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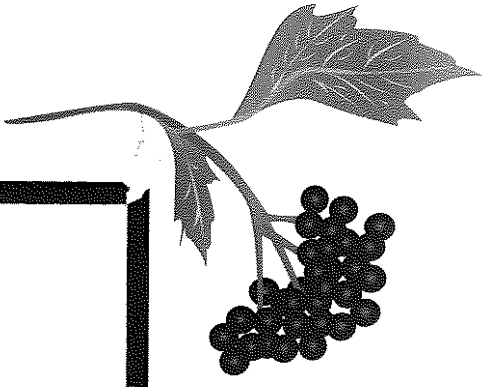
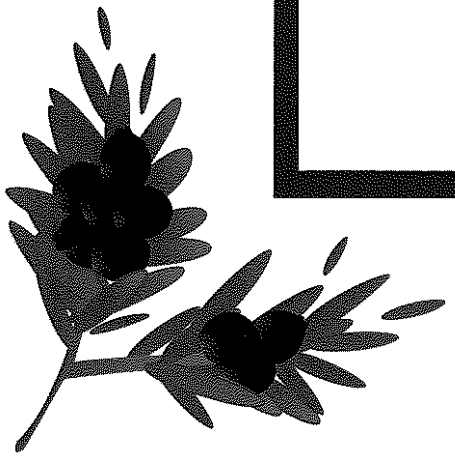
NATIVE FRUIT DEVELOPMENT PROGRAM



The Chokecherry

A Guide For Growers



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The Chokecherry

A Guide For Growers

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Introduction

Chokecherry. The very name conjures up images of an unpleasant fruit. Yet, despite the usual astringent, bitter taste of this wild cherry, semi-sweet varieties can be found. Chokecherry fruit produce excellent processed products including jams, jellies, syrups and wines. Historically, the chokecherry was important to the diet of prairie peoples.

The chokecherry has not been domesticated, that is, has not undergone breeding and selection for cultivated environments. However, a number of selections having superior characteristics have been chosen from the wild, and it is this material which is occasionally propagated and cultivated.

The cultivation of native fruit species, including the chokecherry, could significantly contribute to the diversification and health of our agricultural economy by enhancing alternative agricultural production, by promoting the development of mixed farming operations, and by providing a more substantive base for a processing industry.

In general, the horticultural production of native fruit species, such as the chokecherry, appears to have significant commercial potential. The five year average for lowbush blueberry production in Quebec and the Maritime provinces is 24,518,000 kg (54,038,000 lb), which returns $30,261,000 to growers. Relatively small plantations of such fruit species can produce high yields and profits.

This guide has been written to provide an up-to-date and comprehensive source of information for individuals who are interested in growing chokecherries, in orchards, other types of plantations, or in gardens. Part I of this guide is concerned with the cultural and natural history of the chokecherry. Part II is associated with the basics of plantation establishment and care. Part III includes lists of suppliers of plants and seed and fruit buyers, and Part IV is comprised of an extensive bibliography where the reader can find sources of further information.

This guide was designed to be an educational resource. Every effort has been made to present comprehensive, accurate, up-to-date information. However, the information provided may not be applicable to all locations every year. Additionally, available knowledge changes over time. The suggestions for cultural practices contained in this guide are often minimal. This is because little scientific research has been done on many aspects of the culture and management of chokecherries. Growers of chokecherries are pioneers. General recommendations for growing fruit on the prairies are often useful, but some adjustments may have to be made, and some grower experimentation will be required. Complete and accurate record keeping by the grower will be very beneficial.

Conserving Native Fruit Biodiversity

Cultivating native fruit species as crops will help relieve the pressures of large scale harvesting from wild populations. A renewed interest in our native fruit species may be

critical to their long term preservation. Urban expansion, deforestation and clearing of marginal land for agricultural purposes have contributed to the loss of genetic diversity in many native fruit species, including the chokecherry. Fortunately, many farms on the prairies harbor varieties of native fruit species that have been selected from local wild germplasm. Prairie rural gardens represent an excellent way of maintaining grassroots interest in the preservation of genetic diversity and patches of natural ecosystems.

Acknowledgements

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Part I:

The Cultural And Natural History Of The Chokecherry

The chokecherry is a true cherry and is one of the most widely distributed shrubs or small trees in North America. This wild cherry is a member of the Rose family and its latin name is *Prunus virginiana*. It is a close relative of domesticated cherries, plums, peaches and apricots.

The chokecherry has a variety of common names. These include eastern chokecherry, western chokecherry, California chokecherry, wild cherry, wild black cherry, black chokecherry or chokeberry, rum chokecherry, whiskey chokecherry, chuckley-plum, sloetree, cabinet cherry, and in French, cerisier de virginie, cerisier, cerisier a grappes, cerisier sauvage, and caupulin.

The chokecherry was introduced to Europe in the mid-eighteenth Century and was first cultivated in 1724. Its occurrence in North America may have become more widespread as a consequence of deforestation by European settlers.

Cultural History

The chokecherry was among the most important wild fruits used by North American Indians. Chokecherries were widely used by the Blackfoot and Plains Cree. The period during which the chokecherry was in fruit was referred to as 'black-cherry-moon'.

The fruit were dried and ground, stones and all, for use in soups, stews and pemmican. In the interior of B.C., dried chokecherries were often eaten with salmon or salmon eggs.

The bark was boiled along with other ingredients to produce a remedy for diarrhoea. A strong, black, astringent tea was made from boiled twigs and used to relieve fevers. Dried roots were chewed and placed on wounds to stop bleeding. Teas were made from the bark or roots and used to treat coughing, malaria, stomachaches, tuberculosis and intestinal worms. Such teas were also used as sedatives and appetite stimulants. The fruit were used to treat canker sores, ulcers and abscesses.

Wood of the chokecherry was used for tipi construction, bows and arrows, skewers, digging sticks, pipe stems and fire tongs. Navajo Indians thought of the chokecherry as a sacred plant and used its wood to make prayer sticks.

The Shuswap Indians mixed the fruit with bear grease to make a paint for coloring pictographs.

The chokecherry was also utilized by European settlers in North America. Parts of the chokecherry were the basis of popular home medications. Teas made from the bark have long been used as a sedative, and to alleviate coughs. Extracts of the berries and bark have been used as a flavoring agent for

cough and cold preparations. Wild cherry bark was an officially recognized pharmaceutical from 1800 - 1975.

On the prairies, the fruit have long been favoured for use in jellies, syrups, sauces, jams and wine. Currently, the chokecherry is becoming more widely used in multiple-row shelterbelts, as an ornamental, for wildlife habitat improvement, and for reclamation and rehabilitation (especially for slope stabilization and erosion control).

Natural History

General Botany

The chokecherry is a small tree or, more usually, a shrub with crooked branches and slender twigs. It has an oval rounded to narrow and irregular shape. Stems can grow to 15-20 cm (6-8 in) in diameter and can attain 15 m (30 ft) in height. The chokecherry suckers freely and thus forms loose thickets with an extensive lateral root system.

New branches are red-brown in color, while mature bark is dark grey. The inner bark of the twigs has a strong odor, characteristic of bitter almond.

Leaves of the chokecherry are alternate and simple having finely toothed edges. They are broadly oval and abruptly pointed in shape. The leaves attain their maximum size about the time of flowering.

The chokecherry is a variable species, with several varieties and forms recorded. On the basis of differences in leaves and fruit, botanists sometimes divide this species into 3 varieties, each having a separate geographical range. The variety *demissa* may attain a height of 6 m, has heart-shaped leaves covered in very fine hair, and is found in B.C., Alberta, and the western states. The variety *melanocarpa* can also reach a height of 6 m, has smooth leaves, and is found in B.C., Alberta, Saskatchewan, Manitoba, and the states south of these provinces. This variety has two forms, *melanocarpa*, which has deep-blue-purple to almost black fruit, and *xanthocarpa*, which has yellow fruit. The variety *virginiana* is a large shrub that can reach a height of 15 m, has thin leaves, and is widespread across Canada and the United States. This variety also has two forms, *virginiana*, which has crimson to deep red fruit, and *leucocarpa*, which has whitish to yellowish and amber fruit.

Range and Habitat

The chokecherry grows as far north as the Yukon and North West Territories and as far south as California, New Mexico and Texas. In Canada, the chokecherry ranges from B.C. in the west to Newfoundland in the east. The chokecherry grows throughout much of the western United States and in the mid-west and east ranges from Nebraska south through Kansas, Missouri, Arkansas, and North Carolina.

The chokecherry is commonly found on rich, moist, but well-drained soils. It is also found on poor, dry soils and even sand dunes if water is not far beneath the surface. The chokecherry has medium to low salt tolerance. It apparently performs poorly in arid SW Saskatchewan.

The chokecherry is rather intolerant of shade and therefore is usually found in the open along fence lines, roadsides and streambanks, on cleared land, and along the borders of wooded areas and ravines.

The chokecherry also is able to grow in a wide altitudinal range. In Nevada, the chokecherry grows to an altitude of 2,400 m (8,000 ft).

Growth Characteristics

The chokecherry is a very competitive shrub that grows quickly. Chokecherries are reported to have a 40 year lifespan. In North Dakota, chokecherries may grow from 33-71 cm (13-28 in)/year. It may take from 20-25 years for plants to attain a height of 7 m (23 ft) and a spread of 3.5 m (11.5 ft).

Characteristics of Flowers and Fruit

Flower buds develop the year prior to actual flowering and fruit production. Flowers occur in cylindrical clusters that appear at the ends of new shoots after the first leaves are almost fully developed. Each cluster contains from 25-35 flowers that mature from the base to the apex. The clusters vary from 4-15 cm (1.6-5.9 in) long, and are about 2 cm (0.8 in) in diameter. The flowers are white or cream colored and are from 0.5-1.5 cm (0.2-0.6 in) in diameter.

Flowering occurs from early May to early July, depending on latitude. The flowers are less susceptible to late-spring frosts than other fruit species because flowering occurs somewhat later.

The chokecherry is apparently self-fruitful to some extent, but under these circumstances, much reduced yields can be expected. The flowers are fragrant and primarily insect pollinated. Warm days (under 30°C, or 86°F) and cool nights promote heavier fruit set because of increased insect activity.

The chokecherry may first flower as soon as the second season after seed germination and fall seedling establishment, but 3-4 years is more usual.

The fruit of the chokecherry are true cherries, containing a single seed, or stone. They are from 4-9 mm (0.2-0.4 in) in diameter and vary in color from yellow, orange, red to purple-black. The fruit mature from late June to late August, again depending on latitude. About 10 weeks are required for the fruit to mature.

The fruit are borne densely, are relatively easy to pick and hold up well in shipping.

Potential Yield

The chokecherry appears to produce fairly consistent yearly fruit crops. Chokecherries can yield 13.6 kg (30 lb) of fruit/shrub, with 772-2,425 berries/kg (350-1100 berries/lb). A yield of 11,200 kg/ha (10,000 lb/acre) could be expected.

Wildlife Usage and Forage Value

The chokecherry is utilized by about 70 species of game or songbirds. It provides cover for small mammals and nesting birds. It is an especially important fall and winter food source for ruffed and sharp-tailed grouse, quail, prairie chickens, various songbirds including grosbeaks, jays and waxwings, bears, rodents, rabbits, moose and deer. The fruit, buds, twigs and bark are all eaten. The concentration of protein increases in the stems during the fall, which is beneficial to browsing deer.

The chokecherry is of only poor to fair

forage value for cattle and sheep, and is known to be toxic to livestock under certain circumstances.

Toxicity

The poisonous qualities of the chokecherry were first described in 1847. The consumption of chokecherry leaves and seeds has caused fatalities in livestock and children; children have also been poisoned from chewing on twigs.

The inner bark, buds, flowers, seeds and suckers contain a chemical compound (the cyanogenic glycoside prunasin) which, when acted upon by stomach digestive enzymes, breaks down to yield hydrocyanic acid (prussic acid); the consequence is cyanide poisoning. The highest levels of toxicity apparently occur in the spring and summer; the leaves become non-toxic once the fruits mature (in late summer).

Symptoms of poisoning occur from less than 1/2 hour to 3 or 4 hours following consumption. The symtoms of cyanide poisoning include rapid breathing and gasping, salivation, slowed pulse, dilated pupils, staggering and convulsions, eyes rolling, tongue hanging out of mouth, cyanosis (blue coloring of the lining of the mouth), and loss of consciousness. The blood of the victim is a bright cherry red. The basic cause of death is respiratory failure.

Livestock (cattle and sheep in particular) apparently do not relish chokecherry leaves and will not eat them unless driven to do so by hunger (for example, under conditions of drought or overstocking). The availability and quality of grass determines the degree of browsing by cattle. Early spring and late summer are the most likely periods when cattle are likely to browse on the chokecherry. The degree of poisoning varies with the amount of leaves or fruit ingested, time of season, size and kind of animal, and the ability of the animal to detoxify hydrocyanic acid. Wilted leaves are more dangerous because fewer of them need to be eaten. Fresh leaves have been reported to contain 143 mg hydrocyanic acid/100g (0.02 oz/1 lb) leaves whereas the concentration of hydrocyanic acid in wilted leaves may reach 243 mg/100 g (0.04 oz/ 1 lb) leaves. This concentration is 10 times the level at which poisoning can occur. Consumption of 0.25% of an animal's weight of leaves (about 0.7 kg or 1.5 lb of leaves for cattle, and 0.1 kg or 0.25 lb for sheep), eaten over a period of 30-60 minutes, will cause poisoning. However, hydrocyanic acid is metabolized rapidly and doesn't accumulate, therefore grazing is possible at levels below the fatal dose. Constant exposure to hydrocyanic acid does not confer immunity to the browsing animal.

Susceptibility to Herbicides

The chokecherry is known to be moderately susceptible to 2,4-D amine or low-volatile ester, and is susceptible to: ammonium sulphamate, 2,4,5-T amine or low-volatile ester, 1:1 mixtures of 2,4-D and 2,4,5-T, 1:1 mixtures of 2,4-D and dichlorprop, and 2:1 mixtures of 2,4-D and dicamba. However, other untested herbicides may also be toxic to the chokecherry.

Herbicide Residues on Wild Berries

Currently, the primary sources of chokecherries are those harvested from wild stands. It is wise to be familiar with the management history of the area being harvested from before consuming such fruit, or products made from such fruit. A study made

in Ontario has indicated that significant herbicide residues were found on wild fruits in some areas (less than 1% of the areas sampled) in the same year that herbicides were applied. Such areas include accessible rights-of-way such as highways and railways, crown land, and recreational areas.

Part II:

Chokecherry Culture

Cultivars

A number of cultivars have been selected and named. These are available from various nurseries but quantities are generally limited. Additionally, import restrictions on *Prunus spp.* make cross-border purchases impossible.

Boughen Sweet - large, mild fruit; excellent for jams, jellies and wines; selected by W.J. Boughen, Valley River, Manitoba, prior to 1923.

Boughen's Golden - yellow fruit, full flavour, little astringency; ornamental value; selected by W.J. Boughen, Valley River, Manitoba.

Canada Red - attractive small tree; leaves turn deep red in autumn; high yielding; large fruit clusters; large, black fruit, excellent flavour; selected by McFaydens Nursery.

Centrehill - tasty, large fruit.

Chokeless - non-astringent to sweet fruit.

Honeywood - tasty, large fruit.

Garrington - 3 m height (17-18 year old shrubs); weepy habit; large, pointed leaf; 8-10 mm black fruit, good flavour; fruit held on outside of shrub, easy to pick; 4 year average yield 14 kg (31.5 lb) per shrub (hand-picked); selected by L. Pearson, Bowden, Alberta.

Goertz - columnar form; very winter hardy; 12-16 large fruit/cluster; black, very juicy, non-astringent fruit (good flavour); released by the Alberta Tree Nursery and Horticulture Centre, Edmonton.

Johnson - high-yielding; good quality fruit; ornamental value; originated north of Fosston, Minnesota.

Maskinonge - non-suckering; excellent quality, sweet, non-astringent, medium-sized red fruit; originated in Maskinonge Valley, Quebec.

Mission Red - bright red fruit; excellent for wine-making; ornamental value.

Mission Yellow - yellow fruit; excellent for wine-making (rich, amber-colored wine); ornamental value.

Mission Orange - orange fruit; ornamental value.

Schubert - mature summer foliage reddish-purple, fringed with lime green; pyramidal habit with dense foliage; fruit purplish-black, large; good yield; excellent jams, jellies, wines; introduced by Oscar H. Will Co., Bismarck, North Dakota.

Spearfish - yellow fruit; originated in South Dakota.

Propagation

It is possible to propagate chokecherries using seed, suckers (rhizome sprouts), rhizome cuttings, semi-hardwood cuttings, crown division, by grafting, and through micropropagation. All methods of vegetative propagation produce plants which are identical to the parent plant. Plants propagated from seed tend to be dissimilar to the parental stock.

Seed

The use of seed has some advantages. Plant variability is useful in the search for new cultivars, and potentially for the expression of a range of resistance to insects and diseases. Other advantages of using seed include lower initial cost and the production of disease free material. The disadvantages are that the use of seed will probably require at least one additional year of growth before the production of a fruit crop is possible, and mature plants will not necessarily be identical to the parental stock. Seed of the cultivar Schubert apparently produces plants relatively true to the parental material.

It is suggested that seed be used where a minimal start-up cost is essential, and where variability is not considered detrimental. Seed could also be used if planting chokecherries in hedgerows or shelterbelts.

Seed is best collected or purchased near the area of planting to ensure local adaptability. Fruit should be collected when fully mature; this facilitates cleaning and greater germination. It is desirable to clean seeds of the fruit pulp. If seed is purchased, it is important to ask about the seed generation and age, where it was collected, and how it was stored.

The seed is extracted from the fruit using a blender with dull blades at low speed; the seed will not be damaged, but will have to be sieved from the pulp.

Excessive drying of cleaned seed is detrimental to germination. A few hours of surface drying is all that is required. Extracted and cleaned seed should not be stored in the open, or in a warm, dry atmosphere. Cleaned seeds should be stored dry in sealed containers at temperatures of -3 to 3°C (27-37°F).

A kilogram of cleaned chokecherry seed contains from 6,600-18,500 seeds (3,000-8,400 seeds/lb); 45 kg (100 lb) of fruit yield 3-11 kg (7-24 lb) of seed.

Chokecherry seed will germinate with no pretreatment if sown outdoors in the fall at 65-70 seeds /0.25 m^2 (25 seeds/ft^2). The seed should be sown at 1 cm (0.4 in) depth, or covered with 1-4 cm (0.5-1.5 in) mulch. Seed should be sown in early September to mid-October at the latest. Germination rates vary from 30-70% with a 4:1 ratio of sown seed:usable seedlings. Under such conditions, seedlings may require 1-2 years to reach a suitable planting size. Low seedbed densities should be maintained to ensure adequate plant size and to reduce the percentage cull.

Optimal conditions for the germination of chokecherry seed require 16-24 weeks of stratification at 3°C (37°F) in moist sand:peat. Moist vermiculite, or 1:1 peat:perlite may also be used. The volume of medium used should be 1-3 times that of the seeds.

The seeds are subsequently germinated at 21-27°C (70-81°F) with a 14 hour photoperiod. One study determined that subsequent growth conditions of 7/-4°C (45/25°F) day/night temperatures in vermiculite promoted maximal root growth and minimized root-tip browning.

Further growth and development will

be favoured by a warm, well-lit environment; a dilute 20-20-20 fertilizer may be applied every 2-3 weeks. Maximum growth may be obtained using bright full-spectrum fluorescent light (a mixture of cool and warm white) where bright, but indirect sunlight is not available, a constant 25 to 27 °C (77-81°F) temperature, 70-90% relative humidity, and two 30 minute periods of darkness every 24 hours; a moderate amount of air movement is necessary to provide adequate ventilation and to produce stronger stems. The use of carbon dioxide supplementation in greenhouses so equipped is advantageous in promoting vigorous growth.

Before transplanting outdoors in the fall, acclimatization is necessary; this involves restricting water, switching to natural lighting and reducing the temperature. Before planting out in the spring, the development of vegetative maturity (indicated by falling leaves), and 900-1,000 hours of chilling at 5°C (41°F) are necessary.

Suckers

Suckers are shoots that arise from rhizomes which are underground stems. When removing suckers, it is essential to obtain as large a root mass as possible, and the root mass should not be allowed to dry out prior to transplanting. Suckers are best removed in early spring or late fall when the plants are dormant. Only those suckers that are well-rooted should be transplanted; the roots should never be allowed to dry out. Suckering can be promoted in mature plants growing in light shade or open conditions if the stem is damaged.

Rhizome Cuttings

Cuttings 10 cm (4 in) in length and 1-2 cm (0.4-0.8 in) in diameter should be collected in July. They should be sterilized with 10% bleach, and then rinsed with tap water. The ends should then be sealed with melted paraffin, and the cuttings then planted 1.5 cm (0.6 in) deep in moistened vermiculite in plastic trays. The trays are then placed in a well-lit greenhouse with day/night temperatures of 25/17°C (77/63°F). Most of these cuttings (over 80%) should produce 1-8 shoots in 19-38 days.

Grafting

Chokecherries have been grafted to non-suckering *Prunus padus* (European bird cherry or May Day cherry) rootstocks.

Semi-hardwood Cuttings

Semi-hardwood cuttings, 15 cm (6 in) in length, should be taken from suckers early in June and treated with 0.8% (8,000 ppm) IBA in talc. The treated cuttings are then stuck in 2:1 peat:vermiculite, or 3:1 sand:peat and placed in a mist bed. The rooting medium should be maintained at 21°C (70°F) using heating cables. The proportion of such cuttings successfully rooting varies from 42-100% according to one study. The use of 1.5% IBA, dissolved in 95% ethanol may also provide successful results.

Micropropagation

Micropropagation is a method of propagation analogous to any other form of vegetative propagation, such as the use of

cuttings or suckers. The technique differs in that small plant parts, including pieces of leaves and stems, or entire buds, are cultured under sterile conditions on artificial growing media, ultimately producing thousands of new plants. Micropropagation is a term that has the same meaning as the terms tissue culture and *in vitro* culture. Micropropagation requires some specialized equipment and scrupulous technique, but in the long run, should not produce more expensive plants. Micropropagated plants are not necessarily superior to plants originating from other methods of propagation, but it should be noted that the quality and vigour of micropropagated plantlets can vary substantially, depending upon the source.

Chokecherries have been successfully micropropagated from dormant buds. Micropropagated plants are available from some of the sources listed in this guide.

Plantation Establishment

Chokecherry plantations may take the form of typical orchards, but they also can be established in single or multiple-row shelterbelts. The information that follows is primarily associated with establishing an orchard, but much of this information is applicable to shelterbelt establishment and maintenance.

Site Selection

To select a site suitable for establishing a chokecherry plantation, it is important to consider such factors as soil type, drainage, slope of the plantation site, availability of a source of good quality water, and protection from the wind.

If possible, plantation sites should have a slight slope (1-2%) so as to provide for the drainage of water and cold air; this is especially important during frosts. There should be a break in any shelterbelt at the low end of the plantation to allow for proper air flow. Preferably, the slope should not face south so that the soil will warm up more slowly in the spring, thus delaying flowering. A north or east facing slope will also prevent sunscald.

Prior to transplanting, soil preparation should include tillage and perhaps the use of a non-residual herbicide such as glyphosate, which will eliminate perennial weed infestations.

Preferably, a green manure crop should be grown for 2 years prior to plantation establishment. It is important to eliminate all perennial weeds.

The chokecherry will grow in all types of soil, provided that the soil is well drained. The best soil is a deep sandy loam with high organic matter (2-3% as a minimum). Heavy clay soils lacking in humus should be avoided. A sunny location is preferable.

Soil pH is not overly critical. The chokecherry appears to be tolerant of a wide pH range (5.0 to 8.0); the optimum pH is reported as being 6-8.

For irrigation, surface water is generally of better quality than well water, which can have a high salt content (the measure of salinity, or EC, should be less than 1 mS/cm). Ideally, the water supply should be situated near the plantation and the supply should be sufficient to meet annual irrigation requirements.

Windbreaks

For orchards, protection from the prevailing winds is important. Strong or persistent winds can cause severe dessication, especially in the winter, and damage from abrasion and tearing. The consequences may include the loss of shoots, buds, flowers and fruit. Such damage acts as a natural form of pruning and results in reduced bush size and an atypical form. Additionally, leafing out and flowering can be negatively affected on the windward side of bushes; both can be delayed and the amount of bloom can be reduced. Fruit size may also be reduced.

Windbreaks provide protection from drying winds, help maintain snow cover, and decrease moisture loss and soil erosion. Windbreaks also allow for better pollination.

Windbreaks should be situated so as to reduce the effects of the prevailing winds in both summer and winter. Windbreaks should extend 10-15 m (30-50 ft) beyond the area to be protected. The porosity and height of the windbreak determine the protective effect. A 3 m (10 ft) high windbreak will reduce wind velocity for up to 90 m (300 ft) downwind. Synthetic windbreaks should have a porosity of about 50%. Planted shelterbelts provide the best wind protection. A 9 m (30 ft) high shelterbelt reduces wind speed for 90 m (100 yd) upwind and 275 m (300 yd) downwind.

Plant Spacing

Plant spacing is dependent upon the type of equipment available for tillage and harvesting, the method of harvest, and whether chokecherries are to be grown in an orchard or as part of a shelterbelt. In general, rows should be at least 1-2 m (3-7 ft) wider than the equipment available.

It is suggested that spacing between plants be 1 to 1.5 m (3-5 ft) with rows 4.5-6 m (15-20 ft) apart. A between plant spacing of 1 m (3 ft) and a between row spacing of 4.5 m (15 ft) requires about 2,100-2,500 plants/hectare (850-1,000 plants/acre); the exact number varies with the dimensions of the area planted.

Wider between row and within row spacings provide for better plantation ventilation and therefore help reduce the risk of disease problems. Smaller within row spacings increase early yields and returns.

Transplanting

Vigorous plants 15-60 cm (6-24in) tall should be used. A well developed root mass is essential. The roots must not be allowed to dry out.

Generally speaking, transplanting of field-grown stock is best done in early spring after the soil thaws (greenhouse grown stock requires hardening off). Transplanting can also be done in the late fall, before the soil freezes, provided that the material has been hardened off. However, a dry fall, followed by a cold, dry winter may result in a large percentage of loss. It is possible to transplant rooted cuttings and micropropagated plants in mid-August. This allows some time for further root growth, but also provides sufficient time for natural winter hardening to occur. Significant shoot growth will likely not occur until the growing season after transplanting.

Fall planted suckers should not be pruned until the following spring. Spring planted suckers should be pruned to a height of 20 cm (8in). Rhizome cuttings are best transplanted in early spring, as is bare-rooted stock.

When transplanting, plants should be set a little deeper (2-5 cm; 1-2 in) than they were in the propagation container. The soil can then be firmed around the roots. Subsequently, the plants need to be watered well, and consistently, but not overwatered. Pruning the shoots back should not be necessary, except as noted for suckers. Well composted manure can be mixed in with the soil around the transplant. Four to eight ounces of a phosphate fertilizer (0-20-0, 11-48-0) could also be mixed in, using less if phosphorus levels are adequate, or if manure has been used. This will help promote root growth.

Growers should normally count on a minimum 10% loss of transplanted material, which will therefore need to be replaced.

Grassing Down

This involves the planting of a permanent grass cover between the rows of chokecherry plants. A grass cover is important for the control of erosion and enables mechanical harvesting even in wet conditions; it also may help retain soil moisture and control some weeds. A grass cover will also increase the absorption of rainfall and at the same time minimize runoff.

Suitable grasses must not be weedy (like quack grass), must produce only one seed crop per year, must be hardy and resistant to snow mold, and should form a resilient turf capable of withstanding the use of a mechanical harvester during wet weather. Some tests in the Peace River country of northern Alberta indicate that Chewings Fescue (cv. Oasis) and Creeping Red Fescue (cv. Boreal) have performed well in saskatoon orchards. These grasses may be useful in chokecherry plantations. Observations made at the University of Saskatchewan suggest that Crested Wheat Grass (cv. Fairway) may also work well. This grass is an easily established bunch grass that can withstand dry weather, greens quickly in the spring, and is dwarf in stature.

Some species of grass native to the prairie may offer excellent potential for an understory soil cover.

Plantation Management

Irrigation

Most native fruit species, like the chokecherry, will survive under normal moisture conditions without supplemental irrigation, provided that weeds are not allowed to grow. However, irrigation will improve plantation establishment and rapid growth, and may be required to maximize fruit yield, depending on natural rainfall. Once plants are established, one or two annual irrigations may be sufficient.

Accurate estimates of water requirements for all native fruit species are not available. Research on the best timing and amount of irrigation required has not been reported. In semi-arid climates, newly established trees and shrubs require about 4 l (1 U.S.gal) of water/week (equivalent to 2.5 cm/0.25 m^2 or 1 in/3 ft^2 of rainfall around the plant). During the second year, 15-19 l (4-5 U.S. gal) every 2 weeks is required. These amounts may be met by rainfall.

A simple test to determine if irrigation is required is to squeeze a handful of soil into a ball. If this soil ball holds its shape when jarred slightly, then there is no need for irrigation; if the soil crumbles, water is required. This method is quick and inexpensive but is somewhat inaccurate.

However, it is possible for chokecherries to be irrigated too much. Excess water can result in root damage from poor soil aeration and may prevent the uptake of mineral nutrients and water; young plants may be especially susceptible to root rot. Excessive water may also contribute to insipid fruit flavour and bursting.

Wide-row spacings and limited supplies of water make trickle or drip irrigation the most cost effective method. The use of sprinkler or surface irrigation requires about twice as much water as does the use of trickle irrigation.

The advantages of trickle irrigation are many. Water is placed where it is needed (no watering between rows, fewer weeds), irrigation equipment is semi-permanent (nothing to lift or move around regularly), low labour and operating costs are normal, foliage is not watered (thereby reducing the incidence of plant disease), wind has no effect on the application of water, other field operations can be carried out simultaneously, and fertilizers can be applied through the system. Operating pressures and flow rates are low, therefore the required pumps and piping are smaller and leaks at connections are not common. Because water requirements are lower, conservation of energy and water is easily possible.

On the negative side, emitters may easily clog with salts, algae or soil, mechanical or rodent damage is possible, and sunlight may cause the plastic pipes to crack.

In contrast to trickle irrigation, overhead irrigation systems can be used to advantage for frost protection during flowering, and even earlier in the spring to delay flowering, if spring temperatures are warmer than normal.

Simpler irrigation techniques include gravity fed irrigation from raised tanks, and hand-watering from a tractor-pulled tank and trailer. These methods may be the most economical for small plantations in particular.

Fertilization

Proper use of fertilizers is important to reducing costs, to growing healthy plants, and to minimizing the ecological impact of fertilizers on water bodies. An excess of fertilizer can result in problems as serious as a deficiency.

Of all the essential mineral nutrients, nitrogen (N), phosphorus (P), and potassium (K) are the ones used in quantities that may require replacement. Nitrogen is the most common nutrient requirement, but it has been observed that excessive levels of nitrogen occur more frequently in fruit orchards than deficient levels.

Magnesium, manganese and boron are only rarely required. Iron, although present, may not be available to plants on alkaline soils. Members of the rose family are particularly susceptible to a lack of iron, which is indicated by a yellowing of the foliage (termed iron chlorosis).

Prairie soils generally require that soil nutrient levels of 35 kg (77 lb) N, 27 kg (60 lb) P, and 136 kg (300 lb) K, per acre be maintained.

Soil analysis will indicate the nutrient status of the soil. It is important for growers to monitor new shoot growth, leaf color and luxuriance, and fruit production and size. Short terminal growth and pale green leaves suggest a need for fertilizer.

Nutrient requirements are probably higher during growth, prior to maturity. During periods of active growth, it is generally suggested for bush berry crops that 39 to 45

kg N, 6 kg P, and 56 kg K per hectare (35-40 lbs N, 5 lbs P, 50 lbs K per acre) per year be applied. At maturity, nutrient requirements decrease; the general recommendations for other bush berry crops are 17 kg N, 3 kg P, and 34 kg K per hectare (15 lbs N, 3 lbs P, 30 lbs K per acre), assuming yields of about 5,600 kg per hectare (5,000 lbs per acre).

Leaf analysis is the most accurate method of determining mineral requirements, provided that optimum nutrient concentrations have been established. Province of Ontario recommendations for sour cherry leaves include 2.2-2.8% N, 0.15-0.2% P, 1.3-2.3% K, 1.2% Ca, and 0.35% Mg.

Fertilizers are best applied late in the fall or early in the spring before the leaves flush. It is best not to fertilize (or irrigate) after harvest because high levels of soil fertility (and water) delay the development of winter hardiness.

Fertilizer requirements for chokecherries have not been determined. It is not known how necessary or suitable the above recommendations are for the chokecherry. Soil tests should be made before fertilizers are applied.

Pruning

Regular, careful pruning is important to maintain plant health and improve yield, but major pruning does not become necessary until the plantation is about 6-10 years old.

Pruning primarily involves the removal of weak, diseased and damaged shoots. Low, spreading branches should be removed and the centers of shrubs thinned to keep them open and thus allow good air circulation. The removal of older, less productive stems is also suggested. The production of new plant growth should be encouraged because the largest fruit are usually produced on 1-4 year old shoots.

Late-winter and early-spring pruning (prior to budbreak), is suggested. Active shoot growth following pruning at this time will encourage healing and will better prevent diseases from infecting the tissues. Late-fall and early-winter pruning may leave shoots susceptible to winter damage. Summer pruning is not recommended because removal of the leaf surface limits normal growth and development, fresh cuts can enhance the spread of various diseases, and pruning at this time may induce the formation of new shoots that will not have time to harden properly for winter.

However, certain diseases require immediate pruning for the most effective control (including canker and fireblight). In these circumstances, the benefits of immediate pruning outweigh any disadvantages.

Shrubs should be maintained at about 2-3 m (6.5-10 ft) in height by pruning the leaders. Such heading back should not be practised until the plants reach this desired height and plants are well established.

Large plantations will require the purchase of pneumatic or hydraulic pruners.

When pruning diseased growth, tools should be disinfected with Lysol (1 part Lysol to 19 parts water), or household bleach (1 part bleach to 9 parts water) after every cut. Lysol is less corrosive to pruning tools. Pruned material should be removed and burned.

Mulching

The use of mulches, will help suppress weeds (especially between plants in the row), will reduce extreme fluctuations between

daytime and nighttime soil temperatures, and will aid the retention of soil moisture. Common materials used for mulching include wood chips, bark, straw, sawdust (spruce or poplar in particular), waste hay and gravel. A maximum of 30 cm (12 in) of mulch should be applied (greater thicknesses may not be economical) and the mulch should be kept 20-30 cm (8-12 in) from the plant stems to discourage mice. A black plastic mulch can also be used, but is more expensive, requires the irrigation to be laid first, and also requires the use of a fertilizer injector.

Pollination

Because chokecherry flowers are insect pollinated, supplemental pollination using honeybees will likely be beneficial. Every tenth plant in a row should be of a different cultivar.

Harvesting

Normal harvest dates vary from late-June to late-August, depending on latitude.

The simplest harvesting methods are hand picking, or using a berry rake (a comb with large teeth). A small power vibrator and catching frame, as is used for highbush blueberries, is another method of harvesting.

Mechanical harvesting can be accomplished using a pull type harvester (as is used for raspberry harvesting), or a self-propelled harvester (as is used for highbush blueberry harvesting). Effective machine harvesting of chokecherries requires that row width at ground level be about 50 cm (20 in), and bush height no more than 3 m (10 ft).

During the first 3 to 4 years of production, it may not be economical to use commercial harvesters because yields may be low; therefore U-Pick, or contract hand picking should be considered.

It is essential that freshly harvested fruit be rapidly cooled to remove field heat. Immediate post-harvest cooling (within 2-3 hours of harvest) slows the chemical changes within the fruit that lead to over-ripening and deterioration, reduces the activities of micro-organisms that cause fruit rot, and reduces dessication; shelf life is consequently increased. A refrigerated truck or nearby facility is often considered essential. Completing fruit harvest in the morning (prior to about 11:00 AM) substantially reduces problems resulting from field heat.

Problems

Weather-induced Disorders

Problems caused by weather may include cold injury, desiccation, wind damage, and sunscald.

Cold injury and desiccation are, in part, associated with the development of winter hardiness and dormancy. The development of winter hardiness (a process called hardening-off) and dormancy allow a woody plant to survive our winters. The requirement for a period of dormancy is often referred to as a chilling requirement. If this chilling requirement is not met, abnormal growth and development, or no growth, may result. Dormancy requires, and follows hardening-off, which is a physiological process initiated by decreasing daily temperatures and shorter days. Inadequate hardening-off predisposes a plant to cold injury.

Cold injury is associated with

prolonged extreme cold temperatures, or sudden extreme drops in temperature following a warm spell. Desiccation is caused by relatively warm dry winds that have effects when the ground, and consequently a plant's roots, are still frozen; the aboveground parts of the plant lose water to the warm, dry winds, but this water cannot be replaced because the roots are frozen.

Symptoms of both cold injury and desiccation are similar and often associated. Warm, dry winds can be followed by sudden drops in temperature. Symptoms may include death of an entire plant, or death of more susceptible plant parts such as new wood, leaf buds and flower buds. Winter damage may allow the subsequent entry of dieback and decay fungi such as *Cytospora* canker.

Killing frosts are defined as temperatures of -2.2°C (28°F) or lower; at this point, most actively growing plant tissues are killed. Symptoms of spring frost damage include light browning of flowers and leaves; damaged parts will drop off. Flowers are especially susceptible to frost damage. Such damage may be restricted to the internal parts of the flower and may not be noticeable except under magnification.

Strong winds can cause abrasion, tearing and desiccation. Hard brown edges result from this damage. Leaves and new shoots are susceptible to wind damage. Fruit can also be affected, grey or light brown scabs forming.

Sunscald, which is a bark injury, can occur in both summer and winter. Bark exposed to the hot summer sun can discolor and bubble, subsequently forming cankers. On cold, sunny days during the winter, bark exposed to the sun may become warmer than the air and then cool rapidly after sunset; splitting and subsequent canker development can occur.

Prevention of these problems is associated with proper site selection and management practices. The development of winter hardiness requires low levels of soil moisture and fertility in late summer and fall. Substantial irrigation, or fertilization after harvest is not suggested. Low lying sites with a high water table are also conducive to delaying hardening off, and also to frost damage because of poor air drainage. Windbreaks are important for reducing the effects of strong, persistent winds. A slight NE slope to the plantation will help prevent sunscald; a spray of dilute white exterior latex paint can also be used. This may also help delay flowering in the spring.

Insect Pests

The timing of insect feeding has a great effect on the extent of damage caused. The two most important periods are: a) during flowering and fruit set; and b) during fruit development. Insect damage during flowering and fruit set decreases potential crop yield through flower and fruit loss; insect damage during fruit development can induce loss of young fruit. At later stages of fruit development, damaged fruit are not lost, but marketable yield is reduced.

The effects of leaf feeding insects are less well defined. If damage to the total leaf area of a shrub is great enough, some fruit loss could occur because sugar production would be substantially reduced. Flower bud production (which occurs in mid to late summer) could also be reduced. Additionally, leaf feeding could affect the storage of sugars within the plant and this could have longer term effects on plant survival and growth, depending upon the severity of the damage.

The chokecherry is attacked by a variety of insects; a partial list follows.

Beetles

Shot-hole borer (*Scolytus rugulosus*)
A bark beetle (*Chaetophlocus heterodoxus*)
Round-headed wood borers (*Clytophorus verrucosus, Ropalopus sanguinicollis*)

Sucking Insects

Lacebugs (*Corythucha spp.*)
Chokecherry aphid (*Rhopalosiphum cerasifoliae*)
Plum aphid (*Asiphonaphis pruni*)
Leafhoppers (*Gyponans flavilineata*)
Treehopper (*Tortistilus inermis*)

Moth Caterpillars

The chokecherry is fed upon by a large diversity of caterpillars, only some of which are listed here.

Chokecherry leafroller (*Sparganothis directana*)
Tent caterpillars (*Malacosoma spp.*)
Fall cankerworm (*Alsophila pometaria*)
Uglynest caterpillar (*Archips cerasivoranus*)
Fall webworm (*Hyphantria cunea*)
Cecropia moth caterpillar (*Hyalophora cecropia*)

Gall-forming Insects

Fruit gall midge (*Contarinia virginianiae*)
Leaf gall insects (*Pachypsylla spp.; Phytoptus emarginatae*)

Sawflies

Chokecherry sawfly (*Hoplocampa lacteipennis*)

Three common insect pests include the fruit gall midge, the chokecherry sawfly, and the tent caterpillar.

Chokecherry Sawfly (*Hoplocampa lacteipennis*)

Adult sawflies emerge from the litter and feed on nectar and pollen in late-May. The adults are 5-6 mm (0.2 in) long and primarily yellow in color. Eggs are laid in the calyx of the flower. Larvae emerge in 5 days, and enter and feed within the developing cherry which dries up and turns black. The larvae then enter a second fruit and feed on the seed. These fruit ripen along with uninfested fruit, although they are not marketable. Mature larvae are 8-9 mm (0.3 in) long and white with yellow heads. Mature larvae exit the fruit as they begin to ripen, fall to the ground, overwinter as larvae in cocoons in the soil, and pupate the following spring.

Fruit Gall Midge (*Contarinia virginianiae*)

The fruit gall midge is a significant cause of fruit loss. Adults emerge in May and lay eggs in the flowers. The tiny yellowish-orange maggots feed on the developing fruit which become enlarged, pear-shaped, and hollow; the developing seed aborts. Larval feeding continues until late-July, when the larvae drop to the ground and pupate in the soil. The damaged fruit dry up and drop off.

Tent Caterpillars (*Malacosoma californicum lutescens, other spp.*)

Tent caterpillar adults are brown moths with thick bodies; their wingspan is 30-40 mm (1-1.6 in) and each front wing is marked by two whitish bands. Only one generation occurs per year. Eggs of *M. californicum* are laid towards the base of a stem, within 30 cm (12 in) of the ground, in late summer.

Overwintering occurs in the egg stage; hatching in the spring is timed to leaf bud break. The larvae construct a webbed nest near a fork in the stem. Larvae feed for 6-8 weeks and are about 5 cm (2 in) long when mature. *M. californicum* larvae are black on top, with a white stripe, and powdery blue on the sides. Tent caterpillars can completely defoliate shrubs. An infestation of 200 caterpillars in a single web can defoliate a 1.5-3 m (5-10 ft) high shrub.

Control of Pest Insects

No insecticides are registered for use on the chokecherry. Proper plantation management and maintenance of plant health will help plants withstand insect attack. Good sanitation practices, including the removal of fallen fruit and leaves will help decrease the incidence of insect pests.

Two potentially very useful candidates for registration include *Bacillus thuringiensis* (Dipel, Thuricide), a biological control agent effective against caterpillars, and dormant oil spray (Sunspray 6E; Sun Refining and Marketing Company, Philadelphia; apparently no phytotoxicity if applied at 1-3%). Dormant oils are applied in the spring to destroy insect eggs. The timing of application is important, but knowledge of this is lacking for the chokecherry.

Diseases

Diseases may be significant barriers to successful chokecherry production. A variety of diseases are known to affect the chokecherry. These include black knot disease, x-disease, bacterial spot (*Xanthomonas pruni*), shothole (*Coccomyces lutescens*), apricot ring pox virus, twisted leaf, canker, damping-off, brown rot and fireblight. The two most important diseases appear to be black knot and x-disease. Germinating seeds and seedlings may be affected by damping-off.

It is important to carefully monitor for diseases and to take preventive measures. Disease problems are more prevalent in years of greater than normal precipitation. At present, no fungicides are registered for use on the chokecherry and therefore, disease control is primarily associated with pruning and sanitation. Regular inspections and pruning are required to effectively control diseased shoots. Pruning tools must be disinfected with Lysol (1 part Lysol to 19 parts water), or household bleach (1 part bleach to 9 parts water) after every cut. All pruned material should be burned.

Black Knot (*Apiosporina morbosa*)

Black knot is a disease of wild and domesticated cherries and plums. It is closely related to the fungus that causes blackleaf and witch's broom in the saskatoon. Infected branches are deformed and growth is substantially reduced. This disease can girdle and kill infected branches; plants may become stunted and deformed after several years. A greater incidence of black knot is associated with decreased plant moisture stress and lower soil temperatures (generally, sites that receive and hold more spring moisture).

The black knot fungus penetrates soft bark on new growth and causes a gall (a localized proliferous growth of plant tissue). The first symptoms are a slight swelling of the current season's twigs in the fall. The swellings or knots are normally confined to one side of the stem. The following spring, the swellings become large, the bark ruptures and the surface of the gall becomes covered with a velvety green fungal tissue which turns black and smooth in the fall. These black knots are the source of new infections of nearby branches. The swellings increase in size and

produce new spores every year.

Black knot can be controlled by pruning infected branches at least 10 cm (4 in) below the knots.

X-disease (causal organism unidentified)

X-disease is caused by a mycoplasma-like pathogen that infects chokecherry, sweet and sour cherries, several varieties of peach, and other *Prunus* species. Chokecherry is apparently its primary host. X-disease is widely distributed in North and South Dakota and Minnesota; presumably it occurs on the Canadian prairies as well. This disease spreads rapidly and can destroy a plantation in 3 to 4 years. Because it can cross-infect economically important peach and cherry plantations, with chokecherries being the primary source, chokecherries in proximity to such plantations are eradicated. Once a single plant becomes infected, the entire plantation usually becomes infected.

X-disease is spread by insect vectors, in particular, a variety of leafhopper species (about 15 species). Leafhoppers acquire the pathogen while feeding on leaves of diseased chokecherries and inject the pathogen into healthy leaves. Leafhoppers are generally present from late-May through to early-October; disease transmission occurs from June through to early September. Leafhopper populations can be monitored using yellow sticky cards. Symptoms of the disease develop the year following transmission.

Infected leaves become greenish-yellow in late-June (they may have a reddish tinge on the margins). In July and August, the leaves turn a deep red. As the disease progresses, shoots become stunted, and leaf rosettes result from decreased growth. X-disease initially reduces growth, which is followed by a decline in plant vigor and subsequent death. Infected fruit are pointed and yellowish-red. Infected fruits are not marketable and seeds from such fruit do not germinate.

Control requires that infected shrubs be eradicated. Unfortunately, some infected trees can be symptomless. All infected material should be removed and burned. Pruning of symptomatic branches is apparently not effective because the pathogen moves to the roots on infection. Leafhopper control is important; weed cover for these insect pests must be removed.

Damping-off (*Pythium* and *Rhizoctonia*, and other fungi)

This disease destroys germinating seeds and very young seedlings. Pre-emergent damping- off affects the sprouting seed and is favored by cold, wet germinating media. Seedlings affected by post-emergent damping-off wilt upon emergence and have rotting stems, especially near the surface of the medium. This type of damping-off occurs in warm, humid conditions and where seedlings are crowded. The fungi survive in soils with high organic matter. Prevention involves the use of sterilized soils and other potting media when germinating seed and growing seedlings. A 5 minute surface sterilization of the seed, using household bleach (1 part bleach to 9 parts water), prior to placing in the germination medium, may help.

Weeds

Weeds can substantially reduce shrub survival and growth because they are strong competitors for moisture and nutrients. A vigorous stand of weeds may consume 6-8 mm (0.25-0.33 in) of water per day. Weeds should not be allowed to go to seed.

No herbicides are registered for use on

the chokecherry. Periodic, shallow cultivation (5-8 cm; 2-3 in) in combination with some hand hoeing are the primary means of control. Deep cultivation and cultivation too close to the plants is not suggested because roots can be damaged and extensive suckering may be promoted. Cultivation for weed control is especially important during the early years of plantation growth. Mulching may be the easiest method to control weed growth between plants in a row.

Birds

Many bird species that are normally beneficial (because they feed on destructive insect pests) may cause serious crop losses when fruit are ripe. It is generally illegal to kill birds and ecologically unwise; most birds are protected under the Migratory Bird Act. Consequently, control can be difficult. Control efforts must begin as soon as birds start to damage crops, before they develop an established feeding pattern. A combination of two or more methods of control is likely to be more successful.

The use of netting (plastic impregnated paper, nylon, cotton, or polyethylene) may be the only effective solution, but it is necessary to keep the netting off the bushes using simple frames of poles and wire. Anti-bird netting has been shown to be both effective and economically feasible for blueberries. Once installed, netting requires little maintenance, is non-toxic, and neither causes noise nor injures birds.

Some observations suggest that several strands of monofilament fishing line strung crosswise over the top of a strawberry crop mimic spider webs that many birds prefer to avoid. This idea may be applicable to chokecherries.

'Scare-Eye' balloons (Pest Management Supply, Inc., P.O. Box 938, Amherst, MA, 01004, U.S.A.), suspended on flexible poles (bamboo, poplar, willow, fiberglas), and moved every 7-10 days, appear to be effective in apple orchards.

A Reflective Mylar Tape is currently being used in commercial strawberry fields in California for bird control. The tape is 2.5 cm (1 in) wide and is used in 30-60 cm (1-2 ft) lengths tied to fence posts, or whatever is convenient. The tape produces a fluttering sound in light winds and reflects light brightly. It is not known how effective this might be in chokecherry plantations. The tape is available from: Sutton Agricultural Enterprises Inc., 538 Brunker Ave., #7, Salinas, CA 93901, USA. The tape costs $5.00 U.S. per 500 ft roll.

Hanging hawk silhouettes and twisted yellow tape strung above the crop may also be of use. More sophisticated solutions include the use of infra-red motion detectors that trigger a loud alarm.

Rabbits and Mice

Rabbits and mice can also be a cause of damage. Rabbits may eat young shoots and both rabbits and mice can girdle stems (strip away bark completely around the circumference of the stem). Damage from mice is associated with excessive weed growth within the crop and normally occurs in the winter when there is a protective snow cover. Prevention of damage is the most effective means of control.

Controlling weeds and keeping grass strips mown on a regular basis will help discourage mice and rabbits. Brush piles and other trash should be removed from fields, ditches, fence rows, and from around buildings because this material provides protection and

breeding sites.

A homemade mixture of 1 part (by weight) thiram (75% wettable powder) with 10 parts water-emulsifiable black asphalt can be used as a taste repellant. This mixture must be sprayed or thoroughly brushed onto plants from soil level to a height of 60 cm and must be applied to dry stems after leaf fall on a warm day. Natural soaps containing ammonium salts of fatty acids (eg. Hinder) have an unpleasant odor and may repel rabbits.

Mulches applied after the ground is frozen in the fall may also help to prevent damage from mice.

Poison baits are very toxic to most mammals and are not suggested for use.

Deer

Deer may feed on twigs and larger branches; they can destroy or alter the shape of shrubs. Browsing may be heavier where alternative sources of food are unavailable and in severe long winters.

Many native plant species are ecologically adapted to annual moderate or heavy browsing. Winter browsing stimulates new vegetative growth in the spring, even on dry rangeland. However, browsing does remove flower buds and therefore reduces the potential fruit crop. Some light to moderate browsing may have little overall effect.

The most cost-effective way to protect against deer is to enclose the area to be protected with a woven-wire or electric fence. Woven-wire fences must be 2.3 m (7.5 ft) high as a minimum; gates must be kept closed. Lower fences may reduce but not eliminate browsing. Electric fences should be 1.8 m (6 ft) high and consist of 7 strands of wire 20-30 cm (8-12 in) apart.

Commercial deer repellants are considered to be generally ineffective. Guard dogs may be another possible solution.

Part III:

Economics, Plant Sources, Fruit Buyers And Processors

Economic Considerations

The commercial grower of chokecherries faces a number of problems including the difficulty of obtaining the large number of plants of the desired cultivar required for plantation establishment, the length of time from planting to production, the lack of sufficient information on management practices, and poorly defined opportunities for marketing and processing. No pesticides are registered for use on the chokecherry and effective, alternative methods of pest and disease control need to be developed. Economical methods of mechanical harvesting and grading are also not available for small plantations. Suitable methods for postharvest storage and processing, the establishment of commercial processing facilities, and major marketing efforts are required; substantial initiatives in these directions have yet to be taken. The lack of consistent supply and volume of fruit means an uncertain market.

Fresh chokecherry fruit sells for $1.10-2.20/kg ($0.50-1.00/lb). Pickers can earn $15.00-20.00/hour. Chokecherry products sell well. Single 125 ml (4.2 U.S. oz) jars of jam retail at about $3.50 and 250 ml (8.5 U.S. oz) containers of syrup at $4.75.

It is important to note that chokecherry production requires a long term commitment and can be very labour intensive. Because of the long time required to realize a profit, other fruit or vegetable crops that will realize immediate income can be grown during the establishment phase of a chokecherry plantation.

Suppliers of Plants and Seed

The following are some suppliers of chokecherry seed and plants. The list is not complete and is not meant as an endorsement.

Prices vary, so it is wise to approach several sources and request information on prices, plant size and age, and pre-transplant requirements. Note that recommendations regarding any one chokecherry cultivar are not valid; data from cultivar evaluation trials are not yet available.

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

Alberta Tree Nursery and
Horticulture Center
R.R. 6,
Edmonton, AB,
T5B 4K3.
Tel 403-422-1789.
(cultivar Goertz, micropropagated)

Aubin Nurseries,
Box 1089,
Carman, MB,
R0G 0J0.
Tel 204-345-6703.

Beaverlodge Nursery
Box 127,
Beaverlodge, AB,
T0H 0C0.
Tel 403-354-2195.

Boughen Nurseries,
Box 12,
Valley River, MB,
R0L 2G0.
Tel 204-638-7618.
(cultivars Boughen Sweet,
Boughen's Golden)

Farmer Seed and Nursery, Co.,
Box 129,
Faribault, MN 55021,
USA.
Tel 507-334-1623.
(cultivar Schubert)

Honeywood Lilies and Nursery,
Box 63,
Parkside, SK,
S0J 2A0.
Tel 306-747-3296.
(cultivars Mission Red, Mission
Yellow, Schubert)

John's Nursery,
Box 24,
Henribourg, SK,
S0J 1C0.
Tel 306-764-8139.

Lakeshore Tree Farms,
R.R. 3,
Saskatoon, SK,
S7K 3J6.
Tel 306-382-2077.

Lawyer Nursery Inc.,
950 Highway 200 West,
Plains, MT 59859,
USA.
Tel 406-826-3881.
(cultivar Schubert)

McFayden Seeds,
Box 1800,
Brandon, MB,
R7A 6N4.
Tel 204-726-0759.

Native Fruit Nursery Ltd.
(T. and E. Laidlaw)
Box 316,
Tofield, AB,
T0B 4J0.
Tel 403-662-2778 (evenings).

Pacific Biotechnologies Inc.,
(Dave Woodske),
Box 242,
Vedder Crossing, BC
V0X 1Z0.
Tel 604-858-2311.

Pearson's Berry Farm Ltd.
L. Pearson
R.R. # 1,
Bowden, AB,
T0M 0K0.
Tel 403-224-3011.

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

Shelmerdine Nurseries,
7800 Roblin Boulevard,
Headingley, MB,
R0H 0J0.
Tel 204-895-7203.

Valley Nursery,
Box 4845,
Helena, MT 59604,

USA,
Tel 406-442-8460.

Windmill Point Farm and Nursery,
2103 Perrot Blvd. N.D.,
Ile Perrot, PQ,
J7V 5V6.
Tel 514-453-9757.
(cultivars Centrehill, Honeywood, Maskinonge)

Windy Ridge Nursery,
Box 301,
Hythe, AB,
T0H 2C0.
Tel 403-356-2167.

Fruit Buyers and Processors

The following are some (primarily Saskatchewan) buyers of native fruit, some of whom may purchase chokecherries. The list is not complete and is not meant as an endorsement.

Classic Promotions Inc.,
Box 8205,
Saskatoon, SK
S7K 6C5.
Tel 306-873-4812.
(J. Polson)

Crow's Country Flavors,
Box 389,
Melville, SK
S0A 2P0.
Tel 306-728-5382.
(Y. and T. Crow)

Genii Gift Baskets,
Box 174,
Dundurn, SK
S0K 1K0.
Tel 306-492-4918.
(G. Griffin)

Gramma Bep's Gourmet Foods,
164-1st Ave. N.E.,
Swift Current, SK
S9H 2B2.
Tel 306-773-7224.
(B. and J. Hamer)

Harvest Pie Company Ltd.,
Box 191,
Pangman, SK
S0C 2C0.
Tel 306-459-2778.
(C. and P. Sotropa)

Healthy Harvest Food & Craft Co -op,
Box 1856,
Tisdale, SK
S0E 1T0.
Tel 306-873-4685.
(J. Reese)

Hill Valley Farm,
Box 186,
Lloydminster, SK
S9V 0Y1.
Tel 306-825-3348.
(R. and P. Baynton)

Juneilent,
Box 155,
Eatonia, SK
S0L 0Y0.
Tel 306-967-2540.
(N. Specht)

Last Mountain Berry Farms
R.R. # 1,
Southey, SK,
S0G 4P0.
Tel 306-726-4683.
(B. and B. Isaac)

Lorna's Homemade Fruit Leather,
Box 15,

McMahon, SK
S0N 1M0.
Tel 306-773-9196.
(L. Andres)

Mari-Maid Jams,
Box 658,
Hague, SK
S0K 1X0.
Tel 306-225-2180.
(C. and M. Steiner)

Meadowlark Products Ltd.,
Box 66,
Cadillac, SK
S0N 0K0.
Tel 306-785-4730.
(B. and A. Lacelle)

Nature Berry Inc.,
Box 543,
La Ronge, SK
S0J 1L0.
Tel 306-425-3005.
(G. and E. Keller)

North Saskatchewan Wild Foods,
Box 2371,
Prince Albert, SK
S6V 6Z1.
Tel 306-953-2770.
(Co-operative)

Nutters Fruit & Nut Co.,
365- 36th St. W.,
Prince Albert, SK
S6V 7L4.
Tel 306-922-3838.
(J. Favreau)

Peace Country Fruit Producer's Co
-operative Ltd.,
Box 144,
Hythe, AB
T0H 2C0.
Contacts: Arnie Meyer (Tel 403
-567-2495); Sam Backmeyer (Tel 403-
356-2218).(washing, grading,
packaging, freezing)

Pearson's Berry Farm Ltd.
R.R. # 1,
Bowden, AB
T0M 0K0.
Tel 403-224-3011.
(L. Pearson)

SIAP Marketing Co. Inc.,
Box 3003,
Prince Albert, SK
S0G 6G1.
Tel 306-953-2770.
(J. Hemstad, General Manager)

SIMA Garden & Kitchen,
Box 676,
Outlook, SK
S0L 2N0.
Tel 306-867-8511.
(S. Verwimp)

Part IV:

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