Fruit Varieties Journal 51(4):233-238 1997

Sweet Cherry Breeding in Canada from the Early 1900s to 1994

FRANK KAPPEL[1] AND WILLIAM LAY[2]

Sweet cherries in Canada are grown commercially in both Ontario and British Columbia. Both provinces have had a long history of growing cherries. The report on the Fruits of Ontario in 1906 (6) provided both production and cultivar recommendations for the growers of Ontario. Sweet cherries have also been grown in British Columbia since the start of fruit production in the province and by 1917 British Columbia was producing 475 tons of cherries (3).

In Ontario the major production area is in the Niagara Peninsula bordering Lake Ontario. There is some production outside that area, specifically in Essex and Kent Counties but it is limited. The Okanagan Valley is the major sweet cherry production area in British Columbia with a smaller industry in the Creston Valley in the southeast portion of the province.

The latest census in Ontario suggests that production of sweet cherries will be increasing. There was a 34% increase in the number of trees from 1990 to 1994 (1). In British Columbia there appears to be a renewed interest in planting sweet cherries and tree numbers and acerages appear to be increasing. Present cultivar recommendations in Ontario include: 'Viva,' 'Valera,' Viscount,' 'Bing,' 'Vogue,' 'Vic,' 'Hedelfingen,' and 'Van' for general planting and for limited plantings the cultivars include: 'Vista,' 'Vega,' and 'Venus' (5). In British Columbia, plantings of 'Lapins,' 'Sylvia,' and 'Sweetheart' are increasing, whereas planting trends of 'Summit,' and 'Sunburst' are stable. The planting trends of the older established cultivars such as 'Bing,' 'Van,' 'Lambert,' and 'Stella' are declining (4).

The objective of this report is to give a brief recounting of the history of the two sweet cherry breeding programs in Canada that began in 1915 at Vineland Station and 1936 at Summerland. The varieties recommended for Ontario at that time included: 'Napoleon,' and 'Yellow Spanish' for the blushed cherries and 'Tartarian,' 'Elkhorn,' 'Windsor,' and 'Schmidt' for the black cherries. The cultivars recommended to British Columbia growers at that time included 'Bing,' 'Lambert,' and 'Deacon' as the pollinizer. Most of the information for this report was drawn from the various annual reports from the research institutions.

History of the Sweet Cherry Breeding Program at Vineland Station, Ontario, 1915 to 1994.

The first objectives for the program were to develop cultivars with a range of maturities throughout the cherry season that were firm, dark-fleshed, flavorful, large, and non-cracking. The first crosses were made in 1917 using the parents 'Black Tartarian,' 'Napoleon,' 'Olivet,' 'Windsor,' and 'Rockport.' Beginning in 1915 open-pollinated seed from 'Late Duke,' 'Windsor,' 'Black Tartarian,' 'Napoleon,' and 'Reine Hortense' were sown as part of the breeding effort. From those early years 1330 open-pollinated seedlings and 1079 seedlings from cross-

Pacific Agri-Food Research Centre Contribution No. 1033.
[1]Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland B.C., V0H 1Z0 Canada.
[2]University of Guelph, Horticultural Research Institute of Ontario, Vineland, Ont. L0R 2E0 Canada.

Table 1. Vineland sweet cherry cultivars from 1925 to 1994.

Cultivar	Year named	Maturity	Fruit size	Skin color	Firmness	Flavor	Splitting	Shape	Pollination	Fruit Set	Tree vigor	Hardiness
Victor	1925	midseason	large	blush	firm	sweet-good	tolerant	oval	S2S3	good	vigorous	tender
Velvet	1937	late-midseason	large	black	soft	sweet	moderately susceptible	kidney-round	S253	light	vigorous	tender
Vernon	1937	early-midseason	large	red-black	firm	very good	susceptible	flat-round	S3S4	good-heavy	vigorous	very tender
Venus	1958	early	medium	dark red	soft	fair	moderately susceptible	oval-round	S1S3	heavy	vigorous	tender
Vic	1958	late-midseason	med.-large	black	firm	fair-good	tolerant	cordate	O	heavy	vigorous	tender
Vista	1958	early	medium	black	firm	fair-good	moderately susceptible	round	O	heavy	vigorous	tender
Vega	1967	midseason	large	blush	firm	fair	moderately tolerant	kidney	O	good	vigorous	moderately tender
Valera	1967	early	medium	black	firm	good	tolerant	flat-round	O	heavy	vigorous	moderately tender
Viva	1972	early	medium	dark red	medium	good	tolerant	cordate	S2S3	good	vigorous	moderately tender
Vogue	1974	midseason	large	dark red	medium	good	moderately tolerant	heart	S2S3	good	vigorous	moderately tender
Viscount	1984	midseason	med-large	red	firm	good	tolerant	kidne}	S1S4	good	vigorous	moderately tender

0 = universal pollinizer.

pollinations with varieties like 'Bing' were planted in seedling orchards.

The additional focus to develop self-fertile cultivars was added to the objectives in 1969 with a cross of 'Van' x 'Stella' and to date, this cross has blossomed 34 selections that span Ontario's cherry season.

The sweet cherry breeders at Vineland during this period include G. H. Dickson, G.W. Eaton, C.D. Whitty, and G. Tehrani.

A number of observations were noted from the early breeding work, these include: fruits may mature without developed embryos; no intermediates in season, from a cross between an early and a late variety; differences in winter hardiness; variability in skin and flesh color; and varying yields. Throughout the breeding work at Vineland, pollination studies were conducted to study pedigrees and to determine compatibility groups of cultivars released from Vineland.

The first cultivar, 'Victor' was introduce in 1925 followed by 'Vernon' and 'Velvet' in 1937 (Table 1). These older cultivars resulted from selections of seedlings from collections of open pollinated seeds of 'Windsor' (Table 2). 'Windsor' is a small, light-coloured, productive cherry that once was Ontario's main cultivar. With the release of 'Venus' 'Vic,' and 'Vista' in 1958, selections resulted from controlled crosses. 'Hedelfingen' was the maternal parent for many of the cultivars released. It has been extensively used because of its firm, good fruit quality traits, good level of resistance to cracking and its productivity. In 1967, 'Valera,' a sister seedling of 'Venus' and 'Vega,' a large firm, white fleshed cherry maturing earlier than most white cultivars were introduced. The emphasis for early cultivars with tolevance to rain-induced cracking resulted in the introduction of 'Viva' in 1973. 'Vogue' was introduced in 1974 as a productive substitute for the cracking susceptible cultivar 'Bing.' 'Vis-

Table 2. Parentage of cultivars released from the Vineland breeding program.

Cultivar	Female Parent	Male Parent
Victor	Windsor O.P.[z]	
Velvet	Windsor O.P.[z]	
Vernon	Windsor O.P.[z]	
Venus	Hedelfingen	Windsor
Vic	Bing	Schmidt
Vista	Hedelfingen	Victor
Vega	Bing	Victor
Valera	Hedelfingen	Windsor
Viva	Hedelfingen	Windsor
Vogue	Hedelfingen	Windsor
Viscount	V35024[y]	V35029[x]

[z]O.P. = Open pollinated.
[y]V35024 is a seedling of 'Hedelfingen' x 'Bing.'
[x]V35029 is a seedling of 'Hedelfingen' x 'Bing.'

count,' released in 1984, was the unique product of a cross using two selections from the Vineland program.

The objective to develop a wide range of large size, self-fertile cultivars with more consistent pollination and improved precocity was embarked upon and by 1983, six self-fertile selections were being extensively tewted in trials. Two of these advanced selections, the early to mid-season V690618 and the mid- to late-season V690620, have proven to be more productive than standard cultivars grown in Ontario, and have been named 'Vandalay' and 'Tehranivee' in 1996.

A number of studies were done to assign cultivars to different pollen-incompatibility groups and verify the pedigree of various cultivars. Among those, 'Vic' and 'Valera' were found to belong to Group 'O' (Universal Donor) rather than group VII (S_4S_5) (7).

With Ontario's increased interest in high density, pick-your-own operations, the program will continue to develop the self-fertile trait. Cultivars conducive to solid block plantings and adaptability to size controlling rootstocks of today without compromising fruit size will be Vineland's focus. Crack resistance will still hold a high priority also, and with the availability of superior germplasm, efforts using standard breeding techniques will still be continued.

History of the Sweet Cherry Breeding Program at Summerland, British Columbia, 1936 to 1994.

The objectives of the program in 1936 were to develop a cherry with the characteristics of 'Bing' and 'Lambert' that matured earlier, were more resistant to rain-induced cracking, and could be used as pollinizers for those cultivars. The sweet cherry breeding program at Summerland began when A.J. Mann made the first crosses using 'Bing,' 'Black Republican,' 'Deacon,' 'De Schrecken,' 'Empress Eugenie,' 'Giant,' 'Hinton,' 'Lambert,' 'Royal Ann,' 'Schmidt,' 'Vevnon,' 'Victor,' V160140, and 'Windsor' as the first set of parents. They started with 593 seedlings which were reduced to 17 by 1948.

In 1951, the objectives of the program were modified slightly when 'Van' was used as the reference cultivar rather than 'Bing' and 'Lambert' and also new cultivars should be immune to the virus, little cherry. In 1966, cold hardiness was added to the objectives of the breeding program. By 1990 the breeding goals were reported to be self-fertility, resistance to splitting, improved fruit size, growth habit and improved fruit quality (including taste, firmness, stem quality, and post- harvest characteristics).

There have been three breeders since the inception of the program in 1936 until 1994 and they include A. J. Mann (1936 to 1955), K. O. Lapins (1955 to 1974), and W. D. Lane (1974 to 1994).

Attempts were made to develop dwarf sized trees by the use of ionizing radiation beginning in 1956. Thermal neutrons, x-rays, and gamma rays were used to irradiate dormant scions. Treated scions were grafted onto rootstocks and selections and repropagations were made of individual grafts showing dwarf growth habit. 'Compact Stella,' 'Compact Van,' and

Table 3. Summerland sweet cherry cultivars from 1944 to 1994.

Cultivar	Year named	Maturity	Fruit size	Skin color	Firmness	Flavor	Splitting	Shape	Pollination	Fruit set	Tree vigor	Hardiness
Van	1944	midseason	medium	black	moderate	very good	moderately tolerant	kidney	S1S3	heavy	moderate	moderately tender
Sparkle	1945	early-midseason	small-medium	blush	moderate	good	moderately tolerant	round	S1S2	heavy	vigorous	tender
Star	1949	early	moderately large	dark red	firm	good	very tolerant	heart	S3S4	good-heavy	modevate	tender
Sam	1953	early-midseason	moderately large	dark red	firm	good	good tolerance	heart	?	Moderate	vigorous	moderately tender
Sue	1954	early	medium	blush	firm	good	very tolerant	round-heart	S2S3	heavy	vigorous	very tender
Compact Lambert	1964	late-midseason	medium	dark red	moderate	fair-good	moderately susceptible	heart	?	heavy	moderate	moderately tender
Stella	1968	midseason	large	black	moderate	fair-good	moderately susceptible	heart	self	heavy	v. vigorous	tender
Salmo	1970	early-midseason	medium	black	firm	fair-good	moderately susceptible	round	?	Good	vigorous	moderately tender
Compact Stella	1973	midseason	medium	black	moderate	fair-good	moderately susceptible	heart-oval	self	heavy	moderate	?
Summit	1973	midseason	very large	red to dark red	moderate	good	tolerant	heart	?	light	vigorous	moderately tender
Lapins	1984	late	very large	black	very firm	good	tolerant	round	self	heavy	v. vigorous	
Sunburst	1984	midseason	very large	dark red	moderate	very good	tolerant	round	self	good	moderate	?
Newstar	1988	early	medium	black	moderate	good	moderately susceptible	round-kidney	self	heavy	moderate	?
Sylvia	1988	late-midseason	large	dark red	very firm	good	tolerant	heart	?	light	moderate	?
Sweetheart	1994	very late	medium	red	very firm	fair-good	tolerant	round	self	heavy	moderate	may be tender

'Compact Lambert' have been released from this irradiation work.

In the mid-fifties various techniques were used to help in the selection of suitable cultivars. These include freezing tests to evaluate the hardiness of cherry cultivars and selections, water-baths to assess tolerance to splitting and even taste panels were used to determine the suitability of different selections for canning use. Before the freezing tests, the selections and cultivars were evaluated for hardiness after test winters such as the winter of 1954.

The breeding program at Summerland has had a number of accomplishments with the release of the following cultivars. 'Van' was released in 1944 and because of its good quality characteristics it was still the second most important sweet cherry cultivar in British Columbia in the early 1990's (4). Not only is it important in British Columbia but it has found a home in most of the sweet cherry industries around the world (2). With the release of 'Stella' in 1968, Summerland was the first sweet cherry breeding program to release a cultivar with a reasonable level of fruit quality that was also self-fertile. It resulted from crosses using the material from the John Innes Institute starting in 1956. 'Stella' is still being grown in the Okanagan, although at a reduced level. It has been extensively used in the breeding program as a source of self-fertility. The introduction of 'Summit' in 1973 set the

Table 4. Parentage of cultivars released from the Summerland breeding program.

Cultivar	Female Parent	Male Parent
Van	Empress Eugenie O.P.[z]	
Sparkle	Empress Eugenie O.P.	
Star	Deacon O.P.	
Sam	V160140[y] O.P.	
Sue	Bing	Schmidt
Compact Lambert	Irradiated Lambert	
Stella	Lambert	J.I. 2420[x]
Salmo	Lambert	Van
Compact Stella	Irradiated Stella	
Summit	Van	Sam
Lapins	Van	Stella
Sunburst	Van	Stella
Newstar	Van	Stella
Sylvia	Van	Sam
Sweetheart	Van	Newstar

[z]O.P. = Open pollinated.
[y]V160140 is a seedling of 'Windsor' O.P.
[x]J.I. 2420 is the source of self fertility from the John Innes Institute.

standard for fruit size. It consistently produces reasonable crops of fruit with average fruit weights over 10 g.

There have been 16 cultivars released from 1944 until 1994 with a range of maturity dates and characteristics (Table 3). Early named cultivars resulted from selections of seedlings from open pollinated seeds of various old cultivars such as 'Empress Eugenie' and 'Deacon' (Table 4). The self-fertility of 'Stella' came from the selection J.I. 2420 which was produced from X-ray radiation ('Emperor Francis' x 'Napoleon' X-ray pollen). The self-fertility of all present Summerland cultivars is derived from 'Stella.' Other sources of self-fertility exist in the Summerland program and these are being used to develop cultivars that are self-fertile but from sources other than 'Stella.'

The program has a number of advanced selections spanning the cherry season from about eight days before 'Van' (13S-5-22) to about 20 days after 'Van' (13S-25-25). Most have good fruit size and quality and most are self-fertile. These selections will continue to be evaluated in British Columbia and around the world. The best of these selections will be named and introduced.

The future work of the program will continue using traditional breeding methods to extend harvest period at both the beginning of the season and at the end. Self-fertility will remain an important trait but sources other than 'Stella" will be used. Efforts will be made to begin using molecular genetic techniques, such as marker assisted selection, to enhance the breeding effort.

References

1. Bany, P. 1995. Survey of tender fruit trees in Ontario, 1944. Ont. Mm. Agric., Food, and Rural Affairs. Toronto, Ont. Canada.
2. Bargioni, G. 1996. Sweet cherry scions: characteristics of the principal commercial cultivars, breeding objectives and methods. Pg 73-112. In: A.D. Webster and N.E. Looney, eds. Cherries: crop physiology, production and uses. CAB International. Wallingford, Oxon UK.
3. B.C. Dept. of Agric. 1921. Agricultural statistics, 1920. Bull. 88. pg. 19. Victoria, B.C. Canada.
4. B.C. Ministry Agric. Fisheries, and Food. 1996. Tree fruit production guide for interior districts for commercial growers. pg. 117. Victoria, B.C. Canada.
5. Dale, A., D.C. Elfving, K.H. Fisher, N.W. Miles, G. Tehrani, and K. Wilson. 1992. Fruit Cultivars. Publ. 430. Ont. Mm. Agric., and Food. Toronto, Ont. Canada.
6. Ont. Dept. of Agric. 1907. Fruits of Ontario in 1906. Toronto, Ont. Canada.
7. Tehrani, G., and W. Lay. 1991. Verification through pollen incompatibility studies of pedigrees of sweet cherry cultivars from Vineland. HortScience. 26(2):190-191.