The optimum loblolly, shortleaf, and slash pine seedling

by

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The trend toward planting fewer seedlings per acre points up the need to concentrate on growing and planting optimum seedlings. This means that grading is more important than ever and, if the tree planter must pay extra for this service, the increased survival and growth of his plantation will pay him back immensely.

The optimum seedling should have some resistance to disease and insect damage. The stem or top must be long enough to handle in machine planting and stiff enough to withstand rain, ice, and wind. The root must be long enough to reach below the zone desiccated by grass roots. At the same time, the seedlings should not be so large that the weight unduly increases shipping charges or makes field handling difficult.

In their simplest form, the current grading rules specify that healthy, unbroken loblolly, slash, or shortleaf pine seedlings shall be culled if: 1) They lack secondary needles, 2) the root system is less than 5 inches long, or 3) the diameter at the root collar is less than 1/8 inch. Because many foresters reported good success in outplanting Grade 3 seedlings. Shoulders and Jorgensen (9, 12) divided this grade into two classes:

Grade A-Seedlings 3/32 to 4/32 inch in root collar diameter that had stiff woody stems and fascicled needles.
Grade B-Other grade 3 seedlings that lacked any of the above attributes.

Their grade 3A mycorrhizal slash pine seedlings survived as well as non mycorrhizal grade 1 and 2 stock, and mycorrhizal grade 3A loblolly pine seedlings had an 8 to 30 percent higher survival rate than grades 1 and 2 nonmycorrhizal plants from the same nursery. All of this points out the mycorrhizae presence and grade together provide better criteria than grade alone.

Despite continued refinement in grading rules, the poorer grades have outperformed Grade 1 in some instances. Evidently some nurseries (presumably because of climate or soil) can produce an internal chemical or physiological condition in the seedlings which greatly influences their survival. Wakeley (15) has hypothesized that: (a) Initial survival and height growth of planted southern pines depends on an excess of water-intake over water loss; and (b) excess of water-intake, in turn, often depends on formation of new root tissue promptly after planting. He believed that a seedling's ability to resist excessive water loss, to take in water, and to extend its root system promptly might depend far less on its size and form than on its internal chemical or physiological condition-that is, on its physiological quality.

Particularly important causes of differences in physiological quality seem to be: (1) Differences in mineral nutrition: (2) differences in stored food reserves of the seedlings; (3) differences in water tension under which the seedlings are grown; and (4) fungicidal sprays, spreaders, adhesives, rodent repellent sprays, or other sprays applied at lifting time and presumably affecting the transpiration of the seedlings immediately after they are planted. All emphasize the need for continued refinement in nursery practices.

A number of investigators (1) (2) *(4) (5) (6) (18)* have tried nurserybed selection as an easy method of selecting seedlings of superior phenotypes. In this method, seedlings in the middle of the bed that stand out because of height. vigorous appearance. sturdy stem, and freedom from insect damage and disease are outplanted for comparison with average adjacent stock. In general. the survival of these carefully chosen seedlings-variously called "super". "select" or "outstanding"-has been quite similar to that of the control seedlings. Height growth of the selected stock has been greater but. with one exception (6), probably not different enough to excite the interest of the field forester. It is noteworthy that the select seedlings were not overly large. being well within Wakeley's Grade 1. and that the control seedlings were generally Grade 2.

Hunt and Gilmore (8) established three plots of 1400 seedlings each in east Texas in which the heights 1 month after planting ranged from 0.3 to about 2.0 feet. The taller seedlings grew significantly faster during all four growing seasons. Survival rate of the larger seedlings, 1.2 feet plus. was as good as that of the smaller but not quite as good as that of the medium size seedling. The larger seedlings survived and grew better on the best site.

Silker (13) also studied the survival and growth of pine seedlings of various sizes and characteristics in east Texas. He suggested that "premium" seedlings be considered as those with 50 percent fascicled needles, stem diameter exceeding 3/20 inch, and with 6- to 12-inch top length for loblolly, and 6- to 9-inch top length for slash. Larger slash pine seedlings than this attained greater growth in good planting years, but did not have as consistently good survival rates in dry years.

In two studies established by the author near Oxford, Miss., the survival rate of loblolly seedlings ranging from 0.2 to 1.0 feet in height immediately after planting was nearly perfect. Growth during the first two and three growing seasons after out-planting was not significantly cor-related with seedling size at the time of planting.

However, differing site conditions, soils, and rainfall patterns most assuredly make comparison of one study with another impossible.

The real pay-off in any planting study is the final determination of the effect of "treatment" on yield. In one of Wakeley's Bogalusa, La., loblolly and slash pine planting studies (17) at age 30, the Grade 1 stock consistently exceeded the Grade 3 stock in survival rate, mean total height, mean d.b.h., percentage of dominant plus codominant trees per acre, rough pulpwood per acre, and sawtimber per acre.

With a few minor exceptions. values for the Grade 2 stock were intermediate between those for Grades I and 3. In mean d.b.h. and in pulpwood per acre, Grade 1 significantly exceeded Grade 2. and Grade 2 significantly exceeded Grade 3. At a 6 x 8 foot spacing, the yield per thousand planted Grade 1 slash exceeded that of the Grade 2 slash by 26 percent, and the grade 3 slash by 100 percent. Comparative advantages of similarly planted loblolly were 59 percent and 125 percent. These differences were accentuated by unequal competition resulting from systematic arrangement of grades in 1-2-3 order in successive trials of rows. Wakeley states that such unequal competition occurred, however, only because the graded seedlings already differed markedly in survival and height by the time the crowns closed or roots met between rows.

Clark and Phares have reported on the 20-year yield from planting graded shortleaf pine stock in Indiana and Missouri. Seedlings were sorted into two height classes and three stem caliper classes (2/20, 3/20, 4/20 of an inch) and outplanted. The tallest seedlings grew fastest during the first 3 to 5 years, but by age 20 this early difference had little practical significance. Average 20-year survival rates by stem caliper classes were as follows: 2/20 - 66 percent; 3/20 - 74 percent; and 4/20 - 83 percent.

It was this difference in survival that resulted in the yields from the sturdiest stock being significantly greater. For example, at age 21, the subplots in Missouri of the largest stock (8-12 inches tall, 4/20 inch stem caliper) had 4,700 cubic feet of volume per acre while subplots of the smallest stock (4-8 inches tall, 2/20 inch stem caliper) had only 2,440 cubic feet. They concluded that for better survival and higher timber yields, 1-0 shortleaf pine planting stock should be at least 6 inches tall with a stem caliper of 3/20 inch or more 1 inch above the root collar. Such seedlings would grade out as number l's according to Wakeley's rules.

Despite modifications by some (7) (10) (13). Wakeley's grading rules are still sound. Where both easy and difficult chances are to be planted. the forester-in-charge is advised to apply prescription planting (7). This calls for an appraisal of summer moisture conditions on each area to be planted. Plant the larger grade 1 seedlings, i.e., those with top lengths of 10 to 14 inches for slash, 9 to 12 inches for loblolly and 8 to 12 inches for shortleaf on good moist sites. On the drier sites, plant Grade 2's and the smaller Grade l seedlings. i.e., those with top lengths of 6 to 9 inches for slash, 5 to 9 inches for loblolly. and 4 to 7 inches for shortleaf. Seedlings much taller than 1 foot tend to wind whip after planting, wallow out a hole around the stem, and dry out rapidly.

Specifications for stem diameter should he strictly adhered to. Roots should be pruned to 7 or 8 inches. Unless mychorrhizae are abundant, Grade 3 seedlings should be culled where wide spacings are to be used.

Grading is costly but it pays off in greater yields. It can be dispensed with only where density, watering, and fertilizing are so rigidly controlled in the nursery that the endproduct is a sturdy, well-balanced seedling. Too, advantage should be taken of the knowledge that some nurseries consistently produce large seedlings and others generally grow small seedlings.

To support his planting prescription, the field forester should grade a sample of each seedling shipment, establish survival and growth plots immediately after planting, and inventory their performance at the end of the first growing season. Armed with this information, the field forester is in a strong position to communicate with and demand from the nurseryman a quality product.

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News & Reviews

What Nutrients Do Pines Need?

Farmers fertilize their corn crops. Stockmen provide supplemental food for their range cattle. Having seen the benefits from these practices, forest managers are asking if they should be fertilizing their pine trees.

Adding fertilizer to bring soil nutrients into balance probably will improve growth and vigor of pine trees if done right. That is the opinion forest scientist Eugene Shoulders expresses as he talks about his work to develop land management practices to maximize growth and quality of southern pines on the Coastal Plain soils of the Gulf region.

In the past, physical properties such as texture, depth. and available moisture were the soil characteristics most often used to estimate site productivity, said Shoulders, a Southern Forest Experiment Station researcher at the USDA Forest Service laboratory at Pineville, Louisiana. But land managers now want to know if they can greatly improve tree growth by adopting agronomic practices. such as fertilization.

Forest fertilization is a proven and acceptable management practice in limited areas of the South. But for most of the area, general use will probably have to wait until exact amounts and specific kinds can be reliably prescribed for individual soils. Shoulders said. He and his fellow researchers are on the way to providing at least some of the prescriptions.

In certain areas of the South, a single nutrient, usually phosphorus, is very deficient in the soil. There have been pronounced responses where supplemental feeding has been tried. Often, though, a combination of nutrients is needed rather than a single element. Loblolly pine may require a slightly higher level of nutrients than slash pine.

In their response to mineral nutrients, trees are influenced by their physiological condition and genetic make up, and also by various environmental conditions. Fertilization at planting time may be ineffective unless competition from grasses and other vegetation is controlled. Shoulders said researchers find the complex responses difficult to anticipate. Spectacular gains from fertilization may depend as much on developing strains of southern pines that are unusually responsive as on solving other problems in pine nutrition.

In a new publication, Shoulders and his coworker William H. McKee, Jr.. consider both soil and plant aspects of the problem. They summarize knowledge of chemical properties that determine the ability of soils to hold nutrients added for pines, and they evaluate results of a number of greenhouse and field studies. They also outline areas where additional information is needed. Their discussion is concerned chiefly with pine growth on the Coastal Plain soils of Arkansas. Louisiana. Mississippi, and Texas. Much of it, however, applies equally well to other parts of the South.

Copies of "Pine Nutrition in the West Gulf Coastal Plain: A Status Report," are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113. Ask for Forest Service General Technical Report SO-2. (Front Forest Research News for the South.)

Continued on p. 15)