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ARTIFICIAL REGENERATION: AN ESSENTIAL COMPONENT OF LONGLEAF PINE ECOSYSTEM RESTORATION

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ABSTRACT: Regenerating longleaf pine by artificial means is an essential component of restoring the ecosystem across most of its range because there are limited acres of longleaf stands remaining. Establishing longleaf pine is an early step in the ecosystem restoration process. An overview discussion of artificial regeneration techniques and related issues are presented this paper. Other papers follow in the proceedings that provide more specific information related to reestablishing longleaf pine forests.

INTRODUCTION

Although longleaf pine ecosystems once occupied over 90 million acres in the southeastern United States' coastal plain from southern Virginia to central Florida and west to eastern Texas (Frost 1993), less than 3 million acres remain (Kelly and Bechtold 1990). Utilization of trees in the original forest was so complete when lumbering reached the western Gulf Coast Region that inadequate numbers of seed trees remained to naturally regenerate many of the harvested stands. So, artificial regeneration must be used to restore longleaf on the appropriate sites where it originally grew. Research indicates that productivity of an ecosystem is controlled to an overwhelming extent by the functional characteristics of the dominant plants (Grime 1997). So, with reestablishment and appropriate management, restoration processes will begin. Until recently, regeneration success from planting was generally unacceptable due to problems related to severe competing vegetation, delayed stem elongation, and poor storability of bare root seedlings.

Direct seeding of longleaf pine was widely used in the 1950's and 1960's to reforest large areas of cutover forests (Derr and Mann 1971). But, difficulty in controlling the density of stand stocking reduced the use of direct seeding. We now have the knowledge and technology to reestablish longleaf by planting bare rootstock, but meeting of the criteria to assure success is difficult to achieve on an operational basis. As a result, the use of container stock has increased dramatically. Now, about 50 million container longleaf seedlings are produced annually across the South. The quantity of container stock continues to increase and is limited primarily by the availability of good quality seeds.

A short discussion of reforestation related issues important in reestablishing longleaf pine forests follow and more detailed papers on these topics occur in the proceedings.

LONGLEAF PINE SEEDLING PRODUCTION

Key to the effective production of longleaf pine nursery stock is availability of quality seeds. Longleaf pine seed collection, processing, storage, and treatment require exceptional care to maintain high quality (Barnett and Pesacreta 1993). Longleaf seed coats carry a significant population of pathogenic fungi and benefit from treatments that minimize disease losses (Barnett et al. 1999).

The knowledge and technology to successfully plant 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. Because controlling all five elements is difficult in most cases, planting success with bareroot stock remains elusive.

Numerous studies have demonstrated that under adverse planting conditions, such as poor sites, conditions of moisture stress, and out-of-season planting, container seedlings survive and grow better than bareroot stock (Barnett and McGilvray 1993, Boyer 1989). Guidelines for successfully producing longleaf container stock are now available (Barnett and McGilvray 1997).

PLANTING METHODS

Successful establishment of longleaf pine seedlings requires that bareroot seedlings are lifted and planted promptly. Storage for more than a few days, even if refrigerated, results in poor survival. Treatment of seedling roots with a benomyl fungicidal dip does improve establishment if planting is delayed (Barnett *et al.*

1988). On the other hand, container stock can be held either in the containers or extracted and cold stored with good success.

The key to a seedling's survival after planting is the ability of the root system to quickly begin taking up water and nutrients. Depending upon the site, either hand or machine planting can be the most efficient and reliable option. Large, level, open tracts are most efficiently planted by machine, while smaller tracts or sites with minimal site preparation are more easily hand-planted. Proper planting depth is critical for longleaf pine. Plant longleaf seedlings so the bud is not buried nor the root collar exposed.

SITE PREPARATION AND RELEASE

Longleaf pine has long had a reputation as a difficult to regenerate species. Because longleaf seedlings have no initial stem growth, they are very sensitive to competition. Cultural treatments should be aimed at improving longleaf survival during the critical first year after planting by reducing competition. Initial site preparation that has as extended effect is highly desirable. It may not be necessary to apply post-planting competition control measures if the initial treatment is long lasting (Boyer 1989).

On many sites, post-planting release with a herbicide is an effective treatment for promoting rapid early growth of planted longleaf pine. Release is most important for seedlings with low levels of site preparation. Post-planting applications will likely be economical because early growth response may reduce the grass-stage by 1 to 2 years.

SEED MOVEMENT AND GENETICS

The genetic variability of longleaf pine is less than for loblolly or slash pine. It is most important to avoid seed sources from the southern extremity of the range (Lantz and Kraus 1987). However, Schmidtling and Sluder (1995) found no consistent seed source differences in performance among physiographic provinces.

Considerable research has been conducted on evaluating regional seed sources for susceptibility to brown-spot needle blight and brown-spot resistance has been one factor incorporated into development of tree improvement programs.

COST-SHARE AND INCENTIVE PROGRAMS

Although government funding for cost share programs to encourage reforestation has been decreasing, there are still incentives for planting longleaf pine seedlings (Karrfalt and Lantz 1998). Planting can be justified for programs other than timber production, e.g., wildlife and restoration. In addition, longleaf pine has a favored status in that there is a higher level of support permitted for longleaf that some other species.

Because of the harvests of pine exceeds growth in some areas of the South, a number of southern states are considering creating incentives for reforestation of small-landowner properties. An example of this is in Louisiana. Concern about sustaining the productivity of Louisiana's forest lead the legislature to establish in 1997 the Louisiana Forest Productivity Program. The act directs that 75 percent of the state's share from timber severance tax be used us support cost sharing for site preparation, planting or seeding, and control competing vegetation (Barnett 1999).

WEST GULF TREE IMPROVEMENT PROGRAM AND SEED ORCHARDS

The West Gulf Tree Improvement Program is one of the premier programs with the objective of developing and producing genetic material in the western Gulf Region. This program--and the tree improvement efforts in the Southeast--are responsible for forest industry and state organizations being able to produce genetically improved seeds for loblolly and slash pines in quantities to meet their needs. Much less effort has been put on improving longleaf pines, but the West Gulf Tree Improvement Program does have an emphasis on longleaf pine. A number of longleaf pine seed orchards are in production.

The current seed orchards do not produce sufficient quantities of longleaf seeds to meet the demand, but improved seeds are becoming available in increasing quantities.

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