

SHORTLEAF PINE SEEDLING PRODUCTION AND SEEDING TRENDS IN MISSOURI

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ABSTRACT.—The Missouri Department of Conservation operates the only nursery that supplies bare-root shortleaf pine seedlings in Missouri. Seedlings and seed have been sold to landowners since 1935. Prior to 1981 most seed was locally collected wild seed, some was purchased from neighboring states. After 1981, most of the seed for artificial regeneration was improved orchard seed. The highest production of shortleaf pine seedlings occurred prior to 1987 with at least 2 million seedlings being produced annually. Today less than half a million seedlings are produced at the nursery. Before 1990 most of the seedlings were delivered to the Mark Twain National Forest, but now it is a minor player in artificial regeneration of shortleaf pine. Trends in seed distributed for direct seeding followed those of seedling production. This paper discusses factors that influenced the trends in shortleaf pine seed distribution and seedling production, and makes suggestions for future direction.

INTRODUCTION

George O. White Nursery, which is operated by the Missouri Department of Conservation (MDC), is the only nursery that produces bareroot shortleaf pine for use by private landowners and state and federal agencies. This nursery was owned and operated by the U.S. Forest Service from 1935 to 1946 with assistance from the Civilian Conservation Corps (CCC) employees. The goal of the nursery in its inception was to grow shortleaf pine seedlings for reforestation efforts at the Clark and Mark Twain National Forests, to ensure continuous supply of timber production. In 1947 the nursery was leased to MDC by the U.S. Forest Service; in 1976, MDC obtained ownership of the site (Mugford 1984). The nursery currently occupies about 748 acres of which 50 acres are a seedbed production area.

Shortleaf pine seedlings and seed have been sold to landowners to improve habitat, increase biodiversity and produce timber since 1935. From 1935 to 1981 most shortleaf pine seed was locally collected wild seed or purchased from neighboring states, particularly Arkansas. After 1981, most of the seed for artificial regeneration came from a grafted seed orchard established in Mt. Ida, AR, using Missouri superior trees. Today all planting and seeding needs in Missouri are being met from genetically improved seed collected from this grafted seed orchard.

All shortleaf pine seedlings produced at the George O. White nursery are 1-year-old bareroot seedlings. Shortleaf

pine is stratified and sown in nursery beds in spring. Seed for direct seeding is stratified, repellent-coated, and sown in late March or early April. Seed germination will begin about 4 weeks after sowing as temperature and moisture conditions become favorable.

The objective of this study is to summarize trends in shortleaf pine seedling production and seeding in Missouri.

SEEDLING PRODUCTION

At least 2 million shortleaf pine seedlings were produced each year at the George O. White Nursery from 1960 to 1987, except in 1977 and 1984 (Figure 1). The highest seed production was between 1963 and 1966, when at least 6 million seedlings were produced each year, reaching a peak of nearly 9 million seedlings in 1965. After 1987, seedling production decreased exponentially to about 400,000 seedlings in 2005. Since 1990 annual seedling production levels have stayed below 1 million, where they remain to this day. This more recent production figure is well below the 45-year long-term average annual seedling production of 2.7 million.

Seedling Distribution by Land Owner Group Federal

Although the Mark Twain National Forest (MTNF) owns only 9.9 percent of Missouri's forest land, most of the shortleaf pine seedlings produced by the George O. White Nursery were delivered to MTNF from 1960 to 1989 (Figure 2). The biggest orders from MTNF were in the 1960s, particularly from 1963 to 1968, when between 2.5 million and 5 million seedlings were delivered annually. The second biggest orders were in the early 1980s, when 4.4 million were delivered in 1980 and 2.5 million in 1985.

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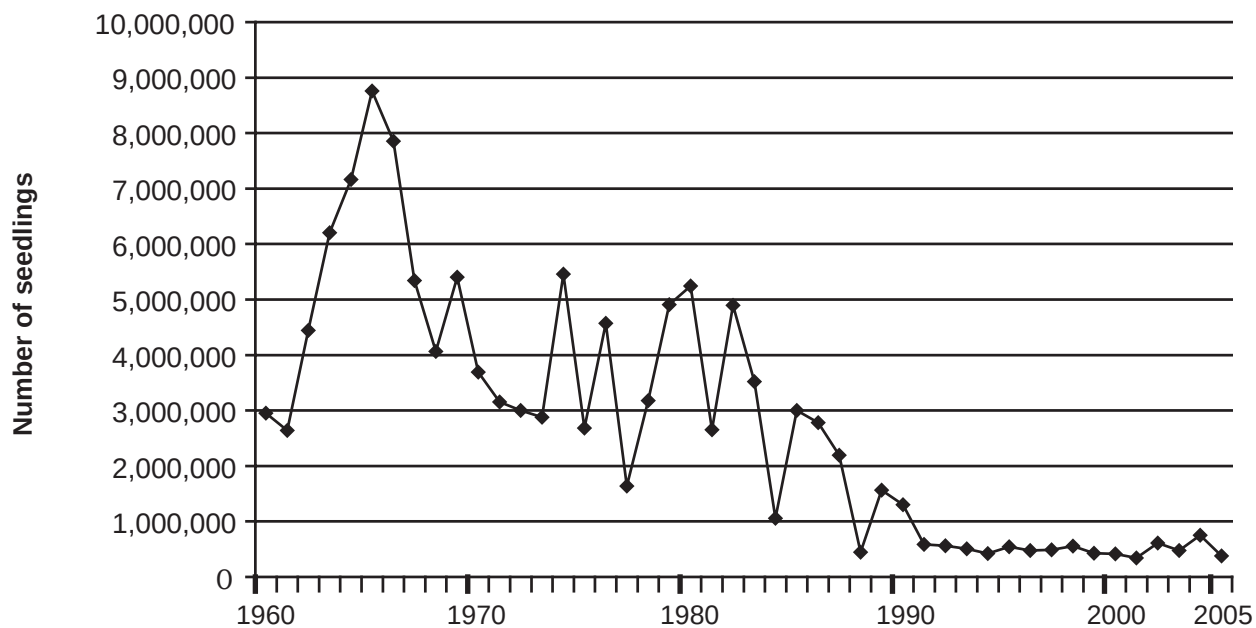


Figure 1.—Number of shortleaf pine seedlings produced at the George O. White Nursery 1960-2005.

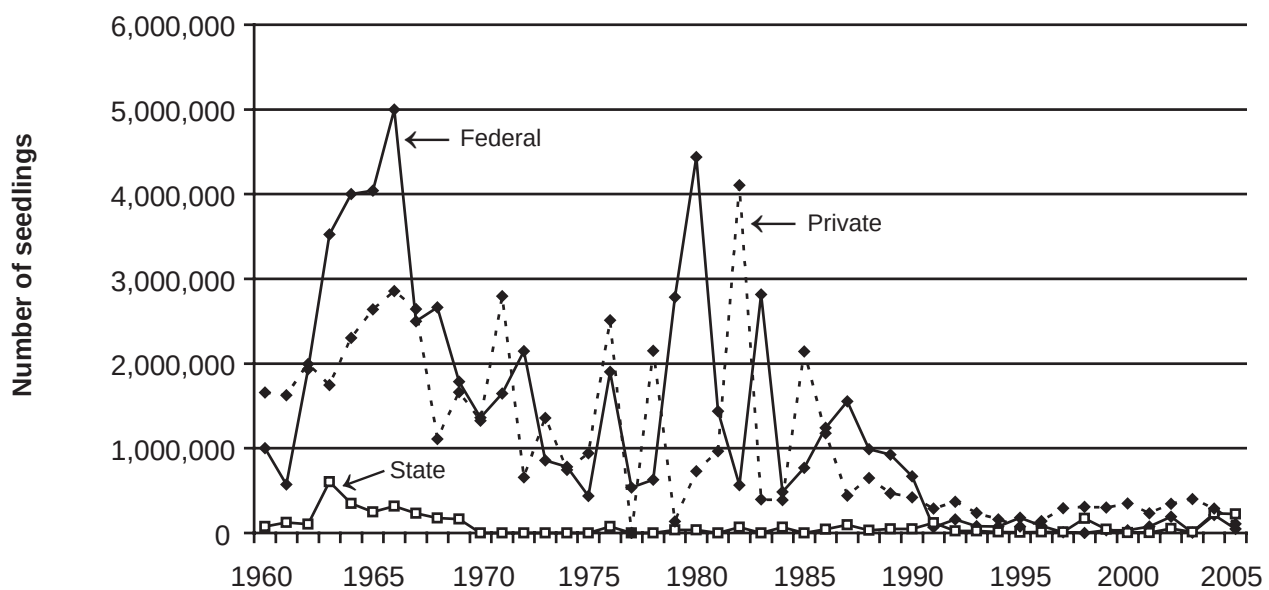


Figure 2.—Number of shortleaf pine seedlings distributed by the George O. White Nursery by ownership group 1960-2005.

After 1985, the seedlings ordered by MTNF never exceeded 1 million, and since 1990 the orders have remained below 0.2 million. Since 1990, MTNF has been a minor player in artificial regeneration of shortleaf pine. In 2005, it ordered only 46,000 seedlings, representing a dramatic drop in shortleaf pine planting from the 1 to 2 million seedlings planted annually during the 1980s.

Several factors profoundly influenced the trend in shortleaf pine seedling demand by MTNF. Changes in policies by the Federal government caused less demand for seedlings from MTNF. In the early 1990s, the U.S. Forest Service adopted the concept of ecosystem management, which called for a reduction in the practice of clearcutting. As a result, timber harvesting practices on the National Forests shifted to favor methods using natural regeneration, such as seed tree, shelterwood, and uneven-aged management. This policy shift led to less timber harvesting and dramatically reduced artificial regeneration. In general, fewer old fields were purchased after the 1980s, which also meant fewer plantings. The new initiatives such as the Healthy Forest Initiative are unlikely to greatly accelerate seedling and seed demand on MTNF. The 2005 Forest Plan, however, emphasizes restoration and enhancement of natural communities, and an increase in pine planting will be required to restore shortleaf pine in parts of its former range.

Private Landowners

Generally, private landowners ordered the second largest quantity of seedlings, particularly prior to 1990 (Fig. 2), but there were a number of years in this period when their orders surpassed those from MTNF. Since 1990, private landowners have taken the lead, but the amount ordered has dropped sharply. The biggest order from private landowners was in 1983 when 4 million were ordered, and between 1960 and 1970, they consistently ordered more than 1 million seedlings per year. Since 1987, the private landowners never ordered more than 1 million seedlings in any year, and more recently they have ordered less than 0.5 million have been ordered annually.

Shortleaf pine seedling distribution to private landowners has been a response to major federal planting programs. The major federal program that assisted with tree planning from the 1970s to the present were the Forestry Incentive Program (FIP) and Forestland Enhancement Program (FLEP). FIP was originally authorized in 1978 to share up to 65 percent of the costs of tree planting, timber stand improvements, and related practices on nonindustrial private forest lands, and was terminated in 2002. FLEP replaced FIP in 2002 and its objective is to provide educational, technical, and financial assistance to help private forest landowners implement their sustainable forestry management objectives. The maximum FLEP cost-share payment for any practice may be up to 75 percent. Despite the existence of these federal programs, demand for shortleaf pine seedlings by the private landowners continues to decrease perhaps because of

the limited markets for shortleaf pine products in Missouri. With 85 percent of the forest lands in Missouri in private landowners' hands, efforts should be made to identify solutions for increasing shortleaf pine seedling demand by the private landowners.

State

Finally, the smallest number of seedlings was distributed to MDC (Fig. 2). The seedlings delivered to MDC never exceeded 1 million in any year, and only exceed 0.5 million in 1963. The small amount of seedlings distributed to MDC could be due to the fact that the state only owns 3 percent of the forested lands in Missouri.

In 2005, 59 percent of the seedlings were delivered to the MDC, 29 percent to private landowners and 12 percent to federal government (Fig. 3). That year was the first time MDC had ordered more seedlings than the federal government and the private landowners.

DIRECT SEEDING

Direct seeding received a lot of attention during the 1960s and 1970s, and peaked between 1960 and 1964 when 4,500 pounds of seed was distributed for direct seeding by the George O. White Nursery (Fig. 4). The largest amount of seed for direct seeding in a single year was 1200 pounds, which was delivered to MTNF in 1963. Seed distributed for direct seeding decreased during the 1980s and 1990s. The relatively large amount of seed distributed between 1995 and 1999 was due to aerial seed requirements for the Eminence District of MDC in 1997.

The reduction in demand of seeds for direct seeding at the MTNF could be attributed partly to reduction in the practice of clearcutting and the difficulty in using herbicides. The reduction in demand for seeds for direct seeding by the private landowners may be attributed to shrinking markets for shortleaf pine timber products.

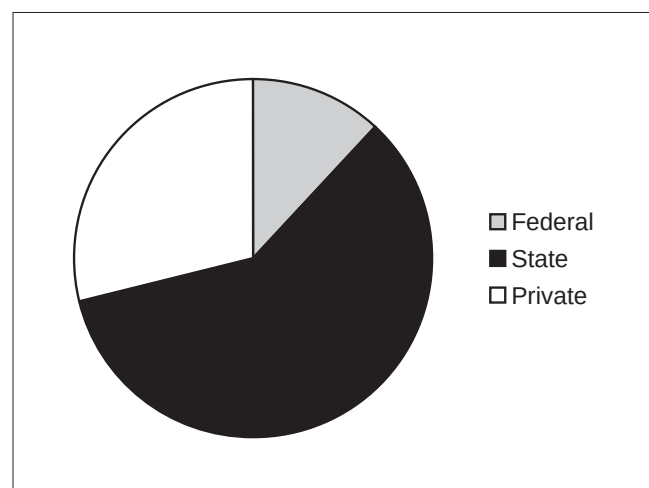


Figure 3.—Seedling purchase by land owner group in 2005.

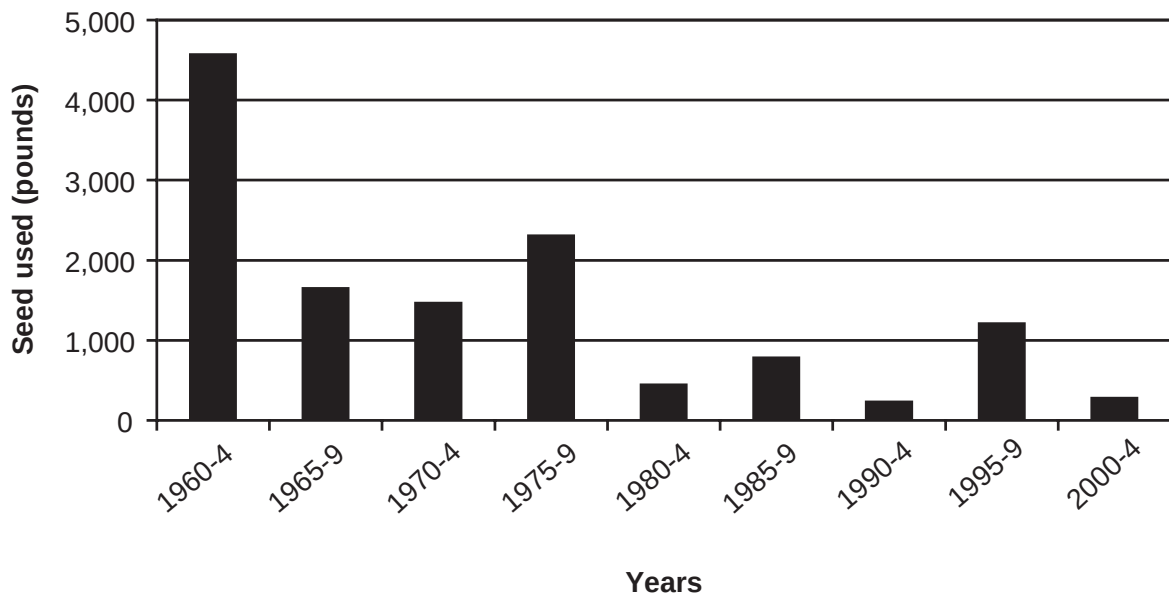


Figure 4.—Shortleaf pine seed distributed by the George O. White Nursery for direct seeding, 1960-2005.

SEED SUPPLY AND REQUIREMENTS

Most of the seed collected between the 1960s and early 1980s was collected in Missouri by local contract pickers. Some seed was obtained from other states such as Arkansas (e. g. Arkansas Forestry Commission, Ouachita National Forest, and Ozark National Forest), Oklahoma and Louisiana. Seed collections by the U.S. Forest Service for operational planting in Missouri date back to 1967 when unimproved seed was collected from Ozark National Forest, AR and given to MDC for storage (Table 1).

Beginning in 1981, improved seed was used mostly for artificial regeneration of shortleaf pine. The improved seed came from an 85-acre clonal seed orchard, located on the Womble Ranger District of the Ouachita National Forest, Mount Ida, AR. This seed orchard was established using 50 superior trees selected from the MTNF. These trees were grafted into a clonal seed orchard between 1969 and 1971. Seed was first collected from the Mt. Ida orchard in 1981, when 215 pounds were collected. A total of 1,578 pounds were harvested in 1983. After this second collection, there was an ample supply of seed in storage and a decision was made to collect only when there was a good seed crop. The third collection was made in 1986, when a massive 2,554 pounds were collected. The bumper harvest in 1986 is attributed partly to the use of pesticides and fertilizers. After this large harvest, no cones were picked from the orchard until 2003. In 2003, 1,500 pounds of seed were collected. This harvest was attributed partly to favorable weather conditions and partly to the thinning and rouging carried out in 2000. The only improved seed not collected from the seed

orchard in Mt. Ida was supplied by the Arkansas Forestry Commission in 1986 and 1987.

Currently, all planting and seeding needs in Missouri are being met from genetically improved seed collected from the grafted seed orchard in Mt. Ida. The State of Missouri has used 34 to 80 pounds of seed for planting and 0-109 pounds for seeding per year over the past 8 years (Fig. 5). Seed requirements for direct seeding fluctuate greatly while seedling production needs are more stable. Thus, average annual seed requirements are approximately 100 pounds for both direct seeding and seedling production. Based on this seed requirement figure, MTNF and Missouri Department of Conservation in combination have about a 30-year supply of shortleaf seed available for future afforestation needs. Storing shortleaf pine for 30 years should not present any problems as shortleaf pine is known to store well for up to 35 years (Wakeley and Barnett 1968). However, recent tests in Arkansas have shown that viability decreases rapidly after 10 years of storage (Barbara Crane, USDA Regional Geneticist, pers. comm.).

OUTLOOK

Restoring shortleaf pine throughout its native range in the Ozark Highlands is a top priority in Missouri. Restoring shortleaf pine on former pine and oak-pine sites is a long-term strategy for mitigating chronic oak decline (Law et al. 2004). To restore the ecological and economic importance of shortleaf pine, several restoration efforts were established, including the U.S. Forest Service Pine Knot

Table 1.—Details of seed collections for shortleaf pine restoration in Missouri. All seed was stored at George O. White State Nursery except for the 2003 collection, which is stored in Watersmeet, MI.

Seed source	Year of collection	Lot Number	Amount (pounds)
Ozark National Forest, AR	1967	MT617	842
Northwest Arkansas, AR	1972	MT618	400
Mark Twain National Forest, MO	1975	MT613	49
Ouachita National Forest, AR	1975	-	941
Mark Twain National Forest, MO	1979	MT614	1793
Seed Orchard, Mt Ida, AR*	1981	MT619	215
Seed Orchard, Mt Ida, AR*	1983	MT621	1578
Arkansas Forestry Commission, AR	1984	-	110
Seed Orchard, Mt Ida, AR*	1986	MT625	2554
Arkansas Forestry Commission, AR*	1986	-	350
Arkansas Forestry Commission, AR*	1987	-	510
Missouri Department of Conservation, MO	1995	-	43
Unknown supplier, MO	1997	-	31
Louisiana Forest Seed Company, LA	1997	-	48
Seed Orchard, Mt Ida, AR*	2003	-	1500

*Genetically improved seed

restoration project, and MDC's Peck Ranch Conservation Area (CA), Birch CA, Rocky Creek CA and Sunklands CA, restoration projects. More restoration projects are expected to be developed. These projects will increase the demand for shortleaf pine seedlings and seed for direct seeding. The demand is likely to increase because natural regeneration in most cases is inadequate. Moreover, the increased concern about global warming could prompt a major federally funded restoration program, thereby increasing demand for seeds and seedlings. The seedling production and seed demand for direct seeding are expected not come

anywhere near the pre-1990s however, because 1) current policies have shifted from timber production to ecosystem restoration; 2) clearcutting and use of herbicides have been significantly reduced on MTNF; and 3) markets for shortleaf pine are weak.

We propose the following options to ensure seedling and seed demand for shortleaf pine are maintained or increased in the future:

- Develop markets for shortleaf pine and small diameter hardwoods. As markets are developed, demand for shortleaf seedlings by the private landowners is likely to greatly increase. Small increases in demand for seedlings will be expected from public agencies given their increased emphasis on forest values other than timber production.
- Educate the private landowners who own the bulk of the forested lands in Missouri about the benefits of shortleaf pine restoration. The public should be provided with 1) a simple definition of what shortleaf pine restoration is; and 2) a demonstration of the economic and ecological viability of shortleaf pine restoration, including aesthetics.

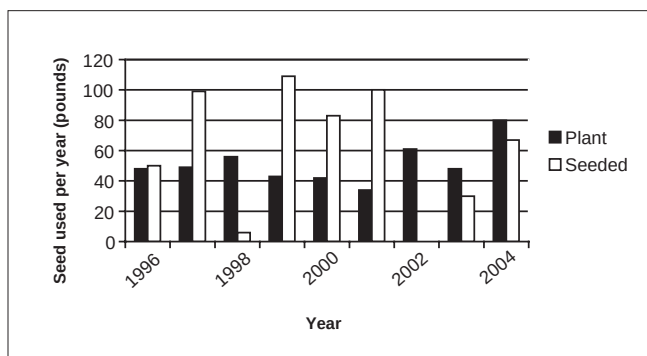


Figure 5.—Trend in the amount of seed used for seeding and planting, 1996 to 2004.

- Every effort should be made to make seed available to those who want to regenerate shortleaf pine by direct seeding. Direct seeding is desirable for landowners and resource managers who prefer low-cost artificial regeneration methods.
- We highly recommend that two shortleaf pine seed orchards be established, one close to the George O. White State Nursery in Licking and the other on the MTNF using existing surplus seed from controlled crosses. This will ensure that all seed needs are met from seed orchards in Missouri. In addition, if the current second-generation seed orchard established the George O. White State Nursery in Licking in 2002 is destroyed by fire or drought, an alternative seed supply of improved seed will be available.

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