TREE IMPROVEMENT AND THE SOUTHERN FOREST INDUSTRIES

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The papers by Mr. Giddings and Mr. White were most interesting. My story about the South will be somewhat different than that of Mr. Giddings, but since many of Mr. White's comments were about conditions in the South, I will find it necessary to depart from the prepared talk in order to avoid repeating the good points made by Mr. White. Many of my comments will supplement or clarify those previously made.

One thing that must be emphasized is the fact that we are not hoping for, nor are we planning for any world-shaking or startling results. We hope to make a degree of improvement, even though small percentage-wise that will be highly significant to the industries in the South, especially for those who clear cut and plant. The literature is loaded with what I call "rah! rah!" articles, either promising or hinting at tremendous, world-shaking improvements in yield and quality. I hope these come to pass, but from what we now know, don't count on them. What we are anticipating are some good solid, though modest, improvements.

Industries in the South have been very active in supporting, as well as doing, forest tree improvement work. Of course, the best-known and most publicized activities are those associated with tree selection and seed orchard establishment, but many other types are underway. The southern industries are not merely talking about tree improvement, but they are employing it as much as possible in managing their forest lands.

Forest industry in the South is dominated by the pulp and paper companies, which are the ones that have been at the forefront of industrial tree improvement. Only a few lumber companies have been active, and then only on a relatively small scale. Certain of the hardwood-using industries have professed interest, particularly the furniture and veneer segment in North Carolina, but no real action has as yet developed from this interest.

Beyond the forest industry, a number of different organizations are doing tree improvement work in the South. They are too numerous to mention in the limited time here so I shall illustrate the work being done by our own industry cooperative program.

The N. C. State Industry Cooperative Program

We work with 13 pulp and paper industries in six southeastern states. Most of our work at present is concentrated on loblolly pine. We have a "gentlemen's agreement" with the University of Florida School of Forestry which works on slash pine in a comparable industry-cooperative program. (Farther west, a similar program is underway at A & M College in Texas) .We also work on shortleaf pine, Virginia pine and pond pine, and expect to undertake work on hardwoods in the near future.

The majority of the companies use relatively short rotations, and many are committed to a management policy of clear cut and plant, following intensive site preparation. During an average year these 13 companies plant a total from 110 to 150 million seedlings.

The money contributed by the companies is used for three purposes:

(1) Advice in their manageme problems concerning genetic aspects of species used, seed collection, seed sources, etc. The bulk of the time on this advisory, or consultant, phase deals with seed orchard and seed production area establishment and tree selection. We do not actually do this work ourselves; by holding on-the-job schools or training sessions, and by working with key company personnel, we teach and advise how the jobs should be done. The one exception to this procedure is the final selection; we grade each tree ourselves and make the final recommendation as to whether any given tree should be used in the seed orchard.

(2) Basic research of mutual interest to all the companies. Although we have a great many studies of various types now underway, we specia1ize in wood genetic studies. Most of our basic research deals with variation and inheritance of several wood properties and first steps of building up strains of pines with desired wood.

(3) Training of students in forest genetics. The students do much valuable basic research which aids the industries. This research is an important part of our total research program. In forest management, for example, next February I shall have 16 graduate students working on problems closely related to forest genetics, all but one of whom is studying for the Ph. D. degree.

Industries' Part in the Program

Please do not construe that industry's part in this program involves only the contribution of funds. This definitely is not all.

As previously hinted, the bulk of the actual field work is done by the cooperating industries. They make all initial tree selections; they lay out, graft, and care for the seed orchards; they mark, cut, care for, and harvest from, seed production areas. They prepare the sites, plant, care for and measure progeny tests. When we need wood samples or soil samples for the basic research, they help with manpower and transportation. They sometimes employ students during the summers and help them to carry out their research programs. The industry nurseries grow the large numbers of seedlings required for progeny testing. Our cooperative budget is, on the surface, rather small but is really considerable when the industry costs are included. The tree improvement programs with the most successful companies have now assigned one full-time man to this work, and one company sometimes employs a number of additional persons during peak loads.

Several companies have their own research groups with whom we wk closely. For example, we are cooperating with one on a very basic, intensive heritability study. This work is done on their experimental forest, largely by their personnel. Some of the more technical phases are done by us at the College, and through our students, but such a complex, expensive, long-term project could not have been attempted readily without industry cooperation.

Results Achieved

Results have been very satisfactory and more rapid than either we or the industries could have hoped for. The tree selection program has gone smoothly with over 500 selected trees now being termed satisfactory for seed orchards. Our selection criteria are very severe, and only about two out of every 100 trees originally selected by the field foresters get into the seed orchards. Many acres of seed orchards have been established already. In a year or two enough acreage will have been established to provide (after they mature) a potential output of nearly 100,000,000 seedlings annually. A considerable acreage of seed-production areas has been marked and thinned, with seed collections beginning from them. Outplantings have already been made from several open-pollinated progeny tests and in a year or two some progeny tests from control pollinations will be ready for outplanting.

A great improvement has been made in seed collection policies, particularly as to geographic origin of seed. Many companies are now planting seedlings from seed collected on their own lands and produced in their own nurseries, half the companies having their own nurseries. A substantial portion of their plantings already come from seed-production areas or at least from the better phenotypes. They have zoned their lands for seed collection, keeping major site changes and provinces, such as Piedmont and Coastal Plain, separate.

Benefits to Industry

Benefits have been large, but very few of them, as yet, have been strictly genetic in nature. It is too soon to begin realizing benefits from the genetic phase of the work, excepting recognition of proper seed source. However, savings effected by emphasizing use of proper seed from the proper site have to date undoubtedly been of much greater benefit to the companies than the costs of the programs.

In my working with and observing industrial programs for the past eight years, it appears that perhaps the most outstanding benefit of the genetic programs is to make foresters realize that a tree is a single living unit which lends its character to, and has its impact on, the quality of the forest of which it is a part. Too often foresters have in the past dealt with forest tracts, acres, basal areas, volume yields, etc., losing sight of the individual tree characteristics in the mass of totals and averages. It has been interesting to note the change in attitude among the foresters. Now they are beginning to look at a tree as an individual and are frequently amazed at the magnitude of individual differences and the frequency with which they occur. No longer is a tree just a tree, This realization has been most impressive in the South as regards bole spiral. If you had asked the average forester about the bole straightness in loblolly pine, he would have until recently averred that his trees were straight, Go out with him and look at each tree. Some men have been so impressed that now they say there is no such thing as a straight loblolly pine. One man told me that I had spoiled forestry for him. He used to think he owned the best timber in the South, but that now he looks at each tree and finds very few of his trees are really good.

In our own particular research, a most valuable contribution to the Industries has been the widespread awakening of an awareness that wood itself is a variable thing, both within a tree and aong trees. Many industrial people have acted as though ood is wood and the only difference is between species. Age of tree and portion of tree used are now getting more recognition in use. Some attempts at pulp bolt grading have been started. Probably the shock with the greatest impact has been the discovery by industry that they really knew very little about the effects of different fiber characteristics upon pulp and paper properties. When we asked the industries what they wanted in the way of wood properties, for which we would gear our breeding research, they were unable to tell us simply because they did not know the effects of various wood properties on paper quality. The effect of this shock has been healthy. A very new, vigorous series of tests and pilot plant studies have now been initiated in this field and new information is coming in daily.

Many auxiliary benefits have also resulted and investigation stimulated in associated fields. Tree improvement needs have, for example, focused attention on botany, soils and other fields. A prime example is the flowering habits of trees used in the seed orchard. Much intensive work is now being done on the physiology of flowering, effects of fertilizer on flowering, phenological variations of different geographic races, as well as individual flowering differences. The list of other and related activities stimulated by tree improvement programs is very long, and some types of studies, such as vegetative propagation, have been greatly advanced. Certainly, many basic silviculture, and even broader forest management, studies have been stimulated by the geneticists' questions in these areas, as well as those bearing on basic botany, plant physiology, soils and statistics.

One of the other important effects has been the increased interest in forest pests. Cone and seed insects and diseases formerly considered harmless are now found to be important. New insects and diseases attacking flowers, cones, grafts and tree progenies are constantly being discovered.

Finally, I should like to discuss one great contribution to foresters and to forestry, though it is an intangible one. In our area, for many years forestry was looked upon as concerning mainly fire fightin', tree cuttin', and maybe tree p1antin'-- at most, a crude form of art. The emphasis on forest genetics and its related disciplines has now helped make it more evident that forestry, if it be an art at all, is certainly one that must rest on a sound scientific base. I have noticed the attitude of the basic researchers in other fields visibly change toward us in the past several years. We, as foresters, are now being accepted by them as more than "woods workers", in fact, as individuals who have something real to contribute to basic biological sciences. This change in attitudes has even seeped noticeably down into the forest industries; many of them now have or call on, research foresters and use them for their technical skills. No longer is scaling, chocker-setting, boundary-marking and the like the only use made of foresters. I feel that part of this change has been triggered by the forest tree improvement approach.

Forest tree improvement is a complex, costly business. I feel that it has already paid its way "genetically" to the industries by its provenance (geographic race) emphasis, although not many other direct genetic effects have yet been achieved. However, even if it only serves to stop de grade, even if no increase in productivity or yield is brought about through genetic approach, a halt to continuing dysgenic practices will pay the cost of the genetic programs.

As yet, most benefits are not genetic in nature But tree improvement has spurred basic studies on many problems of extreme value to forestry Such studies in forest management and in wood technology have in some cases changed the forestry approach much to benefit of industry.

Thirdly, it has helped to promote the idea that a forester is also a scientist. This idea is becoming increasingly evident in industry allowing full use of the foresters training and intelligence.

Finally, though this has not been stressed, the genetic approach will pay off as genetics. New strains that are higher yielding, or of better quality, or resistant to pests, will be developed for industrial use. Indeed, benefits of genetic nature are already being realized, as for example, use of drought-resistant strains which are paying large dividends to the companies using the tree improvement approach.

DISCUSSION

GERHOLD. I'd like to direct a question to Bruce Zobel even though it may be a little bit unfair in that it doest concern his region. Ed Giddings has described serious obstacles to the use of standard tree improvement practices in the spruce-fir type. I would like to pose the question, is the standard orchard concept too limiting for work in the spruce-fir type? Should we perhaps think in terms of pollen orchards using trees already on the site as mother trees and could this approach make any significant contribution to improving properties like wood density, disease and insect resistance and such?

ZOBEL. The reason I'm in the South is that the best opportunities are there. Work in other regions where you have many species and all-age stands reproduced by natural regeneration is more difficult. The biggest contribution the geneticist can do under these conditions is to find out something about the trees, their characteristics and how they are inherited. When you know something about their inheritance pattern, then you can use natural regeneration to advantage because this indicates what sort of tree to leave for your seed tree. But the intensity of genetic improvement and the value of genetics is always going to be much less under natural regeneration and with all-age stands than it will be under the even-age stand conditions that we have in the South.

We recently took a visitor from Belgium to see our industrial operations. After showing him a 1,000 acre area they were planting, where 60 men were lined up abreast planting trees and tout as far as you could see there were just rows of seedlings, he said, "why, you people aren't practicing forestry, you're tree farming". Under such conditions genetics has a real opportunity for-use. In an area such as you described, (which I know very little about) it is going to be much more difficult to sell genetics and to actually use it when you do sell it.

BINGHAM. Is there a tendency, Bruce, for the southerners to wean themselves away from the grafted seed orchard concept and toward the seed production area as almost as likely to get about the same amount of improvement?

ZOBEL The answer is no, though the implication of your question is partially correct. There is a strong interest now in seed production areas for interim use until the seed orchards are producing. But most of the companies in our area of the South eventually look to the time when they will have producing seed orchards after which seed production areas will go out of existence. Don't forget that for these seed orchards progeny testing is going on now, and certain characteristics can be assessed at an early date. I don't want to get involved in a discussion of wood, but one can tell a lot about the wood that a mature tree will have when it is 3 or 4 years old. If you are interested primarily in wood, you have to progeny test too long before you know whether you have the right type of tree in the seed orchard. But the use of seed orchards in the South is still very strong and establishment is active. As White said, the original seed orchard concept and the enthusiasm for it was, in some cases, sold under false pretenses. People were told, "if you put in these seed orchards, you've got it made, going to supersede everything else, you can just about forget about forestry as such." I probably shouldn't say this because it may sound like sour grapes, but a few of the seed orchards in the South really have no business being called seed orchards. They were established under pressure and put in without any thought or any plan; if there is any genetic improvement through these orchards, it's going to be pure luck.

BINGHAM. It would be somewhat different, Bruce, if you were working with a characteristic which could not be determined as easily in the juvenile stage.

ZOBEL. Dick, if you are working only with a characteristic such as growth rate or volume yield then the seed orchard concept is pretty limited. However, you forget that in the South we are working for form and quality improvement. We already have fast growth rate. None of us feel we are going to get too much improvement in growth rate through seed orchards. What we are trying to do is improve the type of wood, the quality of the tree, the straightness of the bole, the limb characteristics. In the literature you always see seed orchards and volume yield tied together. I believe in that at all because we suspect that the heritability of volume yield as such is very low; heritability of diameter growth is low, if you want to put it that way. I'm not looking forward to very much improvement in diameter growth. We are looking forward to considerable improvement in height growth and bole straightness and things of that nature

KLAEHN. I would like to make a point here which concerns the Northeast We are dealing, here in the Northeast, mainly with hardwoods. There are very valuable species and I think that a method of improving what we have out in the woods would be the use of interplantings of, for instance, basswood, sugar maple, or ashes or particular value. We can obtain the seedlings from seed orchard nursery stock plant them out in stands where we have a good site and where they will perhaps some day pay off. I know of several places in Europe where they are doing this sort of thing with beech, oak and other hardwood species. I would recommend this method for consideration by industries which have to deal with Lrge areas of hardwoods.

BALIVET Are any of the companies that you are at present servicing raising any questions about hardwood research or is there any tendency to think in terms of the same genetic approach to hardwoods?

ZOBEL. Definitely, yes. The companies that we are working with are becoming vitally interested in hardwoods. When I started in the South 8 or 9 years ago, many of the industries used little or no hardwoods at all in their mills. Some of them now use up to 30% to 40% by volume of hardwood. They suddenly have awakened to the fact that certain hardwoods are beginning to be a little difficult to obtain. The pulpmill interest in hardwoods, though, is much different from that of the furniture people Our furniture people are vitally interested in hardwoods, too. We have approached them several times about genetic work on their species. They are all in favor until money for research is mentioned, and then the interest drops. These furniture companies mostly are small outfits with limited financial backing. I should say there is a great deal of interest in hardwoods, but there are very few people who are willing to put up the money for hardwood research, at least until the pulp and paper industries go into it. I'll stick my neck out and predict that within the next 3 or 4 years you will see one or two hardwood research programs started in the South. These will stress the use of hardwoods for pulp, not for quality purposes.

WHITE. Bruce, I am very glad to have been a buffer for you and I thoroughly agree with everything you said. I believe that if I have misled the group here I should correct one or two impressions that I may have given them. The pulp and paper companies in the South have taken the lead in tree improvement work and have contributed most of the money. I was giving you the view point of the consulting forester who deals with all forest land owners and you should realize, to put my remarks and Bruces in the correct perspective, that the pulp and paper companies only own 10 to l5 percent of all the land in the South that is of the 200,000,000 acres of commercial forest land. There are lots of other owners who need to be told exactly what forest genetics and tree improvement means.