New Silvicultural Methods

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When we tried to decide which silvicultural methods to discuss as being "new", we set 10 years ago as the dividing point between "new" and "old". But we could not think of a truly new silvicultural method proposed during the past 10 years. Fertilization of forest trees has been tried for many years; only the aerial application of fertilizer seems to be a new wrinkle. Coppice regeneration of hardwoods, which has received renewed interest lately, is an ancient practice. Clear-cultivation of plantations is not new. If our silvicultural methods are not new, what then is new"?

The most important "new" factors are the present and future social and economic conditions under which we must practice silviculture. Skyrocketing taxes and labor costs, the scarcity of labor, and pressures from land-use systems are some of the new developments that are affecting silvicultural decisions. These pressures will force us to find new combinations of old silvicultural methods. Some of these new combinations may grate against our sense of propriety as foresters. But we must be willing to use them if we are to achieve the most efficient and profitable use of the land available.

We have chosen two recent silvicultural developments to discuss today. The first is the increasing availability of improved seedlings from seed orchards; we as foresters should find this very comforting. The second may shock our sense of propriety; that is, the recent proposal called silage sycamore (McAlpine et al., 1966). This is actually a silvicultural concept rather than a cultural method.

Seed Orchard Seedlings

We have heard repeated references today to the progress made in southern pine tree improvement programs during the past 16 years. Several million seedlings have already been produced from the seed orchards. More seedlings will be available from orchard seed next year, and even more the year after that. As they become available, these seedlings are being incorporated into routine planting programs using the same site preparation and spacings that are used on unimproved planting stock. In most cases, there is no post-planting cultural treatment, such as fertilization. Should they be planted with no extra care, or can more intensive cultural practices be used economically on the improved stock?

In agricultural crops, the development of new, varieties has accompanied improvements in cultural methods. These agronomic advances have involved land preparation, planting methods, stand structure, fertilization, and chemical control of diseases, insects, and weeds. Increased mechanization has been an integral part of all these changes. The result has been a reduction in total labor requirements as well as an increase in the productivity of each cultivated acre.

For forest trees, evidence is mounting to indicate the existence of strong interactions of clonal and seedling lines with cultural treatments (Walker .and Hatcher, 1965; Curlin, 1967; Pritchett and Goddard, 1967). In most instances, intensified cultural treatment has been simply the application of fertilizer, although some studies have included post-planting cultivation for weed control and irrigation. Consequently, the university-industry cooperative tree improvement programs in Florida and North Carolina are beginning to incorporate fertilization into their plans for progeny-testing seed orchards. They are doing this to identify those lines that respond the most to fertilizer as well as those that do well with no extra treatment. Hopefully, these interactions of genotype with cultural practices can be exploited fully by controlled breeding.

A number of intensive care studies are also being put in, using bulked lots of seed orchard seedlings. One such study, by Georgia Kraft Company is attempting to achieve maximum growth of loblolly pine seedlings from orchards of the Georgia Forestry Commission. Seedlings receiving the

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intensive treatment were center-planted in holes dug with a motor-driven portable post-hole digger. Since planting, the intensive care plots have been fertilized twice a year, disced once a year for partial weed, control, and irrigated intermittently. BHC and Thimet have been applied for tip moth control and Ferbam for fusiform rust. Seedlings on the check plots were planted with a dibble but have received no additional cultural treatments. Similar but less intensive studies are underway within the North Carolina State University program.

All of these intensive care studies are still too young to allow any firm conclusions about the over-all effects of intensive care on growth and ultimate profit. In most of these studies -- probably in all of them-- intensified cultural treatment has meant an increase in total labor requirements. However, the labor situation is already so critical in some areas of the country that intensified cultural treatment on a large scale would be impossible even if it were known to be economically desirable. Consequently, our silvicultural research in the future should emphasize two important areas. First, it should identify those improved lines that will respond to cultural treatment as well as those that will do well with little or no extra treatment. Second, silvicultural systems must be developed that will integrate, in economical combinations, tree breeding, cultural treatment, and mechanization from site preparation through harvest.

"Silage" Sycamore

While attending the Eighth Southern Conference on Forest Tree Improvement at Savannah, McAlpine **et al.** (1966) put together a silvicultural concept they_ called "silage" sycamore. They were deeply disturbed by skyrocketing taxes and labor costs, by harvesting problems caused by scarcity of woods labor, and by the economic consequences of compounding costs over rotations of 30 years or longer. As a partial solution to these problems, they envisioned growing trees at rotation ages as short as two or three years and mechanical harvesting of whole trees—trunk, limbs, bark, and perhaps even leaves. The harvesting machine would be similar to, but larger than, a conventional forage or silage harvester. In a continuous operation, the harvester would cut the tree, chip the entire tree, and blow the chips into a wagon for movement to a central loading point.

The proposal includes:

(1) Planting or direct seeding a fast-growing hardwood such as sycamore at spacings as close as 2 x 2 feet or 4 x 4 feet.

(2) Mechanical harvesting as early as two or three years of age.

(3) Coppice regeneration.

(4) Repeated harvest and coppice regeneration until the sprouting ability of the stumps drops below an acceptable level.

The wood produced in this operation is strictly juvenile wood, but it has many potential uses. Preliminary tests of paper made from whole five-year-old sycamore trees (trunk, limbs, bark, and leaves) are very promising. In properties such as bursting strength, tearing resistance, and tensile strength, the sycamore paper compared well with paper made from three commercial pulps: northern softwood kraft, southern softwood kraft, and northern softwood sulfite (acid process). This pulp will probably be most valuable as a substitute for present hardwood pulps in mixtures with long-fibered pulp.

On a very limited scale, whole five-year-old sycamore trees (trunk, limbs, and bark) have been made into particle board. Preliminary strength tests were encouraging, but some problems also became evident. These tests are being continued.

These preliminary tests on five-year-old sycamore trees were limited. To establish fully the utility of juvenile wood of the numerous hardwood species that might be grown under this concept, each industry concerned should run its own tests to see where this type of wood can be incorporated into its product line. Processing methods may or may not have to be changed to handle this wood.

As a system for producing wood fiber acceptable for certain products, the "silage" sycamore concept has much to recommend it. First, mechanization and low labor costs are the key words from planting to harvest. The machines needed to harvest saplings should be cheaper to build, lighter, and capable of operating on a wider variety of terrain than those required to harvest conventional pulpwood. Second, short rotations should be, in some respects, more profitable than long rotations in an age of high interest rates and increasing' taxes. Third, the ability of hardwoods to regenerate by stump sprouts and root suckers seems to promise that a single planting may suffice for three or more rotations. Fourth, preliminary estimates indicate that total yields per acre in tons of fiber over an extended period will exceed those produced by pine on conventional 30- to 35-year rotations. Finally, tree improvement by selection and controlled breed-breeding should be a powerful tool in implementing this concept. We should be able to create relatively quickly special, improved strains for short rotations and coppice regeneration.

In spite of the promise that this concept offers, we must be careful in our research and restrained in our enthusiasm to put it immediately on a production basis. We must not over-estimate the value of the concept, but even less can we afford to under-estimate its value. Many questions remain unanswered. Maybe after 10 or 15 years of thorough research, we can put this concept on a production basis. By then, our research should enable us to make recommendations on spec i e s, sites, site preparation, planting or direct seeding, spacing, weed control, disease and insect control, fertilization, rotation ages, harvesting machinery, special improved strains, expected yields, and suggested end products. Each of these points will require major research effort.

At best, the "silage cellulose" concept will supply only part of our needed cellulosic raw materials. It should, however, become an integral part of the over-all picture by alleviating the drain on hardwoods by certain pulp products and allowing these trees to go on to other products requiring larger size and better quality, such as veneer and lumber.

Silviculture of the Future

What will typify our silviculture of the future? Certainly, intensive cultural methods, genetically improved strains, and mechanization will become prominent features of future silvicultural systems. In addition, these systems of the future will most likely emphasize a broader concept of wood quality than present systems.

Seidl (1965) proposed such a broad, practical concept of wood quality for the future: "...quality over a period of time is a changeable attribute that is characterized by a dynamic balance among intrinsic properties, economic value, and consumer satisfaction." Also, "...wherever wood exists in quantity, in concentrated form, and at lowest cost, the force of technology will be applied to make useful products for the population." That is, the wood available and its cost will create a standard of quality. But Seidl also urged, "...we should continually aspire to achieve the maximum volume and weight of wood in trees of good form on the minimum number of stems."

This is a broad concept of wood quality. It definitely includes the ideas on wood quality that were emphasized in the systems used to select the parent trees in our current seed orchards. But the concept is broad enough to include the recently proposed "silage sycamore" or "silage cellulose" concept. This view of wood quality and the pressing need for mechanization will greatly influence the new combinations of old silvicultural methods that we will use on our genetically improved planting stock in the future.

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