A Quick Way to Appraise the Performance Potential of Tree Planting Stock

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Tree seedlings for reforestation can be evaluated using the following characteristics: diameter/height ratio, root/top ratio, catalytic capacity of feeder rootlets, specific gravity of stems, and coefficient of variability. The sum of these attributes provides a quality index of nursery stock.

The quality of nursery seedlings can be determined from a few simply measured attributes. These characteristics can be integrated into a single numerical index. Such an index must be derived from properties of trees that bear on their ability to cope with adverse conditions. In addition, the quality of nursery stock is related to uniformity, precluding a large loss of stock in grading. The properties of trees that answer these requirements include: diameter/height ratio (d/h ratio), root/top ratio (r/t ratio), specific gravity of stems, catalytic capacity of feeder rootlets, and the coefficient of variability (*3*).

Measurements

D/h ratio is the average diameter of sampled seedlings in millimeters divided by the average height of the seedlings in centimeters.

R/t ratio, on a volumetric basis, is determined using a water-filled container of about 10-liter volume, with a faucet-shaped discharge tube near the top. The quotient of the volumes of roots and tops is obtained by a successive hand immersion of roots and tops of a bundle of seedlings and collection of displaced water in a graduated cylinder.

Specific gravity of stems is a quotient of an average of ovendry weight of 20-millimeter-long stem sections and their green volume (equal to 1.57 X d^2 where d is the average diameter of stems).

Catalytic capacity of feeder rootlets is determined on seedlings collected from the center of nurserybeds. After washing and air-drying roots for 24 hours, all rootlets smaller than 2 millimeters in diameter are cut from the trees, mixed, and weighed into 2-gram samples. The analysis is performed in a wide-necked 250 milliliter reaction flask provided with a no. 10 rubber stopper. The stopper has an inserted small glass tube for attachment of Tygon tubing and a 20-milliliter reagent container, held by a wire. The 2-gram sample is placed into the reaction flask. The reagent container is filled with 18 milliliters of 6-percent hydrogen peroxide; the stopper is inserted; and the Tygon tubing is connected to an inexpensive 200-millimeter aneroid manometer. The flask is tipped to allow the hydrogen peroxide to pour onto rootlets, shaken for 3 seconds, and placed on a level surface. After exactly 1 minute of oxygen evolution, a manometer reading is taken. The reading divided by 200 gives the catalytic capacity of feeder rootlets in decimeters of mercury per gram.

Coefficient of variability is determined from the following formula:

$$C = \frac{\sqrt{\frac{\Sigma(x - h)^2}{n - 1}}}{h} \times 100$$

where x represents heights of individual seedlings, h is the average height, F(x - h)? is the sum of squared differences, and n is the number of measured seedlings.

Calculations

The calculation of the index requires compatibility of the numerical values. Therefore, reciprocal values must be used for the coefficient of variability, whereas the catalytic potential of roots must be expressed in terms of decimeters (dm) of mercury column.

Table 1 includes results of analyses of four samples of 2-year-old red pine seedlings collected from four different soils.

Evaluation

The highest integrated value is exhibited by trees of balanced morphology, dense stems, abundant enzyme-producing root system, and uniform development (B). In comparison, the low indexes for the other samples indicate some adverse effects of nursery culture. These include excessive seedbed density, inferior seed, poor soil fertility, and high concentration of residual eradicants. The latter is especially suggested by the low-quality indexes of samples A and D.

Our work suggests that a quality index of 2-year-old red pine seedlings exceeding 1.5 indicates a high performance potential, 1.0 to 1.5 an acceptable potential, and 1.0 or less a questionable potential. For a more exacting appraisal of nursery stock quality, the properties of trees are determined on at least five composite samples. Each of these samples includes 10 trees collected at 10-centimeter intervals with the use of a sampling ruler laid across the nurserybed (3, p. 165). Five samples is the minimum number permitting calculation of a meaningful standard deviation, if there is a considerable variation in measurements. The standard deviation then permits verification of the reliability of obtained results and rejection of erratic values by using the criterion C = x ÷ d, where *x* is the largest deviation from the average and *d* is the standard deviation (3, p. 197). This more precise appraisal does not require a great deal of extra time and provides more reliable quality indexes of the planting stock.

It should be mentioned that a more complicated ordination analysis (*1, 2*) of the stock samples analyzed in this study yielded similarity indexes (A-18.1, B-100.0, C-56.9, D-19.3) closely related to the index obtained by the mere summation of numerical values of important attributes of trees (table 1).

Summary

A systematic determination of the quality index of nursery stock may increase the effectiveness of reforestation. Low values of the index are caused by excessive density, inferior seed, unbalanced soil fertility, unequal distribution of chemicals and organic matter, and high concentration of residual eradicants.

The appraisal can be applied to the stock produced in different nurseries or the stock produced at different locations in the same nursery.

Table 1.—*Properties of 2-year-old red pine seedlings produced in nursery soils of different fertility levels and residual eradicant contents*

	Nurseries			
Properties of nursery stock	A	B	C	D
Diameter/ height ratio (mm/cm)	0.23	0.30	0.21	0.24
Root/ top ratio (ml)	.30	.45	.38	.31
Specific gravity of stems	.28	.33	.35	.32
Catalytic potential (dm HQ/ plant)	.10	.35	.17	.14
Reciprocal of variability coefficient	.12	.24	.16	.08
Total	1.03	1.67	1.27	1.09

Literature Cited

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