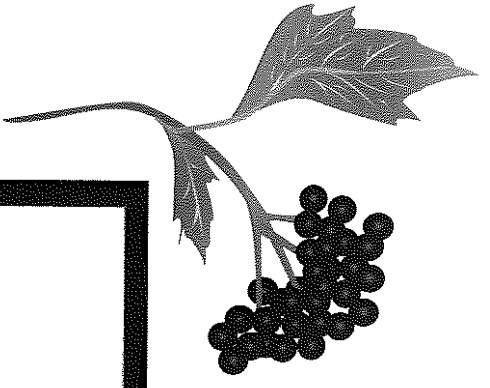
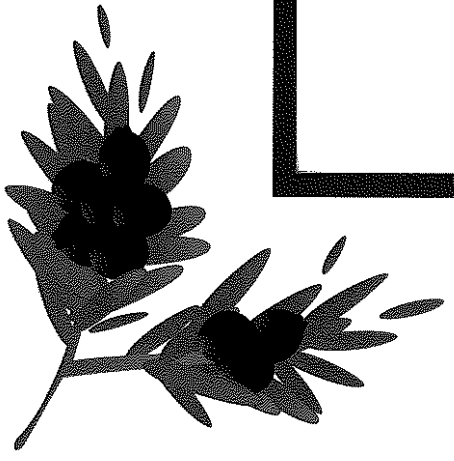
NATIVE FRUIT DEVELOPMENT PROGRAM



Growing Black Currants
In Saskatchewan



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Growing Black Currants
In Saskatchewan

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Introduction

The black currant belongs to the genus *Ribes* and the botanical family Saxifragaceae. This genus includes approximately 150 species of currants and gooseberries. Most currants and gooseberries originated in the northern hemisphere (Figure 1), and all commercially significant *Ribes* species are of this origin. Some of the currants and gooseberries used for food include *R. sativum* (red and white currant), *R. hirtellum* and *R. uvacrispa* (American and European gooseberry), *R. diacanthum* (Siberian red currant), and *R. nigrum* (European black currant). The European black currant will be discussed in detail. Other currants of commercial importance include *R. aureum* (Golden currant - an ornamental), and *R. alpinum* (alpine currant - also an ornamental).

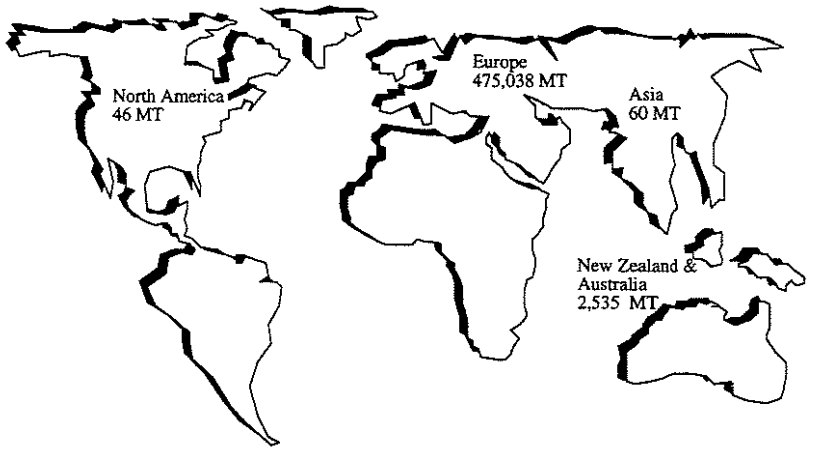
Figure 1. Worldwide distribution of *Ribes*.

Derived from Currants and Gooseberries in Vol. 290 Acta Horticulturae, 1990.

Part I: History and Use of The Black Currant

Black currants are cultivated in many regions of the world (Figure 2). Over 80% of the world's black currants are grown in Europe, Great Britain, New Zealand and Australia. Poland and Germany are the world's largest producers and together produce approximately 60% of the world's production (Table 1). The most popular cultivated varieties of black currant originated from British and Scandinavian breeding programs.

Figure 2. Worldwide distribution of black currant production.



Derived from FAO Production Yearbook, 1989. (MT-metric ton)

Table 1. Worldwide production of black currants (MT - metric tons)

Area of Production	Producton (MT)
World	582,976
Poland	166,680
Germany (FR)	130,000
USSR	105,000
Czechoslovakia	37,786
Germany (DR)	33,012
Austria	30,682
United Kingdom	23,000
Hungary	18,000
Norway	17,000
France	8,000

Derived from FAO Production Yearbook, 1989.

Black currant production has been restricted in the United States because black currants and other *Ribes* species are alternate hosts for white pine blister rust (*Cronartium ribicola*). White pine blister rust is a major concern where forestry-based industries depend on the harvesting of susceptible species. *C. ribicola* infects approximately 40 species of *Ribes* found in North America including *Ribes nigrum*. A federal ban in the United States prohibited *Ribes* cultivation until 1966. After the federal legislation was lifted, many states have continued to prohibit *Ribes* cultivation. In Canada there are no restrictions on growing currants athough planting near susceptible pines has been discouraged. *C. ribicola* has been reported in south-eastern Saskatchewan, but on the prairies it is only considered to be a significant threat in south-eastern Manitoba.

Historically, black currant fruit, roots and leaves have had many medicinal uses. Black currant fruit are very rich in vitamin C; black currant juice, tea, and extracts have been used to treat sore throats (quinsy). Consequently, the name 'squinancy berry' was adopted in Great Britain.

The leaves and buds of European black currants (*Ribes nigrum*) have been used as an anti-inflammatory drug. Various North American native tribes

(including the Mesquakies, Omahas, Winnebagos, & Blackfoot) used the roots of the native black currant (*Ribes americanum*) to treat many conditions including intestinal worms, kidney problems and uterine disorders. The Blackfoot Indians referred to currants as *'Mon-to-na-na-tik'*. The fruit of one *Ribes* species was used as a mild laxative. The inner bark of *Ribes aureum* was used to make a poultice by the Shoshone Indians, although its exact purpose is unclear now. Early settlers used native black currant root infusions to treat dysentery in cattle and fevers in people.

The northern black currant (*Ribes hudsonianum*) and bristly black currant (*Ribes lacustre*) are native black currants found in Saskatchewan and other parts of Canada. Northern black currants growing near a lake were thought by the Thomson Indians of British Columbia to be an indication that the lake was good for fishing. The Cree Indians called the northern black currant *'A-mis-Ko-na-tik'* and they used a mixture of its bark, stems and roots, and skunk currant (*Ribes glandulosum*) berries to increase the likelihood of conception. The skunk currant is a red-fruited currant found in Saskatchewan and other parts of Canada.

Oils extracted from leaf and flower buds of black currants have been used in cosmetic creams, lotions and perfumes. Certain essential fatty acids (omega-3 and omega-6 fatty acids) are currently being used in the treatment of asthma, premenstrual syndrome (P.M.S.), skin conditions, and arthritis. Black currant seed is considered to be a potential source of these and other fatty acids.

In the late 1600's, European black currants (*Ribes nigrum*) were introduced to North America by European settlers. At that time the leaves and fruit of many native currants and gooseberries were already being used for food and as medicinal herbs by North American Indians. Now all commercial production is based on the European black currant, although many other *Ribes* species have been used in black currant breeding programs.

Although most black currant cultivars are not suitable for eating fresh, a small amount of fresh fruit is sold in certain regions of the world. Black currants have a strong and unique flavour that is enhanced by processing. Consequently the fruit are used in a wide variety of processed products. Jams and jelly, juice and juice concentrates, black currant liqueur, and dried currants are some of the more common black currant products.

Dried currants should not be confused with the currants commonly sold in grocery stores which are actually made from small black grapes (the corinthian grape). Although not very common in North America, black currant pies and other desserts are very popular in many parts of the world.

Due to their excellent processing characteristics, high nutritional value, and unique flavour, the use of black currant juice in North America has become much more common. Black currant-flavoured carbonated mineral water, and black currant juice cocktail are two popular examples.

Black currants are also used in a variety of fermented products. In France, a liqueur called Crème de cassis is made from black currant juice. The cultivar Noir de Bourgogne is grown specifically for this product. This sweet liqueur is often mixed with white wine and served as an aperitif. Black currant wine and brandy are also produced in many areas of production. Black currant-flavoured vodka is also available.

Other unique products include black currant candies, black currant-flavoured honey and black currant-flavoured dairy products such as yogurt.

Part II: An Overview of Black Currant Botany

General Plant Characteristics

Black currants have an upright growth habit. Most branching occurs near or just below the soil surface. The shoots are spineless and the leaves are serrated, heart-shaped, alternate, and have a musty odour. In general, black currant bushes are equal in height and width. The canopy of a mature plant ranges from 1 to 1.75 meters in diameter.

Black currant root systems vary depending how the plant was propagated. Vegetatively-propagated plants have a shallow, fibrous root system that may extend slightly beyond the leaf canopy in width and 40 cm below the ground at maturity. Seed-propagated plants have a tap root system that may travel 100 cm below the surface of the soil.

Flowering and Fruit-set

Flower buds are always terminal buds, although they may be very short and look like lateral buds. These short branches are called strigs. The timing of flower bud initiation varies by cultivar and climate. In general, flower bud initiation occurs between mid-June and mid-July. Primordial flowers should be visible under a microscope at this time. Flower development will continue into the fall and will not be completed until 7-10 days before flowering the following spring.

Flowering usually occurs on one-year-old wood. Flowering may occur anytime after mid-May and can last as long as 20 days, depending on the cultivar grown and the climate. The flower cluster contains from 8-30 flowers. Peak pollen shedding occurs between 2-6 PM and is least overnight.

Black currant flowers are, in large part, self-sterile. The degree of self-sterility varies between cultivars. In general, full productivity of most black currant cultivars cannot be attained without a pollinizer. A suitable pollinizer cultivar must have a flowering time overlapping that of the main crop cultivar and produce compatible pollen. Some pollinizers have been shown to influence fruit size as well as fruit set.

The mechanism of fruit-set in currants appears to be fairly complex and is influenced by several interacting factors. Cultivar, pollen source, amount of pollen, weather and pollinating insects are all involved in fruit-set. Some cultivars are self-pollinating while other cultivars (self-sterile) require pollen from another cultivar in order to set fruit. Inadequate pollination can result in 70 to 80% fruit loss. Poor pollination has also been linked to a slight decrease in fruit weight. Insects such as honey bees play an important role in fruit set since they transfer pollen between and within flowers. The use of five honey bee hives per hectare is suggested. Unfortunately, black currant nectar is not very attractive to bees and some research has suggested that self-pollination by hand produces better results than open-pollination. In the case of cultivars that are quite self-fruitful, mechanically blowing plants with air during full-bloom has significantly increased fruit-set over insect pollinated plants.

Premature fruit drop or run-off is a common problem in black currants and is characterized by the loss of fruit approximately 3 weeks after full bloom.

Disease does not play an exclusive role in this disorder. Unfavourable environmental conditions are the primary cause of run-off (as indicated in the section on climate and site requirements) but fungal disease is also associated with this disorder. Whether the cause is disease-related or attributed to environmental conditions, the initiation of this disorder occurs during blooming. Other factors such as poor pollination, inadequate fertilization, and drought may also contribute to premature fruit drop but these relationships have not been clearly demonstrated.

Fruit Characteristics

In botanical terms, black currant fruit are considered to be true berries. Their black colour is the result of certain light absorbing pigments called anthocyanins. Cyanidin-3 glucoside, cyanidin-3 rutinoside, delphinidin-3 glucoside and delphinidin-3 rutinoside are the four most common light-absorbing anthocyanins found in black currants. Fruit deficient in these and other anthocyanins appear as green, yellow or white variants. These have been named *Ribes nigrum chlorocarpum* or *R. nigrum xanthocarpum*. These variants often have reddish brown dots on the fruit which are formed when minor amounts of anthocyanins are still being produced. The appearance of these dots varies with growing conditions. The Finnish cultivar Vertti is one example of a green-fruited black currant.

Black currant fruit have a unique flavour, and exceptional nutritional value. The seeds are rich in both omega-3 and omega-6 fatty acids. Fresh fruit have an abundance of vitamins A, B and C (Table 2), and contain between 6 and 9 % sugar.

Yields

Yield estimates for black currants grown in Saskatchewan are not available at this time but data obtained from European cultivar trials show that yields can vary considerably. Yields ranging from 1.8-6.0 kg/bush (Norway), 2.9-5.5 kg/bush (Romania) and 0.8-8.3 kg/bush (Poland) have been reported. Research conducted during the 1980's at Brooks, Alberta reported average yields ranging from 1.1-2.1 kg/bush. This trial included only five cultivars, none of which were were tested in the European studies. The highest yielding cultivars from the European studies were either experimental or recently released selections.

Table 2. A comparison of vitamin C content of some common fruit.

Common Name	Scientific Name	Vitamin C (mg/ 100g fruit)
Apples	*Malus spp.*	3-20
Black currant	*Ribes nigrum*	90-355
Black currant (wild)	*R. nigrum sibericum*	200-800
Gooseberry	*R. hirtellum*	14-40
Grapefruit	*Citrus x paradisi*	36
Lemon	*Citrus limon*	58
Orange	*Citrus sinensis*	44-79
Red currant	*R. sativum*	16-65

Derived from the Composition Of Foods, McCance and Widdowson, 1991; Currants and Gooseberries (Vol. 290), Acta Horticulturae, 1990; and *Rubus* and *Ribes* (Vol. 352) Acta Horticulturae, 1993.

Part III: Black Currant Culture

Propagation

Black currants can be propagated from seed, hardwood and semi-hardwood cuttings, and through tissue culture.

Seed Propagation

The characteristics of black currant plants grown from seed will not be identical to the parent plant's characteristics. Seed-propagated plants can be used for cultivar improvement, but due to the success and ease of vegetative propagation methods, seedlings are not used for the purposes of developing a commercial orchard.

To extract seeds, ripe fruit are macerated in water and the seeds are separated by flotation. Dried seed can be stored in a sealed container in a cool location. Dormancy varies between cultivars but in general, good germination should occur after 3 to 4 months of cold stratification at 4 °C. The stratification medium should be kept only slightly moist and not wet.

Germination has also been achieved immediately after extraction by placing fresh seeds at 24 to 30 °C for 12 to 16 hours followed by 8 to 12 hours at 4 to 15 °C.

Germination rates vary depending on parentage.

Vegetative Propagation

Vegetative propagation involves the regeneration of whole plants from tissue collected from a single parent plant. In general, vegetatively propagated plants are genetically identical to the parent. Some common methods of vegetative propagation include shoot cuttings (semi-hardwood & hardwood), layering, and tissue culture. All of these methods can be used to propagate black currants. Layering is more commonly used with difficult to propagate *Ribes* species such as the wax currant (*Ribes inebrians*).

Hardwood cuttings can be taken in the winter (after the dormancy requirement has been met) until the early-spring, before new growth begins. Cuttings 15 - 20 cm long with 5 or 6 buds will root best.

Semi-hardwood cuttings should be collected around mid-June. Cuttings should be at least 15 cm in length and should have several nodes. Cuttings 20-30 cm in length are ideal. In general, larger cuttings root best and grow more vigorously than smaller cuttings.

IBA (0.4%) in talc for semi-hardwood cuttings, or 0.8% IBA in talc for hardwood cuttings, or a 3,000 to 6,000 PPM IBA in solution should be applied to the base of each cutting to promote rooting. Cuttings are placed in a mist chamber and rooting should begin in 7 to 10 days for semi-hardwood cuttings and 12 to 15 days for hardwood cuttings. Bottom heat (about 30°C) will enhance rooting. Cuttings may be removed 3 to 5 weeks after rooting. Fertilization with a 10-52-10 fertilizer solution should be started as soon as rooting begins. Propagation media can vary. Commercial mixes such as Sunshine Mix #4 are convenient and light-weight compared to sand-based mixes, however any free-draining medium should work.

An alternative method of vegetative propagation involves taking 15-20 cm hardwood cuttings before fall

freeze-up and planting them 15 cm apart in well-drained soil. Cuttings are placed so that 2 or 3 buds are above the surface of the soil. The rows are then mulched with straw or leaves for the winter and uncovered in the spring. Rooting will begin in the spring and cuttings should be ready for transplanting after one year of growth.

Tissue culture can be used to quickly propagate large numbers of plants starting from a small sample of plant material. Some tissue culture techniques can be used to eliminate viruses from plant material. For tissue culture to be cost effective, a large number of plants must be produced. At present, the demand for black currants is not high enough to warrant this type of production by commercial propagators. If a large number plants are required, there are a number of companies available for contract propagation.

Cultivars

Very few black currant cultivars have been grown in Saskatchewan and none have been formally tested. Most central European cultivars will not be hardy in our region, although cultivars originating from northern Europe offer some promise. The cultivars Willoughby and Boskoop Giant are commonly recommended for the prairies. These and several other cultivars worthy of consideration are listed below.

Boskoop Giant - This cultivar was originally used as a pollinizer for many European cultivars such as Noir de Bourgogne. Fruit quality is considered to be good but the cultivar is quite susceptible to powdery mildew. Fruit size is larger than most but yields are low.

Consort - A white pine blister rust resistant cultivar from Ottawa. Consort must be hand harvested due to the softness of its berries. Lower yields and susceptibility to powdery mildew are common complaints with this cultivar.

Coronet - Developed in Ottawa to be resistant to white pine blister rust. This cultivar have not been tested in our region

Crusader - Developed in Ottawa to be resistant to white pine blister rust. This cultivar have not been tested in our region

Magnus - Recommended by the Alberta and Ontario Agriculture ministries, this cultivar is characterized by very even ripening and an earlier harvest date than Boskoop Giant and Willoughby. Premature fruit drop may be a problem.

Wellington - An early variety that should also be hardy in our region but has not been tested on the prairies.

Willoughby - Reported to be at least moderately resistant to powdery mildew and quite drought-tolerant but fruit quality is poor.

Topsy - Reported to produce a very early-season crop of large, firm berries. This and even ripening makes it a good candidate for mechanical harvesting.

These and several other cultivars are currently being tested for their production potential in Saskatchewan.

Some other cultivars are worth trying but may be difficult to obtain. The cultivars **Ben Alder** and **Ben Tirran** have been recommended in Norway because of their high yields and resistance to powdery mildew. The cultivars **Titania**, **Ojebyn** and **Ben Lomond** are commonly grown in Poland (the world leader in currant production). **Ojebyn** is the most popular cultivar in Poland because it is very resistant to powdery mildew, ripens evenly and resists fruit-drop but it is considered to have only average processing qualities, poor yields (0.6-1.6 kg/bush) and low vitamin C content.

Climatic and Site Requirements

Most sources characterize black currants, particularly varieties of northern origin, as being very hardy. In fact, very few black currant cultivars have been grown in Saskatchewan and it is not known if most cultivars are sufficiently hardy for our climate. It is important to appreciate that cold hardiness involves many factors. Genetics, disease, general vigour, nutrition, and many environmental factors can contribute to winter hardiness.

On average, a fully dormant black currant bush can withstand temperatures between -40 and -45 °C. However injury to certain plant parts may occur at much warmer temperatures. For example, research has shown that cold hardiness is highest during the coldest part of the winter (December, January and early-February) but injury to flower buds can occur in the latter part of winter after temperatures have moderated.

Spring frosts during flowering can totally devastate a crop. Cultivars vary in their susceptibility to frost injury. Varieties that flower later in the season have a reduced risk of frost injury. Flowers are most sensitive to cold at full bloom when they can tolerate temperatures between -0.5 to -2.0 °C. Developing fruit can tolerate temperatures ranging from -2 to -3 °C.

Injury can also occur to flower parts at temperatures above freezing. Exposure to low (below 8 °C) but above freezing temperatures during flowering is the primary cause of premature fruit drop (run-off). Premature fruit drop is characterized by significant fruit loss occurring approximately three weeks after bloom. The susceptibility to low temperature injury also varies depending on the cultivar. Spring frost tolerance and cold temperature tolerance are independent characters. Some cultivars that are frost resistant are also very susceptible to cold temperature injury.

In general, currants and gooseberries require cooler temperatures for normal growth. With prolonged temperatures in excess of 30 °C, leaf injury and defoliation can occur. Planting on a northeast to northwest-facing slope offers some protection from the heat. In some regions of Saskatchewan, excessive summer heat may not be a major concern.

The water requirement for black currants is considered to be low, although reliable production cannot be expected without irrigation due to the erratic nature of rainfall in the Province. As a very general guideline, 1.5 centimeters of water per week is considered to be adequate. Increasing water to 2.5 centimeters per week during June, July, and August should increase growth and fruit production. Maintaining the available soil moisture level above 50% has been shown to increase shoot growth and total bud number. A high water table will hinder black currant growth. The water table should not be less than 1 meter below the soil surface; 1 to 2 meters is considered ideal.

Good air flow is important to prevent the formation of frost pockets, the build-up of excessive heat, and to reduce the incidence of humidity-related disease problems. Planting on a slope will improve air drainage. North-facing slopes tend to be cooler than level or south-facing slopes. Very windy, exposed locations may have reduced insect pollination.

Black currants can be grown successfully on a variety of soil types. A deep loam soil with 1% minimum organic matter and a pH of 5.5 to 7.0 is considered to be acceptable. A slightly acid soil (pH 6.2- 6.5) and an organic matter content greater than 1% is best. Incorporation of well-rotted manure, peat, or compost will improve soil quality. Very heavy soils and excessively

light soils are not recommended. Cooler soils are preferred.

Orchard Establishment and Life Span

An orchard established from one year old plants should reach full productive maturity in 4-5 years. It is recommended that the initial planting material be no older than two years because larger plants are more difficult to handle and older plants often do not establish as quickly. Planting can take place in the spring or the fall. Once productive maturity is reached, this level of production can be sustained for at least 10 years. Due to the long-term nature of black currant production, site selection and preparation are very important.

Plant spacing for a hand-harvested orchard is typically 1 to 1.5 meters within a row and 2 to 3.5 meters between rows. Within-row spacing varies depending on the desired growth habit and harvesting method. Some mechanical harvesters will require wider row spacing. Plants are arranged in a dense hedge row for mechanical harvesting; 0.4 to 1.0 meter within-row plant spacing is typically used.

Experimental high density plantings of black currants have been made in Sweden. This system involves planting currants with a within-row spacing of 0.5 meters (35,000-40,000 plants/ha). The first harvest can be done in the third year using specialized harvesting equipment which removes whole branches and then shakes off the fruit. This type of harvesting completely removes all top growth but is more efficient than traditional mechanical harvesting equipment since losses due to fruit drop past the harvester catch plates can be virtually eliminated. Harvests are conducted only every second year but yields/ha are much greater than those of orchards planted in traditional densities. The planting of shade and mildew-resistant cultivars is essential in high density plantings. This production method is currently in the developmental stage but may become popular in the future.

Training and Pruning

Black currants can be trained on a fence or a trellis. The resulting flat, open canopy maximizes light penetration and improves air flow around the plant; this helps to maximize fruit quality and simplifies hand-picking. The use of training has been limited to home gardens because it is very labour-intensive.

Proper pruning of currants is essential for maintaining plant vigour and consistent yields. It is best to prune currants when they are fully dormant. It is most convenient to prune from mid-September to November while the weather is still relatively mild and before heavy snow accumulation. In general, removal cuts are used to thin the plant and open up the canopy. Fruit are produced on one year-old wood. The goal of thinning is to open up the plant canopy while leaving as much fruit-producing wood as possible. All three year-old canes and any dead or damaged wood should be removed. Branches bending into the rows are often damaged by field equipment and should also be removed. When the previous season's growth has been strong, then pruning is light; but if the previous season's growth was poor, then pruning should be more intense.

Pruning is the second-most labour-intensive activity in black currant production next to hand-harvesting. When mechanized harvesters are used, pruning becomes the primary labour cost. Efforts to mechanize pruning have been somewhat successful. Mechanical pruning machines, tested in Finland, can significantly reduce pruning labour by removing branches hanging in the rows.

The Joonas mechanical harvester is designed to be fitted with mechanical pruning equipment. Other mechanical pruning machines are also available. Mechanized pruning every autumn combined with hand-pruning every third autumn can significantly reduce labour without affecting yields.

Fertilization

Maintaining adequate soil fertility is essential to maximize yields and fruit quality. Plant response to fertilization is dependent on the original level of soil fertility. The nutrient balance within a plant has an impact on hardiness and vigour, vegetative and flower bud formation, fruit set and therefore yield.

The area of black currant nutrition has been researched quite extensively, unfortunately many of the reports are not written in English and are difficult to obtain. Much of the available information is inconclusive or contradictory. The following is a summary of the available information.

In black currants, nitrogen influences shoot growth and the number of flower blossoms produced; phosphorus plays a role in fruit set and shoot development. Fertilization with phosphorus and potassium has been shown to increase the phosphorus, potassium and ascorbic acid content of black currant fruit.

Nutrient levels of black currant tissue can vary considerably between cultivar and tissue type (Table 3). In the case of many nutrients, environmental conditions have also been shown to influence nutrient uptake. Leaf nutrient levels are still considered to be the most reliable indicator of plant nutrient requirements. Black currant leaf nutrient standards have been derived from research conducted in northern China and Finland (table 4). Note that leaf nutrient levels may vary by cultivar and sampling time.

Table 3. Range of nutrient levels in the buds and leaves of 11 black currant cultivars.

	Leaf (% dry matter)	Bud (% dry matter)
Nitrogen	1.00-3.47	2.40-3.91
Phosphorus	0.24-.096	0.41-0.57
Potassium	0.93-3.30	0.77-1.09
Calcium	1.00-3.13	0.95-1.28
Magnesium	0.11-0.51	0.21-0.26
	ppm	ppm
Iron	80.0-171.4	89.2-144.6
Manganese	45-93.6	19.8-51.8
Zinc	26.8-34.0	30.6-51.6
Copper	10.4-12.2	16.1-30.5
Boron		57.6-102.2

Derived from M. Stanisavljevic et al.,1989; W. Lenartowicz et al., 1976; and C. Bould et al., 1972.

Table 4. Nutrient standards for black currant leaves (dry weight.).

Nutrient	Leaf Analysis
Nitrogen	2.8-3.5 %
Phosphorus	0.3-0.8%
Potassium	1.0-4.0%
Magnesium	0.2-0.6%
Iron	50-200 ppm
Manganese	30-200 ppm
Zinc	20-70 ppm
Copper	5-15 ppm
Boron	50-60 ppm
Molybdenum	1-3 ppm

Derived from M. Aaltonen et al. (1993) and L.Yadong et al. (1993).

The effect of fertilization depends on the initial soil nutrient balance and the level of other nutrients within the target plant. The timing of fertilization is also very important. In black currants, nitrogen adjustments should be made prior to flower bud initiation (mid-June).

Increasing nitrogen levels midway through the season will increase leaf nitrogen concentration but will not increase the number of flower buds that are initiated. Adequate phosphorus supplies are most critical during flowering and pollination. A late-season fertilizer application can cause a flush of growth which will not-harden off properly for winter.

One general commercial fertilization scheme is as follows. Fertilization is started the second year when 30 grams of nitrogen is applied to each plant. The following year, nitrogen is broadcast at a rate of 56 kg / hectare over the entire orchard. 90 kg / hectare of nitrogen is applied starting in the fourth year. Phosphorus and potassium are applied when the orchard enters the first production year at rates of 20 kg / hectare (P) and 40 kg / hectare (K). Note that the application of a 10-52-10 solution at planting is recommended by some sources.

Harvesting

Hand labour and mechanized harvesters are both used to harvest black currant fruit. One study indicated that a mechanical harvester is essential for large-scale currant production, unless labour costs are low. In Poland, labour costs represent 50% of the cost of production where hand-harvesting is employed. Labour cost can decrease to as low as 9% of the cost of production when mechanized harvesters are used. From the same study, pickers were able to harvest approximately 4 kg of fruit per hour whereas a mechanical harvester was able to harvest over 400 kg of fruit in the same period. Currently in Europe, there is a large unskilled labour force which has limited the use of mechanized harvesters. However, long-term predictions call for increasing orchard size to an average of 5-10 hectares and a sharp decline in the use of hand-labour for harvesting.

A variety of mechanical harvesters are used. Some popular manufacturers include Pattenden Co. (Great Britain), Joonas International (Finland), and Peco Berry Harvesting Equipment (New Zealand). Some dealers of harvesting equipment are included in part V of this publication.

Mechanically harvested plants are often spaced very close (0.4m). Wider within-row spacing (0.6 m) will decrease damage caused during mechanical harvesting. Reducing harvester speed and/or vibration frequency will also reduce harvester damage. Some cultivars such as Ojebyn and Ben Lomond are less prone to mechanical harvester damage. Between-row spacing must be wide enough to accommodate harvesting equipment.

Ethephon sprays are used in Europe to make ripening more uniform and to facilitate mechanical harvesting. Applications of ethephon synchronize the formation of the fruit stalk abscission layer. Harvests of ethephon-treated plants must be timed properly or severe fruit losses may result. 240 PPM ethephon is sprayed approximately 10-12 days before harvest. Ethephon sprays can also be used to control the degree of ripeness at harvest time. Fruit used for jelly are harvested when they are slightly under-ripe because the pectin content is higher. Fruit that are used for juice and jam are harvested when fully ripe.

Diseases

Botrytis-induced premature fruit drop (run-off)

The infection of flowers with *Botrytis cineria* will lead to premature fruit drop. The infection spreads from the stigma to the ovary, later leading to

fruit drop. Ethylene production by the fungus may play a role in fruit drop.

Powdery Mildew

American powdery mildew (*Microsphaera grossulariae*) and European powdery mildew (*Sphaerotheca mors-uva*) infect the leaves of black currants. American powdery mildew will also infect the shoots and fruit. Powdery mildew spreads over leaf surfaces extracting nutrients from epidermal cells using feeding organs called haustoria. Powdery mildew rarely kills the host plant but can significantly reduce vigour and yields. The greyish-white appearance of the leaves is the result of a mat of fungal mycelia on leaf surfaces. A period of fairly high humidity is essential for the germination of powdery mildew spores, but once spores have germinated, this fungus will spread rapidly, regardless of humidity. Warm conditions following germination favours the rapid spread of powdery mildew. Fruiting bodies called cleistothecia form within the mycelial mat during the latter part of the growing season. These fruiting bodies overwinter on dead leaves and the following spring they germinate and release spores which reinfect young leaves.

For control of powdery mildew, avoid planting in shady areas and locations with poor air flow, as humidity will be higher in these environments. For a small planting, it may be feasible to remove and burn leaf litter. This will reduce the amount of inoculum that is available for re-infection during the next growing season. On a large scale, this cultural control method is not practical.

Sulfur 92 WP (13.5 kilograms / 1000 liters of water), applied at a rate of 27 kilograms / hectare just before flowers open (gum tip stage), and repeated once per week (as conditions merit) will provide control. **Sulfur may damage flowers and should not be applied at full bloom.**

Applying a solution of baking soda (1/2 tsp. of baking soda / liter of water) may offer adequate control of powdery mildew for the home gardener.

Susceptibility to powdery mildew varies by cultivar although sources are not consistent in characterizing resistance.

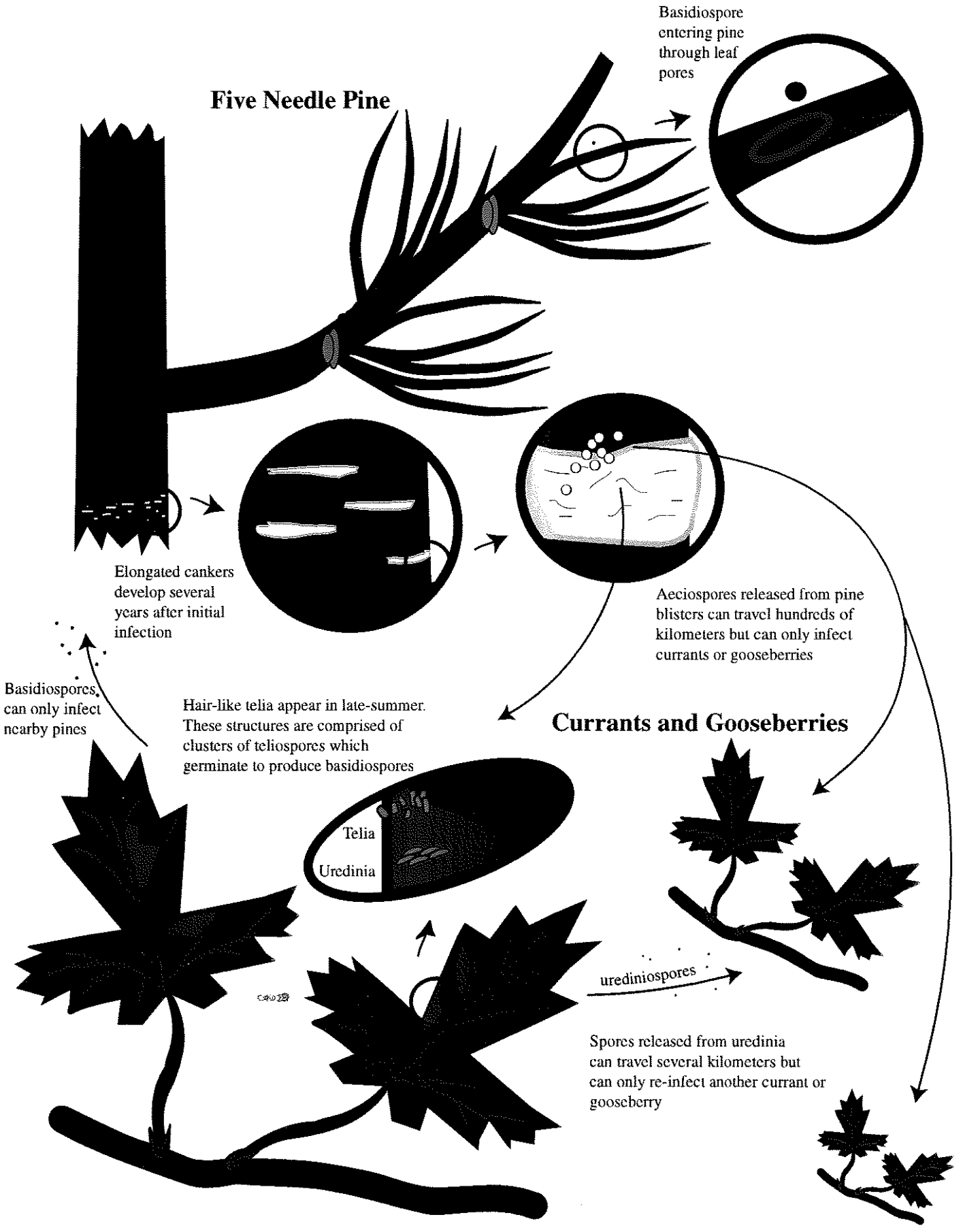
White Pine Blister Rust

White pine blister rust (*Cronartium ribicola*) is not a problem in Saskatchewan. However, this disease is a major concern where white pines (in general, pines whoses needles are grouped in clusters of five) are harvested for commercial purposes. In many areas of the United States, the planting of currants and gooseberries is still prohibited since the presence of a currants and gooseberries is essential for this disease to complete its life-cycle. In western Canada, eastern white pine (South-eastern Manitoba), western white pine (Alberta & British Columbia), whitebark pine (Alberta & British Columbia), and limber pine (Alberta & British Columbia) are all susceptible to white pine blister rust.

The life-cycle of this disease is quite complex (Figure 3). Initial infection occurs when spores originating from a *Ribes* species germinate on the needles of a susceptible pine. The fungus first enters the pine through stomata (leaf pores) on the needles where its mycelium begins to spread through conducting tissues. Two to four years after initial infection, the disease will reach the trunk of the tree, eventually resulting in canker formation. These elongated cankers (blisters) will eventually girdle the trunk and kill the host tree. The spores released from these cankers can travel hundreds of miles but can only infect other currants and gooseberries.

The symptoms on currants and gooseberries appear as irregular or

Figure 3. The life-cycle of white pine blister rust.



H. Tulloch, 1997

rounded rust-coloured patches on leaf leaves are covered with rust-coloured spore-producing structures called uredinia which are dome-shaped, and telia which have a hairy appearance. Two types of spores are released from infected *Ribes* leaves. Urediniospores are produced early in the season and are only capable of reinfecting *Ribes* leaves. These spores can overwinter and will also remain wind-borne for several kilometers. In the late-summer and in the early-fall, basidiospores are formed from the germination of teliospores. These spores are short-lived and can only travel a few hundred feet. Basidiospores can only infect white pines.

White pine blister rust rarely causes serious damage to currants and gooseberries.

Anthracnose

Anthracnose or leaf spot (*Pseudopeziza ribis*) initially appears as small black or brown spots on infected leaves. As the lesions expand, their shape becomes more angular and may have a purplish appearance. Yellowing of the leaves and premature leaf drop usually results. Initial infection can occur anytime after late-July. If infection is severe, considerable defoliation can occur. Infection often reduces growth and yields during the following growing season. Anthracnose is most severe in warm-wet years.

The sources of infection are spores which are formed on leaf litter during the previous season. Removal of dead leaves may control infection.

Ferbam WDG (1 kilogram / 1000 liters water), applied at a rate of 2 kilograms per hectare should be applied four times per season: 1) just before bloom; 2) immediately following bloom; 3) 10 days after bloom; and 4) one post-harvest application.

surfaces. The underside of infected

Insect Pests

Currant Borer (Clearwing Moth)

The currant borer (*Synathedon tipuliformis*) can damage black currants. Eggs are deposited at the base of the leaf around the middle of June. The damage is caused by the larva of the clearwing moth which burrows and feeds on pith cells inside black currant shoots. Stunted growth and leaf-yellowing may result. Damage is often not apparent until early in the next growing season, when affected shoots are usually late in leafing-out and coated with a sticky residue.

Chemical control is not possible once the larvae enter a shoot. Good pruning practices are considered to be the best means of controlling the severity of this pest. Removing and destroying infected shoots prevents the emergence of adults.

Currant Fruit Fly (Currant Maggot)

Adult currant fruit flies (*Epocha canadensis*) lay eggs in developing fruit where the resulting white-coloured larvae feed. Infested fruit ripen prematurely and often drop off at this time. Once fruit drop has occurred, the adult flies exit the fruit and overwinter in the ground. Adults emerge from the ground about mid-May of the following year.

Collecting and destroying infested fruit may help control the next years currant fruit fly population.

Malathion 25 WP (2.5 kilograms / 1000 liters of water), applied at rate of 5.0 kilograms per hectare, should be applied twice: 1) immediately after bloom; and 2) 10 days after the first application.

During application, air temperature should be greater than 20 °C.

Gooseberry Sawfly (Imported Currant Worm)

The imported currant worm (*Nematus ribesii*) is a small, smooth, greenish-coloured larva with black spots. The adult sawfly deposits eggs two times each season (late-May and mid-August). The damage from the second infestation is usually slight. Larvae feed on the edges of the leaves. Damage from this pest can be quite severe and complete defoliation can occur. At maturity, the sawfly larva will be approximately 20 mm long.

Diazinon 50 WP (1 kilogram / 1000 liters of water), or 500 EC (1 liter / 1000 liters of water), applied immediately before blooming at a rate of 2000 liters of solution per hectare, should provide control.

Note: Diazinon is extremely toxic to bees.

Currant Aphid

The currant aphid (*Capitophorus ribis*) and other aphid species, feed on the underside of leaves and on young shoots. Aphids feed by sucking juices from plant tissues. Feeding usually results in the downward curling and crinkling of the leaves. Upper leaf surfaces are often bright-red where feeding has occurred. As aphids feed, they excrete a sugary nectar; the presence of ants is commonly associated with aphid infestations.

The aphid life cycle is quite complex. Adult females can produce many generations of live young. Some winged females are produced during the season. These may migrate to other plant species but their offspring will return to currant plants in the fall. At the end of the season, males are produced so that mating and egg laying can take place. Aphids overwinter as shiny-black egg clusters on shoots and hatch in the early spring.

Malathion 25 WP (2.5 kilograms / 1000 liters of water) is applied at a rate of 5.0 kilograms per hectare when infestations occur; air temperature should be greater than 20 °C. Malathion should not be applied less than 3 days before harvest.

Scale Insects

Scale insects are small (1.5-2.5 mm) disc-shaped insects that remain motionless for most of their life. They attach themselves to the stems and occasionally the fruit where they suck juices from the surrounding tissue. Very high populations of scale will kill branches and even entire plants.

Superior horticultural oils (20 liters of oil / 1000 liter of water), applied before bud break, at a rate of 40 liters per hectare, should control scale insects.

Part IV: Sources - Plants and Harvesting Equipment

Commercial Micropropagators

This list is provided for information only is not meant as an endorsement.

Agri-Forest Technologies Ltd.
4290 Wallace Hill Rd.
Kelowna, BC
V1Y 7R2.
Ph. (604) 764-2224

Alberta Agriculture
Crop Diversification Centre North
RR 6
Edmonton, AB
T5B 4K3.
Ph. (403) 422-1789

MicroGro Research International Inc.
Box 1090
Biggar, SK
S0K 0M0.
Ph. (306) 948-5480

Prairie Plant Systems, Inc.
108 - 106 Research Drive
Saskatoon, SK
S7N 3R3.
Ph. (306) 975-1207

Black Currant Plant Suppliers

This list is incomplete and should not be considered an endorsement.

Aubin Nurseries Ltd.
Box 1089
Carman, MB
R0G 0J0.
Ph. (204) 745 6703

Boughen Nurseries
Valley River Ltd.
Box 12
Valley River, MB
R0L 2B0
Ph. (204) 638-7618

Byland's Nurseries Ltd.
1600 Byland Road, Highway 97 S
Kelowna, BC
V1Z 1H6.
Ph. (604) 769-4466

Greenview Nurseries Ltd.
Box 12, Site 16, RR 7
Calgary, AB
T2P 2G7.
Ph. (403) 936-5936

Honeywood Lillies and Nursery
Box 63
Parkside, SK
S0J 2A0.
Ph. (430) 747-3296

Kato's Nursery Ltd.
29435 Downes Rd
RR 2
Aldergrove, BC
V0X 1A0.
Ph. (604) 856-2470

Lakeshore Garden Centre
RR 3
Saskatoon, SK
S7K 3J6.
Ph. (306) 382-2077

Morden Nurseries
Box 1270
Morden, MB
R0G 1J0.
Ph. (204) 822-3311

Northwoods Nursery
28696 S Cramer Rd.
Molalla, OR 97038
Ph. (503) 651-3737

Skinner's Garden Classics
Box 220
Roblin, MB
R0L 1P0.
Ph. (204) 564-2336

Sprout Farms
Box 538
Bon Accord, AB
T0A 0K0.
Ph. (403) 921-3460

Vanstone Wholesale Nurseries
Box 670
Portage la Prairie, MB
R1N 3C2.
Ph. (204) 857-8435

Windmill Point Farm & Nursery
2103 boul. Perrot
N.D. Ile. Perrot, PQ
J7V 8P4.
Ph. (514) 453-9757

Sources of Harvesting Equipment

This is list is incomplete and is not meant as an endorsement.

B.E.I. Incorporated
2366 Havelstick Rd.
Lynden, WA 98264
Ph. (206) 988-5184

Joonas Agritech
3046 McMillan Road
Abbotsford, BC
V2S 6A8.
Ph. (604) 852-5016

Korvan Industries Inc.
270 Birch Bay Lynden Road
Lynden, WA 98264
Ph. (206) 354-1500

Peco Berry Harvesting Equipment
95 Moorhouse Avenue
Christchurch, New Zealand
64-03-65632

Part V: Further Reading and Technical Literature

Further Reading

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