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LONGLEAF PINE SEEDLING PRODUCTION

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ABSTRACT: Longleaf pine is a highly desirable species, resisting fire, insects and pathogens, and produces quality solid-wood products, but regeneration of the species has been difficult. Natural regeneration is feasible only on a small portion of the area considered to be longleaf pine type. Therefore, artificial regeneration must become a reliable means of regenerating the species if restoration of the ecosystem is to be successful. The knowledge and technology to reestablish longleaf pine by planting bareroot stock has improved significantly within the last decade. However, numerous studies show that container seedlings survive and grow better than bareroot stock. Additional studies are underway to refine these techniques and provide a better understanding of the unique physiological attributes of longleaf seedlings that may allow us to improve regeneration success by planting.

INTRODUCTION

Longleaf pine was widely distributed in the presettlement forests of the southern Coastal Plain, but now occupies less than 5 percent of its original range. It is a highly desirable species, resisting fire, insects and pathogens, and produces quality solid-wood products. Because of its limited distribution, natural regeneration is feasible only on a small portion of the area considered to be longleaf pine type. Artificial regeneration by direct seeding or planting has been difficult, but renewed interest in longleaf pine has caused us to reevaluate these approaches to stand establishment. The difficulty in regenerating longleaf is related to its unique botanical characteristics: (1) low and infrequent seed production, (2) a seedling "grass" stage characterized by delayed stem elongation, (3) poor storability of bare-root nursery stock that results in low survival, and (4) seedling intolerance to shade conditions caused by competition (Barnett and McGilvray 1997).

Direct seeding is an inexpensive reforestation option, particularly suitable for small landowners, because spot or broadcast seedling by hand equipment is easy and can be effective (Derr and Mann 1971). However, the use of direct seeding has declined because it is less reliable than planting, particularly of container stock, and because the seed coat repellent for rodents is not longer available. Thiram is an effective bird repellent, but endrin, which is registered for rodent protection is no longer manufactured in the United States. Recent studies indicate that oleoresin capsicum, in combination with thiram, effectively protects longleaf pine seeds from bird and rodent predation (Barnett 1998, Nolte and Barnett 2000). Broadcast seeding is probably not feasible due to the cost of longleaf seeds, but spot seeding is an acceptable option for small landowners.

The key to successful artificial regeneration is availability of quality seeds. Obtaining adequate quantities of good quality longleaf pine seeds requires extraordinary efforts.

SEED QUALITY AND QUANTITY ISSUES

Use high-quality seed (viability >80 percent is desired) to obtain uniformity in bareroot nursery beds and to reduce costs of sowing multiple seeds and thinning to one seedling per cavity in container nurseries. Obtaining high-quality seeds remains a problem. To achieve good seed quality, organizations inolved in the collection and processing of longleaf seeds need to pay particular attention to cone maturity and collection and seed processing techniques (Barnett 1997). Longleaf seeds commonly have significant populations of pathogenic fungi that result in seedling mortality, so a fungicidal seed treatment is generally effective in reducing early seedling mortality. A ten-minute soak in a benomyl solution (2 tbsp/gal) reduces fungal infestations and improves germination and establishment (Barnett *et al.* 1999).

BAREROOT SEEDLING PRODUCTION

Longleaf pine seedlings have no early epicotyl growth and are, therefore, very sensitive to competition. The seedlings' initial height growth occurs most quickly in full sunlight. Studies have shown that site preparation that delays competition development over an extended period—prescribed fire 1- or 2-years after planting and/or post-planting competition control by mechanical or chemical means—will allow height initiation within 1 to 3 years after planting.

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 (Barnett and Dennington 1992). It is essential that all five of these elements come together for successful planting of bareroot stock. It is difficult to control all of these factors, therefore, planting success with bareroot longleaf pine stock remains elusive. Although these components for successful regeneration apply to container stock, success in establishment is markedly better with container material (Boyer 1987).

CONTAINER SEEDLING PRODUCTION

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. This is generally attributed to the fact that the root systems of container plants remain intact, with those of bareroot plants are severely damaged during lifting. Thus, container stock has a significantly shorter period of transplant shock or readjustment than bareroot seedlings.

Longleaf pine seedlings can be grown in the open without a structure, but if crops are overwintered, polyethylene or other protective covering may be needed to protect seedlings from strong desiccating winds and temperatures below 25°F. An adequate watering system is essential for container production—a simple, stake type is with sprinkler heads is normally sufficient. The ideal container cavity should have a volume of about 6 cubic inches, a minimum depth of 4 inches, and a seedling density of <50 per square foot. A growing mix of sphagnum peat, #2 grade horticultural vermiculite, and possibly a small percentage of perlite has been a consistently good product for filling the containers. The pH of the medium should be adjusted, if necessary, to about 4.5 to 5.0 and most growers incorporate a slow-release fertilizer to reduce the frequency of fertilizer applications during the growing phases (Barnett and McGilvray 1997).

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. The best strategy is to sow one seed per cavity, but excellent seed quality is essential for this option. If viability is below about 80 percent, two seeds should be sown per cavity and then if two germinate, one should be thinned about the time the seedcoats shed. Water management is a critical aspect of seedling culture and experience is the best way to learn proper watering techniques. More details of cultural practices are found in Barnett and McGilvray (1997).

Despite their bulk and weight, 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.

CONCLUSIONS

Regeneration by direct seeding or planting has not been highly successful, so the renewed interest in longleaf pine has caused us to reevaluate these approaches to seedling establishment. The knowledge and technology to reestablish longleaf pine by planting bareroot stock has improved significantly in the last decade. However, establishment of these seedlings remains more difficult than for container stock.

Reforestation success can be improved significantly by planting seedlings grown 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. However, using container stock does not eliminate the critical need for controlling competition during the first growing season. Such competition control ensures that seedlings begin height growth during the second year following planting.

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