JUVENILE SELECTION CRITERIA

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Due to the factor of time inescapably related to the production of trees from seedlings to their ultimate utilization at the point of economic maturity, methods for assessing or predicting the potential value of individual trees from their juvenile characteristics are essential to any practical tree breeding program. Such juvenile characteristics, to be of value to the for-ester or tree breeder, must be of such a nature that they will assist him in appraising the individual tree with respect to growth, hardiness, ultimate form, quality, disease and insect resistance, as well as general adaptability to the whole environmental complex. In addition, in the case of inter- or intra-specific hybrids, there is a need for a knowledge of criteria of hybridity for determining the validity of such hybrids. In most cases, all such criteria must be based upon some observable morphological characters of the existing phenotype.

Potential growth is grossly measurable, and in some cases probably predictable, on the basis of annual height growth in the early years, but it is more reliably indicated by phenological data covering the period of time elapsing between the initiation of growth in the spring and the cessation of such growth in the summer or fall months. In other words, potential growth can be measured by the degree of utilization of the available growing season. This does not mean, however, that very early initiation of growth in the spring is necessarily a desirable trait. On the contrary, in many species such early flushing may be decidedly disadvantageous, exposing the tree as it does to the danger of late spring frosts. European experience in this respect has shown that such early flushing trees are the slowest growing and least vigorous individuals in a given progeny. Translating this clue to practical forest management, it is immediately apparent that selective cutting as currently practiced, and Which often discriminates against the high vigor, quick-ly maturing trees, can lead to genetic deterioration of naturally reproduced

stands through the progressive elimination of the late flushing high vigor types. Abnormally late flushing, on the other hand, which occurs when southern forms are brought too far north, is often followed by prolonged growth into the latter part of the season, with incomplete lignification and winter injury the result. This latter phenomenon is correlated with the long northern summer day and probably to a lack of sufficient heat in the short cool fall days to complete growth. High latitude and high altitude types, inherently slow growing, are similarly affected by being brought into lower latitudes or altitudes where they come into growth too early and are liable to injury and disease. Broadly speaking, however, the variation existing in a given progeny is probably simply indicative of its range of adaptability, and in the natural course of events the variants least adapted to a given environment, whether late or early flushing, will tend to be eliminated and their frequency progressively reduced in succeeding generations.

In respect to form, in the case of conifers, the correlation between a slim, narrow-crowned type in early youth and the same type in a mature tree is perhaps safely established. In poplars, Pauley is currently carrying on, by means of year to year photographs, a study of the life histories of various individuals showing the progressive changes that take place. Here an important feature in establishing and maintaining good form seems to be the branching angle and relative degree of apical dominance.

In respect to that elusive quantity referred to as quality little will be said. There are so many variables involved that a prolonged enumeration of various features making for timber quality would not be useful here. Mention has been made at this meeting, however, of spiral grain. To what degree is this defect in quality genetically controlled and how early is it detectable in a tree? We have currently under observation pine seedlings in which the cotyledons are twisted clockwise or counterclockwise as well as being normally radiating. Are these indicative of potential spiraling of the grain or merely of stresses incidental to germination?

Concerning insect and disease resistance, many factors again are involved. For instance, blister rust resistance can be due to, among other things, the early dropping of needles, or to actual resistance of the individual tree to the progress of the established disease. Each may be equally effective. Kriebel has pointed out here that high weevil resistance in white pine is correlated with bark thickness--an observable morphological character.

To sum up, it is well to remember that our forests, if they are to be im -proved, will fall more and more toward two distinct types.
extensively managed forest of low to moderately good productivity also yielding watershed, game and wildlife, esthetic, and recreational values which may equal or exceed those realized from timber production alone. In this type of forest, the objective of a forest tree improvement program will be largely the maintenance of the genetic or biological status quo to prevent dysgenic trends and when feasible to upgrade the quality of the stand of native species.

The second type of forest will be the intensively managed, indeed often planted forest: a sort of timber factory created to turn out a tailor-made product. This type may well contain the specially bred and produced trees that will be the product of the tree breeder's art. These may combine many features adapting them to such domestication and to particular uses. They may or may riot be varieties of native species; more likely as time goes on they will not. It may be well to recall at this point that, as a generality, in-

tensively cultivated crop plants are not produced commercially in the region of their origin. This is due to the prevalence of specific pests and diseases indigenous to the area of origin that have evolved hand in hand with the plant. This concept applies equally to general agricultural crops and to such familiar tree crops as rubber, cocoa, and coffee. Drawing from such experience, we may look with more confidence upon the continued testing of exotics and hybrids. It will take time to evolve suitable domesticated types, but it can and will be done as rapidly as the end justifies the means. We can probably look forward with confidence to the achievement of the disease resistant elm and the weevil and disease resistant pine. They may not be exactly american elm or white pine as we know them now, but they will be reasonable and acceptable facsimiles.