Producing Sea Buckthorn of High Quality. Proceedings of the 3-rd European Workshop on Sea Buckthorn EuroWorkS2014. Natural resources and bioeconomy studies 31/2015. Naantali, Finland. P. 36-42

EXPERIENCES ABOUT SEA BUCKTHORN CULTIVATION AND HARVESTING IN LATVIA

Andrejs Bruvelis

andrejsbruvelis@gmail.com

Association of Latvian fruit growers, Bezdeligu str. 12, Riga, LV – 1048, Latvia

Abstract

A survey of the sea buckthorn cultivation history and management of orchards in Latvia is presented. There are several groups of sea buckthorn varieties, grown commercially in different regions of EU countries. Each group represents specific genotype adapted to certain climate. The influence of climatic conditions on the choice of sea buckthorn varieties grown in Baltic States is described. Among other orchard maintenance work a special attention is paid to supply of sea buckthorn plants with water and nutrients. Prospective sea buckthorn crop in Latvia can be harvested mostly on sites with controlled irrigation and fertilization. Functions of the sea buckthorn root system separate parts are studied to achieve the maximum effect of the irrigation and fertilization. Biological and economic benefits and disadvantages of the large and small plantations are evaluated. A separate chapter is given to represent some specific intelligent harvesting methods – vertical split and horizontal split of shrubs, as the primitive cut-harvesting is not suitable for varieties grown in Baltic States.

Key words

Varieties, irrigation, fertilization, roots, harvesting.

History, statistics and market situation

Sea buckthorn (SBT) is not a native plant in Latvia, though fossil pollen records indicate its presence in postglacial raw soils. Until 1980 only wild sea buckthorn seedlings from Kaliningrad region were grown in Latvia along the roadsides as windbreakers and have been planted for recultivation of used dolomite, sand and gravel pits. There were several trials of SBT introduction in Baltics of Russian continental varieties from Altai region. This group of varieties belongs to ecotype *Hippophae rhamnoides ssp. mongolica*. They were not able to adapt to Baltic maritime climate with frequent winter thaws. In 1984 another introduction trial took place, using different group of varieties. As these varieties have been bred by crossings among *H. rhamnoides ssp. mongolica, H. rhamnoides ssp. rhamnoides* and *H. rhamnoides ssp. fluviatilis*, the adaptation was more successful mainly due to the presence of *H. rhamnoides ssp. rhamnoides* genes. Since then they are still grown in Latvia and Estonia.

There are about 350 ha of SBT orchards in Latvia, about 250 ha of them are in the age of harvesting. Average yield is 4 tons/ha. Harvesting is done by cutting off the whole branches. Until last year most of harvested fruits were consumed by local processing companies, producing different SBT drinks. On year 2014 situation was changed – several local and Estonian enterprises made a big demand of non- processed fresh fruit bearing branches. Gross price (fresh fruits on cut branches) raised from 1,00 EUR/kg in season 2013 to 1,60 EUR/kg in season 2014. Net price (cleaned IQF fruits) accordingly from 2,20 EUR/kg to 3,00 EUR/kg. The reason of market change is a rising demand of large juicy fruits. Some technically equipped local entrepreneurs buy small lots of non-processed fruit branches. After freezing, cleaning and blending fruits are bulk exported. Price was pushed up as well due to recent poor harvest of SBT in Baltic countries. Residues of SBT fruits by insecticides applied against the SBT fly in southern regions may as well influence the international market shares.

Choice of varieties

Active growing season in Latvia lasts 180-200 days; the sum of temperatures above +10^{0}C is 1700-2150^{0}C. Winter weather conditions in the Baltic States can change – even though the average temperature in winter is around -6°C, the cold can reach even -30°C, and spring-like warm weather can set in, with temperature staying above zero. Area along the Baltic Sea side is where winter temperatures oftenrise up above zero, therefore continental varieties adapted to unchangeable cold weather during dormancy are not winter hardy in our climate.

There are four existing environmental groups of SBT varieties, potentially suitable for commercial growing in the NE of Europe:

A. Selections of native SBT in Germany (Sirola, Leikora, Hergo, Askola, Dorana, Frugana, Orange Energy, Pollmix etc).

B. Selections of native SBT in Finland (Tytti, Terhi, Tarmo etc).

C. Crossings between continental Russian varieties with native SBT from southern coast of Baltic Sea (Botanicheskaya Ljubitelskaya, Prozrachnaya, Podarok Sadu, Marija, Tatjana, Lord etc).

D. Crossings between continental Russian varieties with native SBT from northern coast of Baltic Sea (successful trials since 2004, no commercial plantations yet).

Latvian climate allows grow all of them, however we have chosen C and D groups because of larger and more juicy fruits with better taste. Latvian final product market demands mostly SBT juice and drinks. We can get only 50-60% juice out of SBT varieties of A and B groups in comparison to 80-90% out of C and D groups. There are significantly less troublesome stellate hairs on the fruits of groups C and D. Juice made of C and D groups is not as acid and requires less sweeteners.

Planting and maintenance

SBT orchards are planted by one or two years old mostly bare root plants. Potted plants are not so popular for commercial plantings, as they are expensive and difficult to transport. Due to very late entry to dormancy bare root plants overwinter in the nursery, and they are planted out in next spring. Distance between plants within the rows is 2 m, between rows is 4 m. That results in 1250 plants/ha. Male plants are arranged in mixed or single rows in ratio of 1:8 to female plants. Grass growing between rows is mowed several times per season. Grass between plants within row is mowed only first two years after planting, when young plants are small. Both organic and mineral fertilizers are applied right under the plants in the area of fine roots, as space between rows is occupied mainly by propagative roots, which do not take up nutrients and water. Creeping rootstalks or “cable roots” are diageotropic or growing perpendicular to the force of gravity. They send out new shoots from their nodes. Some growers retain them within rows, as they are clones and can replace lost main plants. These roots do not feed the main plant, conversely they move water and dissolved nutrients from the main plant to the root sprouts. The evidence of this one-way streaming was observed in Canada, BC, Summerland, where system herbicide glyphosate was applied to eliminate weeds and SBT suckers. Suckers died without any visible influence on the main plants.

SBT, especially the varieties with juicy fruits tend to have a great water use. SBT grows best on sandy soils, where without irrigation they may experience severe water stress, which can result in loss of foliage, dieback of twigs, fruit fall and, in extreme cases, death. Water stressed plants will exhibit less cold tolerance than plants that have been well maintained. Stressed plants are more susceptible to the winter temperature changes and attacks of pests and diseases.

Optimum growth and sufficient yield can only be achieved if water is properly managed. Successful growing of juicy varieties of SBT is dependent upon farmers having sufficient access to water. We try to locate SBT plantations close to the surface water source – river, lake or large pond. Ground water extracted from wells can supply only small plantations. Perfect place for SBT plantation are ”regulatory” floodplains – the low, flat bottomlands adjacent to rivers and lakes within a reach of a 100-year flood. If the groundwater level holds on 80 -120 cm, plants have the amount of water they need, neither too much nor too little. Surface water in springtime must disappear before SBT buds open, as well the land should be sandy and well drained.

Distribution of rainfall is not even; therefore irrigation is needed on the most of growing sites. First two years after planting some growers deliver water in mobile tanks, pulled by tractors. When plants grow larger, this method is not effective anymore.

Localized drip or sprinkler irrigation is too expensive, if only 1250 plants/ha are planted. Cheaper alternative is a simple plastic pipe system, where main supply pipes are buried down in the soil, 6 outputs/ha are placed above the ground within rows, and connected garden hoses are moved around manually.

Size of plantations

There are three plantations in Latvia with size of 20-40 ha, but most of SBT orchards are 1-3 ha large. Two hectares could be considered as a minimum size for a small commercial growing and processing enterprise. It is large enough to use equipment efficiently and implement a continuous orchard renovation program, yet small enough that one person can take care of most of the work. In case of selling non-processed fruits on branches, the optimal size of plantation is 10-20 ha. Larger orchards can make more efficient use of

machinery and equipment, but more hired labor, and thus more management skill is required. In Baltic states migrant workers would be needed in this case. Large sized orchards usually are poorly maintained, as a rule without irrigation, so their annual yield is well below the average and unpredictable.

To reduce production costs of water demanding juicy varieties it is advisable to place SBT orchards on well drained lowlands along the rivers, streams and lakes, out of flood reach. Such plots in Latvia are small sized.

The appropriate time of harvest is one of the most important factors affecting the quality of SBT fruits. Owners of small plantations have advantage to manage late harvesting, when fruits are completely ripe. This is very important for quality juice and oil producers.

Harvesting methods

For commercial production, a common harvesting technique is to remove an entire branch. It is done in various ways, which can be divided as follows:

Total cut

Upper part of bush is completely cut down. The whole tree disruption occurring after that is immense. Mainly loss of significant volumes of storage space and initiation of storage connectivity problems take place. By pruning of main dominant branches with fruits at the beginning of September, we destroy the greenwood primary pathways still in the period of active growth. Pruning the dominant branches can be done in March to rejuvenate old bushes. Then plants are still dormant and carbohydrates are stored down in the lower parts of trunk. By cutting the bush heavily during growing season plants get weaker. Total cut is not used in Latvia, as our SBT varieties do not tolerate this way of harvesting: plants recover only if not more than 50% of leaves are removed in case of late harvest, or not more than 30% in case of early harvest.

Lower cut

Deciding what to cut off and what to leave growing, branches that are marginal and had been barely hanging on for last seasons are chosen. “Blind cobs" with the berries are cut, since these will not continue to grow and will die and wither away by the end of the growing season. The problem is that the growth control pathway is taken over by the remaining dominant shoot, no new side shoots appear and the whole plant becomes like a tree with a single trunk. In this case amount of fruits in next years is reduced and located high above the ground, that causes necessity of radical cut down of the whole plant with following two “empty” years without harvest.

Vertical split

Bush is divided in two parts, leaving equal number of major branches on each side. Age difference between both parts is one year (picture 1). Harvesting is done by complete removing of one of the part, when it has reached the age of three years. Three years old branch holds six times more fruits than two years old one, therefore it is useful to skip the minor yield of the second year. Two years of harvest are followed by the third year of rejuvenation (picture 2)

Advantages of this method: yielding part of the bush is located at easy accessible height for many years, bush is gradually rejuvenated, avoiding long interruptions between harvesting years.

However, there are some preconditions to be taken into consideration. There are no active buds near the wound of three years old wood of SBT, as it contains only dormant growing points (adventitious buds). They will be released if there are carbohydrates available. Availability of carbohydrates depends mainly on two conditions:

- Sufficient growing factors are present (water, nutrients, light, temperature etc.).
- Removing time of the branch is optimal: The later in autumn the branch with fruits is removed, the more carbohydrates are stored around the forking point below the wound.

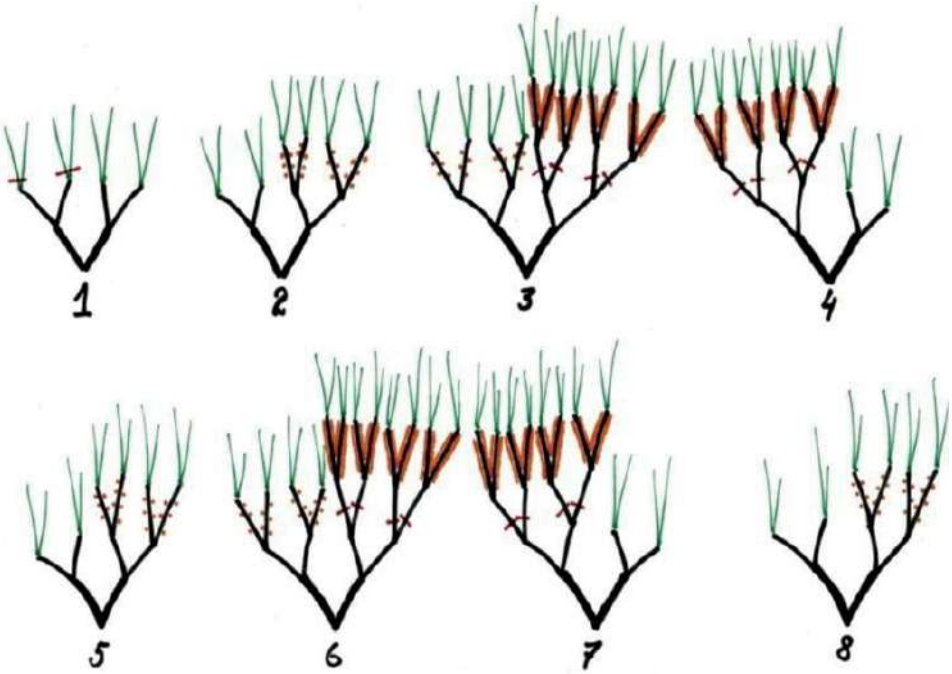
Therefore this method works well with healthy and strong growing plants, that are harvested late. Another condition is to remove all branches of the harvested side of bush. Any branch left will become the dominant growing point with active buds that subordinates all other growing points. It will keep adventitious buds dormant and no new shoots will appear on the harvested side. Trials of vertical split in Latvia have taken place for three years now, but more time for observations is needed.

Horizontal split

Annual dormant shoots are bent down, attaching their tops to the ground, thus creating “arches” (picture 3). This position initiates realignment of growth hormones – buds located on the top of arches become terminal and create the group of the next leading upward shoots. Bending is done in March. Downward directed parts of branches blossom and set fruits. In harvesting time they are pruned, leaving new leading shoots at the top of arch untouched (picture 4).

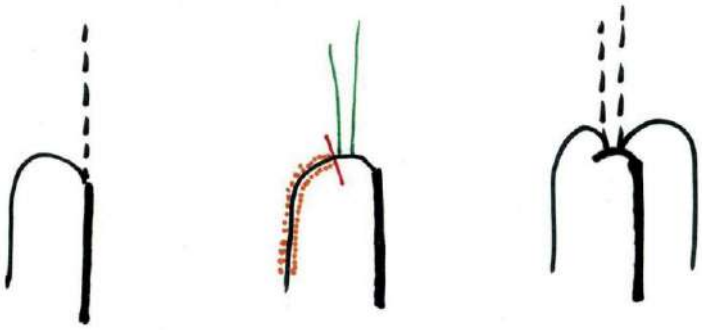
Next year the procedure is repeated with next new leading shoots. Thus we split up the whole plant in two zones – upper vegetative and lower generative zone (picture 5).

Picture 1. Bush vertically divided in two parts with age difference of one year.



Picture 2. Schematic illustration of annual cutting sequence by vertical split.

Picture 3. Principle of the horizontal split.



Picture 4. Schematic illustration of the horizontal split.

Picture 5. Bush divided in two zones – upper vegetative and lower generative zone.