Nursery Problems With Size

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The preceding speaker has told us about the importance of stock size to survival and growth. My topic is "Nursery Problems with Size". The problems could be summed up as: (1) what size to grow and, (2) how to grow the desired size. These two topics are being covered by the other two members of the panel. They have the answers so I am left with the problems. The specific problems and solutions vary between. species and between nurseries. However, nurserymen all have the same general problems of what size to grow and how to grow the desired size.

Size is one of the nurseryman's major problems. He is vitally concerned with the production of stock of suitable size. He needs more information regarding size in relation to customer planting objectives, practices, costs and results in order to know what the customers need. Silvicultural practices, and planting machine limitations have a direct bearing on the size of stock desired. Planting practices and equipment may be improved for large stock but in the meantime the demand seems to be for small to medium sized stock. Seedlings over 18" tall are said to be pushed over by the seat on standard tree planters. Root systems over 8 inches long cannot be planted deep enough with standard planters. Top pruning at planting time is frowned upon by some planters. It is futile to grow large stock if it is not handled and planted properly.

Size alone is not a good indication of quality. Most of the few papers available on hardwood stock size compare superior seedlings with inferior ones from the same lot. This is not an evaluation of size alone. Small dominant seedlings from one lot might prove to be superior to large suppressed seedlings from another lot. Seedlings must be large enough and vigorous enough to compete with other vegetation, but competing vegetation must be adequately controlled in many cases. If competing vegetation is controlled smaller stock can be used.

- Measurements are used to set standards and evaluate stock. Stem diameter is the best single measurement of size. Measurement of diameter 1 inch above the ground line is above much of the basal

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enlargement of the stem. This is a convenient point for measurement in the field as well as in grading operations. Stem diameter is the basis for stock grading. Other measurements are useful for stock evaluation but are usually not justified in grading large quantities of stock.

Seedling balance is an important consideration related to stock size. The root system must be adequate to support the top. Overcrowding in the seedbed or severe root pruning may result in an unfavorable top root ratio Lifting and planting equipment should be designed to lift and plant most of the roots.

Form should be used more in the evaluation of hardwood nursery stock. A form factor arrived at by dividing the height by the diameter may be the best and simplest method of indicating stock quality if the root system is not severely pruned. A form factor of 100 would indicate good stock. A seedling 1/4 inch in diameter and 25 inches tall has a form factor of 100.

Hardwood seedling form factors usually fall between 50 and 150. A form factor of 75 would be excellent. The lower the form factor the sturdier the seedling. Tulip at the Mason Nursery grown at very low density had an average form factor of 62, height 19 inches and diameter of 4.87 sixteenths or .3 inches. The form factors of individual seedlings ranged from 55 to 80. Diameters ranged from 4 to 7 sixteenths. A sample of tulip from the Union Nursery had an average form factor of 77, height 20 inches , and diameter of 4.11 sixteenths or .257 inches. The form factors of individual trees ranged from 53 to 116. Diameters ranged from 3 to 6 sixteenths. This was very good stock apparently grown at medium density.

Optimum size is a term that I like to use. I define optimum size as the average or median size of acceptable stock. We hear a lot about minimum size, but only a few seedlings may be near the minimum. The optimum or average size may be considerably larger. The minimum size may be 1/8 inch while the optimum may be 3/16 or 1/4 inch or more. If the optimum size is 1/4 inch, one-half of the seedlings might be less than 1/4 inch and one-half of them over 1/4 inch. Most of them would be closer to 1/4 than to 1/8 inch. Optimum size describes the stock. Minimum size only defines the lower limit. Stock can be described as being above or below the optimum size.

Variation, a natural and universal phenomenom, is a problem that we try to minimize in the nursery. Variation of stock is influenced by numerous variable factors, many of which we can partially control. We can partially control weather through irrigation but we cannot prevent excessive rainfall. We shorten the germination period by seed stratification to reduce variation but we are unable to prevent genetic variation. We have stock variation: (1) between species, (2) between nurseries, (3) between years, and (4) between individual seedlings.

Variation. results in different classes of seedlings. Hardwood seedlings can be classified like forest trees as dominant, co-dominant, sub-dominant and suppressed.

Dominant seedlings may have some genetic superiority but larger seedlings also result from lower density in spots, early germination, large seed and edge effect. I would prefer to have these dominant seedlings scattered through a plantation than to have them graded out and planted together unless the cost of using only dominant seedlings could be justified under average conditions. The intensity of plantation management, objectives and anticipated returns may not justify the use of expensive, high quality stock.

Co-dominant seedlings often comprise the bulk of the stock. Many of them are almost as tall as the dominants but usually have smaller diameters. Since co-dominants often make up a large part of the stock, seedbed density should be low enough to insure that co-dominant seedlings are of good quality. Many of them should be near the optimum size.

Sub-dominant seedlings are smaller and less vigorous than co-dominants. They have been suppressed to varying degrees. Sub-dominant seedlings are of marginal. and sub-marginal quality. Better standards are needed for the disposition of this class of stock. Perhaps 20% of the stock could be sub-dominant depending on planting objectives and spacing, if it meets minimum requirements.

Suppressed seedlings are of sub-marginal quality. They are normally culled due to obvious inferiority.

Grading can be very simple or very complex. We feel that it must be simple because of the seasonal nature of the work, the caliber of available workers, the lack of close supervision, and the policy of keeping costs at a minimum.

Would it be advisable to follow the commercial practice of making several grades, priced according to size? Customers would tend to buy by price rather than need. Results would not be uniform between grades. The nurseryman cannot anticipate the needs of individual customers. If a customer wishes to plant only superior seedlings or discard all sub-dominant seedlings, he can purchase more stock and grade it to his own specifications. The higher cost of larger seedlings should be absorbed by whatever grading practices are followed.

Some stock variation in field planting may be desirable. If it were possible to plant very uniform stock it might be difficult for the best trees to maintain dominance. Stagnation might occur sooner and be more severe unless wider spacing were used. Stagnation is severe in many older plantations.

Production of one grade normally eliminates suppressed seedlings. 80% of the remaining seedlings are more or less average. The average trees must be of good quality in order to have good stock. Little can be accomplished by heavy culling since many of the trees culled would be nearly average.

Seedbed density is the major problem. Seedbed density influence size. Seedbed density also determines quality. Each nurseryman is very much on his own in this area due to variations between species, nurseries, years, and seed quality. Hardwood seeds are frequently planted soon after collection. This often eliminates the possibility of regular germination tests prior to seeding. More reliable and readily available quick seed tests would be helpful. Hardwood seeding is an art that may improve with practice under each set of conditions. Records and experience enable the nurseryman to improve the quality of his stock under his particular conditions.

Uniformity of seedling size is an objective that can be partially achieved by various means. Uniform seedbed density is necessary to produce uniform stock. Measures such as proper seed treatment produce more rapid and uniform seed germination. Top pruning during the growing season will slow up the larger seedlings allowing the smaller ones to catch up. It is possible that sorting seed into size classes would be helpful.

Standardization of size is an important problem. We would like to produce the same optimum quality each year. Standardization promotes

efficiency and economy of operation. It permits the use of standardized equipment, facilities and methods.

We can presumably grow whatever size is needed. Larger stock may require different and larger equipment and facilities, more area, and more personnel. Costs increase with size. If we increase size by reducing density we obviously increase our cost proportionately. The cost of distributing stock increases rapidly with size.

At what point does the cost of the stock start to exceed-the cost of site preparation. for smaller stock? Is larger stock satisfactory without adequate site preparation? How much investment can be justified by the objectives of the planting? The market for large expensive stock should be assured in advance. It is even more difficult and expensive to throw away large stock.