Clonal forestry of radiata pine. Lessons for Europe.

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Abstract

Clonal forestry is now a commercial reality for radiata pine in New Zealand and Australia, with two companies contributing approx 5% of total current N.Z. planting stock requirements to supply 10+ plantation growing companies. Based on evidence of excellent realised gains (in growth rate, log and wood quality, and disease resistance) from earlier control-pollinated (CP) crosses, plus estimates of substantial further gains from clonal field trials, clonal varieties are expected to capture a major portion of the N.Z. and Australian markets within 10-15 years. Costs of clonal plants, at NZ$750-850 per thousand, are similar to the costs of CP cuttings 15-20 years ago, and are expected to reduce over time with further improvements in propagation technologies. Failures in past attempts to commercialise radiata pine clonal forestry were due primarily to the inability to successfully store and retrieve the better varieties in juvenile form, following the 6-10 year period required for field screening. Somatic embryogenic (SE) methods have provided a complete and cost-effective solution to the 'physiological ageing' problem, since juvenile tissue of field-proven varieties can be retrieved and multiplied for establishment of clonal stoolbeds. Juvenile cuttings from these can be routinely harvested for the production of both containerised and bare-root planting stock. Although further improvements in SE methods are expected to both increase genotype representation and reduce overall production costs, there are no current impediments to realising the substantial gains now available from planting clonal crops.

Deployment of varieties in single-clone stands is preferred by most growers, although clonal mixtures offer similar levels of gain (except in uniformity), and can offer greater risk protection against disease and pest hazards. Genotype-by-environment interaction is most evident in growth rate, versus quality and disease resistance traits, but can be easily accommodated through efficient clonal testing by region and site type, combined with deployment of sets of 10-15 unrelated clones. The main technical challenges include:

- Increasing SE efficiency of cell line 'capture' from immature seed, such that a higher proportion of genotypes become commercially available.
- Improving SE multiplication efficiency, initially to achieve greater balance in yields per clone, and subsequently to enable SE seedlings to be planted directly in the field.
- Automating plant production systems to achieve reduced costs of production.

Clonal testing has provided additional seed production options from top varieties, while marker-assisted selection and genetic engineering show future promise. The ability to operate in a commercial environment is a key performance indicator for a successful clonal forestry programme.

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