Potential for *Ribes* Cultivation in North America

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SUMMARY. Fruit from black, red and white currants, and gooseberries (*Ribes* L.) were grown commercially in North America at the beginning of the 20th Century. However, when white pine blister rust (WPBR) (*Cronartium ribicola* J. C. Fisch.) was introduced into the new world, their cultivation was discontinued. About 825,000 t (908,000 tons) of *Ribes* fruit are produced worldwide, almost entirely in Europe. The fruit is high in vitamin C, and is used to produce juice, and many other products. Now a wide range of imported *Ribes* products is available particularly in Canada, and the pick-your-own (PYO) market is increasing. Two diseases, powdery mildew [*Spaerotheca mors-uvae* (Schwein.) Berk. & Curt.] and WPBR, are the major problems encountered by growers. Fortunately, many new cultivars are resistant to these two diseases. Commercial acreage of *Ribes* in North America is located where the growing day degrees above 5 °C (41 °F), and the annual chilling hours are at least 1200. Initially, the *Ribes* industry will develop as PYO and for farm markets. But for a large industry to develop, juice products will needed. Our costs of production figures indicate that about 850 Canadian dollars ($CDN) per 1.0 t (1.1 tons) of fruit will be required to break even.

Different *Ribes* fruit are popular in Europe, but despite interest from growers, very few acres are cultivated in North America. The main reason for this is that *Ribes*, especially black currant (*Ribes nigrum* L.) is an alternate host for WPBR. Because forest products are a major industry in North America, *Ribes* plants were declared to be a pest and destroyed to control the disease in pines (*Pinus* L.). However, now that many areas are devoid of commercial five-needle pine plantations and the laws that limit fruit production have been repealed, growers have renewed interest in cultivating black currants.

To examine the potential of *Ribes* in North America, we need to define the present situation, and then discuss the future potential. Barney (1996) discussed this topic, but this paper will update the current situation and explore the potential for cultivation in greater detail.

The present

***Ribes* USED COMMERCIALLY.** The *Ribes* used commercially are found in three subgenera: *Ribes, Ribesia* and *Grossularia*. Black currants (subgenus: *Ribes*) are the most widely grown commercially, and the most economically important species in this subgenus is *R. nigrum*. Most red and white currants (subgenus: *Ribesia*) grown commercially are related to *R. sativum* Syme, *R. petraeum* Wulf., or *R. rubrum* L. The gooseberries (subgenus *Grossularia*) are mostly hybrids between the european gooseberry *R. grossularia* L. (*R. uva-crispa* L.) and the american gooseberry, *R. hirtellum* Michx. (Brennan, 1996).

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Table l. World production of currants, averaged from 1996–98 (FAO, 1999).[z]

Country	Production (t)
Europe (25 countries)	648,695
Russian Federation	190,000
Poland	176,086
Germany	144,843
Rest of the world	1,793
New Zealand	1,867
Australia	866
North America[y]	60
Total	650,488

[z]1 t = 1.1 tons.
[y]Non-FAO estimate.

Table 2. World production of gooseberries, averaged from 1996–98 (FAO, 1999).[z]

Country	Production (t)
Europe (12 countries)	174,484
Germany	74,344
Poland	38,705
Russian Federation	34,333
Rest of the world	
New Zealand	27
Total	174,511

[z]1 t = 1.1 tons.

Recently, jostaberries (*R. nidigrolaria* Bauer), black currant x gooseberry hybrids have been released, but so far these have made little impact commercially (Bauer, 1986).

WORLD PRODUCTION. World production of *Ribes* is reported to be about 825,000 t (Tables 1 and 2), 99% of which comes from Europe (Food and Agricultural Organization, 1999). Most of the tonnage for trade is black currants of which about two-thirds, come from Poland (Andrews, 1999). Although Russia and Germany produce large quantities, most of these are consumed locally.

North American production is very small and largely unrecorded. Black currants are more popular in Canada and the northern states and red currants and gooseberries are of more interest further south. Present estimates of production would suggest that several hundred acres might be grown throughout North America, mostly in Ontario, British Columbia, Oregon and Washington.

PRODUCTS. *Ribes* fruit are used mainly as processed products, although red and white currants and gooseberries are edible as a fresh dessert. Processed products include juice, jams and preserves, pie fillings, dessert toppings, yogurt, ice cream, mineral waters, teas, liqueurs, candies, perfumes, and the seeds can potentially be used to produce gamma-linolenic acid.

About 80% of the black currant crop is used to produce juice, which is extremely high in vitamin C (ascorbic acid). Its concentration in fruit can be four times higher than in oranges [*Citrus sinensis* (L.) Osbeck] and 50 times higher than in apples (*Malus domestica* Borkh). (Table 3). Despite the lack of Canadian-grown fruit, various black currant products are available in the supermarkets and speciality stores throughout Canada. So far this year, I have found a number of products locally available. These include Crancurrant from Ocean Spray (Lakeville-Middleboro, Mass.) and own label brands, Ribena juice concentrate bottled in Ontario, jams, tea bags, mousse torte, cookies, black currant liqueur (Ontario produced and imported), candies, and throat lozenges. All this indicates that a demand for the product exists but that a major marketing effort would be needed to increase the volumes.

The potential in North America

AREA OF POTENTIAL CULTIVATION. North America is one of the main geographical centres of diversity for *Ribes* (Brennan, 1996) and various species are found throughout most of the continent. Various species are native from northern Canada (Hudson Bay) and Alaska, south to California, New Mexico, Arkansas and North Carolina (Rehder, 1937). For example, the wild black currant, *R. americanum* Mill., grows from New Brunswick to Alberta and south to New Mexico and Delaware and the wild gooseberry, *R. hirtellum*, grows From Newfoundland to Manitoba south to Minnesota and West Virginia (Soper and Heimburger 1982). Thus, *Ribes* can be cultivated throughout the range of the native species provided that adequate moisture is supplied (Barney, 1996).

Another way of looking at the potential areas of cultivation is to find parameters that define northern and southern limits. However, individual microclimates exist beyond the edges of the general limits of cultivation. At these locations, adapted cultivars could be grown.

The length of the growing season and the maximum midwinter temperature could define the northern limit. At Simcoe, Ontario, currants and gooseberries usually produce ripe fruit in the middle of July and the 30 year average growing day degrees above 5 °C (41 °F) from January to July are 1221 (Environment Canada, 1982), which would suggest that 1200 would be a reasonable northern limit for *Ribes*. Also, fruit buds in cultivated *Ribes* deep super-cool so that their maximum winter hardiness is –40 °C (–40 °F). However, some species have been reported to be hardy to as low as –60 °C (–70 °F), and Russian scientists have made considerable efforts to breed winter hardy varieties (Keep, 1975).

The number of chilling hours and the summer temperatures can define the southern limit. Modern *Ribes* varieties need between 800 to 1500 HR below 7 °C (45 °F) to remove bud dormancy or physiological rest (Himelrick and Galletta, 1990). So a compromise of about 1200 HR would set a reasonable southern limit. All provinces of Canada and all states of the U.S. except Florida, Hawaii, and Louisiana have at least some areas that exceed this level (Swartz and Gray, 1981). Harmat et al. (1990) indicated that leaves of many varieties are damaged at air temperatures above 30 °C (86 °F). Our experience with other

Table 3. Nutrient composition of selected fruits from 100 g (3.5 oz) edible portion (USDA, 1982).[z]

Nutrient	Black currants	Red currants	Oranges	Apples
Water (%)	82.0	84.0	87.0	84.0
Food energy (kJ)	266.0	234.0	197.0	237.0
Protein (g)	1.4	1.4	0.9	0.1
Total lipid (g)	0.4	0.2	0.1	0.3
Total carbohydrates (g)	15.4	13.8	11.8	14.9
Ascorbic acid (mg)	181.0	41.0	53.0	4.0

[z]1.0 kJ = 239 calories, 1000 mg = 1 g = 0.035 oz.

Table 4. A capital budget enterprize analysis for black currant pick-your-own production, inputs and results.[z]

Input or output	Quantity used	Cost or price/ unit used ($Canadian)
Inputs		
Establishment		
Plants	5436 plants / ha	0.73, $ / plant
Planting labor	20 h·ha^{-1}	15.00, $ / h
Land preparation		247.00, $ / ha
Fumigation / row		310.00, $ / ha
Black plastic		495.00, $ / ha
Irrigation equipment		310.00, $ / ha
Annual		
Fertilizer[y]	224 kg / ha / year	2.21, $ / kg
Irrigation	1000 kL / ha / year	0.264, $ / kL
Pruning labor	90 h / ha / year	15.00, $ / h
Herbicides (materials plus application)		148.00 ,$ / ha / year
Insecticides and fungicides[x]		0.00, $ / ha / year
Land		247.00, $ / ha / year
Harvest		
Other labor	49 h / ha	15.00, $ / h
Outputs and revenue		
Yield	1 kg / plant / year	4.40, $ / kg
Time related factors		
Life expectancy of plants (years)		20
Discount rate (%)		10.00
First year production adjustment (%)		0.00
Second year production adjustment (%)		50.00
Results		
Present value of annual cash flow ($ / ha)	$127,071.43	
Internal rate of return (%)	104.98	
Benefit cost ratio	25.83	

[z]1 ha = 2.47 acres, 1 kg = 2.2 lb, 1 kL = 264 gal.
[y]Minimum composition = 20N–20P–20K.
[x]Varieties planted are resistant to powdery mildew.

small fruit has been that these symptoms are exacerbated by wind and drought and can be alleviated by shelter and supplemental irrigation.

MARKET. Because most *Ribes* products are processed in some form, the markets will be tied to those products. At present, PYO has considerable interest in Canada and this market is growing steadily. Eventually surplus fruit from PYO operations will be found in local farm markets. However, this market is relatively small and I estimate that it would become saturated if 50 states and provinces had on average 40 ha (100 acres) of PYO *Ribes*, i.e., 2,000 ha (5,000 acres) continent-wide.

The major market for expansion would be for juice products. The juice market in the United States is presently worth about $CDN 8.72 billion (Industry Canada, 1999), so a 1% market penetration would be worth $CDN 87 million. The amount of acres required for this is extremely difficult to estimate. The most reliable figure I could find was that 100 t (110 tons) of fruit, [20 ha (50 acres) at 5 t·ha^{-1} (2.2 ton / acre)] yields about 9450 L (2,500 gal) of juice concentrate (10:1) (J. Sheffrin, personnel communication).

Other untapped markets exist. Evidence from many states and provinces suggests that the market for dessert fruit wines is expanding. This could become the next marketing blitz for the alcohol industry and just where *Ribes* crops may fit into this industry is unknown. However, already in Ontario, Southbrook Farms is winning prizes in international competitions for Cassis.

Provided that suitable markets can be developed, North America could support a *Ribes* industry similar in size to that of Poland. Poland presently produces about 200,000 t (220,000 tons) of currants and gooseberries, which would represent 28 to 40 thousand ha (70 to 100 thousand acres).

COSTS OF PRODUCTION. Because few acres of *Ribes* are grown in North America, accurate costs of production have not been published. My colleague, Glenn Fox, Dept. of Agricultural Economics and Business, University of Guelph, and myself have been able to construct two spreadsheets to estimate the costs of production of black currants for the juice market and for PYO (Tables 4–7). We have used a yield of 1 kg (2.2 lb) per plant (5 t·ha^{-1}) as this has been attained regularly in trials at Simcoe and appears to be the average in Europe. We also used 20 years as the life of the planting because reversion virus is not present in North America.

Plantations of PYO Black currants can be very profitable as indicated by the present value of the annual cash flow of $CDN 127,071 / ha ($CDN 51,426 / acre) and the benefit cost ratio of 25.83 (Tables 4–5). This model uses $CDN 4.40 as the price per kilogram ($CDN 2.00 / lb), which is at the low end of prices charged in Ontario. Also no costs have been at-

Table 5. A capital budget enterprize analysis for black currant pick-your-own produce, annual cash flows (in Canadian dollars per hectare).[z]

Year	Revenues	Establishment costs	Annual operation costs	Harvesting coats	Cash flow
0		5,630.28		–5,630.28	
1	0.0		2,502.92	0	–2,502.92
2	11,959.20		2,502.92	367.00	9,088.78
3	23,918.40		2,502.92	735.00	20,680.48
4	23,918.40		2,502.92	735.00	20,680.48
5	23,918.40		2,502.92	735.00	20,680.48
6	23,918.40		2,502.92	735.00	20,680.48
7	23,918.40		2,502.92	735.00	20,680.48
8	23,918.40		2,502.92	735.00	20,680.48
9	23,918.40		2,502.92	735.00	20,680.48
10	23,918.40		2,502.92	735.00	20,680.48
11	23,918.40		2,502.92	735.00	20,680.48
12	23,918.40		2,502.92	735.00	20,680.48
13	23,918.40		2,502.92	735.00	20,680.48
14	23,918.40		2,502.92	735.00	20,680.48
15	23,918.40		2,502.92	735.00	20,680.48
16	23,918.40		2,502.92	735.00	20,680.48
17	23,918.40		2,502.92	735.00	20,680.48
18	23,918.40		2,502.92	735.00	20,680.48
19	23,918.40		2,502.92	735.00	20,680.48
20	23,918.40		2,502.92	735.00	20,680.48

[z]1 ha = 2.47 acres.

tached to harvesting, although allowance has been made for the labor required to handle customers at a PYO farm.

For the juice market, profitability is closely tied to the world price for black currants. In the spread sheet we have set the price at $CDN 0.85/kg ($CDN 0.39/lb) ($CDN 850/t, $CDN 773/ton), which is the price needed to break even (Tables 6–7). The largest component in this model is the capital cost of a mechanical harvester. The Pattenden Challenger harvester (Ledbury, United kingdom) costs UK pounds sterling (UKL) 68,000, and will harvest 0.5 to 5.0 t (0.55 to 5.5 tons) per h. In Europe, contractors charge UKL 100 to 150/h to harvest the crop (Pattenden Machinery Ltd, personal communication). The recent world price for black currants has fluctuated between $CDN 450 to 1440/t ($CDN 409 to 1309/ton), which puts the break-even price about in the middle of this range.

CONSTRAINTS. For a *Ribes* industry to develop people need to be aware of several constraints. The most important of these are regulatory controls, diseases, marketing, and price.

REGULATORY CONTROL. The availability of new *Ribes* varieties is controlled by importation regulations and by WPBR legislation within several states. The importation regulations for *Ribes* in Canada and the United States are harmonised. Both countries now prohibit direct entry of *Ribes* from other countries. These regulations are designed to prevent reversion, a major endemic disease in Europe, from entering the North American continent.

Ribes which can be certified as originating in Canada and the United States can be imported between the two countries without restrictions. However, entry into both countries requires a phytosanitary certificate. The USDA Animal and Plant Health Inspection Service (APHIS) considers *Ribes* varieties to be Canadian if they have been grown for at least 1year in Canada and have been grown under postentry quarantine and can be certified reversion-negative. These regulations have been designed to allow free movement of *Ribes* between Canada and the USA while preventing the introduction of major pest problems.

The effect of these regulations is to slow the introduction of new varieties from the breeding programs in Europe. Presently, there are no breeding programs for *Ribes* in Canada, although the new European varieties are being tested at several centers. Researchers in Minnesota, Maryland, Idaho, and Oregon have made crosses to combine WPBR immunity with high quality fruit.

Although WPBR restrictions are in effect in 15 states, some states are considering repealing these restrictions. Steve McKay (2000), presents a summary of the present restrictions.

DISEASES. Two major disease problems *Ribes* growers must contend with are powdery mildew and WPBR. Powdery mildew, called american gooseberry mildew in Europe, is probably the most significant disease which hampers increases in *Ribes* acreage. Most presently grown varieties are susceptible to the disease, and few chemical controls exist. Consequently, the most effective control is varietal resistance. Fortunately, most new European varieties are resistant to mildew.

WPBR occurs on many currant and gooseberry varieties and leads to defoliation of the leaves early in the fall. This disease is becoming less of a concern in main horticultural regions, as cultivation and forestry practices have eradicated white pines from large parts of these areas. However, this disease still causes major losses in the forest industry. Fortunately now, some

Table 6. A capital budget enterprise analysis for black currant production for juice, inputs and results (in Canadian dollars per hectcare).[z]

Quantity units	Cost or price units	Per unit
Inputs		
Establishment		
Plants	5436 plants / ha	0.73, $ / plant
Planting labor	20 h / ha	15.00, $ / h
Land preparation		247.00, $ / ha
Fumigation / row		310.00, $ / ha
Black plastic		495.00, $ / ha
Irrigation equipment		310.00, $ / ha
Annual		
Fertilizer[y] (20–20–20)	200 kg / ha / year	2.21, $ / kg
Irrigation	1000 kL / ha / year	0.264, $ / kL
Pruning labor	90 h / ha / year	15.00, $ / h
Herbicides (materials plus application)		148.0, $ / ha / year
Insecticides and fungicides[x]	0.00, $ / ha / year	
Land		247.00, $ / ha / year
Harvest		
Containers (bins)[w]	62 bins / ha	100.00, $ / bin
Harvesting machine	1	165,000.00, $ / machine
Machine capacity		2, ha / day
		20, days / year
Outputs and revenue		
Yield	1 kg / plant / year	1.23, $ / kg
Time related factors		
Life expectancy of plants (years)	20	
Discount rate (%)	10.00	
First year production adjustment (%)	0.00	
Second year production adjustment (%)	50.00	
Results		
Present value of cash flow ($ / ha)	$166.47	
International rate of return (%)	10.20	
Budget cost ratio	1.03	

[z]1 hectare = 2.47 acres, 1 kg = 2.2 lb, 1 kL = 264 gal.
[y]Minimum composition: 20N–20P–20K.
[x]Varieties planted are resistant to powdery mildew.
[w]91.2 × 1.2 × 0.6 m (48 × 48 × 24 inch). Assumed half the bins bought in year 2 as only half production harvested, remaining bins purchased in year 3.

Ribes cultivars are resistant, and resistant pine seedlings are being selected for reforestation.

In Ontario, we have been actively screening modern european black currant varieties for adaptability in North America. We have selected varieties that are mildew resistant and yield consistently. We feel that varieties with these characteristics will give sufficient benefit to growers to stimulate the industry. We have now started on the second stage to identify varieties which are resistant to WPBR. So far we have identified five varieties that have strong resistance to mildew: 'Ben Alder', 'Ben Sarek' and 'Ben Tirran,' 'Polar' and 'Titania' (Table 8). These have given yields of over 30 $t \cdot ha^{-1}$ (13 tons / acre) over a 7-year period and have remained free of powdery mildew. Of these, only 'Polar' and 'Titania' are resistant to WPBR.

MARKETING. *Ribes* products which are available throughout Canada, are virtually absent from all parts of the United States. A long and concerted marketing effort will be required for them to be accepted and become widely available. Presently, the North American public is unaware that *Ribes* plants or products even exist.

Some marketing efforts are being made, but these are small; either individuals promoting in a small local area, or corporations tied to specific products. Where products are available and promoted people have no problem selling their entire product. This is particularly apparent in areas with many recent European immigrants. Presently, no commission or grower organizations exist to fund the generic advertising, alone or with government.

PRICE. The price of *Ribes* fruit depends on the end-product. Where fruit is sold PYO or is destined for upmarket products in local areas, the price paid for fruit is largely irrelevant. People will pay a price that gives a grower a profitable return on his investment. However, where the fruit is required in large quantities, the world market sets the price. Presently the world market price is depressed and European growers are having difficulty growing their crops profitably.

Conclusions

Since the legislation to control WPBR was rescinded the cultivation of *Ribes* in North America has increased. In Canada and some northern US states, acreage has been planted for PYO operations and to produce locally processed products. This acreage is increasing, primarily for the produc-

Table 7. A capital budget enterprize analysis for black currant production for juice, Annual cash flows (in Canadian dollars per hectcare).[z]

Year	Revenues	Establishment costs	operation costs	Harvesting costs	Cash flow
0		5,630.28			–5,630.28
1	0.00		2,504.04	0.00	–2,504.04
2	2,310.30		2,504.04	4,813.64	–5,007.38
3	4,620.60		2,504.04	813.64	1,302.92
4	4,620.60		2,504.04	250.00	l,866.56
5	4,620.60		2,504.04	250.00	l,866.56
6	4,620.60		2,504.04	250.00	l,866.56
7	4,620.60		2,504.04	250.00	l,866.56
8	4,620.60		2,504.04	250.00	l,866.56
9	4,620.60		2,504.04	250.00	l,866.56
10	4,620.60		2,504.04	250.00	l,866.56
11	4,620.60		2,504.04	250.00	l,866.56
12	4,620.60		2,504.04	250.00	l,866.56
13	4,620.60		2,504.04	250.00	l,866.56
14	4,620.60		2,504.04	250.00	l,866.56
15	4,620.60		2,504.04	250.00	l,866.56
16	4,620.60		2,504.04	250.00	l,866.56
17	4,620.60		2,504.04	250.00	l,866.56
18	4,620.60		2,504.04	250.00	l,866.56
19	4,620.60		2,504.04	250.00	l,866.56
20	4,620.60		2,504.04	250.00	l,866.56

[z]1 ha = 2.47 acres.

Table 8. Characteristics and availability of selected black currant varieties suitable for production in Ontario.

Cultivar	Berry size[z]	Powdery mildew resistance	WPBR[x] resistance	Plant habit	Market	Availability
Ben Alder	Medium	Resistant	Very susceptible	Moderately vigorous	Juice	Available, derived from virus-tested material
Ben Connan	Large	Resistant	Moderately resistant	Semidwarf	Dessert	Not available
Ben Sarek	Large	Resistant	Moderately resistant	Semidwarf	Dessert	Available, derived from virus-tested material
Ben Tirran	Medium	Resistant	Very susceptible	Moderately vigorous	Juice	Not available
Polar	Large	Resistant	Resistant	Moderately vigorous, spreading	Dessert	Not available
Titania	Large	Resistant	Resistant	Extremely vigorous	Dessert / juice	Available
D16 / 8 / 14	Medium	Resistant	Resistant	Moderately vigorous	Not known	For trial
F4 / 1 / 67	Large Dwarf	Resistant	Moderately resistant	Semidwarf	Not known	For trial
C2 / 2 / 1	Medium	Resistant	Moderately resistant	Semidwarf	Not known	For trial

[z]Medium = 0.7–0.9 g (0.025–0.032 oz.) per berry, large = >0.9 g (0.032 oz.) per berry.
[x]WPBR = white pine blister rust.

tion of black currants.

The factors that will govern the rate at which this acreage increases will be purely economic: what are the markets and can a profit be made. WPBR in *Ribes* is a relatively minor horticultural problem that will either be ignored or dealt with by using resistant varieties.

The acreage of *Ribes* will increase initially in PYO operations. Surplus fruit from these operations will find its way into the local farm markets and into local processing. These operations have the potential to be very profitable, but the total acreage throughout North America will be relatively small.

For *Ribes* to become a major crop, farmers will need to plant large acreages for juice and associated products.

When or whether large acreages will come into existence will depend on the world price for *Ribes*, particularly black currants, the existence of markets for the product, the cost of mechanical harvesting, and competition from Europe. However, if these constraints can be overcome, North America has the potential for up to 40,000 ha (100,000 acres).

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