

TREEPLAN finds top performers faster

► Increased profitability and improved performance in Australia's plantation sector are the drivers behind the development of TREEPLAN®, an 'industrial strength' data analysis program designed to quickly and accurately identify the best genetics, based on tree performance.

The Southern Tree Breeding Association (STBA) is a not-for-profit cooperative leading the national tree breeding effort that has developed TREEPLAN® to fast-track the selection of breeding stock for radiata pine and eucalypt plantations.

STBA general manager Dr Tony McRae says TREEPLAN® V2, released in December 2007, represented a major upgrade of the original software and was developed over the past three years with significant funding from FWPA. The upgrade has already been used to analyse data from 275,000 genetically different radiata pine trees in 145 trials across the country, using millions of measurements for each tree, across a wide range of characteristics, at different stages of their growth.

Dr McRae says these trees represent about 4300 different "families". Identifying the familial relationships among all trees in a population is important for maintaining genetic diversity and preventing inbreeding. TREEPLAN® V2 also uses the genetic relationships among relatives in the population to adjust tree performance, accounting for the effect on performance of different environmental factors such as soils, climate and silvicultural techniques.

Analysis identifies the best performers according to specific characteristics and region – there are four geographic blue gum zones, and six zones for radiata pine.

"It has at least doubled and maybe tripled the efficiency with which we select trees for breeding," Dr McRae says. "That should translate to significant improvements – perhaps doubling the rate of gain we can make compared to breeding without this kind of analysis. In the past we've identified some good trees for our breeding programs. But we've also used trees that did not perform so well – trees, which using this program, we would not have selected," he says.

The processing power of the software is based on statistical methods developed for the animal breeding industry. The University of New England (UNE), Meat & Livestock

KEY POINTS

TREEPLAN®'s national analysis of tree performance could double the efficiency of tree breeding programs.

It generates an economic value for all trees in its database based on the commercial importance of performance characteristics.

By integrating quantitative, DNA, environmental and management data it can make regionally-based tree-breeding recommendations.

Australia and the NSW Department of Primary Industries are joint owners with STBA in the intellectual property behind the programming. Dr Bruce Tier and Dr Li Li at the Animal Genetics and Breeding Unit at UNE were important contributors. Dr Richard Kerr and Dr Greg Dutkowski, who work for STBA's subsidiary company PlantPlan Genetics, provided the tree genetic expertise, as did a number of other plant breeders and geneticists working for STBA.

"There are only a handful of people in the world who excel at the kind of work involved in developing this program, and without these people TREEPLAN® would never have come so far," Dr McRae says. "It's about putting the theory of population genetics and statistical analysis into practice, on a commercial scale, and that's not easy."

Improvements incorporated in TREEPLAN® V2 will allow DNA information to be analysed in conjunction with observed performance traits and more accurate statistical modelling. Dr McRae says the forest industry is increasingly collecting genomic data, although the correlation and use of this data with observed traits is still in its infancy.

"Once the geneticists have quantified the association between genetics and tree performance, TREEPLAN® can analyse the available field data to identify trees for future breeding. It might be that one plant has superior genetics but performs poorly in the early years because it is crowded out by more competitive trees, which are initially faster growing. With the right genetic model we can take this into account."

STBA has already identified genetically improved radiata pine trees with a combination of performance characteristics



Mandy Rudd inspects flowers as part of the TREEPLAN breeding program.

that is expected to improve plantations' profitability by a further \$2400 per hectare (net present value).

STBA provides analysis for both radiata pine and eucalypts, with plans to develop TREEPLAN® for other species including subtropical pines, other hybrids and clones. It is a web-based program, which means that data can be entered anywhere in Australia (or the world) for analysis.

"We're preparing to run some trials with a few state-based agencies and smaller tree breeding businesses to show them the potential of program, and the potential to increase the efficiency of their breeding programs. The more participants in the national breeding program we have and the more data we have, the more quickly the best genetics can be identified and delivered to industry as part of the national effort," he says. ◀

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