Superior Tree Selection -- A Comparison of Grading Systems

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One of the most difficult problems in a selective type program such as our companies have underway is that of rating phenotypic characteristics to insure the incorporation of the few most outstanding trees in our seed orchards.

Some of the earlier selections such as those reported on today by Goddard, Brown, and Campbell were made subjectively, using the following criteria 2/: (1) outstanding height and diameter growth, (2) limbs of small diameter, (3) an efficient crown, i. e. , have a small narrow crown and dense foliage while still retaining better-than-average growth rate, (4) good natural pruning ability, (5) exceptional ability to be good competitors, and (6) straight bole with little taper. No attempt was made to put this selection on an objective basis, but each tree was compared to its immediate neighbors and the final selection made on the basis of these comparisons.

About the same time, Dr. T. O. Perry was initiating the first industrial drive for the establishment of seed orchards containing representatives of superior pine phenotypes. Because of the many individuals involved, some method of standardizing the selection procedure was needed. As a result, after a meeting with representatives from the participating industries, the first tree rating form was developed which made an effort to put superior phenotype selection on an objective footing. At this meeting, the concensus of opinion was that growth rate was the most important element and as a result, the first system gave a great deal of weight to vigor. The other items considered were bole straightness, branch diameter, natural pruning, and presence or absence of disease symptoms (although this criteria is not included on the rating sheet). Different values were assigned the various criteria in accord with their comparative importance. The superior tree candidate was compared to the 10 nearest dominants, codominants, and intermediates. The second year this system was in use, the comparison trees were limited to the nearest dominants and codominants.

This system fared differently with individual companies, depending on the person doing the final grading. When one man did all the grading, selection was better on the whole than where several men were involved. Where the individual making the original selection did the final grading, results were generally poor.

1/ Silviculturist, International Paper Company, Southland Expt. Forest, Bainbridge, Georgia.

2/ First Progress Report, Texas Forest Service Circular #35, October 1953.

When North Carolina began its industrial cooperative program, it was noted that many earlier selections made under the Florida system did not exhibit phenotypic superiority commensurate with the point score assigned. In addition, the great weight given volume seemed inappropriate because volume per se is not a strongly inherited character. A revision of the Florida system was therefore made emphasizing form which in general is more strongly inherited. Also, the number of comparison trees were cut to five and these were to be "crop" trees; dominants on the same site within reasonable distance of the superior tree candidate and of the same age or older. More significant, with the new rating form, one man was hired to rate ALL trees selected within the program. Thus, all superior trees in the entire program were put on a more or less comparable basis. The grader, since he was a specialist, became more skillful, and as a result, more consistent and more objective grading was possible.

Ten characteristics are graded by this system, those being- height, volume, crown, form class, bole straightness, pruning ability, branch diameter, branch angle, age, and specific gravity. In addition, cellulose determinations are made and although they are not used for computing the original grade, are used to assist in making the final decisions.

When the International Paper Company decided to combine its regional programs into a division-wide program, the North Carolina State system was adopted with some minor changes.

The State of Georgia, in cooperation with the U. S. Forest Service, has had an active program of superior tree selection, but under this system no attempt is made at a purely numerical rating for individual trees. Final selection is made by the individual in charge. This system is fine as long as an experienced geneticist or the equivalent is heading the program, but this system tends to break down when a personnel change occurs, or when the responsible individual is absent for any length of time.

More recently, the Texas Forest Service has initiated a new rating system which is still in its developmental stages. They have set up a list of 10 criteria, 8 of which must be satisfied to qualify the superior tree candidate. These include. bole straightness, spiral, limb diameter, limb angle, pruning ability, age, height, disease, and insect resistance, bole crown ratio, and basal area increase-crown ratio.

Here again, there is no numerical system to help locate the best of many acceptable trees and in the final analysis, a subjective selection must be made unless all acceptable trees are to be used. In the event that more acceptable trees are located than are desirable in the orchard, a subjective selection must finally be made.

A comparison of the characteristics considered by each system is presented in Figure 1. Note that all systems grade identical characteristics in most cases. Main differences are in emphasis or point value assigned.

In many cases within the existing programs, trades of superior tree scions have been arranged between companies. This practice has now been extended to companies in different programs and it has been necessary to regrade trees so that they can be rated on a comparative basis.

There has also been much discussion as to the relative merits of the various systems and in many cases, the observation has been made that any system, well applied, will work satisfactorily. To test this hypothesis, 16 trees were rated by the North Carolina State, IP Company, Florida, Georgia, and Texas systems. Field grades of 10 points must be attained in the IP and N. C. State systems before trees are accepted. Acceptance under the Florida system is based on the highest scores and the number accepted is based on the number of trees needed. The acceptable trees under the Georgia system are chosen by a combination of numerically and non-numerically rated characters, while the Texas criteria is based on 8 of 10 acceptable characters.

The results of these trials show that of the 16 trees rated, 5 were accepted under all systems, and 3 were discarded. Of the 8 remaining trees, 4 were accepted by four of the five systems, and 4 were discarded by four of the five systems (Fig. 2). The highest number of trees were acceptable under the Georgia system and the lowest under the IP Company system, the numbers acceptable varying from 7 to 11. Where the discrepancies occurred; the IP system discarded two trees which were accepted by the others; N. C. State accepted one tree discarded by the others; Georgia accepted 2 trees discarded by the others, and Texas accepted I discarded and rejected 2 accepted by the others. Interestingly, the Florida system, when an arbitrary acceptance level of 25 points was selected, agreed with the majority in all cases. The discrepancies in the IP system were of a magnitude of 1 point in each case; that of the N. C. State of 3 points.

The results would seem to support the contention that the system is not t. nearly AS IMPORTANT as the grader. The human element is of prime importance and it seems essential that all grading be done by one man. Please note that not all of the trees selected for grading were acceptable, though each was a plausible candidate for a superior tree.

While the sample presented was necessarily small, it shows that standard, unbiased grading can only be attained by eliminating the human element as much as possible. This can best be done by having one disinterested party do the grading. I still feel that a numerical rating system is more practical, for in the final analysis, each tree must be rated against the other, and one man cannot carry a mental picture of every tree in his mind. Therefore, while the numerical system has faults, I believe it is somewhat better than the less objective descriptive systems.

COMPARISON OF GRADING CHARACTERISTICS

SYSTEMS	CHARACTERISTICS															
	Height	Volume	Form Point or Class	Straightness	Spiral	Pruning Ability	Specific Gravity	Crown	Bole Volume/Crown	B.A. Increase/Crown	Branch Diameter	Branch Angle	Age	Disease and Insects	Seed Production	Summer Wood
GEORGIA	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
FLORIDA	✓	✓		✓		✓	✓	✓	✓		✓		✓	✓		
I·P·CO·	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
N·C· STATE	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
TEXAS	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		

Figure 1.

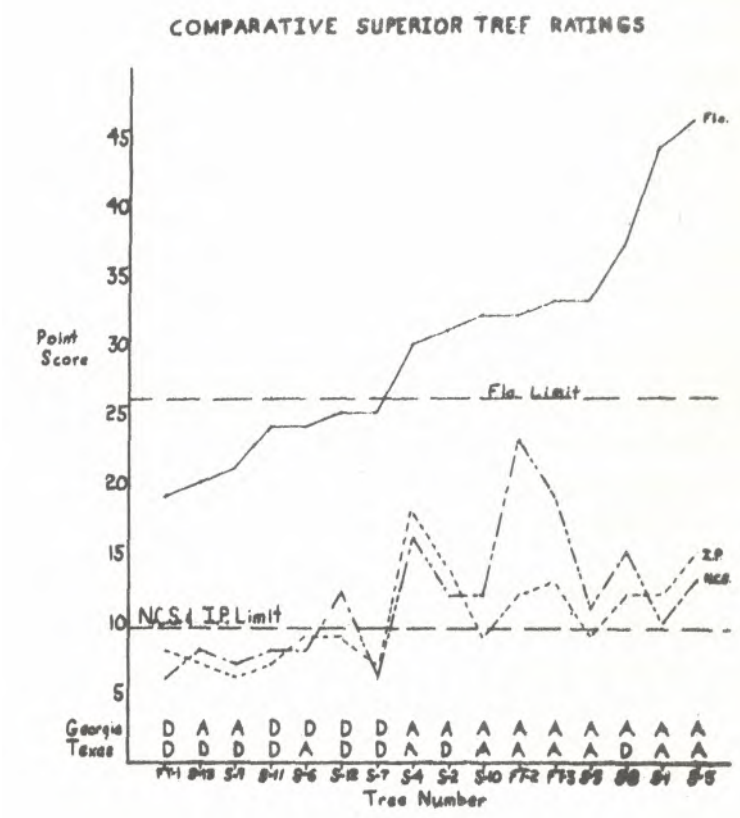

Figure 2.