

Forest Tree Improvement Studies at the University of Illinois

by

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The University of Illinois is firmly committed to, but not yet fully engaged in, a program of research in forest genetics and tree improvement. Graduate research under the recently implemented Master of Science program in forestry will strengthen this program, and the completion of much needed greenhouse space will facilitate more intensive research.

Provenance studies have been greatly expanded during the past two years. Range-wide seed source studies of Scotch pine (*Pinus sylvestris* L.), red oak (*Quercus rubra* L.), Japanese larch (*Larix leptolepis* S. et 4 Gord.), and European black pine (*Pinus nigra* Arn.) have been undertaken in cooperation with the several states involved in the North Central Cooperative Regional Project No. NC-51 on forest tree improvement. Further cooperation in the range-wide seed source study of Douglas-fir (*Pseudotsuga menziesii* Nirb. Franco), to be conducted in Illinois under stand and windbreak conditions, is contemplated.

A 20—year study of 11 seed sources of ponderosa pine (*Pinus ponderosa* Laws.) is nearing completion. All sources performed well in all outplantings up to about the tenth growing season. Soon thereafter a general decline, associated with a foliage disorder, was noted for most sources. This decline was more rapid in plantings originating from seed collected from west of the Continental Divide. All of these had failed completely by the fifteenth growing season. Plantings of more easterly seed origins failed between the fifteenth and twentieth growing seasons. The decline and eventual failure of all eleven sources on all sites on which they were tested is currently attributed to brown spot needle rust (*Scirrhia acicola* [bearn. Siggers). A similar disorder of plantings of ponderosa pine has been reported from the neighboring states of Indiana, Iowa, and Missouri.

The Illinois program is oriented towards basic genetic studies with current emphasis on eastern cottonwood (*Populus deltoides* Bartr.). The following studies with this species are under way.

A study of variation in the development and behavior of cottonwood in natural stands was begun in 1959. Weekly dendrometer measurements and phenological observations in two wild stands have been continued through three consecutive growing seasons. Studies of the incidence of sex and sex-associated traits have not revealed significant deviations from a 1:1 sex ratio or important differences between the sexes with respect to traits of economic importance. A study of variation in specific gravity in natural stands and between sexes was begun by Charles S. Walters in 1962.

The heritable nature of the variation observed in wild stands is being studied in experimental plantings of about 100 clones and 100 progeny groups representing three native Illinois populations. Estimates of the heritability of differences among individuals in total height, resistance to Malampsora rust, leaf shape, branching habit, crown form, etc., are being obtained. Differences observed are of sufficient magnitude to be of interest to both silviculturist and tree breeder. Also, since these estimates varied according to the conditions under which they were made, their value, as those of all heritability estimates, will depend on how skillfully they are interpreted. The amount of nonadditive or epistatic variance relative to additive variance indicated by the present data for certain traits (about 1:1 in the case of the highly heritable rust score) would be of considerable importance as it relates to the "elite-tree" concept, since gene combinations resulting in epistatic effects are not transmitted intact from parent to offspring.

These heritability studies will be continued and expanded to include other species and will be supplemented by studies of genetic and phenotypic correlations between traits. It is hoped also that crossing experiments with cottonwood can be started in the near future.