded, and a rating was collected of powdery mildew on the foliage. Yield data on this plot was not taken due to budget limitations, and the 4 replicated rows were reduced to 2 rows in 2003. A summary of results from 1999 to 2005 is presented in Table 1.

Results and Discussion

A summary of the observations taken in the unusual fruit crops trial shows the species screened falling into 4 categories: 1.) crop potential favorable based on horticultural evaluation; 2.) crop potential appears suitable for limited uses; 3.) crop potential appears unfavorable; 4.) crop evaluation not yet complete (Tables 2, 3, and 4.)

Not all the crops that are well suited horticulturally to production in our region are well suited for commercial production in this area. In some instances (e.g. aronia, currant) market factors are unfavorable, with cheaper product available from other regions. In other cases there are problems of

harvest (sea buckthorn) and processing for which technology or infrastructure are not readily available. Several crops such as hardy kiwi, fig, and table grapes have good potential, and work is proceeding toward a complete evaluation of productivity and quality of specific cultivars. Some work on cultivar differences in currant with respect to powdery mildew (*Podosphaera mors-uvae*) susceptibility and foliar damage from insects, primarily the currant saw fly (*Nematus ventricosus*), has been completed (Table 1).

Proposed Future Studies

Several of the crops not yet fully evaluated show favorable potential: hardy kiwi (*Actinidia arguta*), fig (*Ficus carica*), blue honeysuckle (*Lonicera* spp), currant (*Ribes* spp.), table grapes (*Vitis* spp), and shipova (*X Sorbopyrus*). In 2008 we propose to collect data on 4 of these crops: figs, hardy kiwi, currants and table grapes. In addition, data will be collected on 2 crops, Cornelian cherry (*Cornus mas*) and quince (*Cydonia oblonga*), that are already favorably evaluated, to determine possible differences in productivity among specific cultivars before they are discontinued from the trial. Table 5 provides an overview of the data that will be collected for each crop.

Future work might include a trial of shipova (*X Sorbopyrus*) grafted on certain dwarfing pear rootstocks, to test whether the grafted trees are compatible with pear rootstocks, and if trees grafted on dwarfing rootstocks will be more productive and/or begin fruit production sooner. This very high quality fruit is not commercially viable at present due to the long time lapse between tree planting and fruit production, and the relatively modest yield from mature trees. A high tunnel trial of the most productive fig cultivars would examine the potential to ripen the second crop which does not normally mature in our climate.

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Table 1. Currant evaluation at WSU Mount Vernon NWREC in 2000-2001 (brix average, mildew and foliage damage ratings).

Type	Cultivar	Avg brix ¹	Mildew ²	Leaf Damage ³	Comments
Black	Magnus	21.0	2.8	1.3	strong unpleasant aroma, pulpy not juicy
Black	Titania	20.0	0.0	2.0	strong aroma, juiced acceptably
Black	Blackdown	19.0	1.2	4.0	strong aroma
Black	Tsema	18.0	2.5	1.0	somewhat aromatic, juiced well
Black	Ben Nevis	17.0	2.5	3.0	strong unpleasant aroma, pulpy not juicy
Black	Ben Lomond	16.8	1.2	3.7	strong unpleasant aroma, pulpy not juicy
Black	Ben Tirran	15.0	0.3	2.5	strong unpleasant aroma, pulpy not juicy
Black	Ben Alder	14.0	0.0	2.3	strong unpleasant aroma, pulpy not juicy
Black	Ben Sarek	13.0	0.7	2.0	strong aroma, juiced acceptably
Red	Minn 69	12.6	0.0	3.3	pleasant aroma, juiced well
Red	Rovada	12.2	0.0	3.3	pleasant aroma, juiced well
Red	Viking	12.0	0.0	5.0	pleasant aroma, juiced well
White	Masons	13.4	0.0	4.3	pleasant aroma, juiced well
White	Primus	13.0	0.0	5.0	pleasant aroma, juiced well
White	Blanka	11.4	0.0	4.7	pleasant aroma, juiced well

¹ Brix measured 7/20/2001; fruit notes by Tracy Anderson

² Rated 7/16/2001; rating: 0=no damage, 1=slight <5%, 2=30%, 3=70%, 4=all tips infected, 5=all leaves infected

³ Rated 10/2000, insect damage (currant saw fly); rating: 1=no damage, 5=defoliated

Table 2. Summary of unusual fruit crop trial observations at WSU Mount Vernon NWREC, 1997-2007.

Plant species	# plants	Date Pltd.	Rating*/Status	Comments
<i>Actinidia arguta</i> Hardy kiwi (7 cvs)	16	1998 1999	4 /Good potential commercial, suited to organic production	Very productive, high quality, good potential for fresh market, also value-added products (jam, juice, wine)
<i>Actinidia deliciosa</i> Fuzzy kiwi (5 cvs)	7	1997- 1998 2002	2 /Mainly home garden, possible fresh market	Very productive, few pests, ripen late in season; fruit from other areas more competitive
<i>Aronia melanocarpa</i> Aronia, chokeberry	2	1997	1 /Home garden only; edible ornamental	Highly productive, no observed pests, BUT can't compete with cheap imported juice, no processors
<i>Asimina triloba</i> Pawpaw (9 cvs)	14	1997- 1999 2000	4 /Home garden experimental only, not recommended	Unproductive, few fruit set, often fail to ripen fully
<i>Camellia sinensis</i> Tea (1 cv)	1	1998	4 / Home garden experimental	Small non-vigorous plant, potential for tea leaf production was not evaluated
<i>Cornus mas</i> Cornelian cherry (6 cvs)	6	1998- 1999 2003	4 /Home garden only; edible ornamental	Excellent ornamental in Jan-Feb; seed/fruit ratio is too high, strong flavored fruit best for processed items (jam, sauce)
<i>Cydonia oblonga</i> Quince (2 cvs)	5	1999 2000	4 /Potential niche market, fresh market	Productive, generally trouble free; Mediterranean restaurants a potential specialty market, establish commercial connections
<i>Diospyros kaki</i> Japanese persimmon (9 cvs)	9	1997 2001	2 /Home garden experimental only, not recommended	Unproductive, many fail to ripen except in very warm years
<i>Diospyros virginiana</i> American persimmon (8 cvs)	14	1997 1998 2000	2 /Home garden experimental only, not recommended	Unproductive, many fail to ripen except in very warm years
<i>Eleagnus multiflora</i> Goumi (1 cv)	1	1998	3 /Home garden only	Unproductive in this trial
<i>Ficus carica</i> Fig (16 cvs)	37	1997 1999 2000	4 /Potential commercial fresh market, maybe processed product	Variety selection for yield is important, also try a high tunnel to ripen second crop
<i>Hippophae rhamnoides</i> Sea Buckthorn (3 cvs)	5	1997 2000	1 /No commercial value at this time, may be too invasive for most home gardens, good shelter belt plants	Productive, trouble-free plants; great future potential for juice and nutraceutical BUT no infrastructure for this area (BC growers are developing markets)
<i>Lonicera</i> spp Honeyberry, Blue Honeysuckle (2 cvs, 13 selections)	4 (36)	1999 (2005)	4 /Commercial potential season opener for blueberry growers	Not evaluated; test block of selections from Maxine Thompson transferred to Small Fruit Research
<i>Morus alba</i> Mulberry, Oscar (1 cv)	1	1997	3 /Ornamental only, few or no fruit	Unproductive, few or no fruit; possibly too cool here; tree is spreading, moderately vigorous
<i>Punica granatum</i> Pomegranate (2 cvs)	2	1998 2003	3 /Ornamental only	Unproductive, site too cool
<i>Pyrus communis</i> Stutgarter Gieshirtle (1 cv)	1	1987	1 /Home garden, some potential fresh market	Small tree, very productive, with small flavorful pears that can be eaten fresh from the tree
<i>Ribes</i> spp. Black currant (13) Red currant (4)	84	1998 1999 2001	4 /Mainly home garden, commercial processing for juice	Productive, well adapted to area. Commercial potential limited by narrow market, competition from other areas,

White currant (3)				need for mechanical harvest.
<i>Sambucus nigra</i> Variegated blue elderberry	1	1998	3 /Home garden only, mainly ornamental	Moderately productive, variegated leaves are ornamental, fruit used for jelly, cordial
<i>Sorbus</i> sp. Sorbus (1 cv)	1	1997	3 /Home garden only, ornamental and processed fruit	Excellent ornamental, fruit is strong, astringent, mealy, best used for jams, jelly, sauce
<i>Sorbus aucuparia</i> Mountain Ash (4 cvs)	4	1998 2000	3 /Home garden only, ornamental and processed fruit	Excellent ornamental, fruit is strong, astringent, mealy, best used for jams, jelly, sauce
<i>Vitis</i> spp Table grapes (7 cvs)	27	1997 1998 2002	4 /Mainly home garden, possible fresh market	Generally productive, for good market quality choose warmest sites, early ripening cultivars
<i>X Sorbopyrus</i> Shipova (1 cv)	1	1998	4 /Mainly home garden, potential specialty market	Only moderately productive but fruit is excellent, flavorful; possible farmers' market sales

* Rating: 1 = fully evaluated, favorable; 2 = fully evaluated, limited uses; 3 = Fully evaluated, unfavorable; 4 = Needs further evaluation

Table 3. Bloom dates of selected cultivars at WSU Mount Vernon NWREC in 2007.

Cultivar	Bloom	Comments
Cornelian cherry "Elegant"	March 12 – full bloom March 20 – full bloom March 27 – petal fall	Density 5+, yellow bloom, showy, ornamental
Cornelian cherry "Pioneer"	March 12– 80% March 20 – full bloom March 27 – petal fall	Density 5+, yellow bloom, showy, ornamental
Cornelian cherry "Red Star"	March 12 – 80% March 20 – full bloom March 27 – petal fall	Density 5+, yellow bloom, showy, ornamental
Honeyberry	March 27 – 10% April 2 – 40% April 9 – petal fall	Density 3 , white bloom, inconspicuous
Aronia	May 14 – 10% May 21 – 80% May 25 – full bloom	Density 5, white bloom clusters, conspicuous, ornamental
Shipova	May 14 – 60 % May 21 – full bloom May 29 – petal fall	Density 3, white bloom clusters, conspicuous, ornamental
Mtn. Ash "Ivan's Belle"	May 14 – 40% May 21 – full bloom May 29 – petal fall	Density 4, white bloom clusters, conspicuous, ornamental
Mtn. Ash "Nevezhinskaya"	May 14 – 10% May 21 – 60% May 25 – full bloom May 29 – petal fall	Density 4, white bloom clusters, conspicuous, ornamental
Mtn. Ash "Rabina"	May 21 – 60% May 25 – full bloom May 29 – petal fall	Density 3, white bloom clusters, conspicuous, ornamental
Mtn. Ash "Rosina"	May 21 – 60% May 25 – full bloom May 29 – petal fall	Density 3, white bloom clusters, conspicuous, ornamental
Quince "Aromataya"	May 14 – 10% May 21 – full bloom	Density 4-5, large white flowers, conspicuous, long bloom period
Quince "Van Deman"	May 14 – 10% May 21 – full bloom	Density 4, large white flowers, conspicuous, long bloom period

Table 4. Crop observations recorded at WSU Mount Vernon NWREC by year, 1999-2005.

Crop	Year	Notes
Aronia	1999 ⁴	First fruit, clusters of black fruit ripe in October, dark purple-red juice, very astringent
Aronia	2000 ⁵	Fruits were sought out by birds, so any plantings should be netted.
Aronia	2001 ⁶	Yield of 2 plants in 4 th leaf averaged 27 pounds of clean berries per bush. Potential for blending aronia juice with apple juice or with grape wines to improve the color, tannin level and sugar (aronia has measured up to 24 brix when fully ripe.)
Aronia	2002 ⁷	Produced heavy yields in 2002, berries tested at 21.4 brix on September 23. Fruit continued to ripen until mid October.
Aronia	2003 ⁸	Produced consistently heavy yields since 2001. Bushes must be netted to keep birds away, as berries do not reach full ripeness (20-22 brix) until mid October. Many hang as “raisins” on the bush.
Aronia	2004 ⁹	Produced consistently heavy yields since 2001, averaging over 25 pounds per bush. Horticulturally, aronia has potential for commercial production. Economically probably cannot provide sufficient returns to growers. Home garden use for juice and jelly, ornamental white flowers in May, colorful wine-red leaves in fall.
Aronia	2005 ¹⁰	Produced consistently heavy yields on 2 plants.
Cornelian cherry	2000	Fruit was produced on several varieties, some fruits very flavorful, plants not yet very productive; compare the varieties in 2001 for fruit quality.
Cornelian cherry	2001	Moderately productive; extended ripening period requires multiple picks. Varieties evaluated: Elegant , Redstar , and Pioneer . Seeds large compared to fruit size; evaluators noted strong, unpalatable flavor eaten fresh. Recommend use in preserves, jellies.
Cornelian cherry	2003	Red Star , Pioneer and Elegant produced well. Fruits red, 1 – 1.5" long, narrowly oval shape, single large seed. Can be eaten off the bush, strongly flavored. Best used for jelly or jam, possibly ketchup or BBQ sauce. Flowers profusely in February - March, showy bright yellow, blooms before the leaves emerge; spectacular ornamental shrub in early spring.
Cornelian cherry	2004	Red Star , Pioneer and Elegant produced good crops.
Cornelian cherry	2005	Red Star , Pioneer and Elegant produced good crops. Olga , Sevetok , and Yevgenii (planted 2003) produced first fruit
Currant	2000	Generally produced well, though harvest data was not taken. A rating of foliage damage by currant saw fly taken October 2000 (Table 3).
Currant	2001	Fruit was harvested and data collected on juice characteristics and mildew susceptibility (Table 3). The cultivars Rovada , Minn 69 , Viking (red), Primus , Blanka , Mason's (white), Ben Alder and Titania (black) had no sign of mildew damage.
Kiwi, Hardy kiwi	2003	Very good crop on all the kiwis. Hardy kiwi varieties Ananasnaja , Hardy Red and Ken's Red produced significant crops of good quality. Hardy kiwi has very good potential for commercial production, particularly organic.
Hardy kiwi	2004	Ananasnaja , Hardy Red and Ken's Red all produced significant crops of good quality.
Hardy kiwi	2005	Ananasnaja , Hardy Red and Ken's Red all produced good crops.
Mountain ash	2002	Ivan's Beauty , Ivan's Belle and Nevezhinskaya produced fruit for evaluation. Fresh berries unappealing in texture (mealy), astringent; need culinary preparation. Trees very ornamental with attractive leaves, white clustered flowers, and bright red or orange fruit.

⁴ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport99.html>

⁵ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport00.html>

⁶ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport01.html>

⁷ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport02.html>

⁸ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport03.html>

⁹ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport04.html>

¹⁰ <http://mountvernon.wsu.edu/FruitHorticulture/HarvestReport05.html>

Mountain ash	2003	Ivan's Beauty, Ivan's Belle and Nevezhinskaya all produced a crop of fruit for evaluation.
Mountain ash	2004	Ivan's Beauty, Ivan's Belle and Nevezhinskaya produced a good crop of fruit.
Mountain ash	2005	Ivan's Beauty, Ivan's Belle and Nevezhinskaya produced a good crop of fruit. Robina and Rosina (planted 2000) produced first significant crop.
Quince	2002	Trees of quince Aromataya (planted 1999) and Van Deman (planted 2000) both produced fruit. Heavy crop on Aromataya cracked or broke several branches. Quinces are primarily used for culinary purposes, very hard and rather inedible direct from the tree.
Quince	2003	Aromataya and Van Deman both produced fruit but not as heavily as in 2002.
Quince	2004	Aromataya and Van Deman both produced large crops of fruit. Small, specialized commercial market supplies ethnic Mediterranean restaurants with culinary quinces.
Quince	2005	Aromataya and Van Deman both produced large crops of fruit.
Sea buckthorn	1999	First fruit, yellow-orange, small (about 3/8"-1/2" in length) and oval-cylindrical, juice orange, subacid to tart, citrus flavor; appears to be very productive even when young
Sea buckthorn	2001	Very productive, effective harvest of fruit from the very spiny branches is the challenge. Young plants of the cultivar Leikora began producing fruit in 2001.

Table 5. Research plan for unusual fruit crops at WSU Mount Vernon NWREC in 2008

Crop	Data to be collected	Timeline
Fig	1. Productivity rating ¹¹ by observation of the "breba" crop. 2. Ripe fruits of each cultivar will be sampled for flavor and juice brix (average 5 fruits) recorded.	1. August 2. At peak harvest
Hardy kiwi	1. Productivity rating 2. Ripe fruits of each cultivar will be sampled for flavor and juice brix (average 5 fruits) recorded.	1. August 2. At peak harvest
Currant	1. Productivity rating	1. July
Table grape	1. Productivity rating 2. Juice brix (average 50 randomly collected berries per cv.) recorded.	1. August 2. At peak harvest
Cornelian cherry	1. Productivity rating	1. July
Quince	1. Full bloom date and bloom abundance rating ¹² 2. Productivity rating	1. April-May 2. September-October

¹¹ Rating: 3 = acceptable commercial productivity; 2 = acceptable home garden, unacceptable commercial; 1 = unacceptable.

¹² Bloom abundance rating: 5 = very abundant, all areas of tree filled with bloom; 4 = abundant, most areas of tree in bloom; 3 = moderately abundant, some areas of tree lack flowers; 2 = sparse, most areas of tree lack flowers or dense clump of flowers and rest of tree bare; 1 = very sparse, few or no flowers.