Tubed Seedlings: A Technique for Plaiting Improved Stock

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Poor survival and initial height growth of certain seedling species like longleaf pine, black walnut, oak, and some others, are major problems. The ability of longleaf pine to become established on dry sand ridges, where few other species are able to survive, suggests that initial root habit of the species is important to survival. Root development and extension are rapid after the seed germinate and seedling roots may penetrate eight feet or more in 10 or 11 months (Wahlenberg, 1946). Derr (1948) found that the survival of 2)0 longleaf pine seedlings was closely related to the amount of lateral roots broken off in lifting from nursery beds. Height growth after six years for trees with laterals was 4.5 feet and without laterals it was 1.7 feet.

Handling of black walnut seedlings poses a problem. If the taproot is severed during lifting, rot causing fungi may enter the wound causing seedling stunting and mortality. Seedlings are generally large and difficult to handle. Height growth the first year after planting is negligible and seedlings often suffer dieback.

Studies have shown that survival and height growth of red oak and white oak seedlings are often unsuccessful (Williams, 1963). Second-year height growth of red oak ranged from 0.0 to 0.26-foot, and survival ranged from 74 to 86 percent. Seed were planted as part of the study and they grew almost twice as much in height as the transplanted seedlings.

Many nursery grown seedlings with a large root system die as a result of heavy root pruning during lifting because the root systems are not able to meet the water demand of the seedling after transplanting; consequently, the seedling suffers dieback or succumbs. Efforts to lessen the problem by direct-seeding some of the large-seeded and deep-rooted species have not been satisfactory because no repellents are yet available to keep rodents from eating seed such as acorns and walnuts.

Due to the root growth habits of many species it was conceivable that a tube-type container could be developed and used to good advantage. The idea was to plant seed in tubes, let the seedling grow several weeks, and then plant the tubed seedling. We have done some work with tubed longleaf seedlings using different kinds of tubes. The best tubes we have found thus far for this purpose are those made with kraft paper and a non-toxic water resistant glue. Two companies that specialize in making tubes or cores made some special tubes for our study.[3/] We also used a polyethylene tube which another company made up for this purpose.

On April 22, 1966, tubes were filled with a mixture of perlite, peat, sand, and soil and then a seed was placed in each tube. About eight weeks later we planted the tubling in a Lakeland loamy sand in south Georgia. Treatments were:

A. Kraft paper tubes, 1-inch i.d. x 10 inches long.
B. Kraft paper tubes, 11/2 inches i.d. x 10 inches long.
C. Polyethylene tubes, 7/8-inch i.d. x 10 inches long, solid.
D. Polyethylene tubes, 7/8-inch i.d. x 10 inches long, with two 8-inch slits.
E. Polyethylene tube s, 7/8-inch i.d. x 10 inches long, with twelve 1/4-inch holes.

*A special planting tool was made to plant them.

The seed germinated and the roots of the resulting seedlings grew 10 inches within a 5-week period. In December 1966, six months after planting, survival ranged from 52 percent in polyethylene tubes with holes to 92 percent in 1-inch kraft tubes (table 1). Some of the tubes and seedlings were dug up with as much of the root as possible and most of the taproots were over two or three feet long.

The kraft tubes decomposed rapidly after plant-

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3/ One-inch tubes made by Sonoco Products Co., Hartsville, S. C.; 1½-inch tubes made by Textile Paper Products Company, Cedartown, Ga.

ing. Root growth was hampered little, and some of the lateral roots went through the wall of the kraft tubes.

The good survival in the kraft tubes is probably due in part to the uninterrupted root growth which permitted the taproot to continue rapid downward growth and reach moisture. If planting is delayed more than two to three months, this rapid taproot growth may be hampered.

Based on the results of these studies, it appears that a kraft paper tube made with a water resistant, non-toxic adhesive is an excellent carrier for long-leaf pine, oak, walnut, and other deep-rooted seedlings.

Table 1...Average survival of two-month-old tubed long. leaf seedlings planted June 15.

Tube Description	Survival percentage	
	August	December
Kraft, 1-inch i.d.	92	92
Kraft, 1-½-inch i.d.	95	88
Polyethylene, solid	84	84
Polyethylene, slit	79	67
Polyethylene, holes	61	52

Due to the persistency of the polyethylene and possible hindrance to root growth, the polyethylene tube cannot be recommended until further results are obtained:

The growing of seedlings in tubes and planting soon after root growth begins offer many advantages, especially in tree improvement work where you want as much uniformity as possible in growing and transplanting seedlings.

ADVANTAGES ASSOCIATED WITH PLANTING TUBED SEEDLINGS

1. The tube method permits the young seedling to begin and maintain rapid root growth in a near natural condition.
2. The V-shaped and L-shaped root caused by planting would not be a problem.
3. One could better schedule seeding and planting to coincide with the species ecology.
4. If demands exceed seedling supply, the tube method would offer a solution since only a few weeks are required from time seed are planted until seedlings are ready to plant.
5. Tubed seedlings offer an opportunity for planting during most of the year.
6. A nursery is not needed; therefore, seedling production could be on a local basis. Expenditures for nursery equipment and facilities are not needed.
7. The tube offers a good potential for mechanization in production of seedlings and in planting of the tublings.
8. Initial seedling development and growth may be improved by the use of special mixed media and fertilizer in the tubes. The addition of systemic pesticides is a possibility.
9. Another advantage of tublings is in studies where 100 percent survival is required. Tubed seedlings in excess of immediate study needs could be prepared and used for replants if some of the original plants died.
10. If seedlings need to be marked, a flag or a marker can be placed in the tube prior to planting.

DISADVANTAGES OF PLANTING TUBED SEEDLINGS

1. The major disadvantage to the tubes at the present time is their cost. Quotations have been $0.013 to almost $0.03 each, depending on size and amount. This cost may be offset somewhat by mechanization, increased survival and improved growth. Cost would be easily justified, however, in research studies.
2. Another disadvantage is transportation and handling of the tubes and tubed seedlings. Until a planting machine is developed and used, planting may be slower than the planting of bare-root stock.

PRECAUTIONS REQUIRED FOR SUCCESSFUL USE OF TUBED SEEDLINGS

1. When ordering tubes, one should be sure to specify that they be made with a water resistant glue and that the glue be non-toxic to plants. Also, the paper should be of a fairly good quality.
2. The tube should be almost completely filled with the medium, with the seed placed on top and lightly covered. The medium should be placed in the tubes in such a way that it will not settle to cause the seedling to be recessed in the tube more than ½-inch.
3. During and immediately after germination, seedlings may need general control measures for damping-off fungi, such as Fusarium spp.
4. The seedlings should be outplanted as soon as, or just prior to, the taproot reaching the end of the tube; otherwise, some of the advantage of the tubed seedling may not be realized because taproot growth may be disturbed or lost at planting time.
5. When planted, the tube should be flush with the ground line. If the tube protrudes above the ground line, it may act as a wick and cause a dry condition around the newly planted seedling roots.

6. Avoid planting on sites after extensive site preparation until the soil has settled.

The use of tubes can be a valuable aid in artificial regeneration, especially in the regeneration of our more i mportant and improved hardwoods.

Tubes could also be used in rooting of cuttings. After root initiation, the cutting and tube could be planted without disturbance to the root as is the case when lifted from a rooting bed.