

21st Century Tissue Culture Partnership



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The New Zealand forest industry has made substantial advances over the last century in improvements to the growth rate, the wood quality, and the resilience of radiata pine. This focus is continuing and is of increasing importance in the face of climate change, increased risk from pests and pathogens and increasing expectations from customers.

The Forest Research Committee, which directs the investment in research arising from the forestry levy, noted the considerable effort sustained in radiata pine breeding, by for example the Radiata Pine Breeding Company Ltd, but at the same time saw there was an opportunity to enhance the deployment of new genotypes.

They therefore invested in a new programme focussed on deployment, that is taking tree breeds developed by others, and speeding up the process of reproducing them, and hence the ability to provide forest growers with these trees more rapidly and in greater quantities.

From this arose a new partnership – the 21st Century Tissue Culture Programme - between Forest Growers Research Ltd, Scion, Georgia Institute of Technology (USA) and the Ministry of Business Innovation and Employment. This partnership seeks to place radiata pine propagation onto a factory footing and reduce deployment time from 24 years to about 9 years using a genomic selection approach in combination with somatic embryogenesis.

Somatic embryogenesis is a process that takes immature embryos, formed after pollination, from green cones. These embryos are then induced to produce masses of cells which contain many tiny somatic embryos – embryogenic cell lines. These cell lines can be encouraged to form mature embryos that germinate into tiny plants which are acclimatised to nursery conditions and finally taken into the field. This process is an extremely attractive option for the rapid reproduction of genotypes with proven performance.



Somatic embryogenesis is already in application in New Zealand. The current approach takes the same cell lines and uses a semi-solid system for supplying the nutrients required by the embryos as they develop. It also requires many transfers to different media as the embryos mature and need different hormones or nutrients. This approach is inherently expensive and limits the ability for wider uptake. Hence the investment in this programme to evaluate production of single varieties (varietals) of trees using high throughput bioreactors,

specifically Temporary Immersion Bioreactor Systems.

*** Picture Above: Some of the immersion bioreactors being installed at Scion.*

Temporary Immersion Bioreactor Systems use a liquid system rather than a semi-solid system and offer advantages such as better access to the medium components for the emerging plantlets and decrease of manual handling (labour). Other advantages include higher proliferation rates, less opportunity for contamination and scalability through use of automation and robotics. Collectively this could make the use of the implementation of multi-varietal forestry (MVF; the use of tested high-value tree varieties in plantations) very cost effective and maximise the opportunity for the widest application in commercial forestry in New Zealand.

The purpose of this new partnership is to test and develop the Temporary Immersion Bioreactor System for application to radiata pine. By complementing the use of the bioreactors with automation and robotics that will take the emerging plantlets all the way through to the nursery we will be creating a high throughput “factory” for the production of radiata pine varieties which can then be taken to nurseries and become part of the tree establishment supply chain.

The 21st Century Tissue Culture Programme is now one year old. Scion, with support from Georgia Institute of Technology is building a facility with 48 Temporary Immersion Bioreactors for testing and evaluation of this new approach for our industry.

The Programme is receiving direct support from every part of the forestry industry from tree breeding, tree nurseries to forest owners and managers. There is a governance group and a technical advisory group that brings extensive skills from within and beyond our industry. This gives us confidence that we have created the best opportunity for testing and developing this new approach for commercial forestry in New Zealand.



We wish to acknowledge the direct financial support from the Forest Growers Levy Trust, who are investing \$600,000 per annum, the Ministry of Business Innovation and Employment who are investing \$400,000 per annum and from the Scion Strategic Science Investment Fund who are investing \$200,000 per annum. We also acknowledge the considerable support from industry with advice, guidance, and supply of material.

Our aim is that by 2026 we will have in place that high throughput factory to produce radiata pine varieties for the benefit of all those involved in the commercial growing of trees in New Zealand.

For further information please contact.

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