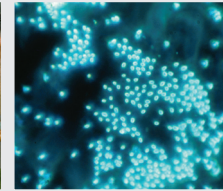
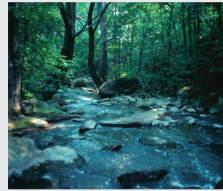




# In Brief

from the Canadian Forest Service – Laurentian Forestry Centre



Number 7 – 2005

## Are wood traits genetically transmitted in white spruce?

White spruce is a quality species suitable for reforestation use in Canada. Canadian Forest Service (CFS) researchers and provincial researchers have been carrying out genetic improvement programs for a number of years, and these efforts have produced appreciable gains in tree height and diameter growth. But what is the situation with respect to wood traits such as density, moisture content and growth ring width?

White spruce is grown mainly as a source of pulp and structural products, the quality of which is largely dependent on wood density. In trees of similar size, rapid growth typically produces wood of low density whereas slower growth yields denser wood.

Through their work, CFS researchers have shown that wood density traits are genetically transmitted just as growth characteristics are; in fact, heredity has an even greater influence on wood density than it does on growth. This underscores the importance of continuing genetic selection efforts in order to identify the best subjects and to grow quality trees while maintaining a desired level of genetic diversity.

**For information: Jean Beaulieu,**  
[jean.beaulieu@nrca-nrcan.gc.ca](mailto:jean.beaulieu@nrca-nrcan.gc.ca)

## An improved in vitro propagation protocol for eastern white pine

Somatic embryogenesis is a technique that can be used to produce a number of seedlings, in vitro, from an embryo derived from a single seed. It involves taking some tissue from the embryo and placing it in a suitable culture medium in order to generate many genetically identical embryos. This approach holds promise for the production of genetically improved trees, such as trees that have greater resistance to certain diseases. Although the assays conducted to date on eastern white pine (*Pinus strobus*) have produced viable embryos, the proportion of viable embryos obtained has varied widely and has rarely exceeded 30%. This rate is insufficient for commercial production and it has been a roadblock to the production of genetically diverse stock. A group of Canadian Forest Service researchers have successfully developed an improved protocol by modifying the concentration of some of the culture medium ingredients, notably, a growth regulator.

This has permitted an increase of between 20% and 53% in the embryo establishment rate. The culture medium improvements have also had an effect on the rate of embryo maturation and transplanting in nurseries, which amounted to 76% for all the different concentrations used.

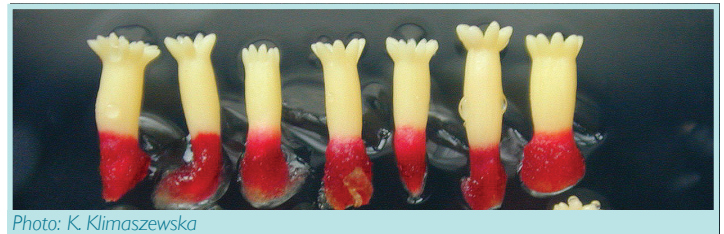


Photo: K. Klimaszewska

The new protocol paves the way for commercial applications of in vitro propagation of eastern white pine.

**For information: Krystyna Klimaszewska,**  
[krystyna.klimaszewska@nrca-nrcan.gc.ca](mailto:krystyna.klimaszewska@nrca-nrcan.gc.ca)

## Analysis of the machining properties of cultivated white spruce

Although the forest products industry is currently dependent on natural forests, it is likely that plantations will soon play a greater role than natural forests in supplying raw materials to the industry. Since cultivated white spruce trees are likely to be used increasingly, it is important to assess the response of spruce wood to machining operations such as planing, shaping, boring, turning and mortising.

CFS and Université Laval researchers subjected white spruce samples from a plantation and from natural stands to machining operations and then compared their performance. They

also studied the effect of two drying treatments on the samples' response to machining. All the wood samples were machined at a moisture level of 7% using different tools, after which they were graded based on surface quality. The maximum depth of grain tearing was also measured according to eight cutting methods.

The cultivated white spruce samples performed well in the planing, shaping and boring tests, but their response to turning and mortising was not as good. While the provenance of the samples was not found to have a major

influence, denser wood responded better than low-density wood to shaping, boring, turning and mortising operations. Denser spruce wood, regardless of origin, has better machining properties. The study also showed that high-temperature drying, as compared with conventional drying, does not affect the machining properties of white spruce.

**For information: Jean Beaulieu,**  
[jean.beaulieu@nrca-nrcan.gc.ca](mailto:jean.beaulieu@nrca-nrcan.gc.ca)

## Do fast-growing trees pose a threat to the nutrient stores in soil?



Photo: C. Coulombe

In Canada, the growing demand for wood fibre, combined with the desire to protect vast expanses of forest from commercial harvesting, has stimulated interest in the use of fast-growing tree species. This interest has raised concomitant fears about the potentially adverse effects of these species on the nutrient reserves of the soil and the need to use costly fertilizers that can have harmful effects on the environment.

Researchers at the CFS and the Université du Québec à Montréal conducted a comparative study to determine the effect of the faster growth rates of some Norway spruce provenances on nutrient availability and distribution in the soil. Another aim of the study was to compare the results with the predictions derived from the PROFILE model, used to estimate the chemical composition of soil. Based on studies carried out at Valcartier and in the Gaspé region, the researchers concluded that, in the short term, faster growth rates do not impoverish the soil (i.e. reduce nutrient stores), possibly because alteration of soil minerals is stimulated and trees can retain nutrients more effectively. The study also showed that the PROFILE model's ability to predict within-site changes in alteration rates needs to be enhanced.

**For information: David Paré,**  
[david.pare@nrca-rncan.gc.ca](mailto:david.pare@nrca-rncan.gc.ca)

## Disease-resistant poplars

Poplars and hybrid poplars have considerable commercial value owing to their rapid growth potential, their capacity to adapt to different climates and soils and the versatility of their wood. Poplar cultivation is limited by the species' susceptibility to various diseases and the attendant risk of large productivity losses. In an effort to increase poplar resistance to certain pathogens, CFS researchers inserted the D4E1 gene, which codes for a synthetic antimicrobial peptide, into this species. Synthetic peptides offer broad-spectrum antimicrobial activity and cause less severe phytotoxic effects than do natural antimicrobial peptides.

The researchers then tested the resistance of these transgenic poplar trees to crown gall, bacterial canker and hypoxylon canker. Among the poplar lines studied, the one with the greatest accumulation of D4E1 gene products also showed the most significant decline in galls and cankers associated with crown gall and bacterial canker infection. None of the poplar lines showed a marked difference in relation to hypoxylon canker.



Photo: A. Carpentier

**For information: Armand Séguin,**  
[armand.seguin@nrca-rncan.gc.ca](mailto:armand.seguin@nrca-rncan.gc.ca)

## Hybrid poplar performance, 10 years after planting

Hybrid poplars are prized by the forest industry, particularly for their rapid growth rate. In the early 1960s, the CFS carried out tests involving 68 hybrid poplar clones on more than 50 sites in Quebec, with the aim of selecting a single clone capable of producing high-quality wood quickly. This work was undertaken in collaboration with the United States Department of Agriculture.

After several years, only 15 clones and 12 sites were retained in the study; the other clones had to be eliminated because of their slow growth or low survival rate. The researchers subsequently selected 8 clones with the aim of identifying the cloned tree with the best overall performance 10 years after planting, based on total height growth, diameter at breast height, health and mortality rate.

Ten years later, the researchers were unable to determine which clone was the best since several clones exhibited a similar performance. However, the research did enable them to conclude that lowland sites encouraged the best performance, with trees reaching an average height of 13 metres, whereas moderately good performance was reported on upland sites, where an average height of 10 metres was attained. The average height of trees on poor-quality sites was 4.5 metres. Soil moisture appears to be the main cause of this difference in performance and growth. Weed control and tillage during the first three years after planting were also found to contribute to the hybrid poplars' growth and survival.

### For more information about the series:

Natural Resources Canada  
Canadian Forest Service  
Laurentian Forestry Centre  
1055 du P.E.P.S.  
P.O. Box 10380 Stn. Sainte-Foy  
Quebec (Quebec) G1V 4C7  
418 648-5789

[cfs.nrcan.gc.ca/publications/series/read/2](http://cfs.nrcan.gc.ca/publications/series/read/2)