

MAXIMIZE SEED ORCHARD GAIN BY BALANCING BREEDING VALUE AND RELATEDNESS OF SELECTED CLONES

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As tree breeding program moves to advanced generations, there are large numbers of related selections with high breeding values. Breeders are thus faced with a dilemma. Would the use of the related clones in a seed orchard result in substantial genetic gain or would it result in an intolerable amount of inbreeding depression? Using a real data set from the 2nd-generation loblolly pine breeding program, an analytical model is evaluated to maximize genetic gain by deploying related clones to seed orchards.

The breeding values of top ranked clones with known pedigree information from 2nd-generation breeding program are used for genetic gain evaluation in a seed orchard. Traditionally, to avoid related mating and inbreeding depression in a seed orchard, only unrelated clones are used for seed orchard establishment, only one individual from a given parent is included in the seed orchard. Then the genetic gain is the average breeding values of all clones. When related clones are chosen for a seed orchard, the genetic gain is modified for inbreeding. This genetic gain can be estimated as the average breeding value of the selected clones minus the likely inbreeding depression caused by mating of related clones. This is the average of all coancestries between pair of orchard clones times the inbreeding depression per unit of inbreeding. Using an algorithm similar to group merit selection (Lindgren & Mullin 1997, but disregarding self-coancestry) considering breeding value, pedigree, and inbreeding depression per unit of inbreeding, genetic gain was maximized for a fixed number of clones. At an inbreeding depression per unit inbreeding of 40%, typical for loblolly pine species, and actual breeding value predictions, it is about 10% better than to avoid inbreeding when five or more clones are selected. The results suggest balancing relatedness and breeding values in an optimal way. The increase in genetic gain is substantial even after adjusting for the inbreeding effect. The use of related but highly ranked clones in a seed orchard would result in greater genetic gain for loblolly pine

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