

Genetic variation and tree improvement

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Abstract

Genetically improved planting stock will be an essential component of plantations with low to medium rainfall (400–600 mm year⁻¹) in southern Australia. The requirement is for trees that are resistant to environmental stressors and that will also produce commercially-valuable products.

This chapter describes a shift in the focus of selection and tree improvement that occurred in the southern Murray–Darling Basin from species for irrigated plantations to species for rainfed sites in low-rainfall areas during the 1990s. Meanwhile, in Western Australia, a program to genetically improve *P. pinaster* had been ongoing for over 50 years. In 1998, interstate collaboration resulted in the formation of the Australian Low Rainfall Tree Improvement Group (ALR-TIG), which drew together research from Australia's southern states. It has identified priority forest plantation species for areas of Australia with low to medium, winter-predominant rainfall. Focus species include: *Eucalyptus cladocalyx* (sugar gum); *Corymbia maculata* and *C. citriodora* ssp. *variegata* (spotted gums); *E. sideroxylon* and *E. tricarpa* (ironbarks); *E. occidentalis* (swamp yate); *E. camaldulensis* (river red gum) and its hybrids; *P. brutia* (Brutian pine); and *P. pinaster* (maritime pine). Also of potential importance are *E. grandis* (rose gum) and *E. saligna* (Sydney blue gum). Reasons for selection of these species along with the tree improvement strategies for them are described. Genetic variation in growth, stem form, and other economically important traits displayed by the priority species in southern Australia is briefly reviewed.

The role of hybrids for commercial plantations in low to medium rainfall forestry is examined. Hybridisation of some of the priority species is being pursued to create new taxa adapted to certain environmental niches. While hybrids are not likely to provide an all-encompassing solution to southern Australia's low to medium rainfall plantation growers, carefully selected hybrid germplasm may improve productivity on specific site types.

Early results from some of the tree-breeding work are presented, including genetic gains of up to 30% or more for growth with improved germplasm and suboptimal growth by seed-orchard seed imported from overseas. The path to growers realising the full benefits of tree improvement that are available now and in the future is described.

Introduction

Until recently, tree improvement in Australia mainly focused on a set of major plantation species generally suited to zones with medium to high rainfall. These include *Pinus radiata* (radiata pine); the tropical pines *P. elliotii*, *P. caribaea*, and hybrids of these two; *Eucalyptus globulus* (blue gum); and *E. nitens* (shining gum). Genetic improvement of the pines, which began in the