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# **Q**uality & Nutritive Value Of Saskatoon Fruit

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## **Introduction**

Orchard management techniques and cultivar selection can have a substantial effect on fruit quality. Once fruit is harvested, quality rarely improves, therefore storage and delivery systems must be able to maintain the quality of the fruit until it reaches the consumer. Fruit which deteriorates or falls below acceptable quality before it can be sold, decreases profits.

Fruit quality characteristics are evaluated to determine which cultivars are the best for specific purposes, better orchard management practices, harvest techniques, the effect of storage and/or the feasibility of processing.

## **How Is Fruit Quality Determined?**

Fruit quality is defined in terms of chemical, physical and sensory characteristics. Microbiological analysis is not routine in the testing and grading of fresh fruit, although it is expected that the fruit would be free from visible growth of molds or bacterial rot. Physical analyses include size, texture, viscosity, colour and fruit firmness before and after storage. Chemical analyses include dry matter content, sugar content, acidity levels, moisture content, benzaldehyde content (this

chemical is responsible for the almond flavour found in cooked saskatoon fruit). Sensory characteristics include sight (colour, size, shape, cosmetic appearance), smell (aroma of the fruit), touch (texture), taste (flavourful, sweet, sour, salty or bitter), or sound (the crispness of an apple).

### ***Fresh Weight***

Fresh weight refers to the weight in grams of a single fruit or the weight of a stated measure of fruit (eg. weight per 250 mls of fruit). Fruit seediness is correlated with fruit weight; larger fruit generally have more seeds.

### ***Soluble Solids Or Dissolved Solids Content***

Soluble solids are the sugar content of the fruit. Soluble solids content is often reported as °Brix. A reading of 12 °Brix would indicate a sugar content of the fruit of 12%.

### ***Dry Matter Or Moisture Content***

Dry matter content is a measure of the quantity of total solids in the fruit. Dry matter content is determined by removing all the moisture from the fruit and then weighing the solids which remain. It is generally reported as a percentage. A dry matter reading of 13.5% indicates that in 100 grams of fresh fruit, there were 13.5

grams of solids and 86.5 grams of moisture. Some analysts will report the moisture content, which would be 86.5%; either method of reporting is acceptable.

### ***Colour***

A very common colour analysis method utilised by the food industry is done with the Hunterlab Colorimeter. It is a detector which reports the degree of lightness or darkness and redness or blueness of a fruit sample and gives these characteristics a numerical value.

### ***Anthocyanin Content***

Anthocyanins are the chemical components of fruit responsible for the red and blue colours. Cyandin-3-galactoside is the major anthocyanin in saskatoon fruit.

### ***pH***

pH is a measure of acidity and the pH scale is calibrated from 1 to 14. Measurements below 7 indicate an acid solution and measurements above 7 indicate that the solution is alkaline or basic, while a reading of 7 indicates neutrality. The pH of foods is used as an indicator of bacterial spoilage. Foods closer to neutrality are generally more susceptible to microbial spoilage. Fruits are on the acid side of the scale and therefore slightly more resistant to bacterial spoilage.

### ***Titrateable Acidity***

Titrateable acidity is a measure of the quantity of organic acids within the fruit and can be reported on a gram or percentage basis. It can be a useful measurement for

determining if fruit are under or over-ripe.

### ***Firmness***

The amount of force required to compress or shear a sample of fruit can often be an indicator of fruit quality. Fruits which are too firm or too soft can be over- or under-ripe. This test can be useful when assessing various storage regimes.

## **Preliminary Evaluation Of Fruit Quality Of Saskatoon Cultivars**

Saskatoon fruit collected from 16 cultivars from five sites in Saskatchewan were evaluated for fruit quality after the 1995 crop year. Although these results are preliminary, the results of this work follow.

### ***Soluble Solids Content***

At irrigated sites, the fruit collected had a range of soluble solids content of 9.1 to 16.9 °Brix. At an unirrigated site, soluble solids content was 16.8 to 22.9 °Brix. Soluble solids can be manipulated by the quantity of water applied through irrigation to the crop.

### ***Moisture Content***

The fruit from irrigated sites had moisture contents ranging from 76.9 to 84.1%; fruit from the unirrigated site were lower in moisture and ranged from 71.2 to 77.4%. Fruit from the unirrigated site were smaller, sweeter and contained less moisture. Such fruit may be very good for processing into jam and jelly, but might not be as acceptable to a U-Pick customer.

### *Anthocyanin Content*

The anthocyanin content of the fruit was analyzed to determine if differences could be detected amongst cultivars. During the 1995 growing season, only 5 cultivars produced fruit in sufficient quantities to be analyzed for anthocyanin content. The analyses indicated that there were cultivar differences. The cultivar Martin had a higher anthocyanin content than did the cultivars Regent, Parkhill, or Honeywood.

### *pH*

The results of the pH analyses indicate that the cultivars analyzed had a wide range of pH's which could have an effect on processing quality. Fruit with a low pH, Martin (3.69 ) and Thiessen (3.72), had greater anthocyanin contents than did Honeywood (pH 4.02) and Regent (pH 4.03). Fruit with a low pH have a more intense color.

### *Hunterlab Colour Analysis*

A weak juice extract and the whole fruit of each cultivar were analyzed for colour using this instrument. It was noted that those cultivars with higher pH's produced juice extracts which were less purple in colour and in extreme cases turned an apricot - brown colour when heated. There was very little difference among cultivars in the purple colour of ripe saskatoon fruit which had been frozen, thawed and tested.

## **How Are Fruit Quality Analyses Utilized?**

Fruit quality analyses are used to determine if the fruit are ready to harvest, if the fruit are of acceptable quality for processing, to improve current cultivars, and to allow fruit breeders to assess potential new cultivars.

As saskatoon fruit mature, the fruit changes from a green to red to a deep-purple colour. Once this has occurred, it is assumed that the fruit have completed ripening. Over-ripe fruit will also be this deep-purple colour. Harvesting fruit when they have reached the just-ripe phase may allow for longer storage and transit times than if fruit are allowed to over-ripen.

In blueberry crops, a maximum ratio of soluble solids to titratable acidity of 18 is considered desirable for fruit that are to be transported to market. As blueberries become over-ripe, the amount of titratable acidity begins to decrease. This decrease in the titratable acidity causes the sugar to acid ratio to rise above 18 and therefore the fruit are less desirable to buyers.

Processors of fruit products may have specifications which the fruit must meet to be considered acceptable for processing. Processors may require certain cultivars known to have characteristics which are desirable for their products, they may require the fruit to be chilled immediately after harvest and shipped in this manner to prevent the continued respiration of the fruit, or their demands may be as simple as wanting a shipment of saskatoon fruit with an average sugar content of

16°Brix. These processors may use one or several of the above tests to determine if they are receiving the fruit required for their method of processing.

Improvements in cultural practices can lead to improved fruit quality, therefore fruit quality analyses are useful for comparing results of orchard management techniques. Once the quality characteristics of the currently available saskatoon cultivars have been adequately defined, it will be much simpler to assess new selections to determine if they are superior in any way.

## Nutritive Value Of Saskatoon Fruit

The following table provides an overview of the nutritive value of saskatoon fruit in terms of the typical characteristics of water content, sugars, fat, protein, fiber, mineral constituents, and caloric content.

Characteristic	Value	Comments
Water	75 to 80%	
Sugar	11 to 19%	Primary sugars are fructose & glucose
Protein	1.9 to 9.7%	
Fat	0.8 to 4.2%	
Fiber	3.8 to 19%	
Iron	55 to 79 ppm	12 to 22% of RDA; higher than blueberries or strawberries
Potassium	244 to 300 mg/100 g fruit	10% of RDA; higher than blueberries, strawberries or oranges
Magnesium	400 mg/100g fruit	100% of RDA; higher than blueberries or strawberries
Calcium	88 mg/100 g fruit	11% of RDA; higher than red meats, most vegetables & cereals
Sodium	0.6 to 1 mg/100 g fruit	low
Manganese	1.4 mg/100 g fruit	34% of RDA
Carotene	0.59 mg/100 g fruit	20% of RDA
Seed to Pulp Ratio	7.6 g/100 g fruit	
Calories	55 to 75 kcal/100 g fruit	

RDA = required daily allowance; ppm = parts per million

## Saskatoons As Nutraceuticals And Functional Foods

Nutraceuticals are products, obtained from foods, which offer health benefits including the treatment and prevention of chronic diseases. These products are sold in powders, pills and other medicinal forms. Functional foods are foods, in natural or processed form, which are consumed as part of a diet, but which contain substances that promote health, physical capacity and the mental health of an individual.

Fruits and vegetables contain natural chemicals which may help to reduce the incidence of chronic diseases. For saskatoons, these natural chemicals include some that are called phenols. Phenols protect plants from oxidation damage, that is, they are antioxidants, and in the human body they carry out the same function. The phenol group includes a subgroup called anthocyanins. Anthocyanins are responsible for the purple colour of saskatoon fruit and have antioxidant properties. Antioxidants may help prevent heart disease, stroke, cancer, cataracts, Alzheimer's disease, arthritis and other chronic illnesses associated with aging. Because saskatoon fruit contain an abundance of anthocyanins, they represent opportunities for the development of new health-promoting products, namely nutraceuticals and functional foods.

Saskatoon fruit are comparable to bilberries and blueberries in terms of total antioxidant activity but with respect to anthocyanin content, bilberries contain 2-3 times as much anthocyanins as saskatoons

and blueberries. Bilberries are currently the standard for comparing anthocyanins among other small fruit. The anthocyanin content of saskatoons and blueberries is close.

Processing saskatoons into syrups, jams, pie-fillings, toppings and juice concentrates may increase antioxidant activity and anthocyanin content because these value-added products contain concentrated fruit extracts.

Saskatoon fruit also have potential to become natural food colourants.

Anthocyanin pigments are being considered as replacements for banned artificial dyes in foods; anthocyanins dissolve easily in water and they have an attractive colour. Because of the abundance of anthocyanins in saskatoons, the fruit can be incorporated into processed foods.

## Further Reading

Mazza, G. 2000. Potential Health Benefits of Saskatoon Berries. *Prairie Fruit Journal* Volume 7, Issue 1, Pages 3-4.

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