

## FERTILIZERS INCREASE SEED PRODUCTION OF SHORTLEAF PINE IN MISSOURI

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Recent interest in setting up formal seed production areas for shortleaf pine (*Pinus echinata* Mill.) has directed attention to means of increasing the viable seed per tree and per acre. Shortleaf pine produces sporadic crops of seed in the Missouri Ozarks where soils usually are low in fertility. One possible way to improve seed production is to use fertilizers, particularly nitrogen, phosphorus, and potassium. As a trial, commercial fertilizers containing several combinations of these nutrients were applied to the soil in a stand thinned specifically for seed production.

This initial study was made in a 37-year-old, even-aged, natural stand of shortleaf pine on the Willow Springs Ranger District, Missouri National Forests, in Douglas County, Missouri. The stand is on a nearly flat upper slope with a northwest exposure. Soil type is Clarksville stony loam. The site was once cleared and cultivated. When the study began in 1958, the trees ranged from 8 to 16 inches in diameter and had a basal area of about 90 square feet per acre. Most of the less desirable trees had been removed in thinnings made in 1950 and 1956. The understory consisted of 2 to 5 thousand hardwood trees per acre.

### Treatments

A 4-acre block was thinned in 1958 to create a seed-production stand with a basal area of about 45 square feet per acre (fig. 1). The best potential seed trees were left, those with good crowns and some indication of past seed production. Form, vigor, spacing, and apparent root-firmness also were considered in selecting the seed trees. The hardwood understory was controlled by cutting and/or spraying with 2,4,5-T.

The block was divided into four 1-acre plots. Each of three plots was given a standard dosage of all three nutrients (nitrogen, phosphorus, and potassium) plus an additional dosage of one of the nutrients (table 1); The fourth plot was not fertilized. Half the total amount of fertilizer was applied in April of 1958 and half in 1959.

TABLE 1.--Fertilizer treatments and seed produced in 1960

Treatment	Total fertilizer applied per acre in 2 years				Seed produced per acre 1960 <sup>1</sup>
	N	P	K	Total	
	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Phosphorus.....	120	180	84	384	54.0
Potassium.....	120	60	252	432	45.6
Nitrogen.....	360	60	84	504	33.7
Check.....	0	0	0	0	24.8

<sup>1</sup> Assuming 40,000 seeds per pound.

<sup>1</sup>Field office maintained in cooperation with the University of Missouri Agricultural Experiment Station.



Figure 1.--Shortleaf pine seed-production area after thinning. Understory hardwoods have been controlled.

Fertilizers were spread on the ground under the crowns of the residual trees. The amount used under each tree was based on tree size and the total amount of fertilizer allotted to each acre. This resulted in the application of about 1 pound of the mixed fertilizer per diameter inch on the "high nitrogen" plot, and about two-thirds of a pound of the appropriate mixture per diameter inch on the other two treated plots.

### Results and Discussion

All three fertilizers increased seed production in 1960. Trees receiving fertilizers with large amounts of phosphorus and potassium produced about twice as many sound seeds as the check trees. Applying large amounts of nitrogen resulted in a smaller increase in seed production.

At least two other results of this study may have a bearing on the feasibility of fertilizing shortleaf pine seed trees. Heavy stands of grasses and herbs developed on all fertilized areas and no doubt compete with the seed trees for soil moisture and nutrients. The harmful effects of grasses and herbs, if not controlled, eventually may more than offset the beneficial effects of fertilizers on seed production.

The current interest in increasing seed production of selected trees and stands adds importance to the early results of this study. Although there is still need for more detailed information on types and amounts of fertilizers to use and follow up treatments that may be required, the study has demonstrated that seed production of shortleaf pine in Missouri can be increased by the use of fertilizers.