

GAS EXCHANGES AND GROWTH OF THREE SIZES OF CONTAINERIZED PICEA MARIANA SEEDLINGS UNDER DIFFERENT MOISTURE REGIMES

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The use of large planting stock is often seen as a possible alternative to herbicides. Under conditions of high competition, large seedlings can compete more efficiently for light and reduce long-term maintenance needs. However, their greater transpiring surface which might make them more susceptible to water stress than conventionally-sized seedlings. This study was designed to address this concern.

Containerized black spruce (*Picea mariana* [Mill.] BSP) seedlings of three different sizes (table 1) were planted in three raised sand beds. The top 15 cm in each bed was maintained under dry ($Y_{soil} = -0.5$ Mpa), moderate ($Y_{soil} = -0.1$ Mpa), and moist ($Y_{soil} = -0.04$ Mpa) conditions. Gas exchanges, pre-dawn and mid-day water potentials and dry masses were measured on seven occasions during the summer.

Seedling size influenced significantly gas exchanges, xylem water potential and growth. Small and medium seedlings (sizes 1 and 2) maintained a higher net photosynthesis, transpiration and stomatal conductance over the three watering regimes than did larger (size 3) seedlings. Values of mid-day xylem water potential were lower in the large than in the medium or small seedlings under dry and moderate conditions. In all watering regimes, large seedlings showed the smallest relative growth rates (RGR) for total biomass. Comparisons of root RGR under the moist regime showed dynamic root growth in small and medium seedlings, but a negligible one for the large seedlings.

The results suggest that, in our seedlings, canopy size by itself had little influence on the susceptibility of the seedlings to water stress. The higher levels of water stress and the slow growth observed on the size 3 seedlings were linked with poor root vigour in that particular stock type. Shoot/root ratio of the three seedling sizes could not have been used as an *a priori estimator* of susceptibility to water stress.

In practical terms, the size 2 black spruce seedlings offer a vigour and growth performance comparable to that of the conventional size 1 seedlings. In addition, size 2 seedlings also have an enhanced competitive advantage conferred by their larger sizes. Reforestation of sites with heavy competition using size 2 seedlings would probably result in improved survival and growth and reduced need for weed control.

Table 1: Characteristics of containerized seedlings used in the experiment.

| Seedling size: | Small | Medium | Large |
|----------------------------------|-------|--------|-------|
| Cavity volume (cm ³) | 110 | 340 | 700 |
| Height (cm) | 22.1 | 40.6 | 72.2 |
| Total dry mass (g) | 2.6 | 8.4 | 49.3 |