PRODUCTION COALS. COST REDUCTION AND QUALITY STOCK PRODUCTION

C. A. Muller, Superintendent
E. A. Hauss Nursery, Atmore, Alabama

Asa background to my comments on this subject, I submit herewith a brief account of the construction and development of the E. A. Hauss Nursery located in Escambia County, Alabama, approximately 12 miles north of Atmore. It is situated in the heart of the longleaf pine belt. I was given the responsibility for planning the nursery development program and supervising the various installations. This nursery contains 107 acres of seedling production area and is equipped with the old type overhead irrigation system which is moved to each seedling crop area. There are sufficient irrigation lines and accessories on hand to irrigate 60 acres. Cost records have been maintained from the time the nursery was established. The average production cost per 1,000 for the 12 seedling crops in which 343,000,000 seedlings have been shipped is S3.24. The annual costs range from $4.29 for the first crop year in 1952 to $2.48 in 1956 and again in 1958. The soil is of the Red Bay type and is a fine sandy loam. The land is gently sloping and has lost about half of the original top soil prior to its being cleared. There are about 8 inches of loamy sand top soil lying over 30 inches of sandy clay loam sub-soil and water movement through these layers is relatively free. The adjacent forest is of the longleaf-slash pine type, and is gradually being converted by the industrial ownership and management to pure slash pine plantations. The annual rainfall varies from 40 to 80 inches and averages 60 inches. The periods of excessive rainfall usually occur during the months of June, July, August, and September. The usual occurrence of the first and last frosts are November 10 and March 1, respectively.

Act No. 120 of the 1951 legislature was signed June 22, 1951, by Governor Gordon Persons. This law provided a special appropriation of $100,000.00 to be used in establishing a suitable forest tree seedling nursery and the improvement of existing nurseries. Following approval of Act 120, land was acquired by lease and gift. The development program was begun January 1, 1952, A total of $76,000 was made available with the balance of the appropriation allocated to the Auburn Nursery. In spring, 1952, the first crop of forest tree seedlings was established. The annual production of seedlings varied from the initial amount of 7,000 M in 1952 to the peak years of 1958 and 1959 when 62,000 M were grown. This greatly expanded production at this nursery was made possible by financial assistance amounting to S86,726.41 from the Soil Bank Conservation Reserve Program. After the close of the Federal Soil Bank Project, seedling output decreased immediately by approximately 50 percent. The current annual rate of decline in nursery stock distribution is roughly 4,000 M seedlings. Hauss Nursery sales during the 1963-1964 planting season amounted to 21,000 II of which 6,000 M were produced on a contract basis for large industrial concerns. Contract seedling production seems to have leveled off at the 6,000 /4 annual rate. A further drop in regular seedling distribution this coming season is quite probable. Should the total annual

production of seedlings decline below the 15 million level, the capability of growing seedlings at a cost per 1,000 less than $4.00 will be quite difficult.

Production goals

The planned production for any given year is based necessarily on the sales volume of the previous shipping season. The Hauss Nursery is scheduled by the State Forester for the following seedlings for the 1964-1965 planting season:

slash pine	10,000 M
loblolly pine	2,000 M
shortleaf pine	310 M
longleaf pine	162 M
sand pine	54 M
spruce pine	30 M
yellow poplar	100 M
	12,656 M

The production for contract grown seedlings for the same season is:

slash pine	2,700 M
loblolly pine	2,875 M
longleaf pine	45 M
pond pine	45 M
sweetgum	450 M
sycamore	14 M
	6,129 M

This gives a total planned production for this year at this nursery of 18,785,000 seedlings. The current production of longleaf pine seedlings is off due to the lack of sufficient seed. The production goal for this species would otherwise have been at least 500,000. There has been a gradual increase in longleaf pine planting because of several successful plantations being established with machine planted longleaf pine seedlings which were root pruned in the nursery bed. Interest is also increased due to the fact that slash pine plantings on adverse sites are not very promising. It is also locally evident that as the seriousness of fusiform rust becomes more acute, landowners will show increased interest in both longleaf and shortleaf pine reforestation.

Quality stock production

The production of high quality forest tree seedlings has been very well summarized in literature and especially in S. P. Darby's article in Tree Planters' Notes No. 52. June, 1962, and it is probable that most nurseries are managed accordingly. To select the most important step in producing high quality nursery stock would be a very difficult task for every detailed operation is of prime importance in any given

time of the production year. No single step can be inadvertently by-passed or short cut without a sacrifice in quality control. As high standards are allowed to fall, a repercussion will occur and will be noticeable in the chain of events that must take place in the successful establishment of a new forest stand. No great achievements are likely without sincere efforts towards quality control by the nurseryman.

The increased use of high quality and genetically superior seed is one of VT most important advances in nursery stock production. When such valuable seed reaches the nursery in quantity every detail in management is amplified and the nurseryman's skill will be challenged all the more.

At Hauss Nursery, the sowing of uniformly sized seed is considered to be one of the next most important steps and it has been standard procedure since 1961. This method assures an even stand of equally developed plants that respond in the same manner to cultural practices. The seedlings from small sized seed may be forced into high quality grades instead of being culled in the grading process. The number of good plantable seedlings produced per pound of seed sown has thereby been increased singificantly.

The use of methyl bromide as a soil fumigant has been found to be a most useful material in producing high quality stock and is now recognized region wide. For reasons of economy, an attempt has been made at the Hauss Nursery to use ethylene dibromide in the control of black root rot. However, because of its partial ineffectiveness, it is quite probable that within the next few years, large scale fumigation with methyl bromide All be an absolute necessity. The 1964 experimental use of Trizone, a Dow Chemical Company product consisting largely of methyl bromide and chloropicrin, has shown promise of being an economical and effective fumigant.

At the Hauss Nursery emphasis has been placed on the fertility level and the physical texture of the soil since 1952. The use of sawdust or a mixture of sawdust and pine bark in the rotation with a soybean cover crop has been a standard procedure, but it has not been entirely satisfactory. The repeated use of the land has caused a severe tendency of soil clodding in spite of corrective efforts. This year prior to sowing soybeans broadcast at 3 bushels per acre, 140 cubic yards of pine bark-sawdust mixturewere applied on 22 acres of land. Other areas which are currently surplus to seedling needs were sown to "Kentucky 31" tall fescue grass as an economical method of retiring land and simultaneously improving soil texture and fertility. This perennial grass, when properly sown, eliminates practically all weed competition after one year's growth. A 5-acre stand of fescue sown in the fall of 1961 shows promise of eradicating a serious nut grass infestation. Drainage problems have been corrected by the construction of a concave type roadway system and by the annual use of an Eversman Land Leveler to fill depressions or wet spots. Quality stock can not be produced on a land subjected to standing water.

Cost reduction

The problems encountered in seeking various methods of reducing nursery operation costs are numerous and most interesting. In general, the nursery manager should first strive for a pine seedling density of 30 to 35 per square foot and then manage his cultural practices in such a manner that every seedling has a chance of becoming a plantable one that actually reaches the planting site. Some of the many opportunities for reducing nursery costs follow:

The nurseryman should make the most efficient use of the prime material --which is, of course, the forest tree seed lot. All the information affecting the rate, method, and time of seeding must be secured well in advance and sufficient time must be allowed for stratification when necessary. The sowing equipment should be carefully calibrated and checked prior to its being moved to the field. In certain cases, stratified seeds require coating with a metallic powder to permit an even distribution of seed over the seedbed. Standard procedure at the Hauss Nursery includes maintaining in the office a reference sheet on every seed lot which contains all the facts pertinent to the sowing rate as well as period of stratification, wet and dry weights of the seed lot, a calculation of the area on which the seed is to be spread, type of seeder used, correct amount of seed sown, actual area sown, and the true sowing rate which is computed after completion of the job. These reference sheets can be used as checks on the efficiency of the operation as well as sources of information on past experiences.

A revised seedling harvesting and packaging system that will eliminate one or more costly steps without adversely affecting quality control should be devised. There is little question that field culling and packaging can not be made a significant step in a sizable reduction in labor costs with the use of modernized counting, handling, and packaging methods. In fact, as late as the 1930's, harvesting was accomplished almost exclusively in the field at many nurseries. In order to make this method applicable to present day conditions, some changes must be successfully made and a sacrifice in accuracy in grading and counting tolerated. The use of kraft-polyethylene bags or lined crates will have to be made more economical and practical. Larger storage areas for packaged seedlings will be required at many nurseries and possibly mobile work shelters will be a necessity in the field. The flow of packaged seedlings from the nursery to the planting site can not be interrupted by adverse lifting weather. At the Hauss Nursery during the past shipping season, it was observed that the number of culls in field graded stock was double that in table graded stock. Also, field grading in standing seedlings in early fall was somewhat expensive. The cost of 2 roguings in the field has reached as high as $0.12 per M seedlings in a uniform stand of slash pine grown at a density of 32 seedlings per square foot. During the past 3 shipping seasons it has been the usual practice to maintain the cull of graded and baled seedlings at a level of from 1.3 percent to 1.6 percent, while using

the conventional mechanized grading table method at a predetermined and economical speed. The allowable tolerance in accuracy in count and grade is debatable and is affected by the standards demanded by the customer. It has been observed that large industrial planters using a wide spacing are becoming increasingly particular about the quality of their stock.

Costs could be reduced by the development and use of a longer range rotation using a perennial cover crop and an effective soil fumigant. The management of a forest tree nursery on a 2-3 or 3-3 rotation offers possibilities of reducing seedling costs. During a 3—year growth period of a perennial grass cover crop, the fertility level and organic matter percentage can be economically restored and any abnormality in pH value and phosphate or potash level may be corrected. The effectiveness of a soil fumigant would be increased when it is applied after turning under a cover crop with such a dense and fibrous root system as tall fescue provides. By producing two and possibly three successive seedling crops on the same area, the additional cost of fumigation can be prorated over a longer period.

The elimination of manual labor used in material handling by modernized equipment such as hydraulic front end loaders, fork lift trucks, conveyors, and bulk storage facilities should be a goal in cost reduction. To mention just one example, the use of a 2,000 pound capacity fork lift truck during the shipping season has eliminated 2 laborers entirely at the Hauss Nursery. The machine is operated by one of the nursery foremen and it is used to transport all seedling bales from the packing shed to the storage or shipping shed, to load incoming trucks, and to supply bulk sphagnum moss containers to the packing tables. This one man easily performs all the loading jobs, keeps an up—to—the—minute inventory of seedling bales on hand, and uses a front end loader to refill the sphagnum moss bins which are mounted on pallets.

More effective use of soil amendments and cultural practices for improving both fertility level and soil texture should be incorporated into nursery methods. This step requires the recording and study of soil test results covering a period of years. In order to manage nursery soils economically, a ready to use reference on all soil tests and applied amendments must be kept on hand and consulted in working toward a fertility level standard. All guess work applying to fertilization must be eliminated. The general trend of fertility levels over a period of years can best indicate the needs of the nursery soil. To illustrate, the phosphate level for one compartment at the Hauss Nursery during the past 12 years has varied from 6 ppm in 1952 to 24 ppm in 1963. During this time, 6 seedling crops were produced and 1,636 pounds per acre of P205 were applied.

The constant observance and adherence to carefully planned work schedules is a necessity in order to spread out periods of peak work loads. As in other agricultural enterprises, the need for labor varies considerably during the year. By following carefully prepared work plans, some of the

tasks falling in periods of peak work loads may be spread out into the usual summer slack periods. Labor costs may be reduced by using a small permanent force effectively in a planned program. Field roguing of cull seedlings in late summer and early fall is just one method of keeping a crew constantly producing a better product during a slack period. At the Hauss Nursery, an up-to-date work plan is kept constantly available to the nursery foreman in the event the nurseryman is temporarily out of reach.

As in the case with industrial concerns, research has a direct influence in production costs. Constant alertness to research findings at the tree seed laboratory, experiment stations, and the schools of forestry is an absolute necessity.