

## Routines for Quality Production of Forest Plants in Container Trays<sup>®</sup>

**Morten N. Andersen**

The Norwegian Forestry Society, Høgskoleveien 12, N-1432 Ås, Norway

### INTRODUCTION

Seedlings of liner plants for forestry in Norway are mainly *Picea abies* (85%) and *Pinus sylvestris*. Norwegian nurseries use two different trays, so called M60 (60 cells, each cell is 75 cm<sup>3</sup>) and M95 (95 cells, each cell is 50 cm<sup>3</sup>), to produce about 50 million 1/0 and 2/0 liner plants each year. The plants are grown 2 to 4 months in a greenhouse before they are moved outside.

One-year-old plants are packed in the autumn and overwintered in a coolstore before they are sold in the spring. Two-year-old plants are normally overwintered outdoors after the first growing season, grown at the same place the second season, and then sold in the autumn or packed for cool storage and sold in the spring.

### ROUTINE REGISTRATIONS

Forestry plants are sold according to "Rules on Forest Seeds and Forest Plants" (Anonymous, 1996), which includes guidelines on quality standards for forest liner plants. According to the guidelines, producers of forest liner plants should, when complaints or requests for information on plant quality occur, be able to provide such information based on routine registrations.

As a minimum requirement the producers shall make written notes on the following:

- Plant type and age.
- Seed lot number, date of sowing, and sowing number. Seed used by nurseries are bought from Norwegian Forest Seed Station. Each seed lot is followed by a certificate with all necessary information regarding seed origin, harvest date, germination percentage, etc.
- Date of initial wetting of substrate to start germination. Some nurseries do the sowing during the winter because it is not that busy in the nursery at that time of the year. Seeds are sown in very dry peat (mixture of peat and perlite 80 : 20) and the trays are held in a cold store until they are transferred to the greenhouse for germination in the spring.
- Supplemental irradiation. Growth of *P. abies* is controlled by daylength. To avoid bud formation under short days in March just after germination, nurseries have to give light during the night.
- Date for thinning (if applicable). Nurseries use precision seeders. If the seed quality is high (high germination percentage) the seeder places one seed in each cell, if the seed quality is inferior, 2 to 3 seeds are sown in each cell. In the latter case surplus seedlings are removed leaving one seedling per cell.
- Temperature, irrigation/precipitation, and fertilization.
- pH and conductivity measurement. Nurseries use liquid fertilizer given through the irrigation water. Measurements of pH and

conductivity are used for regulating fertilization. pH measurements are normally made 2 to 4 times per season. Conductivity measurements are done in connection with irrigation.

- Date, duration, and night length for short-day treatment. *Picea abies* plants that are supposed to be sold and planted during the fall are normally given a short-day treatment for about 14 to 16 days in July – August. Some nurseries may also give seedlings a short-day treatment in July to stop stem elongation if the plants tend to be very long early in the season.
- Use of plant protectants: cause, agent, and date of application.
- Dates for start of cold storage, initiation of thawing after storage, and removal from cold store.
- Results from quality tests.

### QUALITY TESTS

The guidelines direct the producer to perform the following quality tests before fall sale, cold storage, and sale in spring:

- Subsequent to winter hardening the nutrient status of a certain number of plants must be measured. According to the guidelines the nutrient status of *P. abies* is evaluated. Samples of shoots and needles are taken in early October each year for analysis. Results are compared with the normative values in Table 1 and are used for planning the fertilization strategy the following season.
- Before fall sale or cold storage, terminal bud set and frost tolerance must be examined by morphologic evaluation and by freeze testing.

**Table 1.** Normative values in the guidelines for *Picea abies* in samples of shoots and needles taken for analysis early October (Ingestad, 1979).

Inorganic element	g 100 g <sup>-1</sup>	mg kg <sup>-1</sup>
N	2.0-2.9	
K	0.9-1.6	
P	0.1-1.3	
S	0.13-0.18	
Ca	0.09-0.6	
Mg	0.09-1.16	
Fe		>50
Mn		15-25
B		20-25
Zn		>20
Cu		2-3

The freeze test is made in special freezers where the temperature is gradually lowered to a specific test temperature. The test is done to evaluate the degree of acclimation. Based on the test results it can be decided if seedlings can be planted in the field and if they can be cold stored.

- Before spring sale sampled plants must be tested in a standardized controlled environment procedure. Acceptable plants must develop healthy new growth and white root tips during the test period.

### QUALITY REQUIREMENTS

The plant producer shall, according to guidelines, follow the current rules for grading, which include requirements on height, stem caliper, and culling of weak, damaged, and abnormal plants.

### LITERATURE CITED

- Anonymous.** 1996. Forskrift om skogfrø og skogplanter. Ministry of Agriculture, Oslo, Norway.
- Ingestad, T.** 1979. Mineral nutrient requirements of *Pinus sylvestris* and *Picea abies* seedlings. *Physiol. Plant.* 45:373-380.