

Reflections on a productive first year

This quarter has been extremely busy within the 'Healthy trees, healthy future' programme with many key parts of the programme getting into full swing. The first experiment on infecting radiata pine needles with *Phytophthora pluvialis*, and integrating the whole systems biology approach of pathology, detailed microscopy, NMR, gene expression and mass spectroscopy got underway with each analysis cross-informing the other.

It will take awhile to pull all of the data together as it's new ground for all of us, but this will get smoother as we go. We are already starting to see some nice results and indications of resistance to RNC from across the team. Our engagement with the scientific community, end-users and industry has also drawn lots of constructive feedback, with opportunities being developed around the programme.

In October, we welcomed our first PhD student, Simren Brar, to the programme.



PhD student Simren Brar joins us from Canada

Simren will be working with Associate Professor Rosie Bradshaw and Dr Carla Eaton (Massey University), and Dr Rebecca McDougal (Scion) with her focus being on host-pathogen interactions between *Pinus radiata* and *Phytophthora pluvialis*. Simren joins us from Vancouver, Canada, where she completed her undergraduate and Masters studies.

Over summer we are also welcoming Echo Herewini, a BioProtection Masters student whose work aligns with kauri research within

the HTHF programme. Echo is also supervised by Rosie Bradshaw along with Dr Peter Scott (Scion) and Dr Stan Bellgard (Landcare Research). She will be screening lines of kauri against *Phytophthora* taxon Agathis and looking for resistance to kauri dieback.

I recently attended the 7th IUFRO 7.02.09 *Phytophthora* in Forests and Natural Ecosystems conference in Esquel, Argentina, along with HTHF collaborators Ian Horner (Plant & Food Research), Maj Padamsee (Landcare Research) and Tony Beauchamp from the Department of Conservation. The conference showcased research that is happening globally on *Phytophthora* in forest systems, and provided an opportunity to present and discuss many aspects of our HTHF programme with international colleagues.

It was good to have talks and posters presenting research from New Zealand. We received some great feedback on our *Phytophthora* research and the HTHF programme model. This model will build on similar approaches being taken to investigate host-pathogen interactions in other forest tree species, such as cork oak (*Quercus suber*) and Tan Oak (*Notholithocarpus densiflorus*), which are incorporating gene expression and metabolomic analyses.

After the conference I visited Chile and saw *Phytophthora pinifolia* in action in the *Pinus radiata* forests there. We are now in discussion with Arauco and the University of Concepción about opportunities for ongoing collaboration and programme alignment within both the HTHF and Scion's applied RNC research programmes.

Nearing the end of a very productive year, we can reflect on the considerable progress that has been made in getting this project up and running. This is a great credit to the whole team. I look forward to an equally productive 2015 in which the kauri and apple work will gear up to full steam.

Have a relaxing Christmas and New Year, Nari

Progress with Māori engagement



Kauri and the wider kauri forest are of considerable environmental, cultural, spiritual and economic importance to people, both Māori and pakeha across kauri lands. From its inception, the 'Healthy trees, healthy future' programme has recognised the need to work with Tāngata Whenua to achieve optimal programme outcomes for kauri and Māori communities in these areas.

Following the structured step-by-step Te Aroturuki process, our scientists have actively sought to develop a deeper understanding of Māori values and contexts by undertaking dialogue with Māori groups.

Key outcomes for Māori from the HTHF programme will be:

- *Kia toitu he kauri mo ake tonu*: The HTHF programme aims to utilise western science-derived tools to assist in identifying dieback-resistant kauri for commercial planting and restoration of natural forests
- *'Mai te ngahere oranga'*: Programme success will enable the realisation of the economic potential of kauri in areas currently impacted by kauri dieback
- *Kaitiakitanga*: The HTHF programme also seeks to develop tools for kaitiaki/environmental monitoring to improve the management of the disease in natural and planted stands.

Now in the dialogue phase of the process, our HTHF leadership team has met with members of the Kauri Dieback Programme Tāngata Whenua Roopu Executive, and reached an

agreement-in-principle to support the development of Tāngata Whenua across the kauri work within the HTHF programme. This will include representation on the technical advisory group and programme overview committee, co-development of research programmes and assistance with engagement with Mana Whenua groups. We are grateful to the Roopu for their guidance, mentoring and helping the research team improve our understanding of the Māori values across the programme and throughout the engagement and dialogue thus far.

We look forward to developing this engagement as the kauri work is phased into the programme fully in 2015.

Nga mihi

Screening for resistance



Fascicles are collected into tubes for inoculation in the laboratory.

To enable us to identify resistance mechanisms to *Phytophthora* in radiata pine, we first need to identify trees that perform well when exposed to these pathogens. As a result, we have been screening material in Scion's nursery for resistance to *P. pluvialis*, the causal agent for red needle cast.

The first group to be tested consisted of the Radiata Pine Breeding Company (RPBC) Elites, a structured population comprising 63 full-sib families from crosses between 55 unique parents. These industry-relevant families have been planted in trials across 12 sites in New Zealand and Australia, including some dothistroma needle blight prone sites. The trials are also part of the RPBC and Scion's Genomic Selection Partnership programme, providing a valuable opportunity to draw



After inoculation, fascicles are laid out in trays and incubated to allow lesions to develop.

together all the genetic, health and wood quality information being collected for these families.

To date, at least six individuals from each family have been screened using Scion's detached needle assay on nursery material. This involved taking fascicles from trees to the laboratory where they were inoculated then incubated for two weeks to allow lesions to develop. A team then carefully measured all the needles and recorded the number and length of lesions present. This was an intensive task, with a single experiment capturing information for nearly 15,000 needles.

Over the last year we have conducted 16 of these experiments and screened over 400 different genotypes, which translates to nearly a quarter of a million needles measured. We have seen noticeable differences in the way trees respond to infection, with some trees developing severe lesions, while others remained largely unaffected with only occasional small lesions developing.

The lesion measurements collected allowed us to make comparisons and identify which trees are more resistant or susceptible to red needle cast. Early results indicate that some of these differences are genetically controlled, which gives the RPBC an opportunity to breed for resistance and preferentially deploy this material on disease-prone sites.



Lesions are counted and measured for every needle from every fascicle.

Now we have identified resistant and susceptible genotypes we can start understanding what makes these trees respond differently. The trees will be further analysed using the other platforms being developed in the HTHF programme, with clonal propagation underway to generate sufficient material for screening. In addition, inoculations with *P. kernoviae* and *P. cactorum* are planned to determine if resistance to one species of *Phytophthora* could translate to cross-resistance to multiple *Phytophthora* species.

For further information

Email Natalie.Graham@scionresearch.com

Industry recognition

The 'Healthy trees, healthy future' programme was rewarded for its contribution to the forestry sector at the New Zealand Forest Owners Association Conference in October, with Nari Williams taking home the Contribution to a Science Team Award for her work in developing the HTHF project.



Scion's red needle cast (RNC) research team was also recognised with the Science of International Quality Award. Nari says the award acknowledges the enormous efforts that the team puts in behind the scenes. "This award recognises the foundation work in epidemiology, trade risk and disease response to RNC leading to the three papers which we published earlier this year. It also recognises the monitoring, assay development, diagnostics, trails and lab work that have contributed to our current understanding of RNC.

"I also believe both awards reflect the efforts we have all put in to improve communication with the industry and Technical Committees over the last six plus years."

To learn more about this programme

Contact

Email Dr Nari Williams at nari.williams@scionresearch.com

Visit our website and subscribe to our quarterly newsletter

www.healthytrees.co.nz

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