Risks Related to the Extension of the Planting Period of Norway Spruce Container Seedlings: Drought – Growth Stage Dynamics and Handling Practices

P. Helenius, J. Luoranen, R. Rikala

Finnish Forest Research Institute, Suonenjoki Research Station, Juntintie 154, FIN-77600, Suonenjoki, Finland

Approximately 90 million Norway spruce (*Picea abies* (L.) Karst.) container seedlings (of which 50% are frozen-stored) are annually delivered from nurseries in Finland. To take advantage of high stress resistance of dormant seedlings and available soil water, seedlings are usually planted prior to budburst in spring. Consequently, the planting period lasts usually only 4 or 5 weeks (i.e. May and early June) before seedlings starts to grow and soil is considered too dry for survival and growth. Because it is problematic for nurseries and forestry organizations to deliver and plant all the seedlings during such a short period, we investigated would it be possible to extend the planting period to include also late June and July without risk of excessive mortality and growth restrictions due to drought. In addition, we tried to find operational ways to improve seedling outplanting performance under drought (e.g. prolonged frozen storage).

To investigate the effect of drought on outplanting performance, actively growing 1.5-yr old Norway spruce container seedlings were exposed to 0–12 day preplanting drying in the greenhouse followed by 0, 1, 2, 3, 4 or 6 week postplanting drought periods under the plastic rain shelter in the sandy nursery field in central Finland. Seedlings kept dormant by prolonged frozen storage until planting were also exposed to 0–4 week postplanting drought periods. After drought periods, seedlings were irrigated so that the drought period and irrigation lasted altogether 6 weeks.

Height growth and root egress of actively growing seedlings planted in late June-early July decreased when exposed to postplanting drought, depending on the water content of the soil at planting and atmospheric evaporative demand (VPD) during drought periods. Survival and growth under drought were also decreased by preplanting drying of root plugs and especially that of seedlings, i.e. when the water content of root plugs decreased to < 20% ($v\ v^{-1}$). In general, however, mortality of actively growing, well-watered seedlings planted in late June - early July was negligible when exposed to drought periods no longer than 2 or 3 weeks.

Prolonged frozen storage up to 34 weeks in cardboard boxes at –3.5 °C to maintain seedlings dormant until planting in late June had no observable negative effect on needle carbohydrate concentration and subsequent outplanting performance. Contrary to actively growing seedlings from the same seedling stock (storage duration 30 weeks), drought periods had no effect on root egress and chlorophyll fluorescence, and only moderate effect on xylem water potential of dormant seedlings. However, actively growing seedlings showed much greater root egress than dormant seedlings, except when exposed to very long (≥ 3 weeks) drought periods after planting.

The results suggests that no risk of excessive mortality occur due to drought when well-watered, actively growing Norway spruce container seedlings are planted in late June - early July, provided that soil is not dry at the time of the planting.