EVALUATION OF 1986-1987 RADIATA PINE CLONAL TRIALS AT FOREST RESEARCH, NEW ZEALAND

A thesis presented in partial fulfilment
of the requirements for the degree of Master in
Applied Science at Massey University

Silvia Claudia Concheyro

1998

ABSTRACT

Clonal forestry, the establishment of plantations using tested clones, is highly sought after by the forestry industry in New Zealand and worldwide. Clonal testing is a vital element in the process leading to clonal forestry.

Two clonal trials established in 1986 and 1987 by the Forest Research Institute with juvenile ortet material have been analysed in this study. The mating design in the 1986 clones-in-family trial was single-pair crossing with amplification of the clones by fascicle cuttings. It was replicated over two sites, and the trait analysed was diameter at 1.40 m height at ages 4, 7, and 10 years.

The estimation of additive, non-additive and genetic variances showed a high proportion of non-additive variance compared with the additive variance at one of the sites, whereas the proportion was less important at the other site. The high non-additive component of variance can be due to important dominance or epistasis, or to C-effects confounded with the non-additive variance. This trend was similar for all three ages.

Realised genetic gains were obtained from selection of clones at age 10 years for clonal deployment and breeding. For clonal deployment, realised gains were high at both sites (13% and 16%). The gains were similar at both sites provided selection was based on performance values at the site, and not on indirect selection on performance of clones at the other site. Realised gains for selection at age 10 based on the performance of clones on combined sites (10% and 13%) were less than the maximum gain obtained at each individual site. Gains based on information from both sites (10% and 12% at respective sites) were more stable than those selections at any one site. For breeding, the level of gain was significantly inferior than for clonal deployment (4% and 8%), especially when the number of clones per family was restricted to one (2% and 4%). Realised gain on combined-site selection yielded less gain than direct selection at the optimum site for selection (1% and 2%).

The presence of genotype x environment interaction emphasised the need to test clones in several sites if stability of performance is desired.

It is possible to obtain gain from selections made at an early age, but selections made for breeding at the age of final assessment yielded greater expected total gain and gain per unit time.

The mating design in the 1987 clones-in-family trial was a 3 x 3 disconnected factorial. The trial was established on a single site and the trait analysed was percentage of Dothistroma needle infection at ages 3, 4 and 7years.

The mating design allowed estimation of additive, dominance and epistasis variances, which were overestimated for the lack of replication over sites. In this trial measured for Dothistroma resistance, the additive variance was the major component of the genetic variance at both ages. The evolution of components of genetic variance was confounded with the level of Dothistroma infection.

The analysis of these trials indicated the need to improve the mating and field designs to improve the accuracy in the estimation of genetic parameters, highlights the importance of annual or biennual measurements to determine trends of those parameters over time, and showed the difference in gains obtained from selection for breeding and clonal deployment for early selection and selection at the age of final assessment.

Accuracy in the estimation of genetic parameters can be achieved using factorial mating designs together with serial propagation to reduce the incidence of C effects, and with replication over several sites. Further considerations have to be made to find the most appropriate field and statistical design, but alpha designs are a possibility to explore.

Investment in a series of carefully planned clonal trials is fundamental to the future of clonal forestry in radiata pine.

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ACKNOWLEDGMENTS

I want to express my gratitude to:

Prof. Dr Dorian J. Garrick, my supervisor from Massey University, for his direction, advise, support and encouragement throughout my degree. Dr Michael J. Carson, my supervisor from Forest Research, for his advise and understanding during my degree, and for his support in my early days at Forest Research. ***Forest Research*** for providing the funding for me to complete my studies. The Radiata Pine Breeding Cooperative for making available the data for this study. Mr Tony Firth for his assistance with data collection, knowledge of Forest Research trials, and for his constant moral support. Dr Paul A. Jefferson for his permanent assistance and discussions on the issues address in this study, and for the reading and correction of numerous drafts. Dr Michael Hong and Mr Charles Low for their availability and patience in response to my numerous questions on statistics and software packages. Dr Tony Shelbourne, Dr Sue Carson, and Dr Rowland Burdon for their assistance to solve theoretical issues and to discuss enthusiastically clonal forestry. Debbie McGuire for her permanent patience, constant support and help in providing information for the project and aiding with computer hardware and software problems. Mrs Melanie Maika for her assistance in the formatting of this thesis. Mrs Ruth McConnochie for her moral support, and for providing me the time to finish this thesis. GTI Staff for their interest in my project and valuable comments. My parents and my sister Andrea for their moral and financial support during my undergraduate studies in Argentina, and for their encouragement to further study in New Zealand. My husband Paul and my young boy Matthew for providing me the opportunity to work and study sacrificing family time, and for always being there to cheer me up in difficult times.

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