

These interim guidelines are designed for producers and users of longleaf pine container stock. They are not meant to exclude any container product. The seedling specifications listed in the preferred category are attainable by the grower and will result in excellent field survival and early height growth. Seedlings that do not meet the criteria may perform well on some sites. Refining and improving these guidelines requires evaluating performance of seedlings with a range of physiological and morphological characteristics, planted over a number of years and on a wide range of sites. As additional research data becomes available, these guidelines should be revised. Some regional tests that are evaluating seedlings grown in a number of container types are underway. These tests and others should help improve guidelines and provide further benefits to longleaf growers and users. The following standards are proposed as interim guidance until research provides sufficient data to modify and upgrade.

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Literature Cited

Barnett, J.P. 1989. Shading reduces growth of longleaf and loblolly pine seedlings in containers. *Tree Planters' Notes* 40(1): 23-26.

Barnett, J.P.; Brissette, J.C. 1986. Producing southern pine seedlings in containers. Gen. Tech. Rep. SO-59. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 71 p.

Barnett, J.P.; McGilvray, J.M. 1997. Practical guidelines for producing longleaf pine seedlings in containers. Gen. Tech. Rep. SRS-14. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 28 p.

Little, E.L., Jr. 1979. Checklist of United States trees (native and naturalized). *Agric. Handbook* 541. Washington, DC: U.S. Department of Agriculture, Forest Service. 375 p.

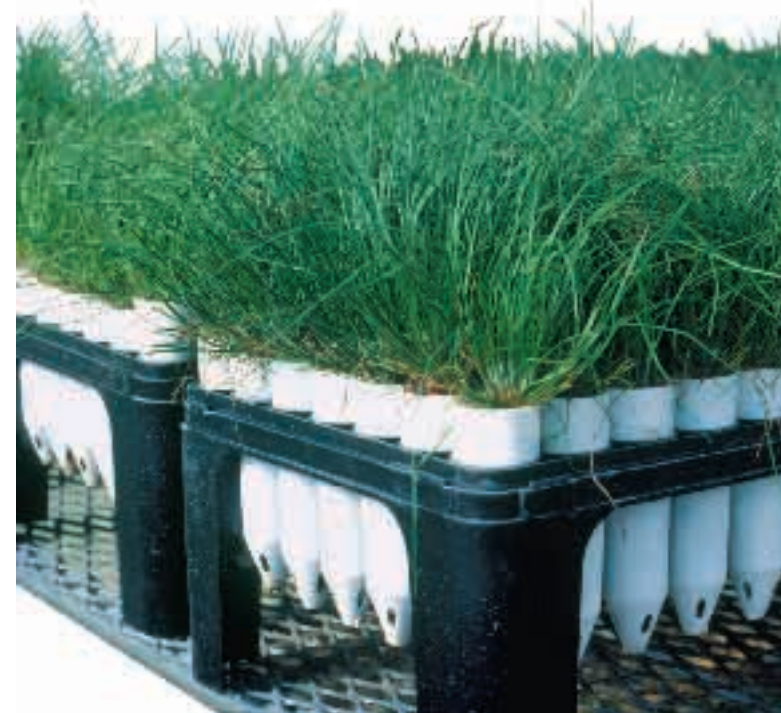
Wakeley, P.C. 1954. Planting the southern pines. *Agric. Monograph* 18. Washington, DC: U.S. Department of Agriculture. 233 p.

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Interim Guidelines for Growing Longleaf Seedlings in Containers



United States
Department of
Agriculture

Forest Service
Southern
Research Station

General
Technical Report
SRS-60



Young longleaf seedlings recently burned.



Longleaf saplings into rapid height growth.



Pole size longleaf pine .

Seedling Characteristics

The short discussion of seedling characteristics that follows should help clarify some of the issues related to the criteria listed in the standards.

Needles

Size and condition of the needles are important to future survival and growth. Most seedlings are grown under nutrient regimes that limit excess growth, eliminating the need for clipping needles. To maximize root-collar development, some growers may use heavier fertilizer regimes. Such regimes may result in excessive needle growth and require needle clipping, especially if needles reach 12 to 16 inches. At this length, they tend to fall over and lodge, causing problems in uniformity of irrigation and increasing the likelihood of disease development. If clipping is required, needles should not be cut shorter than 5 or 6 inches to maintain seedling growth and root-collar development (Barnett and McGilvray 1997).

The presence of needle fascicles indicates a well-developed seedling. If needles do not develop in clusters of two or three, the seedlings will perform well when planted. Generally, needles should be pale to dark green in color. Seedlings grown in northern nurseries may have variations in color that result from exposure to cold temperatures. Yellowish needles indicate poor seedling vigor.



Seedling of acceptable size with mycorrhizae and with a firm plug.

Roots

Root-collar diameter (RCD) is one of the best indicators of seedling quality. Seedlings with RCDs of 1/4 inch or larger should survive well and reach the 1-inch diameter needed for height growth earlier than smaller seedlings. Observation of roots requires more attention than observation of tops. Roots with light brown color and numerous white tips indicate vigorous seedlings. Black roots require close scrutiny because they are likely to be diseased, particularly if a large portion of the root system is black. If the cambium is brown when the root is scraped with a fingernail, the root is dead. Waterlogging in the bottom of a container—caused by roots plugging the drainage hole late in the cultural period—often results in root mortality.

The presence of mycorrhizae indicates a healthy root system. Inoculation of seedlings with mycorrhizal spores is



Vigorous seedlings with good needle color and length and in an appropriate size container.

usually not needed because air-borne spores of native fungi typically inoculate the roots (Barnett and Brissette 1986).

Most commercially available containers have ribs within the cavities to restrict root spiraling. Longleaf seedlings rapidly develop extensive root systems, so spiraling is a potential problem if the ribs are not effective.

Buds

The presence and color of buds depend on the developmental stage of the seedlings. If seedlings are outplanted in late October or early November, their buds will be more likely to be green than brown, compared to seedlings planted in late December or January. Although planting should not be delayed to obtain better bud development, it is desirable to have buds that have developed to the point that they become brown. Green budded seedlings may still perform well, but they lack the maturity that provides hardiness and capability to begin early growth in the field.

Container size

With appropriate cultural techniques, longleaf pine seedlings can be grown in almost any type of container. However, seedlings develop best when density in containers is no more than 50 plants per square foot and container volume is about 6 cubic inches per cavity (Barnett and Brissette 1986). Because longleaf pine seedlings are shade intolerant, close spacings may result in poorly developed plants (Barnett 1989). Seedlings grown in smaller containers may perform well under many conditions, but performance is enhanced by growing plants in larger containers. Container volume is an important consideration because very small containers may result in root systems that are excessively distorted, requiring considerable time to recover after outplanting. A variety of stock types may be suitable for specific sites. But, if stock is contract grown, choice of container type should be agreed upon by the grower and the buyer.

Other important attributes

A number of other attributes should be standard for any container production. First, the seedling plug should stay intact when extracted and handled, with no significant loss of potting medium. Second, the root plug should

Interim specifications for longleaf pine container seedlings.

Characteristics	Preferred	Not Acceptable
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Needles

Length if not top clipped	8 to 12 inches	Less than 4 inches
Length if top clipped	6 to 10 inches	Less than 4 inches
Fascicles	Many present	None present
Color	Medium to dark green	Yellow or brown

Roots

Root collar diameter ^a	1 inch or more	Less than 3/16 inch
Color	Light brown with white tips	Black (diseased)
Mycorrhizae	Present (the more the better)	
Evidence of disease	None present	Any present
Root spiraling	None present	Any noticeable amount

Buds

Present	Present on 90 percent of crop	
Color	Green to brown	Yellow or chlorotic

Container size (per plant)

Diameter	1.5 inches or more	Less than 1 inch
Length	4.5 inches or more	Less than 3.5 inches
Volume	6 cubic inches or more	Less than 5.5 cubic inches

Other important attributes

Firmness: Plug stays intact when extracted and during handling; no loss of potting medium.

Moisture: Root plug is always moist, never dry.

Pests: No competing weeds or insects are present.

Sonderegger: Buyer specifies whether to cull Sonderegger seedlings.

^a At base of needles

Successfully established longleaf pine seedling.



Sonderegger seedlings showing different amounts of stem elongation.



Visible buds at the base of the needle cluster.

always be moist. Third, no competing weed or insect problems should be evident. Seedlings with any such problems should be culled during extracting and packing.

Seedlings that begin height growth during the cultural period are usually Sonderegger pines (*Pinus Xsondereggeri* H.H. Chapm.). Sonderegger pine is a naturally occurring hybrid of longleaf and loblolly (*P. taeda* L.) pines (Little 1979) that have some stem elongation in the nursery. These seedlings produce poorly formed trees that are frequently culled because they are less desirable than longleaf pine. Whether Sonderegger seedlings are to be culled or planted should be agreed upon by the grower and buyer of the stock. Normally a very low percentage of nursery seedlings are Sonderegger pine.