

Industrial Implementation of Multi-Varietal Forestry for Spruces in New Brunswick, Canada

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Abstract

Recent advances in somatic embryogenesis (SE) and cryopreservation techniques in conifers, particularly in spruces, have led to industrial implementation of high-value multi-varietal forestry (MVF, or clonal forestry) in New Brunswick, Canada. The important benefits of MVF include: (1) obtaining much greater genetic gain than through conventional tree breeding; (2) flexibility to rapidly deploy suitable varieties with changing breeding goals and environments; and (3) ability to design and balance genetic gain and diversity in plantations. The key element of MVF is the consistent production of genetically tested genotypes (varieties) with desirable attributes over time, which can be accomplished by the use of SE and cryopreservation. Fortunately, SE technology in spruce species is sufficiently refined, and SE initiation and plant conversion frequencies are high enough for commercial application. Such application allows high levels of genetic gain when incorporating SE into variety development and maintenance of genetic diversity in plantations.

The current deployment of SE varieties in New Brunswick, Canada is in the range of 1.2 million trees, and the program is closely tied to an existing long-term tree improvement program. Over 2000 embryogenic variety lines have been cryo-stored while the corresponding lines are being tested in the field. The deployment of varietal lines requires careful consideration to balance genetic gain and diversity. This involves choosing an appropriate mixture of varieties to deploy, as well as an appropriate configuration for the plantations. In New Brunswick, it is proposed to use a strategy based on “desired gain and diversity” as well as “mixture of varieties and seedlings.”

The implementation of MVF in Canada is carried out through a close collaboration and partnership among technology developers and practitioners. The National Network of Somatic Embryogenesis Laboratories, comprising of government organizations, universities, and industry, was launched in 2006 to effectively transfer SE technology in the forestry sector. More recently, a new IUFRO Working Party on “Somatic Embryogenesis of Forest Trees (2.09.02)” has been created to foster the development and application of SE technology in both coniferous and hardwood tree species (<http://www.iufro.org/science/divisions/division-2/20000/20900/20902/>).