

We are unable to supply this entire article because the publisher requires payment of a copyright fee. You may be able to obtain a copy from your local library, or from various commercial document delivery services.

From Forest Nursery Notes, Winter 2011

**153. © Root preparation technique and storage affect results of seedling quality evaluation in Norway spruce.** Rytter, R.-M. and Rytter, L. *New Forests* 39:355-368. 2010.

# Root preparation technique and storage affect results of seedling quality evaluation in Norway spruce

Rose-Marie Rytter · Lars Rytter

Received: 26 January 2009 / Accepted: 9 October 2009 / Published online: 24 October 2009  
© Springer Science+Business Media B.V. 2009

**Abstract** Evaluation of tree seedling quality is necessary for improving technology for forest nursery production and seedling handling. Nutrient status can be measured to determine seedling quality, but it can be affected by seedling handling techniques. In this study effects of root preparation technique and storage regime on content of macro nutrients (N, P, K, S, Ca, Mg) in fine roots of Norway spruce (*Picea abies* (L.) Karst.) plants were investigated. The root preparation techniques were: (a) rinse in tap or (b) deionised water, and (c) dry preparation. These techniques were tested on seedlings subjected to four storage regimes: (1) no storage, (2) deep freezing below  $-20^{\circ}\text{C}$ , and long-term (3) cold ( $+1$  to  $+3^{\circ}\text{C}$ ) and (4) frozen ( $-3$  to  $-4^{\circ}\text{C}$ ) storage. From the results it was concluded that the nutrient status in needles is not sufficient to describe the whole plant nutrient status in stored dormant plants, fine roots should also be included. The results also showed that deep freezing of fine roots before nutrient analyses should be avoided. Losses of K, P, S, and Mg were substantial with this method. Deionised water or dry preparation is preferred since tap water contains substantial amounts of ions that may affect the analyses.

**Keywords** Fine roots · *Picea abies* · Root:shoot ratio · Fine root:coarse root ratio · Macro nutrients · Plant storage

## Introduction

Cold (just above  $0^{\circ}\text{C}$ ) or frozen (just below  $0^{\circ}\text{C}$ ) indoor storage of containerized coniferous plants during the winter season is a common practice in Swedish forest nurseries as well as in the rest of Scandinavia, the United Kingdom, the United States and Canada (e.g. McKay 1992; Lindström and Stättin 1994). This makes it possible to keep plants in a

---

R.-M. Rytter · L. Rytter  
The Forestry Research Institute of Sweden (Skogforsk), Ekebo 2250, 268 90 Svalöv, Sweden

R.-M. Rytter (✉)  
Rytter Science, Backavägen 16, 260 24 Röstånga, Sweden  
e-mail: Rytter.Science@bwm.se