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COMPARING THE WATER RELATIONS AND GROWTH OF NATURAL AND PLANTED BLACK SPRUCE (*PICEA MARIANA*) SEEDLINGS

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Water stress is often blamed for the initial plantation shock and slow growth in newly-planted coniferous seedlings. However, few studies have been aimed at measuring the absolute effect of planting on the water relations of seedlings. This study tackled this problem by comparing water relations and growth of black spruce (*Picea mariana* (Mill.) BSP) seedlings planted alongside natural black spruce seedlings of similar crown size. The study was carried out over a period of two years in a commercial clearcut block, in the Laurentian uplands, about 150 km north of Québec City. New seedlings were planted both years so that, the second year, each plot contained a natural seedling as well as seedlings planted on both years. The site was visited five times each summer. At each visit, pre-dawn and mid-day xylem water potential (ψ_x), as well as needle conductance (g_n) on seedlings from a selected number of plots. These measurements were also used to compute the resistance to water movement at the soil-plant interface (R_{SP}). The seedlings from the selected plots were then destructively sampled, and the dry mass of their below-ground and above-ground components were determined.

The first growing season was relatively warm and dry, and the relative growth rate of the planted seedlings was 42% lower than that of the natural seedlings. The second growing season was cool and wet, and the relative growth rate of seedlings planted that year was 29% lower than that of the natural ones. Differences between natural and planted seedlings in terms of their pre-dawn and mid-day ψ_x as well as mid-day g_n were small but significant. No clear relation could be found between pre-dawn ψ_x or mid-day g_n and either root extension or seedling growth. However, relative growth rates of natural and planted seedlings over both growing seasons were strongly related to mid-day ψ_x and, to a lesser extent, to soil-plant resistance to water movement. The observations suggest that mid-day ψ_x reflects a combination of soil water availability and root extension into the surrounding soil, and offers the best physiological indicator of seedling establishment to the site under conditions of adequate soil water supply.