CLONAL SEED ORCHARDS[1]

R. L. McElwee[2]

Forest geneticists and others actively engaged in tree improvement programs have divided into two factions with regard to the most efficient approach to use in obtaining maximum gains for effort expended to produce commercial quantities of improved seed. One group, those advocating seedling seed orchards as the most efficient, maintain that maximum genetic gain per generation can be attained by the seedling seed orchard approach. This group reasons that a lower level of selection within single stands (using the better trees within a stand), but using a larger number of total trees, will yield genetic gains surpassing those of clonal seed orchards. They reason clonal seed orchards to be a dead-end approach.

Those advocating clonal seed orchards do so because of an entirely different philosophy in terms of both need and time. A case in point is the objectives of the Industry-N. C. State College Tree Improvement Program. This program is located in the Southeast where in eight states 997,000 acres were planted or seeded in 1961. Of this total, 947,000 acres were on privately owned, largely industrial, lands. The large sums expended to prepare this acreage annually, dictate that the best quality seed possible be used in regeneration to obtain maximum yields in terms of final end product. It is for production of this quality seed, now and in the immediate future, that we believe clonal seed orchards to be the best approach.

In any type of seedling seed orchard it will be fifteen to twenty years after establishment of the orchard before commercial quantities of seed become available. In the clonal seed orchard we believe, and experience is now verifying, that this interval can be cut in half. If, for the seedling seed orchard, control pollinations are made on the trees in the woods to obtain seed for planting the orchard, the time interval for obtaining the seed will be shortened by several years, The expense of control pollination of scattered select trees is large compared to grafting the clonal seed orchard.

To be sure, genetic gain is not obtainable in the clonal seed orchard beyond the first generation. This is the strong point of opposition to such seed orchards. This is the short-sighted approach of those who believe the first orchard to be the ultimate seed source over the longhaul of company operations. However, those first seed orchards are not expected to be the ultimate. New orchards will be established from new selections after the first generation has been established, just as new orchards must be established using the seedling seed orchard approach. The seed orchard is not static, but new material will be introduced as the first generation reaches the age to be properly evaluated. In this manner, genetic gain will be available just as it is available in the seedling seed orchard.

In the clonal seed orchard, with progeny testing, the results of crosses obtained are known. This is the dam-sire approach of cattle breeding. Results of particular crosses (in this case trees in the orchard) are known to produce the types of individuals sought. In seedling seed orchards such information is not known--phenotypes are being used as the breeding stock, Without progeny testing the ability of individuals in the orchard to produce improved lines cannot be ascertained. A few trees having poor general combining ability can dilute the

[1] This was a slide presentation in which the immediate need was demonstrated for large quantities of improved seed Specific arguments (pro and con) on clonal vrs. seedling seed orchards, briefly outlined in this paper, were not brought up for discussion in the original presentation,

[2] Liaison Geneticst School of Forestry, North Carolina State College.

quality of seed produced, even if most of the trees left to produce seed are good. Such poor combiners are removed from a clonal orchard following progeny testing. To circumvent this situation, several generations of inbreeding before outcrossing inbred lines would be necessary (such as has been done with hybrid corn). This approach, entirely feasible genetically, requires several generations to achieve success. With a long-living organism such as forest trees, many years, even hundreds of years, will be required to produce satisfactory lines. Such an approach is not compatible with forestry in the Southeast today, where improved seed is needed immediately.

In the seedling seed orchard we estimate that, with the difficulties of obtaining seed for establishment and the relatively long time before cone production begins it will be twenty years before commercial quantities of seed become available, and question the quality of this seed. By establishing the clonal seed orchard, commercial quantities will be available in eight to ten years. If we do not look at the clonal orchard as static, but as a dynamic en tity with constant reselection from outside sources for the next generation, genetic gain becomes an immediate reality., This philosophy makes it possible to attain the short-range goal of better quality seed in the immediate future and genetic gain through selection and breeding for the seed supply of the more distant future.