

Press Release –TREEPLAN® Version 2 Project, March 2003

TREEPLAN® - An Advanced Genetic Evaluation System for Forest Tree Improvement Dr TA (Tony) McRae



The Forest and Wood Products Research and Development Corporation (FWPRDC) will co-invest in a new project to develop a state-of-the-art genetic evaluation system. FWPRDC will contribute \$418,680 dollars towards a total project budget of \$1.43 M.

A new partnership project between FWPRDC and the Southern Tree Breeding Association (STBA) aims to enhance the capability of TREEPLAN® genetic evaluation software in order to capitalise on innovative breeding technologies.

According to STBA General Manager, Dr Tony McRae, TREEPLAN® uses the most advanced analytical methods available to tree breeders to identify elite trees with the best genes. Genetic improvement is serious business, making a major contribution to profit margins in softwood and hardwood plantations. TREEPLAN® has the capability to rank genotypes using data from across generations, states, localities, ages and silvicultural practices. It allows the STBA to objectively compare different trees for their genetic potential on a national basis. The underlying technology is robust and is widely used in the livestock industries and has recently been adopted in the national tree improvement programs for *Pinus radiata* (Pine) and *Eucalyptus globulus* (Blue Gum). Dr McRae believes tree breeders have been a little slow in adopting 'best practice' breeding methods, because the statistical methods are complex compared with conventional methods. Breeders have placed too much emphasis on subjective gut feelings and ignored objectivity and the science of genetics.

The STBA and FWPRDC will be working closely with the Animal Genetics and Breeding Unit (AGBU) from the University of New England to produce TREEPLAN® V2. AGBU are world leaders in genetic evaluation for livestock and have refined analytical methods for national genetic evaluations in the major animal breeds. Dr McRae says the objective of the new project is to build on the experiences of the animal breeders. Tree breeders from STBA and its Research Members (CRC-SPF and CSIRO-FFP) will continue to work closely with AGBU to exploit the skills and expertise of both tree and animal breeders. Dr McRae believes there is no point to reinventing the wheel - AGBU has the runs on the board with 25 years experience in this area. "We want to exploit their technical excellence in genetic evaluation. We are mindful that animals and plants differ in their biology and genetic make-ups. It is important our tree breeder's work closely with AGBU to ensure the enhanced TREEPLAN® V2 system is optimal for trees. But at the end of the day they are not too different when it comes to genetic models for breeding and selection. The same fundamental principles of genetics and statistics apply".

The aim of the project is to further enhance this 'industrial strength' genetic evaluation software. The software will be used for the routine and efficient prediction of breeding and deployment values for commercially important traits (volume, tree form, wood quality, disease resistance and adaptation to marginal environments where drought, frosts and salinity are important) in plantation species, which includes Pine and Blue Gum.



Left to Right Dr Bruce Tier (Chief Scientist, AGBU), Dr Hans Graser (Director, AGBU), Dr Glen Kile (Executive Director, FWPRDC) and Dr Tony McRae (General Manager, STBA) met to discuss the new project in Melbourne.

Dr McRae recognises that the forest industry and community is investing heavily in genomics and molecular genetics. Genomics and biotechnology remain the 'buzz words'. He suggests investment in this research is largely wasted unless methods are developed that can use the technologies along with performance data (growth, form and wood quality) routinely collected in operational tree improvement programs. TREEPLAN® V2 will integrate information at the DNA level (candidate genes and genetic markers) with performance and pedigree data. The project aims to pull together information from different sources. Superior genetics can be exploited by using different deployment strategies, for example, using family and/or clonal forestry. The plantation sector is becoming increasingly interested in testing clonal material for deployment. The project will enhance TREEPLAN® capabilities so it can simultaneously predict breeding and clonal genetic values using the full pedigree structure and performance data from the national database. The system will distinguish between genetic values, which are important for breeding purposes, and clonal values, which can be useful for deployment. Deployment of tested clones can contribute to greater genetic gain for some traits, but the breeding population must continually be improved by conventional breeding and testing methods to provide the next generation of superior clones. A tree can be a good clone for deployment but may not be any good for breeding. This is because the superiority of a clone can arise from different genetic mechanisms, including unpredictable interactions. This superiority can be lost during sexual reproduction when genes recombine to form gametes (pollen and ovules).

TREEPLAN® V2 will also better model environmental effects in trials. Local environmental effects (such as different moisture levels, drainage, fertiliser, weeds, soil changes and competition) can differentially influence the relative performance of different genotypes in trials. This 'noise' can confound comparisons and adjustments are needed to ensure all trees are evaluated on a level playing field. Researchers are developing better statistical methods and these need to be incorporated and used in routine genetic evaluations of plantation species.

Dr McRae says we can better define the production environments in which trees are grown. This is particularly the case for *P. radiata*. The best genotypes suited to one region are not necessarily the best in another area. If we are able to identify repeatable environmental effects we can breed and select the optimal genotype for a particular region. For example, resistance to *Dothistroma* is required in areas where warm humid conditions are found in spring and summer. However, different genotypes may be adapted to growing conditions found in the Green Triangle region of SA. Different genotypes are probably required for drier marginal country. It is therefore necessary to test progeny under these conditions to find superior individuals. The trick is to combine all the data and information collected over a sixty-year period from several hundred trials contained in the national database and correctly weight the data for specific locations.

The STBA manages the tree improvement programs for Pine and Blue Gum and genetic evaluations are routinely done on a national basis. The capability of the TREEPLAN® system will be enhanced to incorporate these innovations. The research results will be incorporated into the TREEPLAN® system and the benefits made readily available to the Australian plantation sector. The TREEPLAN® system will be flexible and readily adaptable to handle different tree species.

Dr McRae believes TREEPLAN® is unique and the only genetic evaluation system available internationally with the 'industrial strength' to apply leading edge technologies in tree breeding. The current project will improve on this world class genetic evaluation system. Dr McRae expects the system to more than double the current rate of genetic gain achieved by conventional methods. This gain is achieved simply by applying the best statistical methods, making use of all the pedigree and performance data in our national databases.

The system is for serious tree improvement programs, underpinning the profitability of the Australian plantation sector. The STBA anticipates the plantation sector will be better able to distinguish among the various sources of germplasm available in the marketplace using TREEPLAN® genetic values as a national standard for bench making.

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