

# Overview of cultivation technologies and their challenges

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## ABSTRACT

The text will give an overview of the Sea buckthorn cultivation in Central Europe. The plant propagation, the cultivation, the assortment, diseases and pests, and harvesting methods are discussed.

**Key words:** Sea buckthorn, cultivation, diseases and pests, harvest

## INTRODUCTION

Sea buckthorn is still a young fruit species in Europe. In Germany the first plantation was planted 34 years ago with 3 hectares. Now there is 600 ha of sea buckthorn cultivation in Germany. The cultivation is not easy and there are still many problems.

About the sea buckthorn cultivation in Europe, there are only a little information. Quite a lot of sea buckthorn is grown in the Baltic States. In Finland and Sweden sea buckthorn plantations are small. There are also plantations in Italy, France, Poland, Belarus and Romania, but statistics wasn't available.

## PROPAGATION OF SEA BUCKTHORN PLANTS

The seedling production is not very problematic. There are two methods – the propagation with hard-wood cuttings or green cuttings.

Hardwood cuttings have all the summer time to grow. They are already well rooted in the end of June. In November they will be nearly 1 meter high (Pictures 1 and 2). Approximately 80% can then be planted. Green cuttings usually need two years before they can be planted on the field.



**Picture 1.** Hardwood cuttings in Germany in the end of June. **Picture 2.** Same cuttings in November.

## SEA BUCKTHORN VARIETIES

The number of Sea buckthorn varieties for European climate is too low. In Germany there are now four varieties (Hergo, Askola, Habego, Leikora) + one new late ripening variety. The problem with German varieties is that they freeze to death at temperatures below -25°C. This means that they can't be grown safely in Northern Europe and in the Baltic countries.

The sea buckthorn cultivation in Germany is situated almost exclusively in the north-east area: in the federal states of Mecklenburg-Vorpommern, Brandenburg and Sachsen-Anhalt.

In Estonia only Russian varieties are in cultivation (Botanitscheskaya, Botanitschkaya Ljubitel'skaya, Gibril Pertsika, Otradnaya, Podarok Sadu, Trofimovskaya). Belorussian new varieties have not yet convinced in Estonia. In Sweden is the Russian variety `Botanitscheskaya Ljubitel'skaya` the most widely cultivated variety. In Europe, new sea buckthorn varieties are wanted in several countries. In Finland, new frost-resistant varieties are searched. In Sweden new varieties are bred. In Romania there are new sea buckthorn varieties, but their cultivated area and their characteristics is so far unknown. This means that there are many new varieties in Sweden and Romania, but they are not yet tested.

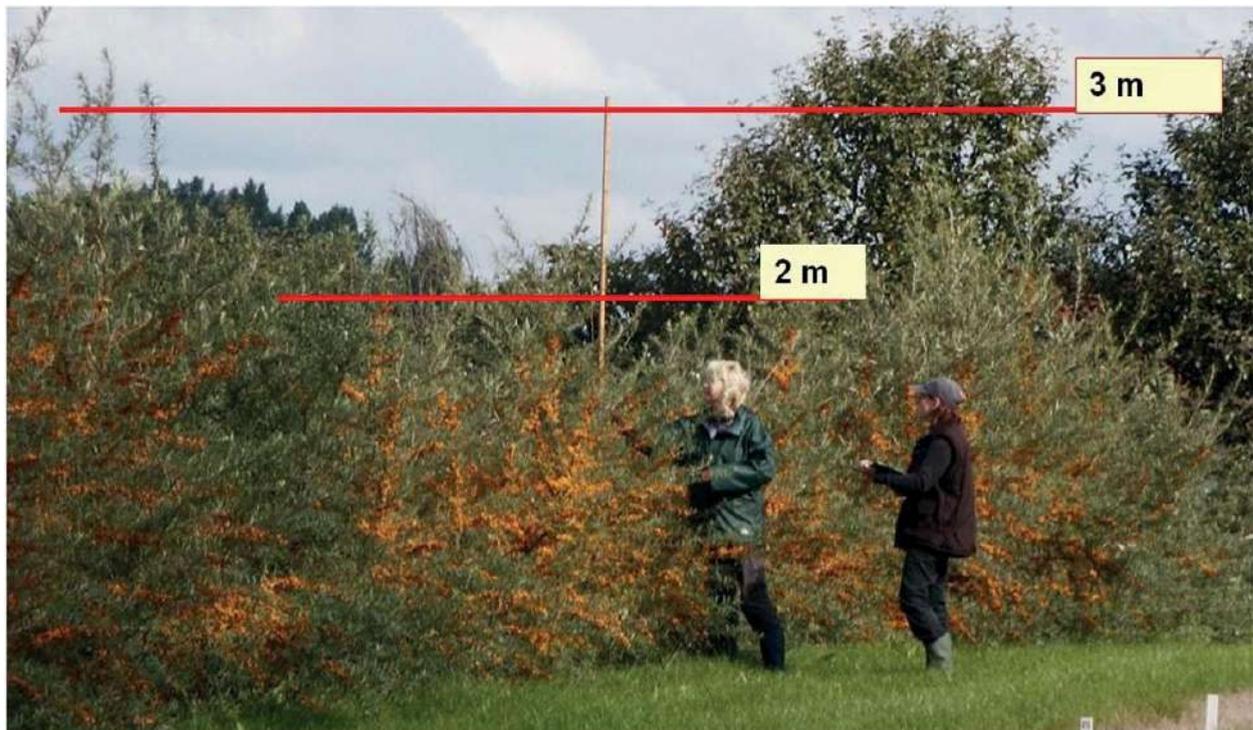
Also in Germany new varieties are searched. For example from the selection of alpine sea buckthorn clones subspecies *fluviatilis*.

A great common problem is the frost susceptibility of the male sea buckthorn varieties.

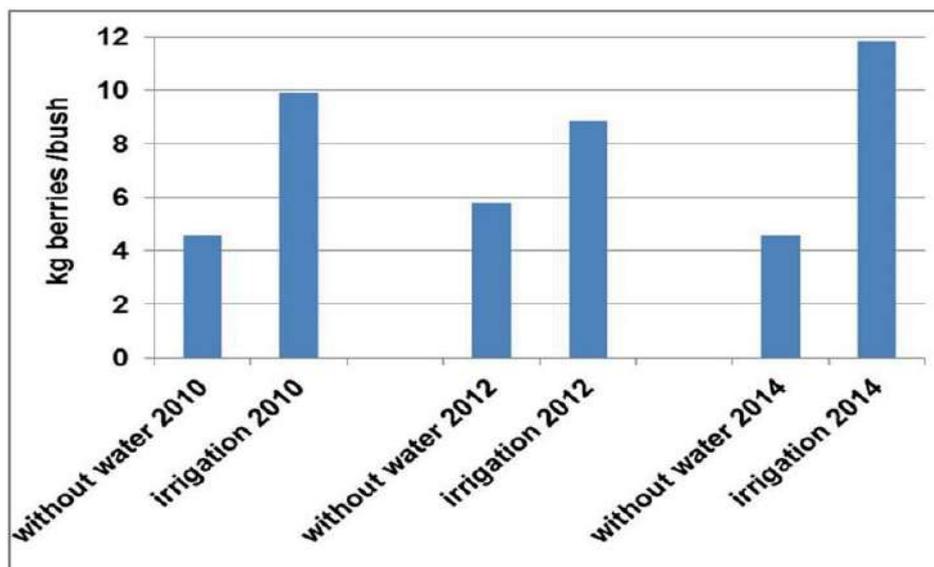
### CULTIVATION OF SEA BUCKTHORN

Sea buckthorn is relatively easy to grow. It grows well on sandy loams. But sea buckthorn also needs water in the soil. If there is too little water in the soil, sea buckthorn may wither and die, as seen in Ludwigslust in 2006. The effect of irrigation to the yield is proven to be significant.

In Gülzow, Germany, already in the third year after planting, in 2010, the growth differences between irrigated and non-irrigated plants were clearly visible at the beginning of harvest (Picture 3). The yield of the sea buckthorn berries from the bushes with irrigation was in average a twice as high as without irrigation (Picture 4).



**Picture 3.** Difference in plant height between irrigated (in the front and in the back of the picture) and non-irrigated (in the middle of the row) plants on field trial in Gülzow in 2010.



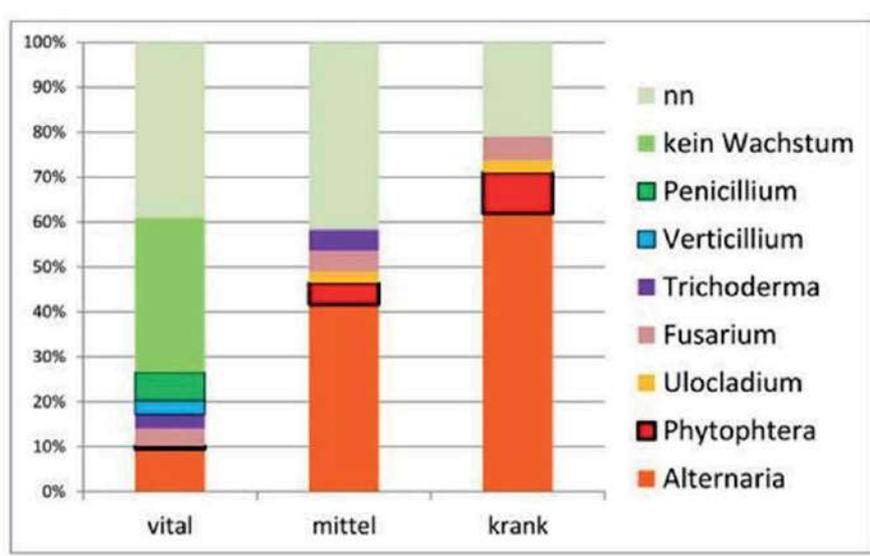
Picture 4. Influence of irrigation to the yield in field trial in Gülzow

#### PLANT PROTECTION: DISEASES AND PESTS

Even a few years ago was thought sea buckthorn is unproblematic in the cultivation. Today we know that there are many problems with the plant health.

In Germany *Verticillium* and other fungi are serious problems in some varieties, especially in Russian varieties. In 2005 we planted Russian sea buckthorn varieties. In 2007, many plants died to *Verticillium* and other fungi.

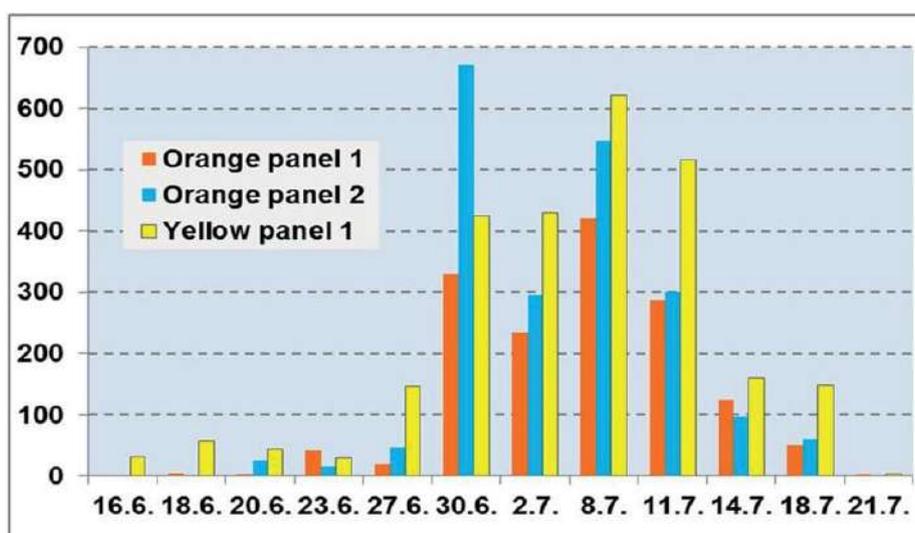
In the year 2012 sea buckthorn plants and soil from Gülzow were tested for fungal infection in ZALF Muencheberg. The question was what species of fungi colonize the sea buckthorn? Is *Verticillium* the principal fungus? Which species of *Verticillium* cause the damage? Healthy and diseased parts of the sick sea buckthorn branches were analyzed. The result was surprising: The fungus *Verticillium* was found only in 2% of samples (Picture 5). In the medium-damaged and diseased plant parts, *Verticillium* was not detectable. The more the plant parts were diseased, the more both *Alternaria* and *Phytophthora* infection could be found.



Picture 5. Species of fungi that could be found from healthy and diseased parts of sick sea buckthorn plants in Gülzow. Vital= healthy, mittel= medium-damaged, krank=diseased plant part.

An extremely serious problem is the occurrence of sea buckthorn fruit fly (*Rhagoletis batava*) since 2013 in Germany. In 2012 no signs of fly could have been noticed. On 19<sup>th</sup> of August 2013 many maggots were found in frozen sea buckthorn berries. A few days later was the great damage seen in the plantation. In the soil under the sea buckthorn bushes many fly pupae were found. 100 fly pupae were put in gauze cages to observe when the first flies fly.

Also fly pupae was studied in the laboratory. In the laboratory of the Plant Protection Service Rostock the first sea buckthorn flies were seen in late April. During year 2014 also several yellow and orange sticky traps were hanged. The first flies were trapped on 16<sup>th</sup> of June (Picture 6). Main flight time of sea buckthorn fruit flies was from June 27<sup>th</sup> to July 14<sup>th</sup> in 2014.



Picture 6. Number of trapped sea buckthorn flies per day in Gülzow in 2014.

In the last years the bird starling (*Sturnus vulgaris*) has been a serious problem, especially for the early ripening varieties.

The starlings are not on the fields every year. The first time in 2008 the starlings ate the berries, and since 2012 this has happened each year. In 2014 the damage was especially bad.

## HARVESTING OF SEA BUCKTHORN

We know a lot of harvest methods, but no one is perfect.

1. picking by hand,
2. Shaking off the fruit from the bush,
3. Cutting of the branches, freezing the branches with berries, shaking off the frozen berries.

Hand picking is laborious and costly. Only about 1 or 2 kg per hour can be picked. In Germany a harvesting machine was developed 30 years ago. The machine shakes the berries off from the beforehand cut branches. Unfortunately, only the variety Hergo is suitable for this method without freezing.

In Estonia a berry-shaker HK-2 was developed (Picture 7). That berry-shaker was purchased also to Germany. From 2007 to 2009 it was tested and the results were following:

- The berry-shaker is suitable for the harvesting of sea buckthorn berries. The optimum thickness of the branches is 1-2 cm.
- There is a big difference in variety suitability. Russian varieties suit well for shaking, German varieties don't manage very well.
- The best result is obtained at almost ripe but still hard berries.
- By berry-shaker harvest of 20-30 kg / h can be reached.
- Work with the berry-shaker is hard physical work.

- The "Berry Shaker HK2" is no alternative for large-scale plantations in Germany.
- Applications are limited to small-scale cultivation, where the heavy physical work is not avoided.



**Picture 7.** Berry Shaker HK2 is developed in Estonia.



**Picture 8.** Harvester developed and manufactured by Kranemann, Germany.

In Germany has prevailed the method: cutting off the branches, freezing the branches with the berries and shaking off the frozen berries. The problem is that some of the berries remain on the shrub. However, it is necessary to leave leafy branches to the bush, because the plants have to assimilate another 2-3 months. If they don't have enough leaves for assimilation, many shrubs die during the winter.

A large farm in Saxony-Anhalt, in Quellendorf, has developed a harvester for sea buckthorn branches (Picture 8). Only one man harvests the sea buckthorn branches and moves them in a hall. In the hall the branches are crushed, frozen with nitrogen and then the berries are shaken down. The quality of the harvested berries is very good.

## SUMMARY

- The seedling production is not very problematic.
- The number of Sea buckthorn varieties is too low.
- For the sea buckthorn cultivation water is very important.
- There are many problems in plant protection. The most important are *Verticillium* and other fungi and sea buckthorn fruit fly.
- For harvesting, there are several methods, but no one is perfect.

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