

SEEDLING SEED ORCHARDS FOR JACK PINE

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Provenance and Seed Production - Jack pine provenance experiments have demonstrated strong clinal variation associated with climate together with important, but unexplained, variation among geographically and climatically associated populations (Yeatman 1973b). The first can be taken into account in seed production by creating seed zones or breeding districts but variation within regions can be utilized to advantage only if the better populations can be identified and their genetic character retained intact.

Artificial regeneration after cutting has altered the natural population structure over extensive areas of commercial jack pine forest. However, in most areas naturally regenerated stands in the younger age classes are to be found and are representative of original populations. These need to be evaluated and the best used to supply the large quantities of seed required for direct seedling as well as planting (Scott 1970). Immediate requirements are best met from seed production areas (s.p.a.'s) developed within a number of selected populations within each breeding district. Serotinous (closed) jack pine cones can be collected by felling portions of a seed production area as required. Simple production tests based on s.p.a. seed and planted at several locations will permit early identification of the better populations within each district. Replanting with local seed will maintain the characteristic gene pool of each seed production area and thus ensure that repeat collections can be made of the same genetic material (Yeatman 1973a).

Seedling Seed Orchards - Natural populations can be improved for seed collection by converting seed production areas into seedling seed orchards. As the original stands are felled for cone collection the cleared areas can be replanted with progenies of local plus trees. In this way the development of a regional breeding program can be spread in time as well as place.

Jack pine plus trees are selected on the basis of stem straightness, branch angle and growth rate from cone-bearing dominants growing in even-aged stands. Systematic sampling on a unit area basis is recommended to avoid selecting close relatives within limited neighborhoods and to maintain a prescribed proportion of trees selected, i.e., intensity of selection (Burdon and Shelbourne 1971). Between 100 and 200 plus trees are needed for a single orchard to permit family selection of 30 to 50% on the basis of clonal and progeny tests. Sufficient seed is required from each tree to plant the orchard and to establish progeny tests at several sites in the region. Scions are needed for grafting and establishment of clones in a breeding archive. Open-pollinated progenies are used in the initial orchard plantings, to be followed by

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control-pollinated families from selected parents. These parental genotypes will be chosen on evidence of breeding value derived initially from comparisons among clones (stem and branch form) and subsequently from progeny tests (survival and growth). This information will also permit early culling of families from seedling orchards planted in small family plots (2 to 4 trees) at close spacing (1 to 1.5 meters). Combined with culling of individual trees to leave no more than one tree per plot, stocking for seed production may be reduced to 600 to 1,000 trees per hectare (250-400 trees/ac), or about one tenth of the original. The choice of selection intensities to be applied among and within families is limited by the relatively high cost of the progeny testing (Namkoong 1969).

Thinning may best be done in two stages, first to about half the original stocking at 6 to 8 years, with final culling at 11 to 14 years. Jack pine flowers early, bearing predominantly female strobili for some years. In a well-stocked plantation large numbers of cones per acre can be harvested from the ground by 10 years-of-age (Roe 1963). This seed will have been pollinated predominantly by background pollen from surrounding stands. Following reduction to one tree per plot to eliminate inbreeding between sexually mature siblings, a final harvest can be made by clear felling at between 15 and 20 years-of-age when a number of years' cone production will have accumulated on the trees. At this time more recent and further improved orchard plantings will be producing seed. The cleared area will be available for planting a still higher level of progenies.

The Regional Program - By confining the first generation of seedling orchards to local populations the attributes of a given population will be maintained in all seed collected in the orchard. On the basis of accumulated evidence, advanced generation orchards may combine progenies of the best trees, families and populations and be located within the background pollen of the best populations in each district or region.

This approach to seed production and improvement of jack pine is designed to ensure retention of present values of selected populations currently used for mass collection of seed, to identify the best seed sources, to provide a broad genetic base for regional improvement and to obtain rapid rate of gain by constantly upgrading the breeding populations.

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