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CWFC Facts 001

## Canadian Wood Fibre Centre Fibre Facts

### Multi-varietal Forestry

The Canadian Forest Service has developed a new strategy for plantation forestry incorporating tree biotechnology—multi-varietal forestry (MVF)—that will have a major economic impact on forest productivity and the delivery of desirable fibre attributes. As well as maximizing growth and yield, as in traditional programs, MVF can also improve wood quality, resistance to pests, and uniformity of product quality more efficiently. Important advantages of MVF include greatly enhanced forest productivity, flexibility to respond to changing breeding goals and changing climate, and design and management of plantation diversity.

Multi-varietal forestry is defined as the use of genetically tested tree varieties in plantation forestry, balancing genetic gain with diversity. In the past 30 years, plantation forestry using genetically improved seed has resulted in greater forest productivity. More recently, the emergence of new biotechnological approaches—namely somatic embryogenesis (SE) and cryopreservation—have added a new dimension to forest tree improvement programs.

Somatic embryogenesis is a tissue-culture technique whereby genetically identical embryos are produced in large numbers. Cryopreservation, which is the storage of embryogenic tissue at ultra-low temperatures, allows embryogenic varieties produced by SE to be stored indefinitely in liquid nitrogen without incurring changes

in the genetic makeup or loss of juvenility while field testing is carried out using somatic seedlings grown from a thawed portion of the cryogenically stored tissue. Together, these techniques offer a unique opportunity to produce tested tree varieties consistently over time. Dr. Yill-Sung Park, of the Canadian Wood Fibre Centre in Fredericton, is using these technologies to develop high-value tree varieties with desirable attributes that can be mass produced for plantations.

Dr. Park accomplishes this by careful exploitation and capture of natural genetic variability, without resorting to genetic engineering.

These high-value varieties can be deployed in MVF in mixtures. Some sacrifices are made to genetic gain to ensure diversity. Management of plantation diversity is carefully designed and continuously revised based on the best available data; the MVF process is highly flexible, and can adapt to changing circumstances. Thanks to development of these technologies, industrial implementation of MVF has begun in eastern Canada in connection with regional tree improvement programs. Dr. Park has founded the National Network of Somatic Embryogenesis Laboratories to build competency in SE of all commercially important Canadian conifers through collaboration, research, and development. The Network is the delivery mechanism for technology transfer, and it consists of five R&D Laboratories and eight Applied

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Laboratories/Strategic Partners. The primary role of the R&D laboratories, which include the Canadian Forest Service and university laboratories, is the development and refinement of technology and its adaptation to new species, and provision of technical support. The applied laboratories and strategic partners, which include provincial governments and industry, are focusing on the implementation of current technology in MVF.

Natural Resources Canada is a world leader in SE and related research, and has developed promising tools that, in the context of sound forest management practices, will contribute to the ultimate goal of increasing productivity of desirable fiber attributes to enhance the competitiveness of Canada's forestry sector.

### Reference

Park Y.S. 2002. Implementation of conifer somatic embryogenesis in clonal forestry: technical requirements and deployment considerations. *Ann. For. Sci.* 59:651–656.



Seed from trees selected for desirable characteristics are developed into varietal lines using somatic embryogenesis; tissue from all candidate varieties is cryopreserved while field tests are conducted to evaluate them for desired traits; somatic seedlings of high-value varieties are then mass produced from cryogenically stored tissue and deployed in plantations



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