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It isn't all about Rugby: New Zealand and France unite to give Douglas-fir somatic embryogenesis protocols a workout

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Integrating vegetative propagation, biotechnologies
and genetic improvement for tree production
and sustainable forest management

book of abstracts





Session

Somatic Embryogenesis



1

Session

It isn't all about Rugby: New Zealand and France unite to give Douglas-fir somatic embryogenesis protocols a workout

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DOUGLAS-FIR is the second most important exotic forest species in New Zealand next to radiata pine which is currently 89% of the planted estate. There is significant interest in genetically improving this species to provide diversification of the national planted forest estate away from radiata pine. Benefits include; the better matching of species to sites at higher altitude and cooler climates; minimising exposure to disease; timber would produce a wider range of forest products. Additionally it would give us a contingency species if radiata pine was to fail in some significant way. Breeding programs to improve and select the best Douglas-fir genes for New Zealand conditions are advanced and two seed orchards have been established in the South Island.

Propagation of this species is challenging, seed production is affected by climatic factors and production of control-pollinated seed is not straight forward. The combination of irregular seed crops, plagiotrophism and dormancy in cuttings as well as the limited life of stool beds (approximately 2 years as compared to 4 plus years, for radiata pine) make producing improved genetic planting stock problematic. Somatic embryogenesis could potentially address some of these issues via amplification of control-pollinated seed, production of non-plagiotrophic plants and arrest of maturation in clonal material while field testing takes place. There is potential to integrate somatic embryogenesis with nursery stoolbed production methods.

Somatic embryogenesis methods are established for this species overseas and part of the Weyerhaeuser forest strategy. We wanted to develop independent capability with this species using *P. radiata* protocols. Preliminary investigations were started in New Zealand to develop SE capability with Douglas-fir essentially adapting the *P. radiata* protocols we were most familiar with. We got to know our French collaborators and the importance of Douglas-fir in France (2.6 million m³ harvested/year) via the two previous IUFRO Somatic Embryogenesis of Forest Trees conferences held in Whistler (Canada) and Suwon (Korea). INRA and FCBA have been developing breeding programs for growth rate, branching and other traits of interest for more than 40 years. Joint funding was obtained for two years from both the French and New Zealand governments via the Dumont d'Urville scheme to develop the collaboration. Progress with this species is a direct result of happy and vigorous discussions (and a bit of mutual rugby appreciation through 2011).

Using only slightly modified radiata pine protocols we were able to initiate cell lines, cryopreserve tissue, mature embryos and establish plants in the greenhouse. But, there were a few challenges. Culture initiation rates using pine methods were satisfactory but the resultant tissue grew slowly and many of the cell lines had a mixture of both embryogenic and non embryogenic tissue. This was the most limiting step with regard to developing capability with Douglas-fir at Scion. We are pleased to report that progress has been made with proliferation and this is the data we would like to concentrate on in this presentation. However, all the methods we are using will be discussed and data presented as appropriate on initiation, proliferation, cryopreservation, maturation and organogenesis.

Keywords: somatic embryogenesis, Douglas-fir, initiation, proliferation

