



# Genetic variability in the root architecture of 2+0 white spruce seedlings

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Over 150 million containerized tree seedlings are produced annually in Quebec. At delivery, these plants must meet morphological standards established by the provincial ministry of Natural Resources (MRNF). Inadequate root system development and root plug cohesion are among the principal reasons that millions of seedlings are rejected each year. Since seedlings are usually grown under standard nursery cultural conditions, it is important to investigate the role that genotype plays in architecture of seedling root systems.

The primary objective of this study was to quantify the genetic variability of selected root system characteristics of white spruce seedlings from 75 open-pollinated families after two growing seasons under standard conditions in a private forest nursery (CPPFQ, Ste.-Anne-de-Beaupré, QC; 47°02'N, 70°55'W).

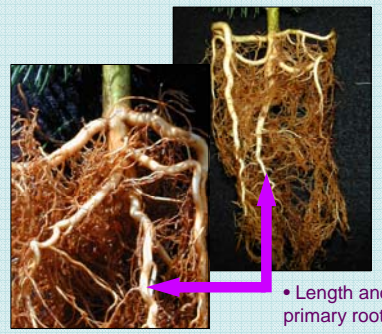
The seedlings were grown in IPL 15-320 containers (IPL Inc, Saint-Damien-de-Bellechase, QC). During their first year of growth, the seedlings were subjected to two different fertilization regimes: optimal and sub optimal. All of the seedlings received the same fertilization treatment during the second growing season.



Measurement, visual evaluation and statistical analyses at the end of the second growing season showed that family did not significantly affect the following root system characteristics:



• Degree of root plug colonization



• Length and orientation of primary root



• Distribution and re-orientation of first order lateral roots (FOLR)



• Number of first order lateral roots colonizing each ¼ of the cavity by depth

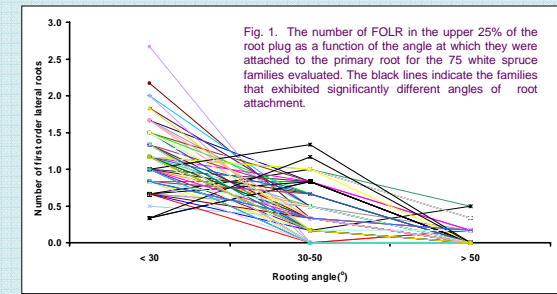
However, family did have a significant effect on:

- The angle at which the first order lateral roots in the upper 25% of the cavity were attached to the primary root (<30°, 30° to 50°, >50°)



For the majority of families, the first order lateral roots were attached to the primary root at angles of <30°. However, six families had an elevated number of secondary roots growing at angles of between 30° and 50° (Fig.1).

A profile analysis showed that this characteristic was only evident in seedlings grown under the sub-optimal fertilization regime during the first growing season. This characteristic may be an attempt to exploit the nutrient reserves in a larger volume of the root plug.



Although it was impossible to conclude that there is a significant genetic influence on the root architecture of the 75 families that we evaluated, we did confirm the sensitivity of white spruce root systems to differences in substrate fertility and that not all families exhibit the same type of adaptation to rhizosphere nutrient status.