CURRENT QUALITY REQUIREMENTS OF SEEDLINGS IN FINLAND

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Abstract. --Finland's national economy depends heavily on forestry. The need to meet future demand for high quality raw wood material and drawbacks in forest regeneration has necessitated devising and implementing measures to increase planting success and decrease regeneration costs. Size classification of bareroot planting stock was implemented in mid-1970s. In 1980 an Act became valid to enforce quality requirements for seed and seedling trade. A recommendation for the size classification of containerized Scots pine seedlings was given in 1983. The quality requirements are descriptive and do not assume vigor testing. Proper test methods are being worked out for both container and bareroot seedlings.

Additional keywords: bareroot and container seedlings, Forest Regeneration Material Trade Act, size classification.

INTRODUCTION

In Finland, forestry and forest industry products account for about 45 % of net foreign exchange earnings and 17 % of labour force. National economic reasons thus necessitate the utilization of the growing stock on a sustained and, preferably, progressive basis. This may often require legislative measures.

Concern about how to meet the future demand for high quality raw material on the one hand, and drawbacks in nursery stock production and forest regeneration on the other hand has brought about the need for new measures to increase planting success and decrease regeneration costs. First, a simple classification of bareroot planting stock into size classes, based on age, height and diameter of root collar, was enforced in mid-1970s. A more recent policy was an establishment of an Act, enforcing quality requirements in the seed and seedling trade. The Forest Regeneration Material Trade Act (No. 684/1979) relates to the trade of all regeneration material collected or growing of which has started after January, 1980. A recommendation of the measures for containerized Scots pine seedlings was given in 1983.

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ANNUAL SEEDLING PRODUCTION

The total annual area of seeded and planted sites is about 140 000 hectares, of which ca. 20 % is sown. Moreover, at least an equal area is regenerated naturally through seed tree and shelter wood methods. The annual output from state, private and company nurseries is ca. 250 million seedlings, of which 75 % is Scots pine (Pinus sylvestris L.), 20 % Norway spruce (Picea abies (L.) Karst.) and 2 % European silver birch (Betula pendula Roth). The share of containerized seedlings is now ca. 50 % but it is steadily increasing. The number of the active nurseries is about 45 and the total nursery area is ca. 1 100 hectares.

Table 1. shows the division of mean regeneration costs (per hectare) into expense groups. The price of seedlings is annually decided upon by the National Board of Forestry (Finnish Forestry Service), and based on the production cost of the previous year's stock. Only birch seedlings are priced according to size class.

Table 1.--The distribution of mean regeneration costs into expense groups at Scots pine sites in Finland (1984).

Expense group	Cost per hectare US$ (1 US$ = 6.50 FIM)
Clearing of cutting area	37
Scarification	75
Plant material	130 (80 US$/1 000, bareroot (pine transplant)
Planting	128
Supervision	77
Other expenses	23
Total costs	470 US$

QUALITY REQUIREMENTS

Bareroot Seedlings

The official grading requirements for bareroot planting stock are primarily based on a visual definition of the seedling

condition and vigor. Secondarily, the seedlings are graded into size classes. Both classifications are morphological.

The Forest Regeneration Material Trade Act comprises the statutes for the trade, import and export of all regeneration material. The material has to meet the quality requirements set by the Ministry of Agriculture and Forestry. The National Board of Forestry, as a supervising organ, can give annual specifications for the quality classification of seedlings.

The quality requirements of seedling stock as stated in the Act (Section 13) are as follows:

> "Seedling to be sold shall be healthy and vigorous as well as otherwise appropriate. The seedling is not considered to meet the above-mentioned requirements in the following cases:
> 1) the seedling has detrimental defects of the bark or other wounds than occluding cut wounds,
> 2) the seedling has more than one leader or the seedling is otherwise forked,
> 3) the seedling is not, as concerns time, perfectly woody,
> 4) the leader of a coniferous seedling has no healthy terminal bud,
> 5) the seedling has an insufficient amount of needles or buds,
> 6) the main root is stronly bent, there are not enought lateral roots or the root system is otherwise insufficient or faulty or in case of containerized seedling, the pot is not suitable for planting, and
> 7) the seedling has plant diseases, pests or their eggs.
>
> What has been said in items 3 and 4 of Subsection 1 does not apply to the containerized seedlings during the growth period or seedlings to be sold for transplantation. As an exception to what has been said in item 2 of Subsection 1 a spruce seedling may have two leaders.
>
> Of the seedlings of a seedling lot to be sold a minimum of 95 per cent shall meet the quality requirements mentioned in Subsections 1 and 2." (Inofficial translation by the National Board of Forestry).

The seedling bundle or container must not include extra, undersized or unacceptable seedlings. Local District Forestry

Boards may give supplementary intructions for their region. For the 1985 planting season, the main root must not be bent more than 45 degrees. Previously, an inclination of 90 degrees was allowed.

The size classification of both bareroot and container seedling stock is a secondary grading system. For bareroot seedlings the classification was constructed so that seedlings would fall into natural classes and consequently, culling from the lower end of the class would be minimized (Räsänen and Leikola 1974). Size classification is done using systematic samples on each seedling lot concurrently with the nursery stock inventory in the autumn. Each seedling lot is classified as a whole. A seedling lot is defined as those seedlings raised from the same seed lot of a defined area, which have been raised uniformly according to the same schedule, and in which the height and vigor of the seedlings is rather uniform. The lot may not be divided into sublots but must be sold as a whole (Räsänen and Leikola 1974). All the seedlings within each class have to meet the minimum height and diameter requirement of the class. In Table 2 are shown the size classes for Scots pine, Norway spruce and white birch seedlings. No recommendations are given on the shoot:root ratio.

Table 2.--The size classes of Scots pine, Norway spruce and European white birch seedlings.

Scots pine *Pinus sylvestris*	Size class			
	I	II	III	IV
The median height of the seedling lot, cm	- 12	13 - 18	19 - 25	26 -
The recommended height, cm	10	15	21	29
The minimum height, cm	6	10	15	21
The minimum diameter, mm (1 - 2 cm above root collar)	2.5	3.0	3.5	4.0

Norway spruce Picea abies	Size class			
	I	II	III	IV
The median height of the seedling lot, cm	- 27	28 - 34	35 - 42	43 -
The recommended height, cm	24	30	38	47
The minimum height, cm	15	20	26	33
The minimum diameter, mm (1 - 2 cm above root collar)	4.0	4.5	5.0	5.5

European white birch Betula pendula	Size class			
	I	II	III	IV
The median height of the seedling lot, cm	- 40	41 - 55	56 - 70	71 -
The minimum height, cm	25	30	40	50
The minimum diameter, mm (1 - 2 cm above root collar)	3.0	4.0	5.0	6.0

Container seedlings

The quality requirements described above are also applied to container seedlings. A recommendation for size classification of containerized Scots pine seedlings was given in 1983 based on the work by Kokkonen and Räsänen (1980) (Fig. 1) but it is not yet enforced. This is partly because new types of containers are introduced almost annually. (Currently, the number of different type and size of container seedlings is about 60.) The recommendations by the National Board of Forestry deal with the growing of seedlings and characteristics of the container stock raised. Growing density in containers must not exceed 1 100 seedlings/m^2 for Scots pine, 700 seedlings/m^2 for Norway spruce and 270 seedlings/m^2 for birch. Growing density, container volume and seedling height must be in a preset relation to each other (Fig. 1). The length of the raising period depends on container size and only one seedling per pot should be raised. Root cutting, if needed, must be done no later than two weeks before delivery. The delivered container stock must meet the regional minimum height requirements, the stem be free of basal sweep and the roots must not be twisted.

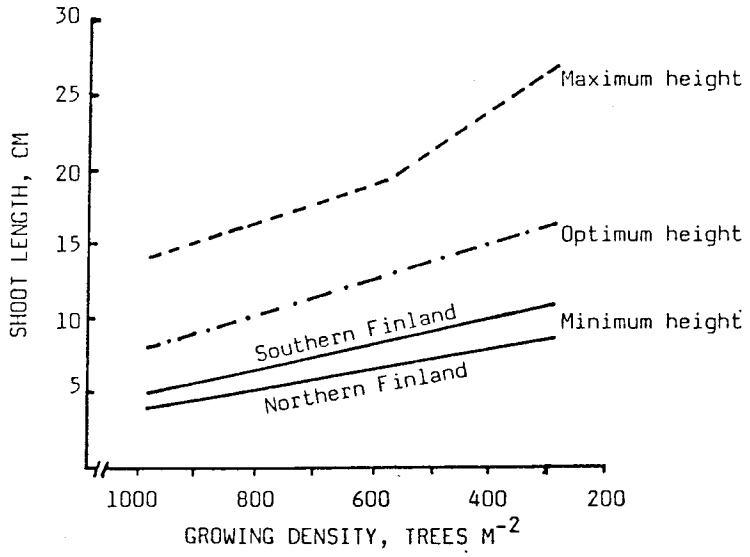

Figure 1.--The recommended shoot height for containerized Scots pine seedlings as a function of growing density.

Consumer Protection

When selling the planting stock, the consignee must be provided with the details of: 1) stock producer, 2) tree species and origin of the seed (location and type of seed collection), 3) code of the seed lot, 4) number of seedlings, 5) growing method, period and site of seedlings, 6) lifting date, and 7) delivery date from the nursery.

During spring delivery, officers of the National Board of Forestry make spot checks of the stock quality at nurseries. In the field, the planting material for private forest owners is usually checked by the local Forest Management Association - an interest organisation of private forest owners. The consignee can make a reclamation of the stock quality to the National Board of Forestry within eight days of the delivery. The supplying nursery is responsible for the information about the seedlings and stock quality.

CURRENT SEEDLING QUALITY PROBLEMS

In the autumn of 1984, exceptionally abundant disturbances in bud development of Scots pine and of frost damaged Norway spruce seedlings were found. Therefore, special guidelines were given for the 1985 planting season to cull these seedlings. Bud disturbances are found both in 2 - 3-month-old pine germinants and in raised 2 - 3-year-old seedlings. The disturbances have

been attributed to various causes, including unbalanced fertilisation, deficiency of micronutrients, aphid feeding, viruses, and drought. It is probably a combination of several factors. Fortunately, slight overproduction of Scots pine seedlings in 1985 allowed a more strict culling.

Although Finnish nurseries produce some 250 million seedlings annually, worth 15 million US$ and increasing to 80 million US$ when planted, the current nursery research is insufficient, depending only on the efforts of a few part-time scientists. The recent drawbacks in nursery production may be an indication of outdated research base.

Development of transplanting and root cutting techniques will probably reduce the occurrence of root system distortion, but the improvement will be gradual as the production period of a planting stock is 2 - 3 years. The nursery lifting and grading phase in the spring is very short, 2 - 3 weeks, which creates problems both at the nursery and at outplanting. Use of casual, seasonal workers in lifting, grading and planting is necessary, but it somewhat compromises the quality of grading. The springtime spot checks at the nurseries have revieled large variability in seedling quality. But based on a few years experience, the new legislation has improved nursery practices and seedling quality (Räsänen 1984).

The current quality requirements of seedlings are morphological and decriptive and do not assume physiological vigor testing. A drought stress test, as described by Hermann and Lavender (1979), has been experimented with but the short lifting and planting season in the spring, after the thaw of soil frost, precludes the rational use of this test. A size classification for containerized spruce and birch seedlings is being worked out.

LITERATURE CITED

Forets Regeneration Material Trade Act (No. 684/1979) and the Decision of the Ministry of Agriculture and Forestry on the Trade of Forest Regeneration Act (No. 685/1979). 9 p. (Inofficial translation by the National Board of Forestry.)

Hermann, R.K. and Lavender, D. 1979. Testing the vigor of coniferous planting stock. Oregon State Univ., For. Res. Lab., Res. Note 63. 4 p.

Kokkonen, M. and Räsänen, P.K. 1980. Characteristics of containerized seedlings and recommendations for quality classification (Summary in English). The Foundation for Tree Breeding in Finland, Information 4/1980.

Räsänen, P.K. 1984. The quality control of forest regeneration material in Finland. Voluntary paper at the IUFRO (S1.05-04 and S2.01-06) symposium "Methods of Production and Quality Control of Forest Seeds and Seedlings", March 19 - 23, 1984, Curitiba, Brazil. 2 + 9 p.

Räsänen, P.K. and Leikola, M. 1974. Morphological and physiological qualities of forest plants, their valuation and signification for succesful planting. Contr. paper, IUFRO Joint Meeting, Div. 1 and 3., "Symposium Stand Establishment", Wageningen, The Netherlands, October 15 - 19, 1974. 7 p.