Template Business Plan for Manitoba Saskatoon Berry Producers

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Prepared for Manitoba Fruit Industry Development Program (MAFRI)
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Notice to Reader

The purpose of this Manitoba Saskatoon Industry Feasibility Study and Business Plan is to provide information to assist potential saskatoon berry producers in Manitoba to conduct preliminary planning for their new business. Use for any other purpose is not authorized. Because this document must address the common needs of the typical situations throughout Manitoba, it does not fully address the specific situation for any one location or any one farm. Therefore it is not to be considered a final feasibility study and definitely does not include all the details and documentation needed for a business plan.

Every potential grower of saskatoons is advised to prepare their own specific information for their unique situation and not to just accept that any information in this document is applicable to their own particular situation and circumstances.

The estimated budget numbers that are included in this Template Business Plan are for example purposes only. They must be revised by every potential grower with their own specific information which they develop for their specific business. The assumptions noted in this document will need to be changed to match each specific situation. Because every new saskatoon orchard will face its own specific set of costs and revenues, every new grower must develop their own specific budget numbers and not use the ones included in this document.

The owners and management of any new saskatoon orchard using any information in this document are responsible for their representations to funding sources and other interested parties about their plans. These users are responsible for disclosure of significant information that might affect the ultimate realization of the projected results. There will usually be differences between the forecasted and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material.

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Executive Summary

Most of Canada and the World's saskatoon berries are grown on the Canadian Prairies, particularly in Alberta and Saskatchewan which represent nearly 80% of the acreage. Manitoba represents the other 20% of the total Canadian acreage with its 700 acres of production. In 2005, it was estimated that there were 600,000 lbs. of saskatoons marketed in Manitoba.

The majority of Manitoba's saskatoons are marketed as fresh berries through U-Pick orchards, farmers' markets, roadside stands, specialty stores, etc. There is a small processing industry in Manitoba that processes some saskatoons into jams, pies, juices, and toppings.

Section 5 of this report discusses orchard management and production issues faced by saskatoon growers, including:

- Site selection;
- Preparations of the orchard site;
- Planting, irrigation, fertilization and maintenance of the orchard;
- Disease, insect and mite infestations and animal issues;
- Harvesting, primary processing and storage;
- Rejuvenation of the orchard; and
- Quality control of the berry production.

Rootstock Suppliers are listed in Section 6 of this report. Most of the suppliers in western Canada sell seedlings derived from micropropagation or from seed. However, Glenlea Greenhouses, the only rootstock supplier in Manitoba, is offering etiolated cuttings for sale to saskatoon growers.

In Section 7, Technology Sources for Irrigation, Pruning, and Harvesting Equipment are listed. Post-Harvest Berry Handling Technology Sources are detailed in Section 8 of the report.

Risk Management is an important aspect of any type of production. While some risks can be mitigated, other risks cannot. Manitoba Agricultural Services Corporation (MASC) provides coverage to Manitoba saskatoon producers who grow berries commercially and sustain losses due to natural causes during the establishment phase. Unfortunately, during the production phase, there is no production insurance available in Manitoba for saskatoon berry growers.

Section 11 details the accrual-based Cost of Production and Financial Analysis for a 20-acre saskatoon orchard which uses mechanical harvesting. The financial projections are based on a number of assumptions, including:

- The 20-acre orchard is planted over 4 successive years (i.e. five acres per year). As a result, all phases of the orchard management are staggered. Therefore, the first berries will be produced (in Year 4) on the first five acres and on each succeeding year, a new quadrant will come into production.
- The estimated costs of planting are in the range of $69,000 or $3,450 per acre.
- Although it is possible to prune sufficiently so as to remove the need to renovate an orchard, most growers find that renovation is required at about Year 12 after planting (after approximately eight years of production). Because the planting is staggered, the need for renovation would also be staggered. Although the planting is staggered by 1 year for 4 successive years, it is assumed that the renovation will be staggered every 2 years. Therefore Orchard A (the first quadrant to be planted) will be renovated following the harvest in Year 11, while Orchard B, C, and D will be renovated after harvesting in Years 13, 15, and 17 respectively. It is assumed, to be conservative, that there would be a radical renovation and that there would be no production in the following year (e.g. Year 12 for the first quadrant) and only a small amount of production from that part of the orchard in Year 13. It is further assumed that production would recover more quickly than with a new planting, but that it

would still take until Year 16 for production to return to pre-renovation levels in the renovated orchard. It is believed that this is a very conservative assumption.

- The orchard would be planted with 16.5 foot alleys, and 3 ft. between plants resulting in 880 plants/acre.
- The alleys would be seeded to a grass such as sheep fescue. The alleys will be mowed as required.
- Plastic mulch would be used in the saskatoon plant row to suppress weed emergence.
- Trickle or drip irrigation will be installed during planting in order to assure good plant establishment, and to augment water during the productive years.
- A shelter belt would be established around the entire orchard (the costs for this are not included in the budgets).
- The capital costs for land, machinery, and handling equipment are in the range of $200,000.

The financial analysis shows that based on a selling price of $2.00 per pound, the model saskatoon orchard is projected to become profitable on an annual basis in Year 7 with a net income of $9,630. On a cumulative basis, the orchard is projected to become profitable in Year 10 with an estimated annual net income of $50,424. After 20 years, the estimated cumulative net income is estimated to be $466,224.

Since it is impossible to accurately estimate the selling price of saskatoon berries, a sensitivity analysis is included in the Cost of Production analysis. In the Sensitivity Analysis, the price of berries was changed to 20% above and below the base price of $2.00 per pound.

In the pessimistic case, using a selling price of $1.60 per pound, the orchard becomes profitable in Year 7 with an annual net income of $1,330. Cumulatively, the orchard is profitable in Year 11 with a cumulative profit of $40,454. After 20 years, the cumulative profit is estimated at $255,224.

An optimistic scenario was also explored, using a berry price of 20% higher than the base case of $2.00 per pound. Using $2.40 per pound, the orchard becomes profitable on a cumulative basis in Year 9 with an estimated net income of $28,194. After 20 year, the orchard's cumulative profit is estimated at $677,224.

In summary, it appears that a 20-acre saskatoon orchard has the potential to be financially feasible.

1.0 Background

The potential growth of the saskatoon industry can be compared to the rapid expansion of wild blueberries onto the world market over the last 10 years. Saskatoons are used in similar food products and share similar nutritional benefits as blueberries. Berry consumption has been increasing, driven by a more health conscious public and demand from secondary processors in the bakeries and dairy (yogurt) sectors. Continued favourable media reports and berry industry promotions that highlight the highest biomedical benefits of these fruits will encourage future sales.

More than 45.9 million kilograms of Individually Quick Frozen (IQF) wild blueberries, valued at $154.6 million, were exported from Canada in 2005. Much of this came from Nova Scotia, where processors exported more than 25.2 million kilograms of IQF wild blueberries, valued at $80.5 million[1]. Frozen wild blueberries have become the number one fruit crop in Nova Scotia in terms of export sales from that province. Manitoba has the potential to attain similar export market sales for its saskatoon industry, especially if it expands outside of the traditional IQF market.

In order to develop and strengthen the small fruit sector, Manitoba Agriculture Food and Rural Initiatives and its project partners (Prairies East Sustainable Agriculture Initiative, Inc. (PESAI), Prairie Fruit Growers Association (PFGA) and the University of Manitoba Faculty of Agricultural and Food Sciences) have established the Manitoba Fruit Industry Development Program (MFIDP). This program brings all stakeholders together in order to improve the commercialization of Manitoba native fruit crops, with a focus on value chain creation and will address all components from initial breeding and research through to consumer products.

The main emphasis of this program is to evaluate and remove any key barriers along the fruit industry value chain. Saskatoons will be the pilot fruit crop for the program, but other Manitoba native and northern fruit crops will be incorporated in the future. This will include any fruit crops currently produced in Manitoba or those that have the potential to be grown here.

The project partners and MAFRI staff are working together as part of the program working group to coordinate development and maintenance of a strong value chain for the prairie and northern fruit industry (focusing initially on the Manitoba saskatoon industry) through economic analysis, consumer-driven applied research and the identification and development of functional food products and ingredients including saskatoons.

The overall MFIDP objectives include:

- To identify markets;
- To assist with product development; and
- To develop a sustainable and profitable value chain for the Manitoba fruit industry.

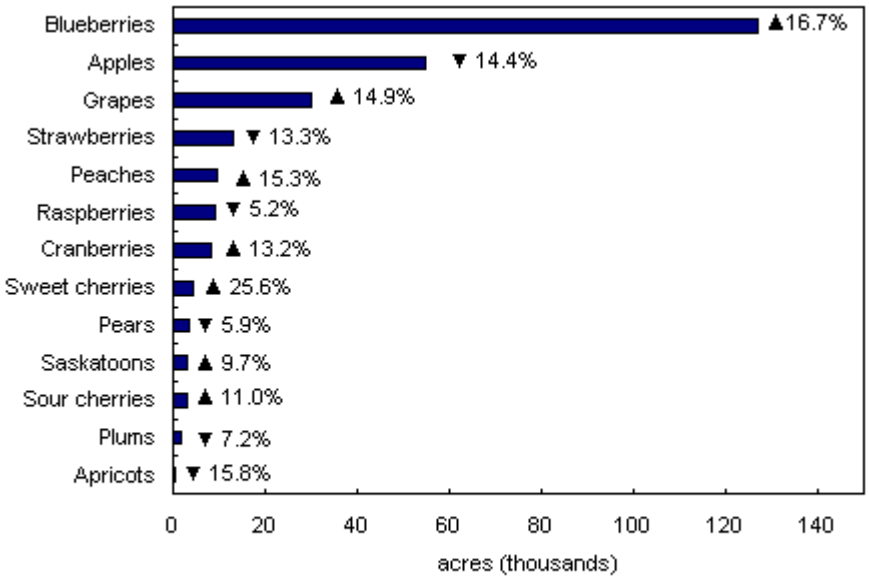
This program will initially promote the increased consumption of saskatoon berries, as this prairie fruit has sizeable production in Manitoba (and on the Prairies) and is making substantial market penetration in Canada and overseas.

[1] Agriculture and Agri-Food Canada news release. August 10, 2006. http://www.agr.gc.ca/cb/index_e.php?page=n60810&s1=n&s2=2006

2.0 The Small Fruit Industry in Canada

The total area in fruit climbed 5.3% between the 2001 and 2006 censuses, to 271,986 acres across the country. Blueberries have become such a popular crop, with their reputation as a healthy food choice, that they have been a driving factor for the fruit sector, accounting for 46.6% of the total acreage in 2006 (Figure 1). Quebec's 24.5% increase in blueberry area, to 41,757 acres in 2006, displaced Nova Scotia from first place. Blueberry acreage in Nova Scotia had only increased 3.0%. New Brunswick was third with 22,107 acres, followed by British Columbia, where blueberry acreage grew 61.5%[2]. In Nova Scotia, there are 35,300,000 acres of blueberries, producing 27,796,000 lbs. with a farm value of over $23 million[3].

Figure 2.1: Major fruit areas and percentage change since 2001, Canada, 2006[4]



Source: Statistics Canada, Census of Agriculture, 2001 and 2006

The Canadian grape sector — driven by the success of Canadian wineries — has also continued to grow, increasing to 30,059 acres, up 14.9%. Ontario and British Columbia are home to the bulk of the vines, but the sector has been spreading beyond the borders of these two provinces. The Maritimes and Quebec both boasted increases in grape acreage as Canada now has a reputation for producing some excellent wines.

Canadian strawberry acreage also declined between the censuses, falling 13.3% to 12,861 acres in 2006. Once a highly anticipated seasonal and local product, strawberries are now shipped in from warmer climates and are available year-round in grocery stores — a competitive factor that has influenced the drop in Canadian strawberry acreage.

[2] Statistics Canada. Catalogue 22-003-XIB or Cansim table 001-0009. http://www.statcan.ca/english/freepub/22-003-XIB/22-003-XIB2007001.pdf

[3] Ibid.

[4] Statistics Canada. Census of Agriculture, 2001 and 2006. http://www.statcan.ca/english/agcensus2006/articles/snapshot.htm

The wild blueberry industry, which was also unknown at one time, is often compared to saskatoon industry because of their market potentials and the berries' nutritional compositions. In order to successfully compete with the cultivated blueberry industry, this industry formed the Wild Blueberry Association of North America (WBANA). The saskatoon industry will also need to consider a promotional campaign to educate the market of this berry's nutritional attributes.

Table 2.1: Nutrient Comparison of Fruit[5]

Per 100 g	Saskatoon berries	Blueberries	Strawberries	Raspberries
Energy (calories)	84.84	51	37	49
Protein (grams)	1.33	0.42	0.7	0.91
Carbohydrate (grams)	18.49	12.17	8.4	11.57
Total Lipid (grams of fat)	0.49	0.64	0.5	0.55
Total Fibre (grams)	5.93	2.7	1.3	4.9
Vitamin C (milligrams)	3.55	2.5	59	25
Iron (milligrams)	0.96	0.18	1	0.75
Potassium (milligrams)	162.12	54	21	152
Vitamin A (international units)	35.68	100	27	139

As can be seen in the above table, saskatoons compare very well with blueberries nutritionally. This was also confirmed in a study by Mazza[6] where he concluded that the saskatoon berry and blueberry are substantially equivalent in all characteristics that are important to the consumer, including fruit color, shape, size, nutrition, texture, and uses. In addition, both fruits are native to North America and they have practically identical historical uses and known health benefits. Their composition, processing, nutritional value and metabolism, intended uses, and levels of undesirable substances are compared.

To further highlight the nutritional benefits of saskatoons, a study has determined that a 100 gram serving of saskatoon berries will supply[7]:

- 22.3% of recommended daily iron
- 88 mg or 11% of daily calcium requirements
- 20% of daily requirements of carotene
- 16 mg of Vitamin C
- 244 mg of potassium or 10% of daily needs
- 2.5% of zinc and 33.8% of manganese of daily requirements
- 32 mg of phosphorus or 1.1% of daily requirements for adults.

[5] Source: Saskatoon berries, SFGA, Conducted by POS Pilot Plant, assistance of Native Fruit Development Program (February 2003); Other fruit--USDA National Nutrient Database for Standard Reference, Release 15 (August 2002)

[6] Compositional and Functional Properties of Saskatoon Berry and Blueberry, by G. Mazza. Published in the International Journal of Fruit Science, 5:3, June 2006.

[7] http://www.albertafruit.com/html/chef_s_corner.html

3.0 Saskatoon Berry Production

The saskatoon, *Amelanchier alnifolia*, is a member of the apple subfamily (Pomoideae) with the Rose family (Rosaceae). As a member of the rose family, it is related to the apple, pear, hawthorn, and mountain ash. The saskatoon is also know as serviceberry, sarviceberry, sarvis, maycherry, Juneberry, Junebush, shadblow, shadbush, shadberry, shadblossom, shadwood, sugar pear, Indian pear, grape-pear, lancewood, boxwood, Canadian medlar, bilberry, snowy mespilus, poirier and petites poires.

The first commercial Saskatoon orchards were established in the early 1970's and a second wave was established in the late 1980's and early 1990's.

Table 3.1: Saskatoon Berry Production in Canada (2002-2005)[8]

Province	2002	2003	2004	2005
	Marketed Value (Cdn. $Million)			
Canada	3,915	2,630	2,665	1,535
Alberta	1,550	930	1,230	425
Saskatchewan	1,760	1,135	930	910
Manitoba	265	315	285	160
British Columbia	285	200	200	30
	Marketed Volume ('000 lb.)			
Canada	1,810	1,540	1,425	955
Alberta	745	600	650	345
Saskatchewan	765	635	525	510
Manitoba	125	175	140	80
British Columbia	150	100	100	15
	Bearing and Non-Bearing Area (acres)			
Canada	2,780	2,815	3,190	3,415
Alberta	1,400	1,400	1,425	1,500
Saskatchewan	915	950	1,200	1,200
Manitoba	340	350	475	695
British Columbia	65	65	65	20

As can be seen in the above table, most of the saskatoons are grown on the Prairies, particularly in Alberta and Saskatchewan which represent nearly 80% of the acreage. Manitoba only represents 20% of the total Canadian acreage.

[8] Statistics Canada

3.1 Saskatoon Berry Production in Alberta

Saskatoon berry production represents the greatest acreage of small fruit crop production in Alberta. It has been estimated that there were 1,300 acres of saskatoons in Alberta in 2006 (Table 4.2).

Table 3.2: Estimated Fruit Crop Acreage in 2006 in Alberta[9]

Crop	Acres	Crop	Acres
Strawberries	400	Black Currants	350
Raspberries	250	Miscellaneous	60
Saskatoons	1,300		

Number of growers = approximately 250

Although there is considerable production in Alberta, there is demand for more commercial production (which does not include farm-gate products) to be used in processing. It has been estimated that in 2006, processor demand for saskatoons was over 1 million lbs. although they were not able to source the entire amount.

3.2 Saskatoon Berry Production in Saskatchewan

In 2004, there were approximately 550 fruit growers in Saskatchewan and an estimated 1,870 to 2,035 acres planted to fruit crops. Of those, saskatoon production accounts for the majority of small fruits commercially grown in Saskatchewan.

Table 3.3: Estimated Fruit Crop Acreage in 2004 in Saskatchewan[10]

Crop	Estimated Acres	Crop	Estimated Acres
Strawberries	250	Dwarf Sour Cherry	125 to 150
Raspberries	80 to 100	Apple	100
Saskatoon Berry	1,200 to 1,300	Chokecherry	80 to 100
Black Currants	15	Blue Honeysuckle	20

[9] Prairie Small Fruit Industry Roundtable Meeting Report, March 22, 2007

[10] http://www.agriculture.gov.sk.ca/Fruit_Overview

3.3 Saskatoon Berry Production in Manitoba

Manitoba has an active small fruit production industry that is dominated by strawberry production, most of which is marketed through U-Pick operations. From the table below, there were 600,000 lbs. of saskatoons marketed in Manitoba in 2005.

Table 3.4: Manitoba Fruit Crop Acreage 2005[11]

Crop	2001 #farms	2001 Area Planted (acres)	2005 Area Planted (acres)	2005 Area Harvested (acres)	Marketings (lb)	Average Price (per lb)	Total value[12] ($)
Apples	**26**	**56**	**55**	**25**	**295,000**	**$0.40**	**$118,000**
Raspberries	**96**	**127**	**235**	**180**	**203,000**	**$4.50**	**$914,000**
Saskatoons	**131**	**342**	**695**	**300**	**600,000**	**$2.75**	**$1,650,000**
Strawberries	**109**	**563**	**690**	**300**	**1,200,000**	**$2.05**	**$2,460,000**
Other fruit[13]	**40**	**180**	**194**	**68**	**68,000**	**$2.00**	**$140,000**
Total	**295**	**1,268**	**1,894**	**873**	**2,368,000**	**$2.34**	**$5,282,000**

In addition to the fruit crops listed in the above table, there are a few acres of sea buckthorn, sour cherries, and currants grown in Manitoba (Table 4.5)

Table 3.5: Estimates of Other Fruit Crops in Manitoba in 2006[14]

Crop	No. of farms	Acres planted	Acres Harvested
Sea buckthorn	40	120	2
Sour Cherry	10	10	0
Currants	10	10	10

[11] Prairie Small Fruit Industry Snapshot

[12] Based on retail direct farm sale values.

[13] Other fruit includes sea buckthorn, sour cherries, chokecherries, currants, and other miscellaneous fruits.

[14] Prairie Small Fruit Industry Snapshot

4.0 Saskatoon Berry Markets

There are several marketing channels available for saskatoon berries. Each market has its own advantages and disadvantages, which vary with the size and location of each orchard.

U-Pick Market

Most of Manitoba's current saskatoon production is marketed through U-Pick operations (either picked by customers or offered as a pre-picked product).

There are a number of benefits to marketing saskatoons through a U-Pick, including:

- It is suitable for small acreage grower or those just starting out;
- The grower has complete control of the product from the field to the consumer;
- Storage costs are minimal; and
- No post-harvest handling is required (cleaning and sorting, cooling, etc.).

However, there are other issues with respect to U-Pick operations that must be considered:

- There is a strong hospitality aspect to operating a U-Pick. Some U-Pick customers consider a visit to a U-Pick orchard as an outing. Growers may need to accommodate their guests with washrooms and playgrounds for children. The U-Pick orchard needs to have a higher level of aesthetics and sanitation than an orchard operated with hired pickers or mechanically harvested.
- Although the harvest is done by the customers, there must be considerable supervision to assure a thorough harvest. Nevertheless, it is common for growers to have pickers complete the harvest.
- Customers will judge their satisfaction with a U-Pick operation using a number of criteria, including: quality of fruit, ease of picking, friendliness of the staff, aesthetics of the orchard, proximity of orchard to home, etc.
- The grower probably needs to buy additional insurance to cover liability.
- All marketing and advertising must be done by the grower.

Before a grower embarks on U-Pick to market saskatoons, further considerations include:

- How far is a major population centre? Studies have indicated that 10,000 people are required to maintain one hectare of a U-Pick operation and the average distance a consumer will travel is 30 to 50 km.
- What is the local market for U-Pick saskatoons? What other U-Pick operations (for saskatoons or other berries) are in the area?

It is estimated that 2% of potential consumers go to U-Pick operations[15] and the average purchase is 10 lbs. of berries. Winnipeg's population is in the range of 680,000 people.[16] Thus, approximately 13,600 customers would be expected to buy a total of 136,000 lbs. of saskatoons.

[15] Estimate by processor of saskatoons (personal communication)

[16] http://www.winnipeg.ca/cao/pdfs/population.pdf

Farmers' Markets

Farmers' Markets are another good outlet for small orchards. Growers rent a stall space and can sell their produce to the public while the organizers of the market handle the advertising. Growers might wish to sell their fresh berries as well as their processed berries (pies, jams, toppings, etc.) at a Farmers' Market. As with a U-Pick operation, selling at a Farmers' Market allows the grower to fully control the production and the marketing of the berries. The disadvantage of this marketing channel is that it usually involves small sales volumes, and the grower must bear the entire burden of transportation and handling costs.

Farmers' Markets are popular with urban people because they give the consumer an opportunity to buy directly from the grower, and establish a relationship with those who produce the food.

Farm Gate Sales or Roadside Stands

If a grower is situated near a tourist attraction or near a city, a roadside stand offers some of the same advantages as a Farmers' Market without having to drive to the market site. As with the previous marketing channels, the grower has the same control of the production and marketing of the berries. However, farm gate sales or roadside stands are labour intensive and are probably better suited for small orchards.

Specialty Stores

Specialty stores such as gift shops at tourist attractions and airports sometimes sell fresh and processed fruit products. This market can be a premium priced market, but may be rather small in volume.

Bakeries and Restaurants

There is some demand for fresh and frozen berries from bakeries and restaurants. However, relatively small volumes are involved in this market and the grower would have to incur increased storage and transportation costs. Nevertheless, this market can be a premium priced market for saskatoon berries.

Packers/Brokers

Packers and brokers buy the berries from the grower and then wash, grade, package, and ship the fruit to the next step in the supply chain. The quantity of berries which could go through such a channel depends on the variety and size of the fresh and frozen saskatoon market. For the grower, the price received from packers/brokers is the main disadvantage of this marketing channel.

Processors

Processing berries adds value to the fruit. Individual growers have been, to some extent, processing their own fruit. However, for the total saskatoon market to expand, a significant processing industry will need to be developed. Unfortunately for the grower, a processor will pay considerably less for saskatoons than a U-Pick operation would garner. Moreover, the processor would need to be assured of a supply of berries.

The key question in dealing with processors is what type of berries do they want? Do they want cleaned and sorted berries? What type of quality do they want? Frozen or fresh? Growers need to know which type of product each processor is making and what type and quality of berry that processor is looking for. Processors may require growers to be on an On-Farm Food Safety (OFFS) program and an Environmental Farm Plan (EFP). In addition, processors may require growers to certify when pesticides were used in the orchard, and when the crop was harvested.

Wholesalers

Another marketing channel is one where wholesalers would buy washed, graded, and packaged fresh and frozen berries to sell to retailers. However, a grower who had a sufficiently large volume to sell may be able to sell berries directly into the retail market.

5.0 Orchard Management and Production Issues

This section lists the management issues that need to be considered when planning and establishing a saskatoon orchard.

5.1 Site Selection

Topography

If possible, orchard sites should have a slight slope (1 to 3%) so as to provide for the drainage of water and cold air. Low-lying areas which form frost pockets and are prone to flooding and standing water should be avoided.

Soil

The saskatoon will grow in all types of soil and a wide range of soil pH (5.0 to 8.0) provided that the soil is well drained. Since the root system for saskatoons is predominantly in the top two feet of the soil, they are particularly vulnerable to standing water. Thus, heavy clay soils lacking humus should be avoided. The best soil is a deep sandy loam with high organic matter (2-3% as a minimum) and a pH of 6.5 to 7.5. A gentle north-east slope will help to delay flowering in the spring.

Availability of Water

A source of water is required for irrigation, mixing pesticides, etc.

Shelterbelts

It is essential that the saskatoon orchard have a shelterbelt. Shelterbelts are important in the creation of a productive and long-lived orchard. [17] The reasons for growing a shelterbelt include to:

- Reduce surface wind speed;
- Increase the air temperature within the orchard during the day;
- Reduce soil moisture loss and evapo-transpiration;
- Help trap snow and maintain snow cover (thus helping to increase potential soil moisture reserves);
- Decrease soil erosion;
- Allow for better pollination;
- Partially screen the orchard from airborne fungal spores;
- Improve growth and yield and quality of fruit; and
- Enhance early maturity.

The proximity of the orchard to the shelterbelt must be well thought out. The orchard requires protection from the onslaught from the prevailing winds. However, the shelterbelt must allow sufficient air movement through the orchard so that disease can be kept to a minimum.

Shelterbelts should be situated on the north, west, and south sides of the orchard in order to reduce the effects of the prevailing winds in summer and winter. A shelterbelt will provide protection upwind for a distance 2 to 5 times its height, and downwind for a distance up to 30 times its height. Therefore, a 3 metre high shelterbelt will reduce wind velocity for up to 15 metres upwind and 90 metres downwind.

Ideally, shelterbelts should be planted 1 to 2 years earlier than fruit trees and they should be situated 10 to 15 metres from the first orchard row[18]. Shelterbelt rows should be spaced at a distance 10 times that of the

[17] Growing Saskatoons – A Manual for Orchardists, by Dr. Richard St. Pierre. Website: www.prairie-elements.ca/saskatoons.html

shelterbelt's height. Trees that are 50% permeable are considered the best for an orchard shelterbelt. Fast growing deciduous trees such as caragana, lilac, laurel willow, sharp-leaf willow, and green ash are good choices for shelterbelts. However, evergreens such as spruce or pine will provide the best long-term protection for the orchard.

5.2 Preparation of the Orchard Site

All of the producers interviewed regarded proper site preparation of the orchard to be extremely important. It is wise to use at least one year to prepare an orchard site.

The orchard site should be levelled and soil and water analyses be done during this time.

The use of herbicides and cultivation to render the orchard land weed-free prior to planting yields long-term dividends in the future.

The grassing of alleys can be done prior to or following planting of the rootstock. If done prior to planting the saskatoons, the entire orchard site would be sown with a grass cover such as sheep's fescue. Using glyphosate, the grass is killed in strips into which the saskatoon plants would be planted. Then the entire orchard site would be mowed, and mulch laid on the strips of killed grass, prior to transplanting the rootstock.

5.3 Planting

Planting can be achieved by equipment or by hand if the orchard is small. Although it is possible, planting 20 acres by hand would take significant labour. It is recommended that several cultivars be planted in the Saskatoon orchard.

Saskatoon plants are susceptible to transplanting shock and going dormant. Although root growth may occur after transplanting, shoots generally will remain dormant until the following season. Transplanting is usually done in late May to mid June, or in the late fall before the soil freezes provided that the rootstock has been hardened off. If etiolated cuttings, or micro-propagated plants are used, the orchard can be planted in mid-August thereby allowing time for further root growth, and for hardening off. Significant shoot growth is not apt to occur until the growing season after transplanting.

There is an advantage of planting in the spring while the plants are still dormant because the plants will not dry out due to the cool, moist soil environment. In addition, root growth occurs at lower soil temperatures which occur early and late in the growing season.

There are also advantages to fall planting of saskatoon plants. There is generally a lower risk of moisture stress at this time of the year, and the roots will grow at a significant rate until the soil temperature drops below 5^{o}C.

Row Spacing

Rows should be oriented with air drainage in mind. North-south rows will maximize the penetration of light into the plant canopy, whereas east-west rows will maximize air flow.

Plants are often planted between 2.5 to 3 feet apart. Between rows, spacing can range from 12 feet for Pick-Your- Own orchards to 18 feet for mechanically harvested orchards. However, there has been success using pull-type mechanical harvesters in orchards with 16.5 ft. row spacing. To calculate the number of plants per acre using the following formula:

$$\frac{43{,}560}{\text{(between row spacing in feet) X (between plant spacing in feet)}}$$

[18] Growing Saskatoons – A Manual for Orchardists, by Dr. Richard St. Pierre. Website: www.prairie-elements.ca/saskatoons.html

Wider spacing between plants within the row and between rows provides better orchard ventilation and help reduce the risk of disease problems. Narrow spacing within rows increase early yields and returns. For the period of 3 to 6 years following planting, a within-row spacing of 0.5 metres yields more than twice as much fruit as a within row spacing of 1 metre[19].

Although row length is not an issue for mechanically harvested commercial orchards, row length for U-pick operations should be no longer than 90 to 120 metres long[20].

Producers should be prepared for a minimum of 10% loss in the rootstock that will need to be replaced.

Alleys

It is common to seed grass in the alleys between the saskatoon rows. A variety of grass cultivars are used in the alleys, from sheep fescue to lawn cultivars. Suitable grass cultivars should be non-invasive, slow growing, and drought-tolerant. Sheep Fescue is often recommended because it is a densely-tufted, low growing, shade and drought tolerant, and hardy. Other grass evaluated by the PFRA Tree Nursery in Indian Head, Saskatchewan included Hard Fescue, Alpine Bluegrass, and Parkland Mix[21].

Grass alleys have the following advantages:

- Cooler soil temperatures thus decreasing soil moisture loss;
- Erosion control from wind and water;
- Control of some weeds;
- Ability to use mechanical harvesting even in wet conditions;
- Winter hardiness of the saskatoons may be increased because the grass alleys will compete with the fruit crop for moisture in early to late-fall;
- Less disruption to root systems of the saskatoon plants, less soil compaction and reduced orchard maintenance because cultivation is reduced.

However, grass alleys may:

- Harbour rodents which could damage saskatoon plants, especially if the alleys are not mowed sufficiently.

Mulching

Mulch helps suppress weeds and retain soil moisture for the growing plants. Mulch can be organic, such as wood chips, sawdust, dried grass, flax shives, and waste hay, or inorganic such as gravel, polyethylene sheets, and fabric sheets.

In comparing mulches, it is generally considered that black plastic mulches are the best choice in terms of cost, ease of management, and their effect on the soil environment and crop response. Although woven plastic mulches are permeable and stronger than simple plastic mulch, they are considerably more expensive than non-woven plastic mulches. UV-stabilized, polypropylene or polyethylene mulches have a lifespan of 5 to 10 years.

Mulches offer the following advantages to a saskatoon orchard:

- Conservation of soil moisture. Thin layers of organic mulch reduce soil moisture loss by 10%, while plastic mulch can reduce soil moisture loss by 50%.

[19] Costs and Returns for a Saskatoon Berry Orchard. Saskatchewan Agriculture. April, 2004. http://www.agriculture.gov.sk.ca/Default.aspx?DN=6b8ffe92-0a86-45b1-95d9-302c42c726f0

[20] Growing Saskatoons – A Manual for Orchardists, by Dr. Richard St. Pierre. Website: www.prairie-elements.ca/saskatoons.html

[21] Ibid

- Modification of soil temperatures. Black plastic mulches increase soil temperatures by 2 to 4°C while clear plastic mulches increase soil temperatures by 6 to 10°C. White or reflective mulches, on the other hand, decrease soil temperatures by 4 to 6°C, and organic mulches usually reduce soil temperatures by 2 to 3°C. Organic mulch tends to act as an insulation and prevents the soil from warming up, thereby delaying root growth and flowering.
- Weed control. Mulches, whether organic or inorganic, suppress weed emergence within the row.
- Soil structure. Mulches help to prevent soil erosion, decrease nutrient leaching, prevent soil crusting and enhance soil aeration. Some organic mulches may add soil nitrogen as they decompose.

The disadvantage of mulches is:

- Cost. The cost of mulching includes the mulch material, its application, as well as its removal and disposal.

The decision to use mulch in the saskatoon orchard also carries the need to use trickle irrigation.

5.4 Irrigation

Irrigation is considered most important during orchard establishment. The use and timing of irrigation once the orchard is in production depends on age, row spacing, soil type and climatic conditions.

The root zone diameter for saskatoon plants 4 years of age or older varies from 1.5-3.0 m.[22] Once the plants are established, one or two annual irrigations may be sufficient depending on the season.

Although producers could use a sprinkler or an overhead system for irrigation, there are definite advantages to using trickle irrigation, including:

- Allows frequent irrigation in the form of drops applied at slow rates;
- More cost effective – wide-row spacing and limited supplies of water make trickle irrigation the most cost-effective method. The use of sprinkler irrigation requires about twice as much water as does the use of trickle irrigation;
- Reduced weed growth because water is placed where it is needed, reducing the amount of soil surface wetted;
- Reduced runoff and deep percolation;
- Reduced weed growth because less soil surface is irrigated;
- Reduced incidence of plant disease because foliage is not watered;
- Allows for other field operations to continue;
- Wind has no effect on the application of water to the orchard;
- Fertilizer can be applied through trickle irrigation;
- Pumps required for trickle irrigation are smaller and leaks at connections are not as common as with sprinkler systems because operating pressures and flow rates are low; and
- Reduced labour and operating costs than for sprinkler systems because trickle irrigation is semi-permanent.

There are, however, several disadvantages of trickle irrigation, including:

- Clogging of emitter orifices with salts, algae, or soil;
- Salts may accumulate at the soil surface and toward the fringes of the wetted soil volume;
- Mechanical or rodent damage to the plastic pipes;

[22] http://www.omafra.gov.on.ca/english/crops/facts/info_saskatoon_production.htm#Irrigation

- Sunlight and other environmental factors may cause the plastic pipes to crack; and
- Trickle irrigation cannot protect saskatoon plants from frost, as sprinkler or overhead irrigation systems can.

Whatever irrigation system is used, care must be taken to ensure that the saskatoon plants are not irrigated too much. Excessive water can lead to root rot (especially in young plants), and may contribute to poor fruit quality. In years when rainfall is greater than normal, large yields of large fruit can be produced, but fruit flavour may be insipid and skin cracking is common.

5.5 Fertilization

It is common practice to fertilize the row prior to or after planting. Although this can be done using granular fertilizer, it is best done through the trickle irrigation system if possible. Fertilization is considered very important in the establishment of the orchard.

Once the orchard is established, fertilizer requirements are best determined through soil and tissue analyses. Annual monitoring of soil and leaf tissue analyses for several years will provide baseline information and can help detect an insufficient nutrient status. It is generally advisable to replace what nutrients are lost from the harvest of a fruit crop with fertilizer.

The timing of fertilization is considered to best done as a split application in May (prior to bud break) and in early June (shortly following petal fall). Post-harvest fertilization prior to leaf fall is not recommended because high levels of nitrogen would delay the development of winter hardiness.

It is generally considered that drip irrigation is a very efficient method of irrigating a saskatoon orchard. Using this irrigation system, water is delivered to the directly to the hedgerow, thus discouraging weed growth in the alleys. In addition, drip irrigation does not interfere with orchard operations such as pruning, spraying, and harvesting.

5.6 Maintenance of the Orchard

Pruning

Saskatoon plants which have never been pruned will produce strong central-leaders with very narrow and weak secondary branches. While some cultivars produce suckers profusely from lateral rhizomes, other cultivars grow more treelike and produce basal shoots from near the crown, but fewer suckers. Using proper pruning techniques, producers can alter growth and improve the plant's fruiting habits.

Regular pruning is necessary to ensure the ongoing productivity of the saskatoon berry orchard. The main purposes for pruning are:

- To establish a desirable shrub form and to modify the architecture of the plants and the hedgerow to adapt them to mechanical harvesting. Typically vase shaped plants best accommodate mechanical harvesting. For mechanical harvesting, the plants must be at an optimum height.;
- To remove damaged, diseased, and unproductive parts of the plant;
- Reduce suckering;
- Increase the production of fruiting wood;
- Increase the size and quality of fruit (i.e. increase yield);
- Delay maturity of the hedge row; and

Pruning should occur within the first year after planting in order to encourage the plant to develop into a multi-stemmed shrub rather than a plant with a strong central leader. During the non-fruiting years, the objective of pruning is to create a multi-stemmed crown and a vase-shaped hedgerow which will best accommodate mechanical harvesting. Pruning during this training phase should be done annually in the spring during the dormant season.

Once the plant begins fruiting, the main objectives for pruning are[23]:

- To maintain a vase-shaped hedgerow as narrow as possible at the base, preferably not much wider than 12 to 18 inches, by reducing suckering and maintaining separate root crowns;
- To maintain the hedgerow with a height not exceeding 7 to 8 feet by annually heading leaders and/or deadheading to lateral branches;
- To maintain a high annual and predictable yield by promoting new growth annually;
- To maintain the hedgerow in a healthy and vigorous state of growth; and,
- To replace some of the oldest canes annually through renewal pruning at the base of the root crown.

Careful consideration should be given to provide an open canopy, to reduce disease incidence, promote vigorous shoot, and maintain a balance between new high yielding shoots and older lower yielding shoots.

Yearly pruning should be carried out in late-March to early-May, prior to budbreak. Pruning for disease control may be carried out anytime between late-winter and late-fall. Pruning any diseased parts prior to harvest is essential if the orchard is machine harvested because disease can be easily spread throughout the orchard. After harvest, pruning damaged stems and branches is important in order to prevent disease development.

Using annual and regular maintenance pruning is an effective way of maintaining the saskatoon hedgerow indefinitely, without the need for radical rejuvenation.

Weed Control

Weed control is an ongoing challenge to saskatoon producers. However, some of this challenge can be alleviated if the site preparation of the orchard succeeded in maintaining a weed free status prior to transplanting.

5.7 Disease Issues

There are a number of diseases which could infect saskatoon berry plants and affect productivity, including:

- Entomosporium Leaf and Berry Spot;
- Saskatoon-Juniper Rust;
- Brown Fruit Rot, Mummyberry;
- Black Leaf, Witches Broom;
- Cytospora Canker and Dieback;
- Powdery Mildew; and
- Fireblight.

For information on saskatoon diseases, consult the Guide to Fruit Crop Production and the Guide to Fruit Crop Protection available through Manitoba Agriculture, Food, and Rural Initiatives.

There are a number of cultural practices that can help reduce disease problems, including:

1. Ensure that transplants are free of disease
2. Avoid planting in wet, poorly-drained soils, or in frost pockets
3. Ensure that there is good air movement in the orchard
4. Avoid planting near diseased plants

[23] Planting, Training and Pruning Saskatoons for Commercial Production, by C.C. Peters, Saskatchewan Agriculture and Food. August 15, 2005.

5. Disinfect pruning tools between plants
6. Prune to remove diseased material in dry weather during June and early-July
7. Avoid late-summer and fall cultivation, irrigation, and fertilization
8. Protect against rodent damage

The following table lists products that can be used to control for saskatoon berry diseases. All of the products listed are applied with a ground sprayer.

Table 5.1: Saskatoon Berry Disease Management Chart[24]

Disease	Product	Pre-harvest interval day(s)
Entomosporium Leaf and Berry spot *(Entomosporium mespili)*	Mission 418EC	38
	Funginex DC	60
	Kumulus DF	1
	Propiconazole 250E	38
	Topas 250EC	38
Fireblight *(Erwinia amylovora)*	Prune out infected shoots and branches at least 20 cm. below the visible symptoms, ensuring that the cutting tool is disinfected with a bleach solution after EVERY cut.	
Powdery Mildew *(Podosphaera clandestine)*	Nova 40W	14
Saskatoon-Juniper Rust *(Gymnosporoangium clavipes)*	Mission 418EC	38
	Funginex DC	60
	Topas 250EC	38

5.8 Insect and Mite Issues

There are a number of insects and mites which attack saskatoon plants, including:

- Two-spotted Spider Mite
- Leafrollers
- Aphids
- Leafhoppers
- Ugly Nest Caterpillar
- Woolly Elm Aphid
- Apple Curculio
- Cherry Shoot Borer
- Fall Webworm
- Hawthorn Lace Bug
- Pear Slug
- Saskatoon Bud Moth
- Saskatoon Sawfly

[24] Guide to Fruit Crop Protection 2004 Edition (with 2007 Addendum), Prairie Fruit Growers Association and Manitoba Agriculture, Food and Rural Initiatives.

The following table lists products that can be used to control insects attacking saskatoon plants. All of the products listed are applied with a ground sprayer.

Table 5.2: Saskatoon Berry Insect and Mite Chart[25]

Insect	Product	Pre-harvest interval day(s)
Apple Curculio, Hawthorn Weevil, Lygus bugs, Leaf Miner, Saskatoon Bud Moth, Sawfly	Decis 5.0 EC	21
Slugs	Sluggo	0
Wooly Elm Aphids	Orthene	11 months

5.9 Animal Issues

Birds

Birds are the most challenging vertebrates that the orchardist has to deal with. The use of netting has been shown to be effective and economically feasible in saskatoon orchards. However, the labour involved in the installation and removal of the netting can be onerous.

There is some indication that the birds feed on the fruit not only for food but also for water. Consequently, providing a water source for the birds can be a partial solution to this problem.

There are a variety of visual and audio scare devices available. Some growers have reported that natural predators such as hawks, owls, and magpies are effective repellents to birds. As a result, some growers endeavor to attract these predatory birds by hanging meat or dog food from a tree to attract magpies, or create artificial hawk nests and roosts near the orchard.

Another method of bird control is to install an electric fence above the orchard rows ensuring that pruning and harvesting operations are not interfered with.

Deer

Deer can be a problem in some orchards. Since the only control available is by building fences, growers must determine whether the damage caused by deer is worth the expense of building a fence.

Rodents and Rabbits

Rodents and rabbits can damage plants either by girdling them (mice and voles), or by eating young shoots (rabbits). Control methods range from managing the habitat, to various repellents, and poisons.

Managing the weeds, grass, and mulch can be a good method of cultural control of rodents and rabbits. Alleys should be kept mowed or regularly cultivated if not grassed. In the winter, rodents can be deterred by packing the snow in the orchard alleys with a snowmobile thereby making it more difficult for the rodents to move freely under the snow.

5.10 Harvesting

Maturity is based on berry surface colour. Generally, red to purple fruit are ready for harvest.

Harvest should be done in the cool of the day, either early in the morning or late in the evening, when field temperatures are below 20^{o}C. It is important that the fruit is cooled down as quickly as possible to avoid flavour loss.

[25] Guide to Fruit Crop Protection 2004 Edition (with 2007 Addendum), Prairie Fruit Growers Association and Manitoba Agriculture, Food and Rural Initiatives.

The use of mechanical harvesters is usually limited to orchards of 10 acres or more and having wide enough alleys to accommodate the equipment.

5.11 Primary Processing and Storage

Proper post-harvest berry handling is critical to successful marketing of saskatoon berries. There are a number of factors that contribute to a decrease the shelf life of fruit, including:

- Excessive use of nitrogen fertilizer;
- Excessive water;
- Cracked or bruised fruit could deteriorate further by decay;
- Fruit picked too early;
- Cooling of fruit following harvest was not adequate; or
- Long delays between harvesting and storage of berries.

Berries need to be picked in the morning (or late evening) before temperatures reach 20^{o}C, and cooled as quickly as possible. There are a number of methods to remove the field heat from the berries:

- Putting the fruit in a storage cooler. This is not a particularly efficient method;
- Cooling with ice where crushed ice is spread over the containers of fruit;
- Cold packs;
- Hydro cooling where the berries are immersed in chilled water. However, this method is best used for berries which are going to be frozen or processed; or
- Forced-air cooling – this is considered the most effective method of cooling berries.

In forced-air cooling, a fan is used to draw cold air through stacked containers within a cooler. This system can be set up either horizontally or vertically. The disadvantage of the horizontal system is that a large portion of the air can bypass the berries through the head space above the fruit in the containers. On the other hand, the cold air must pass through the entire stack of berry containers in the vertical system and is therefore considered to be a more efficient method.

When using forced-air cooling, it is best to cool the berries in one cooler, and then be stored in another cooler. This allows the field heat be removed from the berries more efficiently. Then, once the berries are cooled, they can be moved to the storage cooler.

When designing the post-harvest handling and cooling system, care should be taken to ensure that there are no major bottlenecks in the operation in terms of capacity or performance.

Cleaning and Sorting Berries

Whether the crop is hand picked or mechanically harvested, the berries will need to be cleaned and sorted in order to remove poor quality berries, as well as leaves and twigs. Ideally, berries should be cleaned and sorted before being cooled in order to reduce cooling costs. However, this should only occur if the berries can go through the cleaning and sorting phase quickly and be cooled within 3 to 4 hours of harvest[26]. For most growers, the cleaning and sorting phase represents a major bottleneck in their operation.

Washing Berries

[26] Growing Saskatoons – A Manual for Orchardists, by Dr. Richard St. Pierre. Website: www.prairie-elements.ca/saskatoons.html

If the saskatoons are to be sold into the fresh market, it is advisable that they not be washed as any excess moisture left on the fruit could promote deterioration. However, if the fruit is to be frozen or to be sold directly to a processor, the berries should be washed because most secondary processors do not wash fruit prior to processing.

Storage of Fresh Fruit

Good quality fresh saskatoons can be stored for a minimum of 2 weeks using modified atmosphere packaging (MAP). MAP is a storage method which uses plastic packaging to modify the atmosphere around the fruit by decreasing oxygen levels from 21% (atmospheric level) to 1 to 2% and increasing the carbon dioxide levels from 0.03% to more than 5%. However, the optimum storage temperature for saskatoons in modified atmosphere packaging is 0^{o}C.

Frozen Fruit

Freezing saskatoon berries on farm increases the market flexibility for growers, processors, and consumers by extending the length of time that saskatoons are available. Frozen berries can be sold directly to consumers, or to processors for many other products such as sauces, juices, toppings, etc.

The rate of freezing affects the quality of the berry. As a berry is frozen, the water in the cells expands and creates pressure on the cell walls and even ruptures them. However, if the fruit is frozen very quickly, structural damage will be prevented. Therefore, the objective for achieving high quality frozen saskatoons is to freeze them rapidly.

Individually Quick Frozen (IQF) berries can be produced by using a cryogenic freezer or a blast freezer. Although a cryogenic freezer is much faster at freezing fruit, the operating costs of a blast freezer are much lower. N.G. Stephenson[27] et al showed that saskatoon berries can be frozen within 1 hour to -10^{o}C with an on farm blast freezer if they enter the chamber at 5^{o}C (at the beginning of the harvest day). However, the warmer the berries were upon entering the blast freezer, the longer it took to achieve a frozen state. If the freezing process takes too long, then the cell walls rupture and the markets available for such a product are decreased considerably. Therefore, growers must size the various components of the post-harvest production processes and manage them to avoid serious bottlenecks and possibly unmarketable berries.

5.12 Renovation (Rejuvenation) of the Orchard

Proper pruning throughout the life of the saskatoon plant will prevent the maturation of the orchard and its associated productivity decline. In fact, it is possible to maintain the hedgerow at a proper height, width and shape indefinitely through the practice of regular pruning. While this may be the aim of every saskatoon berry producer, many will find that this level of maintenance will be too onerous and time consuming to undertake. Therefore, renovation of the orchard will be required in order to maintain productivity.

If the saskatoon plants have been allowed to grow to full maturity naturally with little or no proper pruning, renewal options needs to be considered. The challenge of this situation is that the roots will be massive and any removal of the top growth will produce an overwhelming amount of regrowth usually requiring at least one year of additional thinning (up to 100 cuts per crown)[28]. In fact, it may be easier to replant an orchard rather than attempting to rejuvenate a mismanaged orchard.

[27] On-farm blast freezing of Saskatoon berries, N.G. Stephenson, S. Cenknoski, W.E. Mir, M. Izydorczyk and S. Tessier. University of Manitoba. Canadian Biosystems Engineering, Vol. 44, 2002.

[28] Planting, Training and Pruning Saskatoons for Commercial Production, by C.C. Peters, Saskatchewan Agriculture and Food. August 15, 2005.

Peters[29] suggests that the best procedure is to remove a quarter or a third of the oldest branches as close to the ground as possible, each year until all the old wood is replaced. From the regrowth, a limited number of new replacement shoots (5 to 10 shoots total) were selected annually from as close to centre of the crown as possible and the rest were removed.

Another method which has been used and is certainly being talked about is radical rejuvenation involving removing all the growth at once. Although it requires little labour to cut the hedgerow down to the crown, more time and labour is required to thin the tremendous regrowth in the following year. Peters reports that there could be 100 to 200 new shoots/plant as a result of cutting the saskatoon plant down to the crown. In addition, the new growth could be highly susceptible to leaf diseases such as powdery mildew and Leaf and Berry Spot (Entomosporium). Furthermore, the row must be narrowed to 10 to 12 inches by removing all the wide sucker growth as close to the crown as possible.

An adaptation of the above method of radical rejuvenation involves cutting the hedgerow down to the crown followed by burning the remainder of the crowns with flax straw. While this was first done to eliminate disease from the orchard, it has been proven to be a more effective method of radical rejuvenation. The effect of burning the crowns results in killing all of the above ground portions of the plant as well as the shallow rooted suckers. As a result, a much narrower new hedgerow is created with fewer and stronger new shoots than the hedge that was only removed mechanically.

Peters[30] and other small fruit specialists on the prairies recommend that growers use proper pruning techniques during the establishment, training, and maintenance stages so that radical rejuvenation is not required. Proper annual maintenance and renewal pruning precludes the need for a complete and radical rejuvenation.

5.13 Quality Control

Quality control is important throughout the life of the orchard is important to ensure its long-term productivity. Management practices such as pruning, and disease and pest control must be performed at the proper time to maximize its benefits. It is especially important that pesticides be used judiciously and that the pre-harvest interval be honoured at all times.

To the market, whether that is to a processor or a consumer, quality control is of utmost importance. However, each market will have its own quality expectation. Regardless of the market, quality control during harvest and post-harvest handling can greatly affect the value of the berries. In addition to carefully harvesting the berries at the optimal time, cooling the berries immediately after harvest to remove the field heat is also important.

Growers must be aware of the quality expectations of their markets and strive to meet them. Some markets require clean and sorted berries, while others do not. Some processors will set their own grading standards for each product they produce. In some cases, processors can be flexible, using higher quality berries for high-end products and poorer quality berries for juicing. Therefore, processors and producer need to have good communication.

[29] Ibid

[30] Ibid

6.0 Saskatoon Rootstock Suppliers

Saskatoons may be propagated through the use of seed, suckers (rhizome sprouts), root cuttings, softwood cuttings, grafting, hardwood cuttings, cuttings from etiolated shoots, crown division, and through micropropagation.

Regardless of the method of propagation, it should be noted that the quality and vigour of planting stock can vary substantially, depending upon the source. In making a decision on rootstock sources, a grower must consider a number of criteria, including:

- Quality of the rootstock
- Timely delivery;
- Price of the rootstock. Does the supplier offer bulk discount?;
- Written guarantee of quality; and
- References from other saskatoon growers.

Table 6.1: Saskatoon Berry Rootstock Suppliers

Rootstock Supplier	Location	Source of Root Stock	Cultivars
DNA Gardens[31]	Innisfail, Alberta	Micropropagation	Smoky, Honeywood, Northline, Lee #8, Lee #3, Thiessen, Martin
AgriForest Bio-Technologies Ltd.[32]	Kelowna, B.C.	Micropropagation	Northline, Honeywood, Parkhill, Bluff, Forestburg, Lee #3, Lee #8, Martin, Nelson
Prairie Plant Systems Inc.[33]	Saskatoon, SK	Micropropagation	JB30, Honeywood, Martin, Smoky, Thiessen
The Saskatoon Farm	Okotoks, Alberta	Derived from seed	Northline, Smoky
Select Seedling Nursery[34]	Saskatoon, SK	Derived from seed	Martin, Thiessen, Northline, Smoky
Parentau's Berry Farm		Derived from seed	Thiessen
Glenlea Greenhouses[35]	Glenlea, MB	Etiolated cuttings	Smokey, Martin, Northline

[31] http://www.dnagardens.com/Index.htm

[32] http://www.agriforestbiotech.com/wholesale.htm

[33] http://www.prairieplant.com/saskatoon-berries.htm

[34] A division of Lakeshore Tree Farms, Saskatoon, SK. www.selectseedlingnursery.com

[35] http://www.glenleagreenhouses.com/index.html

7.0 Technology Sources for Irrigation, Pruning, and Harvesting Equipment

The table below shows a list of sources of various types of berry production and harvesting equipment. It is not suggested that these are the only suppliers or the best suppliers, but it may provide a good starting point for researching suppliers.

Table 7.1: Irrigation, Pruning and Harvesting Equipment Suppliers

Equipment	Company Name	
Harvesters	Littau Harvester 6881 E. Fifth Place Lynden, WA, 98264	Phone: (360) 398-9845 Fax: (360) 398-9756 www.littauharvester.com
Harvesters, spraying equipment	BEI Inc. 1375 Kalamazoo Street South Haven, MI 49009	Phone: (269) 637-8541 or (269) 637-4233 Toll Free: (800) 364-7425 www.bei-inc.com
Harvesters	Korvan Division, OXBO International Corp. 270 Birch Bay Lynden Road Lynden, WA 98264	Phone: (360) 354-1500 Contact: Brian Foote E-mail: bfoote@korvan.com www.korvan.com
Harvesters	Millshof Colony Glenboro, MB	Phone: (204) 827-2461 ext. 213 Contact: Harry Wollman
Harvesters	Northern Horticulture Equipment Box 752 Calmar, AB T0C 0V0	Phone: (780) 987-3217 Contact: Dave and Monica Turta E-mail: rainacre@telusplanet.net
Harvesters	Joonas Agritech Joonas International P.O. Box 222 80101, Joensuu, Finland.	Phone (604) 852-5016 Contact: Kerry Doyle Joonas Agritech Abbotsford, B.C.
Harvesters	Jovaras Harvester, Lithuania www.factory.lt NA Distributor: EPSI	Box 448, Warren, MB, R0C 3E0 Warren, MB epsi@mts.net Phone (204)227-5679
Sprayers, transplanters, rotovators	Eastern Farm Machinery Ltd. R.R. 3, P.O. Box 3613 Guelph, ON N1H 6P1 E-mail: sales@easternfarmmachinery.com	Phone: (519) 763-2400 Fax: (519) 763-3930 www.easternfarmmachinery.com
Grading, spraying, and washing equipment, mulch applicators	Willsie Equipment Sales R.R. # 1 9516 Northville Road Thedford, ON N0M 2N0	Email: info@willsie.com www.willsie.com
Irrigation, pruners	Michigan Orchard Supply South Haven, MI www.michiganorchard.com	Phone: (269) 637-1111 Toll-free phone: (800) 637-6426 Fax: (269) 637-7419
Irrigation	Even-Spray and Chemicals Ltd. 2-851 Lagimodiere Blvd. Winnipeg, MB R2J 3K4	Phone: (204) 237-9095 Fax: (204) 231-0710 www.evenspray.com/

Table 7.1 (continued)

Equipment	Company Name	
Irrigation	FUL-FLO Industries Ltd. Rosser, MB Fax:(204)633-5539	Phone: (204) 633-4414 Toll-free phone: (888) 223-2491 Email: info@ful-flo.ca www.ful-flo.ca/index.htm
Irrigation	Kroeker Machinery Sales 415 1st. St, Box 1026 Winkler, MB R6W 4B1 Fax: (204) 325-5150	Phone: (204) 325-4311 Toll-free phone: (800) 442-0601 www.kms.mb.ca/
Irrigation	Eljay Irrigation Ltd. #4 170 Murray Park Rd, Winnipeg, MB R3J 3X5	Telephone (204) 694-9442 Fax (204) 694-4075 www.eljay.com/
Irrigation	Mid-Plains Implements Ltd. Box 610, Carberry, MB. R0K 0H0 e-mail:midplns@mts.net	Phone: (204) 834-2515 Fax: (204) 834-2580 www.mid-plainsimplements.com/
Pruning	Growers Supply Co. Ltd. 2605 Acland Road Kelowna, BC V1X 7J4 info@growers-supply-co.com	Phone: (250) 765-4500 Fax: (250) 765-4545 www.growers-supply-co.com/index.html
Pruning	Zeller and Sons Enterprises Ltd. R.R. 1, 2360 Naramata Road Naramata, BC V0H 1N0	Phone: (250) 496-5338 www.zellerandsons.com/
Pruning	The Professional Gardener Co. Ltd. 915 23 Avenue SE Calgary, AB T2G1P1	Phone: (403) 263-4200
Pruning	Timm Enterprises Ltd. P.O. Box 157, Oakville, ON L6J 4Z5	Phone: (888) 769-8466 www.timmenterprises.com/Canhome/canhome.htm

8.0 Post-Harvest Berry Handling Technology Sources

The table below shows a list of sources of various types of post-harvest berry handling equipment. It is not suggested that these are the only suppliers or the best suppliers, but it may provide a good starting point for researching suppliers.

Table 8.1: Suppliers of Post-harvest Handling Equipment

Equipment	Company
Packing, grading	BEI Inc. 1375 Kalamazoo Street South Haven, MI 49009 Phone: (269) 637-8541 or (269) 637-4233 Toll Free: (800) 364-7425 www.bei-inc.com
Washing, packing	Michigan Orchard Supply South Haven, MI Phone: (269) 637-1111 Toll-free phone: (800) 637-6426 Fax: (269) 637-7419 www.michiganorchard.com
Cleaning, washing, packing equipment	Lakewood Process Machinery 11441 East Lakewood Blvd. Holland, MI 49424 Phone: (616) 392-6926 Toll-Free Phone: (800)366-6705 Fax: (616) 392-8977 www.lakewoodpm.com/lakewoodmfg
Cleaning and sorting equipment	Berry Fields Saskatoons Box 1, Site 10, RR2 Grande Prairie AB T8V 2Z9 Owners: Paulette & Earl Langenecker Tel: (780) 538-1034 Fax: (780) 538-1034 Email: bfields@telusplanet.net
Coolers and freezers	Coldstream Products Corp. 1001 Regent Avenue West Winnipeg, MB R2C4M2 Email : sales@coldstreamproducts.com www.coldstreamproducts.com/ Phone: (204) 669-1201 Toll Free: (800) 394-1004 Fax: (204) 654-5442
Coolers and freezers	Western Refrigeration Ltd. 1232 – 36 Ave NE Calgary, AB T2E 6M8 www.westernrefrigeration.com/default.asp Phone: (403) 250-9656 Toll Free: (888) 443-1946 Fax: (403) 291-9213

9.0 Risk Management

As with any business opportunity there are inherent risks that can cause results to be less favourable than expected. There are also several risk reduction strategies that can be employed to mitigate the negative impact of these risks.

Some of the more common risks include:

- Selection of poor quality rootstock – this topic was addressed in Section 6.0 of this document. Please review that section to see a range of suggested strategies to avoid selection of poor planting material;
- Lack of management experience could lead to reduced production levels (e.g. poor plant growth and/or berry yields due to excessive weeds, disease, drought impacts – lack of irrigation, etc.). Several strategies are available to minimize the impact of this risk including:
  - Conducting thorough research and using reliable sources of information;
  - Starting small – so that if problems do occur they can be more effectively managed at a small scale; and
  - Seeking professional assistance as required (potentially including agronomic, technological and financial management issues)
- Cash flow shortages – this can be avoided by using good financial planning and budgeting. The financial projections that are included should help producers to arrange their financing and cash flow planning. This topic is covered in Section 10.0 of this document. Please review that section to see a range of suggested financial management strategies;
- Securing profitable markets into which to sell your production volumes – this is a key part of the success of a saskatoon orchard. The marketing options are discussed in Section 4.0 of this document. Please review that section to see a range of suggested marketing options;
- The risk of the berry market suffering a sudden decline in demand is believed to be very modest. In fact, the trends in recent years have been very positive for berry consumption with increasing recognition of the health benefits of consuming berries of all kinds and saskatoons in particular;
- The risk of selling berries to a processor and then not receiving payment (e.g. because of poor management by the processors) will likely be a risk that producers will face as the processing/marketing industry becomes established. If producers become part of a well-structured and well-managed Value Chain and/or New Generation Co-operative this risk may be reduced significantly.
- The risk of establishing a saskatoon orchard can be reduced by purchasing saskatoon establishment insurance from the Manitoba Agricultural Services Corporation. The details of this program are shown below.

Saskatoon Establishment Insurance

Manitoba Agricultural Services Corporation provides coverage to Manitoba producers who grow saskatoons commercially and sustain losses due to natural causes during the establishment phase. This program insures saskatoon plants for a three-year establishment phase. Saskatoon Establishment Insurance remains in effect from year-to-year until cancelled by the producer. A premium is charged each year of the three-year establishment period.

To qualify for Saskatoon Establishment Insurance producers must:

- Have a PI Contract of Insurance;
- Grow saskatoons commercially;
- Transplant the saskatoon plants on or before June 20 for spring planting;

- For fall transplants – between August 15 and November 30;
- Have a minimum of 500 establishing plants; and
- Insure all plants in their first, second and third year of growth.

The premium for the Saskatoon Establishment Insurance program is cost shared 40% by the producer, 36% by the Government of Canada and 24% by the Province of Manitoba. Producers pay $0.0742 per plant ($7.42 per 100 plants) for the 2008 insurance year.

For 2008, the established dollar coverage is $3.50 per plant and reflects the replacement value of the saskatoon plants. A 20% deductible is applied to all claims.

10.0 Financing the New Saskatoon Orchard

There are many different types of lenders. Banks, credit unions, Farm Credit Canada, and Manitoba Agricultural Services Corporation all focus on different types of programs and each has a specific lending criteria and security requirements. With a new orchard in an emerging industry, it is anticipated that most lenders will require an increased level of equity, including the possible requirement of personal guarantees and a lower level of total debt prior to providing the debt financing.

It is important to recognize several general requirements of lenders:

- To avoid losing credibility, it is necessary to do sufficient research about what type of loan each lender will approve, before submitting a proposal or business plan requesting the completion by the bank/credit union of a draft term sheet.
- Lenders will typically focus their questions on the management of the business, because their experience shows this is a common deficiency.
- Lenders will want to see that there is a good understanding of the risks and of the need for strong financial management systems during the establishment of the orchard and the start-up of the business.

Some of the lenders that may be considered include:

- Credit Unions
- Banks
- Provincial government lending agencies such as Manitoba Agricultural Services Corporation (MASC) Website: www.masc.mb.ca/masc_lend.nsf/%20lend_home.html
- Farm Credit Canada offers a number of loans that may benefit saskatoon orchardists, including the 1-2-3 Grow Loan[36]. This loan provides deferred payment options to producers starting or expanding an enterprise that will have a reduced income stream for one to three years. The option gives them time to build a business and earn revenues before making loan payments.

[36] http://www.fcc-fac.ca/en/aboutus/profile/loanproduct_e.asp

11.0 Cost of Production & Financial Analysis

The Cost of Production budgets and sample financial projections are included in the Manitoba Saskatoon Cost of Production Guide. The key assumptions that were used in the preparation of these projections are summarized in the following sections.

11.1 Key Assumptions

The financial projections are based on a number of assumptions, including:

- The 20-acre orchard is planted over 4 successive years (i.e. five acres per year). As a result, all phases of the orchard management are staggered. Therefore, the first berries will be produced (in Year 4) on the first five acres and on each succeeding year, a new quadrant will come into production.
- The estimated costs of planting the 20-acre orchard are in the range of $69,000 or $3,450 per acre.
- Although it is possible to prune sufficiently so as to remove the need to renovate an orchard, most growers find that renovation is required at about Year 12 after planting (after approximately eight years of production). Because the planting is staggered, the need for renovation will also be staggered. Although the planting is staggered by 1 year for 4 successive years, it is assumed that the renovation will be staggered every 2 years. Therefore Orchard A (the first quadrant to be planted) will be renovated following the harvest in Year 11, while Orchard B, C, and D will be renovated after harvesting in Years 13, 15, and 17 respectively. It is assumed, to be conservative, that there would be a radical renovation and that there would be no production in the following year (e.g. Year 12) and only a small amount of production from that part of the orchard in Year 13. It is further assumed that production would recover more quickly than with a new planting, but that it would still take until Year 16 for production to return to pre-renovation levels in the renovated orchard. It is believed that this is a very conservative assumption.
- The 20 acre orchard would be harvested mechanically.
- The orchard would be planted with 16.5 foot alleys, and 3 ft. between plants resulting in 880 plants/acre.
- The alleys would be seeded to a grass such as sheep fescue. The alleys will be mowed as required.
- Plastic mulch would be used in the saskatoon plant row to suppress weed emergence.
- Trickle or drip irrigation will be installed during planting in order to assure good plant establishment, and to augment water during the productive years.
- A shelter belt would be established around the entire orchard (the costs for this are not included in the budgets).

11.2 Capital Costs

The capital cost for the 20-acre orchard is estimated to be:

- The capital costs for land, machinery and other equipment costs are in the range of $200,000;
- Other equipment costs include: storage shed, berry handling equipment, freezers, and irrigation equipment. These costs are estimated at $99,000;
- Land is valued at $1500/acre with the yardsite valued at $12,500 (5 acres at $2,500/acre);
- Tractor, sprayer, mower, cultivator, harvester, and pruning equipment costs $59,500.

11.3 Income Statement

The Income Statement is based on a selling price of $2.00 per pound and on the assumptions listed in Section 11.1. It is believed that the Income Statement and the associated documents are based on conservative assumptions. Costs to establish the orchard are accounted amortized over 20 years.

At a selling price of $2.00 per pound, the model saskatoon orchard becomes profitable in Year 7 with a profit of $9,630. On a cumulative basis, the orchard becomes profitable in Year 10 with a profit of $50,424. After 20 years, the cumulative profit is $466,224.

11.4 Cash Flow Statement

The Cash Flow Statement accounts for the expenses when they occur. Because there are high costs to establish the orchard, Years 1 to 4 have negative annual cash flows. However, the cash flows turn positive thereafter. On a cumulative basis, the cash flow is positive in Year 10 with a cumulative cash flow of $21,012.

11.5 Accrual Basis Financial Information

To provide information appropriate for making decisions regarding feasibility, it is necessary to develop accrual basis financial projections. New owners of saskatoon orchards need this information to make sound financial decisions. Also, lenders and will typically not accept any other standard for the preparation of financial projections.

11.6 Worksheets and Supporting Detail

The supporting worksheets in the Manitoba Saskatoon Cost of Production Guide analysis detail the establishment and harvesting costs for the orchard.

11.7 Sensitivity Analysis

Since it is impossible to accurately estimate the selling price of saskatoon berries, a sensitivity analysis is included in the Cost of Production analysis. The base case for the Income Statement used $2.00 per pound. In the Sensitivity Analysis, the price of berries was changed to 20% above and below the base price of $2.00 per pound.

In the pessimistic case, using a selling price of $1.60 per pound, the orchard becomes profitable in Year 7 with a net return of $1,330. This is $8,300 less than the base case in which berries are priced at $2.00 per pound. Cumulatively, the orchard is profitable in Year 11 with a cumulative profit of $40,454. After 20 years, the cumulative profit is $255,224.

An optimistic scenario was also explored, using a berry price of 20% higher than the base case of $2.00 per pound. Using $2.40 per pound, the orchard becomes profitable in Year 7 with a net return of $17,930 or $8,300 higher than the profit in the base case. The orchard becomes profitable on a cumulative basis in Year 9 with a net return of $28,194. After 20 year, the orchard's cumulative profit is $677,224.

12.0 Determination of Feasibility and Summary

From the above analysis, it appears that a 20-acre saskatoon orchard is financially feasible. Even in the most pessimistic scenario, the orchard is profitable by Year 7.