

# FORESTATION CHAIN FOR BIRCH (*BETULA PENDULA* ROTH) IN FINLAND

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SELOSTE:

RAUDUSKOIVUN (*BETULA PENDULA* ROTH) VILJELYKETJU SUOMESSA

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During the 1970's an average of 4 million *B. pendula* seedlings are planted annually in Finland. The different activities connected with the planting of this tree species are reviewed in the article. The manuscript is based on the results from studies into the breeding, seedling production and planting techniques of *B. pendula* started by the Finnish Forest Research Institute at the beginning of the 1960's, as well as on practical observations made at the planting sites.

## 1. INTRODUCTION

The forestation chain for *B. pendula* comprises the following interconnected links:

- Selection of forestation sites
- Site preparation
- Selection of seedling material
- Transport and temporary storage of seedlings
- Planting out the seedlings
- Follow-up work on the forestation site

This chain is different in many respects from a chain made of metal. Weak links at the beginning of the forestation chain weaken all the subsequent links. On the other hand, one particularly strong link can strengthen all the other ones. However,

such a chain may be broken at a single strong link if the earlier links have weakened it sufficiently.

When carrying out forestation work with *B. pendula* individual attention should always be paid to all of the links in the chain if the goal of a well-developed plantation is to be attained.

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## 2. SELECTION OF FORESTATION SITES

The following characteristics of *B. pendula* should be kept in mind when selecting the most suitable forestation sites:

- *B. pendula* is a demanding species regarding its soil requirements. It grows well and produces stems of good quality only on nutrient rich sites.
- *B. pendula* is a tree species which is very light demanding. Its metabolism is only able to function properly under good light conditions.
- The root system of *B. pendula* is not able to function properly in poorly aerated soils. Compact clay soils and soils where the ground water table lies

close to the soil surface are examples of such soils.

Some forestation sites suitable for growing *B. pendula* include:

- Coniferous plantations with many open spaces
- Old agricultural fields (which are to be afforested)
- Fertile forest soils
- Forestation sites susceptible to early frosts
- Areas infected with *Fomes annosus* (Fr.) Cooke
- Sites with high scenic value

## 3. SITE PREPARATION

### Regulation of water conditions on the site

*B. pendula* seedlings grow poorly or may even die if the ground water table on the forestation site lies very close to the soil surface. In such areas the water conditions have to be improved by means of drainage or furrowing prior to planting out. Amelioration problems most frequently occur on low-lying lands, especially on peatlands drained for agricultural purposes. Such a situation is not uncommon even on forest land. Drainage should be carried out, when necessary, at least one or two years prior to planting out.

Table 1. Mean height of *B. pendula* seedlings planted under nurse crops of varying density, five and eleven years after planting out.

Density of nurse crop <sup>1)</sup>	Years after planting out	
	5	11
	Mean height of seedlings, m	
0	1.79	7.63
120–140	1.15	3.05
160–180	1.02	2.33
225–275	0.86	1.30

<sup>1)</sup> Nurse crop consisting of large *B. pendula* trees.

### Removal of nurse crop from the forestation site

A nurse crop often has rather a strong detrimental effect on the development of *B. pendula* seedlings, and therefore it should be removed before planting work is started. The effect of a nurse crop on new growth can be seen in Table 1.

### Soil preparation on the forestation site

The favourable effect of soil tilling in fields which have been under intensive

cultivation is due mainly to reduction in the growth of the competing ground vegetation and not to any improvements in certain soil properties (Tables 2 and 3). Especially on compact soils, for instance soils with a compacted upper layer caused by agricultural usage, soil preparation often also improves the properties of the soil and hence promotes seedling growth.

The appropriate soil tilling is carried out during the previous autumn for spring planting, and at the end of the summer the same year for autumn planting. Soil

Table 2. Effect of soil tilling on the height growth of seedlings. (The seedlings were smaller than the surrounding ground vegetation at the time of planting).

Soil tilling method	Mean height of seedlings when planted, 1970, cm	Height growth of seedlings, 1970–72, cm
Untreated stubble field .....	45	51
Ploughing with two-winged plough .....	45	129
Ploughing .....	44	139
Ploughing and harrowing .....	45	98

Table 3. Effect of soil tilling on the height growth of birch seedlings. (The seedlings were taller than the surrounding ground vegetation at the time of planting).

Soil tilling method	Mean height of seedlings when planted, 1970, cm	Height growth of seedlings, 1970–72, cm
Untreated stubble field .....	58	79
Ploughing with two-winged plough .....	58	97
Ploughing .....	59	95
Ploughing and harrowing .....	59	76

preparation is also a recommended practice on forest soils, even though it may often cause difficulties. Prescribed burning has a beneficial effect on seedling development also. Finally, it should be stressed that soil

preparation almost always facilitates the actual planting and reduces the amount of work involved in follow-up activities on the forestation area.

## 4. SELECTION OF PLANTING MATERIAL

Selection of planting material represents the third, extremely important, link in the forestation chain. Special attention should always be paid to the selection of seedling type and grade, seedling quality and origin of the stock.

planting with *B. pendula*. The most common plant types available are:

- 1 M = seedling grown for one year in a plastic greenhouse.
- 1 M+1 A = two-year old transplant grown for the first year in a plastic greenhouse, transplanted in the spring and grown for the second year in the open.
- 1 (Lk+A) = one-year old transplant grown initially in a Paper-pot in a heated plastic greenhouse, and then transplanted out in the open.

### Plant types

Plant type is indicated by means of a special code which shows clearly how the nursery stock has been grown. One- or two-year old transplants or one-year old seedlings should be used if possible in

1 (Lr—Ar) = one-year old transplant initially grown in a peat (Nisula) roll in a heated plastic greenhouse and then transplanted in the open in the same roll.

1 (Lk+Ak) = one-year old transplant initially grown in a Paper-pot in a heated plastic greenhouse, transplanted into a larger Paper-pot and then grown in the open.

These are the plant type codes listed according to the marking system used in the experimental nursery of the Finnish Forest Research Institute.

### Quality of the planting material

Nowadays, the grower has very little to say in the choice of the quality of seedlings to be used in reforestation work. The responsibility in general lies with the producer of the material, who has to ensure that all the plants are healthy, sturdy, in good condition and vigorous. The seedlings should have no bark defects, broken shoots or torn roots. A list should also accompany the delivery giving the tree species, plant type and grade, place of origin and origin code, and the date when lifted. The customer also has the right to request detailed information from the nursery about the raising history of the plant lot sent to him.

### Origin of the plant material

Although seedlings have shown in a number of experiments that they are capable of withstanding transport over fairly long distances, this should be avoided as much

as possible. As a rough guide, seedlings originating from southern Finland should be used only in South-Finland, those from southern or central Finland used only in Central-Finland, and those from northern Finland only in North-Finland.

### Plant grades

All the plant types are divided on the basis of size into four plant grades. Their height and sturdiness requirements are both presented in Table 4.

The choice of grade depends in the first place upon how the ground vegetation on the forestation area is likely to develop in the years following planting. It is generally considered that all seedlings planted should be at least as tall as the ground vegetation already present on the forestation site when it is at its most luxuriant stage.

Table 4. Height and sturdiness requirements of different *B. pendula* grades.

Plant grade	Medium height class, cm	Minimum height, cm	Minimum base diameter, cm <sup>1)</sup>
I	40	25	3
II	41—55	30	4
III	56—70	40	5
IV	71	50	6

<sup>1)</sup> Base diameter is measured 1—2 cm above the root collar. The root collar is that point on the seedling where the uppermost lateral roots emerge.

## 5. TRANSPORT AND TEMPORARY STORAGE OF THE PLANTS

The seedlings should be well protected and transported to the customer as quickly as possible. Seedlings of *B. pendula* are usually packed for transport at the nursery into white polythene bags.

If the seedlings have to be stored temporarily for a number of days, then they

should be heeled-in and left ready for planting.

As far as the weather conditions during transport are concerned, autumn is noticeably better than spring. Thus seedlings which are to be planted in the spring are often taken to the planting site the previous autumn, and heeled-in there for the winter.

## 6. PLANTING OUT

### Technical aspects of planting work

- Care should be taken that roots of the seedlings are not allowed to dry out during planting.
- The plant should be placed in the planting hole so that the roots do not become tangled.
- The planting hole should be filled with good soil.

The planting method most frequently used, and which gives good results, is planting on the side of the hole. On soils which have not received any preparation treatment, large scalps have also been found to have a beneficial effect on subsequent seedling development.

### Choice of planting time

When bare-rooted seedlings in the dormant phase have been used, spring planting has given better results than autumn planting. The planting time for bare-rooted seedlings can be extended by keeping them in cold storage during the spring and then distri-

buting them to the planters in the field as the work progresses.

During the last few years, nurseries have also started to produce different sorts of tubed seedlings. Their use is recommended especially when planting is changed from the spring to early summer or autumn.

### Choice of planting density

According to the most recent information, a planting interval of 2 m × 2 m (2 500 seedlings/ha) is considered to be the best on sites where there are hardly any naturally regenerated seedlings or suckers.

On areas where there are many deciduous seedlings or suckers already established, planting intervals of 2.5 m × 2.5 m, 2.5 m × 3.0 m or even 3.0 m × 3.0 m can be used, depending on the density of the suckers or seedlings. The latter promote the natural pruning of the planted seedlings and are also capable of producing trees. However, special attention should be paid to the condition, size and follow-up work on planted seedlings.

## 7. FOLLOW-UP WORK AND CARE AT THE FORESTATION SITE

### Freeing the seedlings from competition with the ground vegetation and suckers

Planted seedlings almost always have to be freed from competition with the ground vegetation and suckers during the first growing season at least. This measure is the more important, the smaller the seedlings used. Shading grasses should be removed from around the seedlings before the vigour of the seedlings becomes visibly affected. This means in practice that the work should be completed by the beginning of the summer. If weeding is carried out at the end of the summer or in the autumn, as is generally done now, its positive effect will be minimal, because the seedlings will have had to grow throughout the growing season in the shade. This slows down their

growth and often produces serious defects in them.

### Fertilization of seedlings

Experimental work has shown that fertilization, specifically with nitrogen speeds up the initial development of seedlings. Fertilization can be carried out in the same year as planting, for instance at the same time as the seedlings are checked and weeded around mid-summer. However, fertilizer must not be put into the planting hole, but instead spread evenly over a circular area (radius 40—50 cm) around the seedling. A suitable dose varies from 8 to 20 g N per seedling. Table 5 shows how varying amounts of different nitrogen fertilizers

Table 5. Effect of nitrogen fertilization on the height growth of *B. pendula* seedlings.

Fertilizer	Nitrogen dose, g/seedling	Height growth during year of fertilization, cm	Height growth in year following fertilization, cm
	0	45.2	32.4
Ammonium nitrate with lime .....	2	60.8	29.2
» » » » .....	4	67.9	31.8
» » » » .....	8	79.6	29.1
Ammonium sulphate .....	2	57.9	29.2
» » .....	4	71.8	28.2
» » .....	8	82.4	33.6
Urea .....	2	56.8	30.0
» .....	4	65.0	28.6
» .....	8	76.3	29.3

applied at the beginning of the summer increased the height growth during the year when fertilized. It is also evident from the table that in the following year, fertilization no longer had any effect on the height growth of the seedlings.

#### Seedling damage by animals and its control

##### Voles

Field voles and various other types of vole eat the bark and phloem of planted birches in the summer, autumn and especially winter, thus causing severe damage. The vole population varies considerably from year to year, but every fourth year or so their numbers reach a peak. However, birch plantations are susceptible to vole damage for only a short time. Vole damage does not usually occur in plantations once the base diameter has passed 4 cm. No method has yet been developed which gives 100 per cent protection on areas forested with *B. pendula*. However, vole damage can be reduced by the following measures:

— Forestation with *B. pendula* should be concentrated in those years when the vole population is decreasing or when the population is small.

- No autumn planting should be carried out if there are many voles present.
- Fields selected as forestation sites for *B. pendula* should be tilled and then left fallow for the summer before seedlings are planted out. This ensures that there is no large vole population in the area at least when planting is carried out.
- Well lignified, strong and large seedlings should be used and every effort made to increase their base diameter to at least 4 cm as quickly as possible so that they pass the development stage where they are most susceptible to vole damage.
- The natural predators of voles, especially weasels, stoats, owls, foxes, hawks, etc., should be encouraged.
- The forestation area should be inspected early in the spring and the most severely damaged seedlings broken off above the base of the stem. This promotes the formation of new sprouts.

##### Hares and elk

Hares may also cause some damage in birch plantations by eating the seedling shoots protruding above the snow in the late winter.

Elk also damage young plantations by dragging young saplings from the ground or breaking the young shoots. Damage caused by elk is usually directed at plantations

where the height of the seedlings is from one and a half to four meters. Elk very often trample seedlings when eating the leaves from their crowns. However, as is the case

with hares, the overall damage caused by elk is small and confined only to certain geographical areas.

## 8. INSTRUCTIONS FOR GROWING *B. PENDULA*

1. Select, preferably, fertile forest sites and fields as forestation sites for *B. pendula*.
2. Avoid those sites where the ground water table is very close to the ground surface.
3. Remove all nurse trees from the area before starting planting out.
4. Till the forestation site when soil tilling can be carried out at moderate costs.
5. Demand planting material of good quality from the nursery.
6. Use only plants, which at the planting time, are at least as tall as the ground vegetation will be when it is at its most luxuriant stage.
7. Make sure that the planting material is not

- allowed to dry out or is kept in conditions which could affect its vigour when it is being transported or stored temporarily.
8. Try to plant the seedlings in the spring and do the planting work carefully.
  9. Select a planting interval which is too narrow rather than too wide.
  10. Survey the birch plantations every year before midsummer and free the seedlings from competition with ground vegetation or sprouts.
  11. Fertilize the seedlings with nitrogen at least during the two years following planting.
  12. Take measures to combat any damages which occur as quickly and effectively as possible.

## 9. LITERATURE

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## SELOSTE:

### RAUDUSKOIVUN (*BETULA PENDULA* ROTH) VILJELYKETJU SUOMESSA

Artikkelissa selostetaan lyhyesti rauduskoivun viljelyyn liittyviä eri toimintoja. Kirjoitus perustuu 1960-luvun alussa Metsäntutkimuslaitoksen metsänhoidon tutkimusosastossa aloitettuun raud-

uskoivun jalostusta, taimien kasvatusta ja viljelyn tekniikkaa selvittävien tutkimusten tuloksiin sekä käytännön viljelyaloilla tehtyihin havaintoihin.