

## Sea Buckthorn: New Crop Opportunity

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Sea buckthorn (*Hippophae rhamnoides* L., Elaeagnaceae) is a winter hardy, deciduous shrub with yellow or orange berries (Bailey and Bailey 1978). It develops an extensive root system rapidly and is therefore an ideal plant for preventing soil erosion and land reclamation. It can withstand temperatures from  $-43^{\circ}$  to  $40^{\circ}\text{C}$  (Lu 1992). It is considered to be drought resistant (Heinze and Fiedler 1981); however, irrigation is needed in regions receiving  $<400$  mm of rainfall per year for better growth (Li and Schroeder 1996).

### BOTANY

Sea buckthorn is a dioecious multi-branched, thorny shrub, reaching 2 to 4 m in height with stout branches forming a round often symmetrical head. It has brown or black rough bark and a thick grayish-green crown (Rousi 1971). Staminate and pollinate flowers are inconspicuous appearing before the leaves. Leaves are alternate, narrow 4 to 6 cm long, and lanceolate with a silver-grey color on the upper side (Synge 1974). Flower buds are formed mostly on 2-year-old wood, differentiated during the previous growing season. Fruit is subglobose, 6 to 10 mm long and 4 to 6 mm in diameter, turning yellow to orange when mature in mid Sept. The root system is characterized by nitrogen fixing nodules (Akkermans et al. 1983).

### NUTRACEUTICAL VALUES

Sea buckthorn can be used for many purposes and has momentous economic potential. It has been used for centuries in Europe and Asia. Recently, it has attracted considerable attention from researchers around the world, including North America, mainly for its nutritional and medicinal value. The fruits are rich in carbohydrates, protein, organic acids, amino acids and vitamins. The concentration of vitamin C in sea buckthorn fruit, ranged from 100–300 mg/100 g fruit, is higher than strawberry, kiwi, orange, tomato, carrot, and hawthorn (Bernath and Foldesi 1992; Lu 1992). Sea buckthorn is also high in protein, especially globulins and albumins, and fatty acids such as linoleic and linolenic acids. Vitamin E content in sea buckthorn (202.9 mg/100 g fruit) is higher than wheat embryo, safflower, maize, and soybean.

Medicinal uses of sea buckthorn are well documented in Asia and Europe. Clinical tests on medicinal uses were first initiated in Russia during the 1950s (Gurevick 1956). Sea buckthorn oil was formally listed in the Pharmacopoeia in 1977 and clinically tested in Russia and China (Xu 1994). The most important pharmacological functions attributed to sea buckthorn oil are: anti-inflammatory, antimicrobial, pain relief, and promoting regeneration of tissues. Sea buckthorn oil is also touted as a treatment for oral mucositis, rectum mucositis, vaginal mucositis, cervical erosion, radiation damage, burns, scalds, duodenal ulcers, gastric ulcers, chilblains, skin ulcers caused by malnutrition, and other skin damage. More than ten different drugs have been developed from sea buckthorn in Asia and Europe and are available in different forms, such as liquids, powders, plasters, films, pastes, pills, liniments, suppositories, and aerosols. Sea buckthorn oil extracted from seeds is popular in cosmetic preparations, such as facial cream (Li and Wang 1998). In Europe and Asia, there are numerous products made from sea buckthorn, such as tea from leaves, beverages and jam from fruits, fermented products from pulp, and animal feeds from leaves, pulp, and seed residues.

### NEW CULTIVAR: INDIAN-SUMMER

A new cultivar in Canada, 'Indian-Summer', is being released by the Prairie Farm Rehabilitation Administration (PFRA), Shelterbelt Center at Indian Head, Saskatchewan in co-operation with the Pacific Agri-Food Research Center, Agriculture and Agri-Food Canada, at Summerland, British Columbia (Schroeder et al. 1996). It is a seed-propagated cultivar that originates from a hedge located at the PFRA Shelterbelt Center. This accession was obtained from the Morden Research Station, Morden, Manitoba in 1963 as rooted cuttings. The original plants are growing in a seed block at the Shelterbelt Center. The progeny has been tested as Accession E5098 in advanced evaluation and field plantings to determine soil and climatic adaptation.

'Indian-Summer' is well adapted to growing conditions on the Canadian prairies. In the last 20 years, it was tested at 12 sites in Manitoba and Saskatchewan and 'Indian-Summer' performed well on a variety of

soils including moderately saline sites. It shows above average drought tolerance and is fully hardy (Ouellet and Sherk 1967). The most limiting factor affecting growth and survival was weed competition. After twenty growing seasons, the height of established plants ranged from 3 to 4 m (Schroeder and Walker 1994). Indian-Summer will not tolerate prolonged flooding or poorly drained soils. Fruit production ranged from 4 to 5 kg per shrub. Analysis of fruit samples showed average ascorbic acid content of 165 mg/100 g of fruit. Seed oil content averaged 11.9% and contained 31.2% protein, 88.3% to 89.1% unsaturated fatty acids, particularly linolenic acid (32.3%), linoleic acid (40.8%), and oleic acid (15%). Other constituents of the seed oil included gamma and alpha tocopherol.

Based on performance studies conducted by the PFRA Shelterbelt Center the projected area of adaptation for 'Indian-Summer' sea buckthorn was determined to be the prairie and boreal plain ecozones of Alberta, Saskatchewan and Manitoba (Ecological Stratification Working Group 1994). The average annual precipitation of the area of adaptation ranges from 300 to 500 mm. The average annual temperature ranges from 0°C to 3.5°C, average frost-free period is 85 to 130 days. The plant hardiness zones (Ouellet and Sherk 1967) include zones 1a, 1b, 2a, 2b, 3a, and 3b. The annual minimum temperatures range from -40°C to -50°C.

### SEA BUCKTHORN CULTIVATION

Recently, sea buckthorn has been recommended for orchard-type cultivation in British Columbia and the prairie provinces. Sea buckthorn normally is transplanted or directly seeded in the spring. It grows best in deep, well drained, sandy loam soil with ample organic matter. In arid or semiarid areas, water must be supplied for establishment. Soil acidity and alkalinity, except at extreme levels, are not limiting factors, although it thrives best at pH 6 to 7. Sea buckthorn is sensitive to severe soil moisture deficits, especially in spring when plants are flowering and young fruits are beginning to develop (Li and McLoughlin 1997). Sea buckthorn, like other crops, requires adequate soil nutrients for a high yield of good-quality fruit. It responds well to phosphorus fertilizer. Nitrogen fertilization can adversely affect root nodulation and it delays the development of nodules after inoculation with *Frankia*.

Recommended plant spacing for sea buckthorn is 1 m within the row and 4 m between rows to allow equipment access, with rows oriented in a north-south direction to provide maximum light. The ratio of male to female plants is important for maximizing the number of fruit-bearing trees. Recommendations for male:female ratios vary with plant density and region. In British Columbia, with an orchard planting of 4000 trees/ha, a 1:6 to 1:8 male:female ratio is considered adequate. Moderate pruning of sea buckthorn will increase the yield and reduce fluctuation of fruiting from year to year. The crown should be pruned annually to remove overlapping branches, and long branches should be headed to encourage development of lateral shoots. Weed control is very important in sea buckthorn plantings, especially for promoting growth of newly planted seedlings (Li and McLoughlin 1997).

### CONCLUSION

Sea buckthorn is a unique and valuable plant species currently being domesticated in various parts of the world. The species has been used to a limited extent in North America for conservation plantings, but the use of food and non-food sea buckthorn products has not been pursued. The plants are easily propagated and yields are relatively high, and production is reliable, with the potential market mainly in Europe at the moment. Most sea buckthorn research has been conducted in Asia and Europe in the past and Canada has increased its research recently. Unique plant products, especially those with proven nutritional quality, are gaining popularity in North America. Development of a North American sea buckthorn industry presents a unique opportunity for agricultural production of a value-added crop on marginal land.

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