



Southern Forest

Nursery Management Cooperative

TECHNICAL NOTE 19-01

SEEDLING SURVIVAL IS IMPACTED BY PRACTICES IN OUTPLANTING

by
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One of the main objectives of a nursery manager is to ensure the production of high-quality tree seedlings that can reach their genetic potential once outplanted. A high quality seedling is one that has the ability to survive environmental stress and produce vigorous growth once outplanted. Unfortunately, no single seedling characteristic can determine seedling quality in forest-tree nurseries. A combination of characteristics such as height, root collar diameter, plant nutrition, seedling health, root size and crown symmetry are used. Together, these seedling characteristics help forest nursery managers determine the potential ability of the seedling to establish itself and survive once outplanted.

While high-quality tree seedlings are the goal of all forest-tree nursery producers, the seedling can fail to grow or survive once outplanted. The objective of this technical note is to draw attention to the issues that can adversely affect growth and survival of seedlings once they have left the care of the forest-tree nursery. By understanding factors that can affect the quality of forest-tree seedlings, outplanting strategies can be put into place to minimize the factors that negatively impact growth and survival of tree seedlings.

Research over the previous 45 years by the Southern Forest Nursery Management Cooperative (SFNMC) conducted on seedling production and reforestation throughout the southern United States has shown that failure to follow one or more of the below-mentioned planting guidelines jeopardizes the successful establishment and survival of the planting site.

Good Seedling Quality in the nursery can easily be negated with poor outplanting survival by:

- Improper planting:
 - Poor quality planting jobs.
 - Ignoring existing site and soil conditions that are not favorable for seedling outplanting.
 - Planting when environmental conditions indicate otherwise.
- Planting of poor-quality seedlings. Seedlings with larger root collar diameters have larger root systems that is directly related to increased survival and early spring establishment ¹.
- Improper handling of seedlings².
- Improper transportation and storage of seedlings³.

In addition, to proper planting, seedling survival is also affected by environmental factors and planting techniques.

Environmental factors that increase seedling survival:

- Planting season:
 - Seedlings should be lifted from the nursery when dormant.
 - Bareroot seedlings are traditionally planted from late November to late February⁴.
 - Seedlings should be planted early enough to allow for root growth to start before bud break⁵.
 - Planting early allows seedlings to obtain good chilling hours for freeze tolerance.
 - Plant early for good seedling nutrition⁶.

- Planting weather:
 - Critical at time of and/or shortly after planting (Table 1).
 - Seedlings can rapidly die from moisture loss due of high temperatures, low relative humidity, and increased wind speed.
 - Seedling survival is gravely affected when temperatures are either too high or below/at/or approaching freezing.

Table 1. Weather guidelines for successful survival of outplanted seedlings⁵.

	Temperature (°F)	Relative Humidity (%)	Wind Speed (mph)
Normal	33 – 75	> 50	< 10
Marginal	76 – 85	30 - 50	10 - 15
Critical	< 32 or > 85	< 30	> 15

- Soil conditions:
 - Avoid dry soil at time of planting or during the first spring/summer as it relates to seedling mortality (Table 2), especially for seedlings planted late in the season.
 - Never plant seedlings in soils that are frozen.
 - For high or perched water table, delay planting until soil dries and water table recedes.

Table 2. Soil moisture guidelines for successful survival of outplanted seedlings⁵.

	Available soil water, % of field capacity
Normal	75 -100
Marginal	50 -75
Critical	< 50 or > 100

Planting techniques that increase seedling survival:

- Handle seedlings with care after picking them up from the nursery, avoiding conditions that may cause seedling stress³.

- Plant seedlings as soon as they arrive at the planting site.
- Create a good planting hole (at least 8” deep on sandy dry sites, less so on wet sites) when planting loblolly, slash, and shortleaf pine⁷.
- Properly align the seedling in the hole.
- Pack the soil around the seedling to ensure contact of the soil and roots⁵.
- Check planting quality by gently pulling the top of seedlings.
- Don’t carry seedlings out of the bag from planting hole to planting hole.
- Don’t plant too soon after chemical site preparation.
- Don’t allow root pruning or stripping of seedlings.

Best time to plant bareroot and container seedlings for successful establishment:

- Bareroot seedlings:
 - Mid-November to February.
 - When site preparation is properly completed.
 - When there is adequate soil moisture for root / soil contact (Table 2).
- Container seedlings:
 - When site preparation is properly completed.
 - When there is adequate soil moisture for root/soil contact (Table 2).
 - When the container plug holds together when removed.

REFERENCES

- ¹South, D.B., *Planting morphologically improved pine seedlings to increase survival and growth*, in *Forestry and Wildlife Research Series*. 2000, Alabama Agricultural Experiment Station: Auburn, Alabama. p. 12.
- ²Carey, B. and D.B. South, *Saturated seedbeds reduce fine roots and outplanting survival*. 2001, Auburn University, Southern Forest Nursery Management Cooperative: Auburn, Alabama. p. 4.
- ³Landis, T.D. and D.L. Haase, *Maintaining stock quality after harvesting*. Forest Nursery Notes, 2008. Winter: p. 4 - 8.
- ⁴Wakeley, P.C., *Planting the Southern Pines*. 1954, Washington DC: Forest Service, U.S. Department of Agriculture.
- ⁵Long, A.J., *Proper planting Improves Performance*, in *Forest Regeneration Manual*, M.L. Duryea and P.M. Dougherty, Editors. 1991, Kluwer Academic Publishers: Netherlands. p. 303 - 320.
- ⁶Starkey, T.E. and S.A. Enebak, *Foliar nutrient survey of loblolly and longleaf pine seedlings*. 2012, Auburn University, Southern Forest Nursery Management Cooperative: Auburn, Alabama. p. 11.
- ⁷Van der Schaaf, C.L. and D.B. South, *Effect of planting depth on growth of open-rooted Pinus elliottii and Pinus taeda seedlings in the United States*. Southern African Forestry Journal, 2003. 198(1): p. 63-73.