CLONAL PROPAGATION OF *FAGUS SYLVATICA* L. BY CUTTINGS

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Abstract. Cuttings of *Fagus sylvatica* were harvested from 85 one-year-old seed-propagated stock plants and rooted. An important difference in rooting ability of different clones was found. Cuttings harvested in a glasshouse could have about 25 cm of new growth in the first season. In contrast. cuttings harvested from clonal mother stock hedges in the field failed to grow new shoots the first season, overwintered poorly, and had very little new shoot growth after being overwintered.

INTRODUCTION

Fagus sylvatica is commercially propagated by seed. Some selected clones for ornamental planting are propagated by grafting, but the cost of grafting is high and the demand for grafted plants is consequently limited. For forest trees a certain genetic variability is required. From this it follows that seed plants are preferred.

In Denmark it is estimated that 80% of the *F. sylvatica* plants produced are used for hedges and scrub planting. If *F. sylvatica* can be propagated by cuttings by a cheap method it will be worthwhile to select clones with defined genetic quality for this type of planting. For many years there has been a shortage of seed, as the fruiting of *F. sylvatica* varies considerably from year to year. Propagation by cuttings would overcome seed shortage problems.

REVIEW OF LITERATURE

Chalupa (1) had good results with cuttings harvested from 2 to 4 year old seed-propagated plants. Treating the cuttings with indolebutyric acid gave 60 to 76% rooting, Cornu *et al.* (2) succeeded in rooting 80 to 90% of the cuttings harvested from 1 to 5 year old seed plants. *Kobert* (3) harvested cuttings from 25 year old grafted trees and obtained up to 97% rooted cuttings but found however, that it was difficult to overwinter the resulting plants. Spethmann (4) harvested cuttings from 2 to 4 year old seed propagated plants and had 50 to 65% success, but the biggest problem was in overwintering the rooted plants. Of the plants from the first year's experiments Spethmann had 30% surviving, but in the second year only 8%.

MATERIALS AND METHODS

Earlier work by the author (unpublished) emphasized that

it is relatively easy to root cuttings harvested from juvenile plant material. It was therefore decided to focus the experiments on factors influencing the rooting of plant material harvested from very young plants.

F. sylvatica seed from Tolne Skov (a Danish selected seed source) were sown on 1 March, 1977, in pots. The pots were placed in a glasshouse and the plants were grown there until 10 June, 1978. The plants had at this date grown to a height of about 1 m. The plants were numbered 1 to 85; 15 cuttings were harvested from each plant. The cuttings were terminals from side shoots. They were given a quick-dip treatment of 2000 ppm indolebutyric acid in 50% ethanol.

Cuttings were inserted in 5 cm rockwool cubes wrapped in plastic film on 4 sides so that newly-formed roots eventually would have to grow out through the bottom. The rockwool cubes were placed onto a glasshouse bench under a mist system controlled by an electronic leaf. The rockwool cubes were kept at a minimum temperature of 21° C by heating cables.

Rooting of the cuttings was recorded at 6 and 8 weeks after insertion. After the last recording all 15 cuttings of 10 clones with good rooting were potted and grown on in a glasshouse. In June, 1980, 5 clones were selected and planted in the field in stock plant hedges.

In June and August, 1984, cuttings were harvested from the stock plant hedges. The cuttings were inserted in 7 cm pots in a growing medium consisting of 70% peat and 30% rockwool. The pots were placed in a glasshouse bench and covered with clear polyethylene film as well as with a milk-white polyethylene film (50% light transmission.)

Before being covered wth the polyethylene films the cuttings were watered with Orthocid 83. The minimum temperature in the pots was maintained at 21°C. Before insertion, 50% of the cuttings were treated with 2000 ppm indolebutyric acid by the quick-dip method; 8 weeks after insertion the number of rooted cuttings was recorded.

The rooted cuttings from the June experiment were overwintered in a frost-free glasshouse.

On 15 May, 1985, the number of surviving plants were recorded and the plants were transplanted into 10 cm pots.

RESULTS

Selection of easily-rooted clones. The cuttings were recorded as rooted if one or more roots penetrated the bottom of the rockwool cubes at the time of recording. By this method it follows that only cuttings with roots which are long enough to

penetrate the bottom of the rockwool cubes will be recorded as rooted.

By repeating the recording it is possible to collect very useful records. Recording was carried out 6 weeks and 8 weeks after insertion of the cuttings.

Table 1 shows the results obtained. It is seen that 6 weeks after insertion there was a wide disparity in how many rooted cuttings there were in different clones. In 3 clones all cuttings had rooted; 8 weeks after insertion there was still a wide dispersion in percent rooted cuttings of the different clones but on a higher level. No further recording of rooting was done as a rooting period longer than 8 weeks would be regarded as unacceptable by the nursery industry.

Table 1. Rooting of cuttings harvested from 1-year-old seed-propagated stock plants (clones).

Percent rooted	Number of clones	
	Recorded 6 weeks after insertion.	Recorded 8 weeks after insertion.
0	2	1
7	5	1
13	3	3
20	2	2
27	5	2
33	9	5
40	6	0
47	6	2
53	3	5
60	5	4
67	10	7
73	7	12
80	6	8
87	8	9
93	5	10
100	3	14
Total	85	85

For the 10 potted clones the new shoot growth was recorded at the end of the growing season. As seen in Table 2 there were recorded a considerable dispersion in the shoot growth of the clones with the fastest growing clone averaging 27 cm of new shoot growth per plant, while the slowest growing clone averaged only 4 cm of new shoot growth.

In June 1985, the height of the plants in the stock plant hedges was recorded. As seen in Table 3 the clones were very different in their habit of growth.

Clones grown as stock plant hedges. Rooting of cuttings started in 7 cm pots was recorded by carefully removing the

pots from the compost ball and recording the plant as rooted, if roots were visible on the surface of the medium. The rooting of cuttings harvested and inserted in the rooting compost at two dates is shown in Table 4. Data is given for untreated cuttings as well as for cuttings treated with a rooting hormone.

Table 2. New shoot growth at the end of the first growing season; 10 easily-rooted clones.

Clone No.	New shoot growth per plant
8306-06	14 cm
8303-07	27
8303-09	18
8303-15	20
8303-23	24
8303-27	12
8303-35	8
8303-50	14
8303-59	22
8303-80	4

Table 3. Height of clones rooted in 1978 and field-planted in 1980. Recorded July, 1985.

Clone No.	Height
8303-06	210 cm
8303-15	230
8303-27	220
8303-35	290
8303-50	170

Table 4. Percent of rooted cuttings. Recorded 8 weeks after insertion.

Clone No.	Inserted June 17, 1984		Inserted August 15, 1984	
	Untreated	2000 ppm IBA	Untreated	2000 ppm IBA
8303-06	28	60	25	20
8303-15	28	60	32	7
8303-27	82	93	38	40
8303-35	62	84	20	18
8303-50	87	93	60	27
Mean	57	78	35	22

For untreated cuttings harvested in June, it is seen that two clones have rooted sparsely; one clone has intermediate rooting, and two clones have a high rooting percentage. When treated wtih a rooting hormone the two shy-rooting clones more than doubled their percent rooting, while the intermediate rooting clone increased its percentage to a level at which the rooting is commercially acceptable.

For the August-harvested cuttings the rooting percentage is unacceptable for all clones and treatments.

Table 5. Cuttings inserted June, 1984. Results are expressed in terms of the percentage of rooted cuttings surviving by May, 1985.

Clone No.	Untreated	Treated with 2000 ppm IBA
8303-06	32%	27%
8303-15	16	27
8303-27	71	73
8303-35	80	78
8303-50	80	88

Table 5 shows how the cuttings survived the winter of 1984/85. It is seen that the clones which rooted well also survived the winter well, while the clones with low rooting percent to a great extent failed to survive:

DISCUSSION

Chalupa (1) showed that *Fagus sylvatica* cuttings harvested from young stock plants could be easily rooted. Cornu *et al.* (2) and Spethmann (4) also noted good rooting in cuttings harvested from young stock plants. They did not investigate the occurrence of genetic variability in the seed-propagated stock plants.

The present work shows that clonal selection is an important factor in the ability of cuttings to root.

This also shows that overwintering of young cutting-propagated plants of *F. sylvatica* is problematic. This agrees with the work of Kobert (1979) and Spethmann (1982).

From the recorded data it is evident that in *F. sylvatica* there are important differences among the different clones' rooting ability. The variance in rooting ability must be genetically conditioned.

Clonal propagation of *Fagus sylvatica* by cuttings is possible but not yet ready for introduction into the commercial nursery industry.

LITERATURE CITED

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