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Guidelines for producing iongleaf pine seedlings in containers

James P. Barnett (USDA Forest Service, Southern Research Station, 2500 Shreveport Highway, Pineviile, LA 71360)

John M. McGilvray (USDA Forest Service, Southern Research Station, 2500 Shreveport Highway, Pineville, LA 71360)

ABSTRACT: Although longleaf pine (*Pinus palustris* Mill.) is a highly desirable species, resisting fire, insects, and disease, and producing high quality solid wood products, it now occupies only about 5 percent of its original range. Regeneration of the species either by natural or artificial methods or by planting of bareroot nursery stock has been difficult. Renewed interest in longleaf pine has resulted in evaluation of new approaches to seedling establishment. Studies have shown that container-grown seedlings survive better than bareroot stock on typical longleaf pine sites and the length of time seedlings stay in the grass stage is reduced. Thus, planting of container stock generally improves reforestation success. Survival of container seedlings is very good, the planting season can be extended and, therefore, restoration of the longleaf pine ecosystem can be enhanced.

INTRODUCTION

Longleaf pine is considered a very desirable tree, so why have we failed to regenerate more of the longleaf pine sites? The answers to this question are related to the unique botanical characteristics of the species: (1) low and infrequent seed production, (2) a seedling 'grass" stage characterized by delayed stem elongation,. (3) poor storability of bareroot nursery stock that results in low survival, and (4) seedling intolerance to shade conditions caused by competition.

The knowledge and technology to reestablish longleaf pine by planting bareroot nursery stock have improved significantly in the last decade. The components of successful regeneration include: (1) well-prepared, competition-free sites; (2) healthy, top-quality, fresh planting stock; (3) meticulous care of stock from lifting to planting; (4) precision planting; and (5) proper post-planting care. All these elements are essential to successful planting of bareroot stock, but controlling all five elements is difficult. So, planting success of bareroot stock remains elusive.

Numerous studies have demonstrated that under adverse planting conditions, contain seedlings survive and grow better that bareroot stock (Bamett and McGilvray 1993). Improved survival and growth rates are generally attributed to root systems that remain intact during lifting while roots of bareroot plants are severely damaged. Thus, container seedlings experience a significantly shorter period of transplant shock or adjustment. The purpose of the paper is to provide information that will help nursery managers produce good quality longleaf pine container stock. This information is presented in greater detail in USDA Forest Service, Southern Research Station General Technical Report SRS-14 (Bamett and McGilvray 1997).

FACILITIES

Longleaf pine seedlings can be grown in the open without a structure. Research shows that longleaf pine seedlings grown in full sunlight are superior to those grown in shaded structures (Barnett 1989). Some protection from hard rainfall is encouraged during germination because the seeds can be washed from the containers. A 30-percent shade cloth over a simple framework will greatly reduce this hazard. The cloth should be removed as soon as germination is complete. If crops are overwintered, polyethylene or other protective covering may be used to protect seedlings from strong desiccating winds and temperatures below 25°F.

An adequate watering system is essential for container production. The system should supply an even distribution of water and provide nutrients and fungicides as prescribed. A simple, stake type with a sprinkler head is usually adequate.

PREPARATION OF RECOMMENDED MATERIALS

The ideal container cavity should have a volume of about 6 cubic inches, a minimum depth of 4.5 inches, and a seedling de, ısity of <50 per square foot. Styroblock, HIKO, and Multipot containers are typically used in the South. Only one type and size of container should be used within a growing area because cultural practices, especially irrigation, differ among areas and growth phases. If container types are mixed, each type should be kept under separate watering systems. A 1:1 mix of sphagnum peat most and #2 grade horticultural vermiculite has been a consistently good product for filling the containers. The nursery manager may purchase a commercial medium or blend it at the nursery. Usually this depends upon the scale of the operation. The pH of this medium should be adjusted, if necessary, to about 4.5 to 5.0. Most growers incorporate a slow-release fertilizer (typically Osmocote 18-6-l 2 at 6 to 10 pounds per cubic yard of media) to- reduce the frequency of fertilizer applications during the growing phases.

High-quality seeds (minimum viability of 80 percent) should be used to reduce the costs of sowing multiple seeds and the related problems of thinning to one seedling per cavity. Since longleaf seeds commonly have significant populations of pathogenic fungi that result in seedling mortality, a seed treatment to reduce these fungi is generally effective. Soaks for 1 hour in 30 percent hydrogen peroxide or for 10 minutes in a benomyl solution (2 tablespoon per gallon water) have been shown to be effective.

CULTURAL PRACTICES

The best growing schedule, both biologically and economically, for longleaf pine is to sow seeds in the spring, grow through the summer, harden the seedlings naturally in the fall, and outplant them in late fall or early winter (Brissette and others 1991). The best seed sowing strategy is to sow one seed per cavity. However, excellent seed quality is essential for this option. If viability is near the range of 70 to 80 percent (typical for most lots of longleaf pine seeds), two seeds should be sown per cavity and then if two germinate, one should be thinned about the time the seedcoats shed. The scale of the operation determines whether the seeds are sown by hand, by simple, templates, or by more elaborate seeding machines. To facilitate germination, most growers cover the seeds with a thin layer of media or vermiculite.

Water management is a critical aspect of seedling culture. During germination, watering should be frequent but light to facilitate germination. As the seedling develop, watering should become heavier and less frequent. Overwatering early in the growing period is a typical problem and may cause lower germination and promote disease problems.

Fungicide applications should begin as soon as feasible to reduce damping-off of germinants and to inhibit pathogenic fungi development. If slow-release fertilizers are not used, fertilization of seedlings should begin as soon as possible after germination and with the first fungicide application. Water soluble fertilizers, such as Peters' 15-1 6-1 7 NPK Peat-Lite Special, are effective with the peat-vermiculite mix. Frequency of fertilization depends upon whether slow-release nutrients were incorporated into the mix. Heavy fertilization schedules enhance development of the root collar, but may require needle clipping to prevent lodging of extra long needles.

As seedlings become large toward the end of the growing season, they will require frequent watering to me :: transpiratio .:l losses. However, the media should be allowed to dry between applications to enhance seedling hardening and root and mycorrhizae development, Few, if any, nutrients should be applied during this period.

EXTRACTION, STORAGE, AND PLANTING

The grower may extract seedlings from the containers at the nursery or ship the containers with seedlings and extract them in the field. Extracting seedlings at the nursery reduces the bulk for shipping and limits the loss and damage of costly containers that are reused to reduce production costs. During the extraction process, poorly developed seedlings should be culled. Seedlings should be placed in cardboard boxes for storage and shipment. Properly hardened, container **longleaf** seedlings can be extracted, boxed and stored under refrigeration similar to **bareroot** stock.

Despite their bulk and weigh;, container seedlings are easy to plant by hand or machine because their root systems are uniformly shaped. The control of planting depth is critical for **longleaf** pine. The bud should be at about the soil surface. Dibbles shaped like the root plug work well because the problem of planting too deep can be avoided.

Because survival of container seedlings is very good, the planting season can be extended (Barnett and Brissette 1988). Planting **longleaf** seedlings in the fall, as soon as adequate soil moisture is obtained, results in good field performance.

CONCLUSIONS

Reforestation success for **longleaf** pine can be improved by planting seedlings produced in containers. Container stock survives better than **bareroot** stock on typical **longleaf** pine sites and the length of time seedlings stay in the grass stage is reduced. Thus, planting of container **stock** generally improves the reforestation success of **longleaf** pine seedlings. However, using container **stock** does not eliminate the critical need for controlling competition during the first growing season to ensure that seedlings begin height growth during the second year after planting.

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