

Age-Age Correlations In *Pinus Taeda* In Brazil

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INTRODUCTION

A series of four progeny tests of *Pinus taeda* in southern Brazil in the states of Santa Catarina and Paraná was established in 1986 by Rigesa Celulose, Papel e Embalagens Ltda., and served as an excellent opportunity to examine age-age correlations.

METHODS

The genetic material used in the trials was 30 full-sib families created from two six-parent disconnected diallels. The planting design was 6 replications of 6-tree row-plots established at a 2.5 × 3 m spacing. The tests were measured nearly every year from age 1 to age 15. There were some inconsistencies from year to year: at ages 1 and 2, diameters were not measured; each test was measured for DBH at either age 5 or 6, and heights were not measured at those ages; only the Bishop test was measured at age 7. Data from each replication in each trial was standardized to a common mean and variance. The diallel mating design was written into a matrix using a SAS PROC IML routine, and this matrix was then used within SAS PROC MIXED to estimate genetic parameters. For each age and growth trait, estimates were calculated for heritability (h^2), proportion of dominance (d^2), and Type B additive genetic (r_{Bg}) and Type B dominance genetic correlations (r_{Bd}), which express genotype x environment interaction.

RESULTS

Survival in all four trials averaged above 90% at age 15 years. Growth was also quite good, with average height growth of 6 m at age 4 years, 17 m at age 10, and 24 m at age 15 years. All genetic parameter estimates were very similar for all growth traits at all ages. This made it reasonable to use parameters for one trait, e.g., diameter, to serve as proxies for another trait, e.g. volume, in examining age-age relationships. Heritability estimates for all growth traits were quite high, around 0.60. Dominance variance was moderately low relative to additive variance, which is consistent with estimates for *P. taeda* in the southeast United States (Balocchi et al. 1993). Third, there is essentially zero additive genotype x environment interaction (i.e., $r_{Bg} \approx 1.00$). Dominance genotype x environment interaction is also low.

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Heritability increased rapidly to a maximum of $h^2 = 0.71$ at age 4, and by age 7 has stabilized at $h^2 = 0.63$ which was maintained until age 15. Age-age correlations (additive) were modeled using a Lambeth relationship. The results indicated that indirect selection at age 4 was 95% as efficient as selection at age 15, and even age 3 selection was 90% as efficient as selection at age 15. For these 12 parents, the GCA ranks at age 3 were almost identical with the age 15 ranks, with the only changes being a swap of positions 4 and 5, and of positions 6 and 7. It is possible that both the high heritability estimates and the high age-age correlations may be due to a “tail-heavy” distribution of parents in this particular sample of 12 parental genotypes: For example, at age 8 the GCA estimates were 23.1, 13.4, 12.5, 9.0, 6.0, 3.4, -1.2, -3.7, -5.4, -9.3, -20.8, -26.9 (units are % gains in individual tree volume). In this case, $\frac{1}{4}$ of the parents have GCA estimates in the tails of the distribution (i.e., $|GCA| > 20$). This will inflate the additive variance and heritability estimates, and may inflate correlations. However, previous results from another large *P. taeda* data set (10 tests, 83 parents and 310 crosses) established by Igaras Papeis e Embalagens in southern Brazil (Hodge et al. 1999) also indicated high age 3-15 correlations with $r_g = 0.89$, compared to $r_g = 0.91$ in this study.

REFERENCES

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