TRENDS IN NURSERY RESEARCH AND PRODUCTION

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Barnett, J.P. 2002. Trends in Nursery Research and Production. In: Dumroese, R.K.; Riley, L.E.; Landis, T.D., technical coordinators. National Proceedings: Forest and Conservation Nursery Associations—1999, 2000, and 2001. Proceedings RMRS-P-24. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station: 97-100. Available at: http://www.fcnanet.org/proceedings/2000/barnett.pdf

Abstract

Forest nursery production is at an all-time high in the southern United States, and to maintain and increase this production capacity we need to integrate research and operational technology. We must improve the technology to increase production of container southern pine seedlings, especially for longleaf pine. Bareroot nursery managers have challenges to maintain the current level of nursery productivity and to increase the production of hardwoods for wetland restoration and nontraditional species such as wire grass for longleaf pine restoration. Finding alternatives for methyl bromide causes uncertainty in the operation of many bareroot nurseries where the loss of this chemical may cause significant disease and weed problems.

Key Words

Seed treatments, seed predation, pesticides, longleaf pine, tree planting

The United States economy depends on the South for 67% of its pulpwood, 50% of its plywood, 40% of its hardwood lumber, and 33% of its softwood lumber (USDA Forest Service 1997). Timber is the highest valued crop in the region, representing an annual economic value of $90 billion. As harvests from public lands in the Pacific Northwest have been reduced, greater pressure is placed on southern forests to make up this deficit. The South can expect an increase in demand for pulpwood, lumber, and other products. Most of these pressures will fall on private lands, which make up nearly 90% of the forests in the South. It is apparent that the South faces unprecedented timber production pressures, especially on private lands.

As the pressure to increase nursery capacity in the South continues, our capability to conduct research to support nurseries is declining. Within the USDA Forest Service, there has been a significant loss of technical expertise in reforestation, particularly in nursery research (Barnett and Tinus 1999). Research capability in the universities, too, is limited. This means that we face challenges in being able to provide the research needed to address some of our nursery-related problems.

RESEARCH ENHANCEMENTS FOR NURSERY OPERATIONS

To sustain the productivity of our southern forests, new or enhanced bareroot and container nursery technology is needed. The rapidly increasing demand for longleaf pine planting stock has exceeded our capability to produce enough high-quality seeds to meet current needs for nursery production. Longleaf pine seeds are the most difficult of the southern pines to produce. Special effort is required to obtain quality seeds, and the technology and guidelines to produce such seeds are lacking (Barnett and McGilvray 2000). Comprehensive guidelines are needed to provide the knowledge needed by seed dealers, nursery managers, and silviculturists so that high-quality seeds can be produced in quantities that meet current needs.

A significant problem with longleaf seeds is poor seed germinability. Until the knowledge is available to produce high-quality seeds consistently, we need technology to upgrade seedlots with low viability by removing seeds that will not germinate. There is potential to separate good from bad seeds by use of chemometrics (Meglen 1988). This approach uses near far-red spectra scanning technology to sort seeds quickly

based on chemical properties that are related to seed viability. A cooperative effort is underway to apply this technology to longleaf pine seeds. If successful, this approach will be developed and used with other southern pine seeds.

Although direct seeding is currently not widely used for regenerating southern pines, there is interest by small landowners in technology to reforest their land inexpensively. In addition, seeding is an approach to regenerate large acreages quickly after wildfires or other catastrophes. In order to apply direct seeding successfully, chemical coatings are needed to protect seeds from birds and rodents. The fungicide thiram is an effective bird repellent and is labeled for this purpose (Derr and Mann 1971). Endrin, the rodent repellent in the coating, is no longer manufactured in the United States. Efforts have been underway for a number of years to find a replacement. Recent evaluations show that capsicum (hot sauce) significantly reduces rodent predation (Barnett 1998). The combination of capsicum and thiram offers an option to protect seeds for those interested in using direct seeding (Nolte and Barnett 2000).

Container production is now the preferred method of growing longleaf pine planting stock because seedling establishment is improved by use of container-grown seedlings. However, growers typically lose 10% to 20% of these seedlings during production due to disease problems. Longleaf pine seeds are hosts to a number of pathogenic fungi (Pawuk 1978). Recent studies show that eliminating these fungi from the seeds by sterilants such as hydrogen peroxide or fungicides such as benomyl significantly increases the percentages of plantable seedlings from a seedlot (Barnett and others 1999). Application of fungicides during the nursery-growing period also reduces mortality due to disease, but the greatest gain can be made by controlling the microorganisms on the seedcoats.

Another important research effort is to find an effective replacement for methyl bromide in bareroot nurseries. Although a few chemicals have seemed promising, they have not been as effective as methyl bromide for controlling disease and weed problems in nurseries (Lemons 1999). Other non-chemical approaches such as steam sterilization of the soil and application of compost material and mulches are even less effective at the present time (Carey 1999). Obviously, there is a critical need for continued research to find an effective replacement for methyl bromide in nurseries.

Issues Related to Nursery Production

There are a number of issues related to projecting future needs of nursery stock across the South. First, will the demand for container longleaf pine seedlings continue? Much of the demand for longleaf pine stock is related to incentive programs that give an added bonus for planting longleaf seedlings. No one knows for sure if these programs will be maintained beyond the current funding period, but a tremendous interest in the restoration of the longleaf pine ecosystem will likely keep a strong nursery program for this species.

Some foresters anticipate that interest in container production of loblolly and slash pine will significantly increase because planting container seedlings results in increased survival and early growth. Managers with interest in shortening rotations may accept this technique on highly productive lands. If so, container production of these species could replace any loss due to a reduction in incentive programs for longleaf pine.

It is difficult to anticipate the demand for bareroot nursery stock. During the last few years, although there has been an increase in nursery production across the South, the demand for seedlings has generally exceeded production. Some may consider this deficit a short-term effect; however, it may hold over the long term. In many States across the South, harvests of forests now exceed growth. There are, then, numerous efforts underway to provide incentives to landowners to reforest their lands. For example, the Louisiana legislature passed a Forestry Productivity Act to fund incentive programs to help landowners regenerate forest lands (Barnett 1999). Initiatives are underway or planned in other States. Such efforts, and the short-rotation program of forest industry, assure a continuing demand for plantable nursery stock.

There is also an increasing demand for nursery production of hardwood species, primarily for wetlands restoration. It is likely that the need for such species will increase. A number of organizations and conservation groups, such as

Ducks Unlimited and the U.S. Fish and Wildlife Service (Aycock 1999), are supporting reforestation and restoration efforts. Thus, the demand for hardwood nursery stock will continue or may even increase significantly.

The Kyoto conference on controlling greenhouse gases has opened a discussion of carbon credits. Carbon credits provide the right to generate a certain level of carbon dioxide if compensating steps were taken to reduce CO_2 by another activity (Karrfalt and Lantz 1999). Some of these credits would bring new players into reforestation, such as power utilities, who would pay for tree planting on private land.

A new aspect of nursery production is to grow non-traditional species such as wire grass that is used for longleaf pine ecosystem restoration in the Southeast. As emphasis on restoration of longleaf, wetland hardwood species, and other species like bald cypress increases, there will be a need for forest nursery capacity dedicated to such efforts.

Conclusions

There are a number of opportunities for research to enhance nursery operations. Problems remain in the production and successful planting of longleaf pine seedlings. Guidelines can be made available to simplify the production of quality longleaf pine seeds and seedlings. An important need is methodology to sort viable from nonviable seeds. Research is underway to determine if such separation is feasible. In container longleaf seedling production, new presowing seed and seedling applications may reduce pathogenic fungi problems that significantly reduce the numbers of plantable seedlings. Another major problem is finding an effective replacement for methyl bromide. Therefore, continued nursery-related research may accomplish many potential gains.

The demand for forest nursery production should not decline significantly in the near future. In fact, it is likely that the need for both container and bareroot nursery stock will be stable or even continue to increase. Driving forces that contribute to this demand include: 1) short-rotation and high-intensity forest practices; 2) demands for forest products that currently exceed growth in southern pine forests; 3) Southern States' incentive programs that encourage landowners to reforest their land; 4) increasing demands for hardwood species in restoring wetlands; 5) broad regional interest by small landowners and conservation groups to restore the longleaf pine ecosystem; and 6) a growing need for nurseries to grow nontraditional species such as grasses and shrubs for a multitude of uses.

There are many challenges ahead for researchers and nursery managers. Not only will the quantity of production continue to be stable or even to increase, but new technologies will be needed to produce difficult-to-grow species. The challenge is to provide research to overcome problems and to apply technology to increase operational production.

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