REPORT OF TECHNICAL COMMITTEE VIII.

INHERITANCE OF WOOD QUALITY

Some Considerations in Tree Breeding for Better Wood Production

The following discussion is not intended to be a survey of what has been done in studying "Inheritance of Wood Properties." This committee was formed too recently to permit preparation of such a survey. It is intended, however, to call attention to some wood characteristics and properties that should be considered when genetical studies in forest tree improvement are planned.

Wood properties are determined by such things as cell size and cell wall structure, chemical composition, amount and type of infiltrates, and proportion and distribution of cells and cell types. Since particular uses demand particular wood properties, it becomes obvious that the suitability of a given wood for a given use is dependent on its composition--physical, structural, and chemical.

Southern pines would be less suitable for heavy construction purposes if they produced low density wood. This would be the case if average cell wall thickness were decreased greatly, thereby reducing the amount of wood substance present and reducing strength proportionately. Bald cypress, redwood, white oak, and black locust would be less desirable if the infiltrates that cause wood of these species to be insect and decay resistant were not present.

Obviously, the list of negative suppositions could go on indefinitely. However, it is the geneticist's job, insofar as the wood of a species is concerned, to look at the positive suppositions. He should try to change the structure and chemical composition of the wood in such a way as to improve the properties. He may be concerned with any or all properties of a given species. Here are a few of them: strength in proportion to density, density, contrast between spring and summerwood, color, durability, paintability, workability, dimensional stability, grain direction, fiber dimension and pulpability. There are others that will occur to you.

The growth vigor for which the geneticist strives may conceivably react against him. Yellow poplar serve to illustrate this point. Yellow poplar is a diffuse porous wood which, when grown slowly with narrow growth rings, as in the outer parts of the old-growth timber, is light in weight, soft, and easily worked. When grown rapidly, the younger trees produce heavy, strong wood, harder and not so easily worked. The geneticist may give high value to either these two types of wood but if he is breeding for the soft, easily worked material and gets wood with the opposite characteristics because of the rapid growth, he may be in for disappointment. These properties will, of course, relate back to cell wall thickness, cell type, and cell diameter.

An example of a ring-porous wood where a similar situation can occur is oak. Rapidly grown oak is generally of higher density than slowly grown oak because of the higher proportion of summerwood in the former. The geneticist ought to determine first of all what wood properties he is after. If he wants to produce wood of rapid growth but wishes to retain low density, he will need to select parent trees showing promise in that direction. He cannot go on the assumption that a tree producing low density wood when growing slowly will do the same thing when growing rapidly.

Two points with which the geneticist is concerned in forest tree improvement are the number and size of branches. To the user, it is really the knots in the log that are the problem. Here again matters get complicated. Hardwood lumber finds its maximum outlet in shop or factory lumber from which cuttings are made. The size and number of the clear areas determine the grade and value of a given board. Size of the individual knots has less to do with these clear areas than do number and distribution of knots. This relates directly back to the type tree selected for development. One might select the tree with little taper and small limbs. Now it can easily be seen that logs from such a tree will be easy to handle and economical to saw. The lumber grades produced will, however, depend not only on the size of the knots, but also on their number and distribution.

There is another facet of the whole problem of tree improvement that should be mentioned. Eventually, the wood. produced by the geneticist must be evaluated. After all, it is the wood that must be harvested and sold. Its properties will determine its suitability for various uses and this in turn will be a strong factor in the sale price.

For proper evaluation, it is necessary to have comparable material from another source. It is well known that environmental conditions affect the quality of the wood produced to a marked degree. Therefore, the ideal situation is to provide for comparison material by growing both the improved trees and the uni mproved trees in close proximity and under as nearly identical conditions (including age) as possible. The usual replications are, of course, required. This seems very important to me since our knowledge of the effects of environment is still too vague to permit marking comparisons between locations with the accuracy required here. Drawing the wrong conclusions regarding the wood produced because of environmental effects may cease considerable error in planting recommendations.

In general, our knowledge of the wood properties required for specific uses is far more accurate than our knowledge of the effects of environment and heredity on these properties. With respect to heredity, I am, of course, referring to intraspecies variation. However, with the great expansion in forest and forest products research during the last few decades, knowledge in both fields has increased rapily and should continue to increase rapidly.

Eric A. Anderson, Chairman