Fertilization Treatments Increase Black Locust Growth on Extremely Acid Surface-Mine Spoils

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Black locust is one of the more commonly planted species on surface mine spoils with a pH of 4.5 or less. Survival on these sites may be acceptable, but height growth is often quite slow, greatly reducing the effectiveness of the tree cover for site protection. Since black locust is one of the few tree or shrub species that will survive on these difficult sites, it seems appropriate to develop treatments that will result in faster and more complete site protection.

Previous research indicates many surface-mine spoils are deficient in nitrogen as well as in phosphate. Also, greenhouse tests have shown that phosphate fertilization will increase the growth of seeded black locust *(Robinia pseudoacacia, L.)* on many spoils. So we studied the effects of nitrogen and phosphate fertilization on the survival and growth of black locust seedlings planted on mine spoils.

The Site

We chose a site 10 miles south of London, Ky., where the Lily coal seam had been mined. The spoils, derived primarily from shale, had a pH ranging from 2.9 to 4.2. About 70 percent of the samples from the study area had pH values of 3.5 or less. Available phosphate extracted by the Bray # 1 test was very low.

Regrading to a nearly level topography had been completed a year before planting.

Treatments

We used ammonium nitrate as a source of nitrogen, and the following sources of phosphate : dicalcium phosphate, rock phosphate, and triple-superphosphate. The treatments applied were as follows:

(1) Untreated check
(2) Ammonium nitrate
(3) Dicalcium phosphate
(4) Dicalcium phosphate plus ammonium nitrate
(5) Rock phosphate plus ammonium nitrate
(6) Triple-superphosphate plus ammonium nitrate.

A randomized block design was used. Each treatment was randomly assigned to one row of 10 trees in each of three replications.

Rates of application provided equivalents of 100 pounds of P_2O_5, and 50 pounds of N per acre. The trees were planted at a 6- x 6-foot spacing, so the amount of fertilizer per tree was computed by dividing the amount required per acre by 1,200. Thus, if ammonium nitrate and triple superphosphate were used as fertilizers, each tree would receive 57 grams of ammonium nitrate and 41 grams of triple superphosphate.

Two-thirds of the phosphate fertilizer applied to each tree was mixed with the spoil in the planting hole. The trees were planted in this spoil-fertilizer mixture. The remaining phosphate fertilizer and all of the nitrogen fertilizer were mixed and distributed between two slits located about 6 to 8 inches from the tree (fig. 1) .

Results

Survival and total seedling height were measured at the end of the first, second, and third growing seasons. Analyses of this data indicated that the fertilization treatments did

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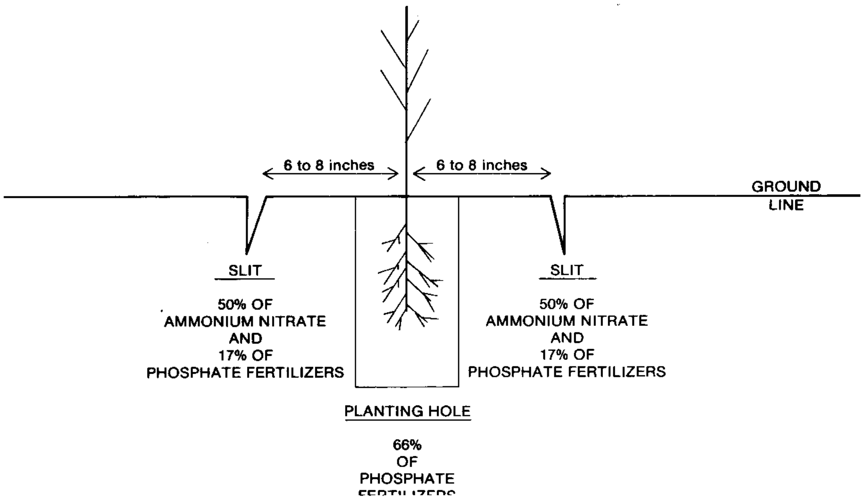


Figure 1.—Sketch showing placement of fertilizers.

not influence survival, but did affect tree growth.

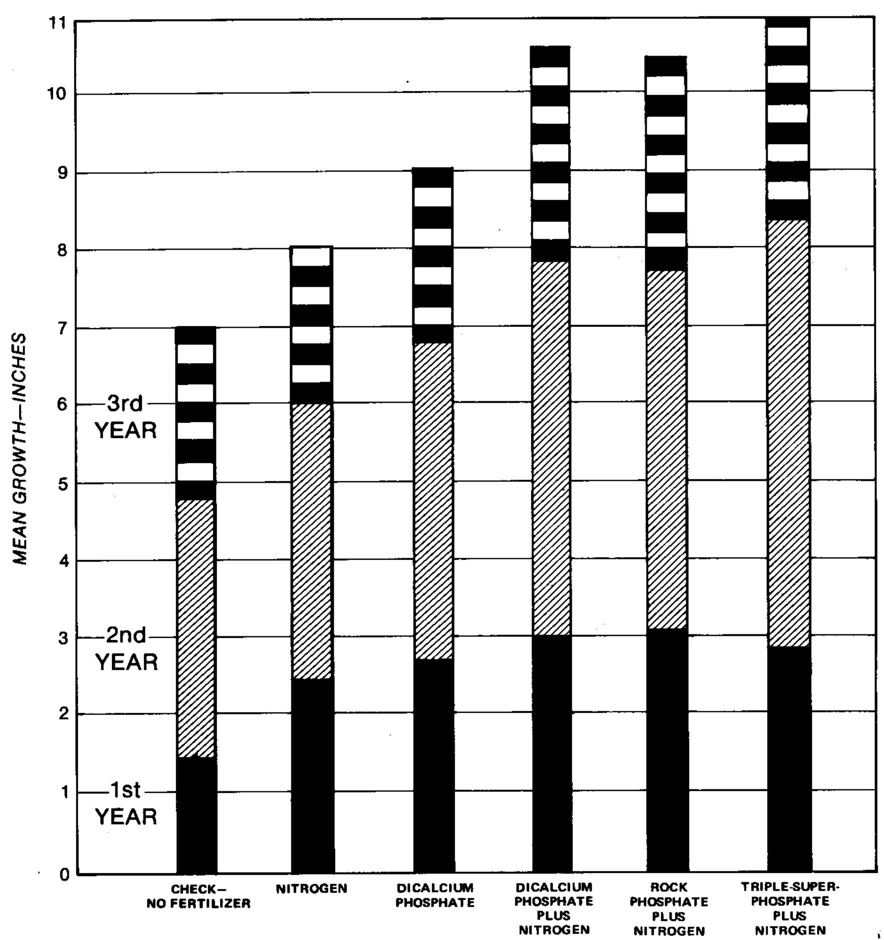
Survival rate by treatments varied from 90 to 97 percent at the end of the third growing season. Survival rate did not differ significantly between treatments. Therefore, we can assume that fertilization did not affect survival.

At the end of the third growing season, the mean total height of fertilized trees was greater than that of unfertilized trees (table 1). Regardless of source, phosphate fertilizer in combination with nitrogen resulted in the tallest trees after three growing seasons.

The greatest growth response to fertilizer treatments occurred during the second growing season. By Scheffe's S-method for multiple comparisons, second year growth between the three phosphate sources in combination with nitrogen did not differ significantly (fig. 2). All phosphate plus nitrogen treatments resulted in significantly greater growth than the untreated check. Growth after application of the dicalcium phosphate and triple-superphosphate plus nitrogen treatments was significantly greater than after nitrogen alone. The triple-superphosphate plus nitrogen treatment was the only treatment that resulted in significantly better growth than dicalcium phosphate alone.

Growth during the third growing season slowed to about 50 percent of the second year growth. Differences in growth between treatments were essentially the same as those during the second growing season. We do not know if the reduction in growth

Figure 2.—Mean annual growth by treatments.



resulted from a depletion of the fertilizer additions, from a less favorable growing season, or from a combination of both. The reduction in growth on the untreated check during the third growing season indicates unfavorable growing conditions were at least a contributing factor.

TABLE 1.—*Mean total height (in feet) of black locust seedings at the end of the third growing season by treatment*

Treatment	Block I	Block II	Block III	Mean of 3 blocks
No fertilizer	8.3	6.0	6.8	7.0
Nitrogen	9.8	6.8	8.0	8.2
Dicalcium phosphate	10.2	7.7	9.3	9.1
Rock phosphate + nitrogen	11.7	8.6	10.8	10.4
Dicalcium phosphate + nitrogen	11.5	10.1	10.3	10.6
Triple-superphosphate + nitrogen	11.3	11.4	10.2	11.0

Conclusion

Black locust seedlings planted on extremely acid surface-mine spoils responded to phosphate and nitrogen fertilizers during the first 3 years after planting. The three sources of phosphate were equally effective, and all sources were most effective in combination with ammonium nitrate.

Incorporating the phosphate fertilizer with the spoil at the planting site and placing the nitrogen in slits 6 to 8 inches from the tree was effective in this study.

This evidence suggests intensive fertilization treatments can be used with black locust to hasten site protection on many extremely acid surface-mine sites.

News & Reviews

Forest Trees for Foreign Lands

During its first 6 months of operation, the *United States Forest Tree Seed Center* has furnished experimental lots of seed to 13 foreign countries. The Center, which began operations at Macon, Ga. Jan. 1, 1972, is managed in cooperation with State forestry agencies, universities, and private forest industries of the U. S. It was established to furnish seed for species introduction trials, tree breeding, and other similar purposes to forest researchers outside this country. The program does not compete with commercial seed sales but offers small lots of seeds for experimental purposes only. Primary emphasis is on the major southern pine species, but stocks include such far West species as Douglas-fir and giant sequoia. Hardwoods as well as conifers are represented in the inventory which currently includes about 60 species. Until recently, Timber Management Research in the U. S. Forest Service, Washington office, handled the International Tree Seed Exchange Program.

Anchor Chain Aids Growth of Forest

Anchor chain originally intended for a Canadian destroyer is being used to grow forests in Ontario.

Twenty-foot lengths of chain are dragged by tractors across waste land where trees have been harvested for newsprint and other forest products.

To each 76-pound link is welded a long heavy tractor pin, which churns the soil up over the surface mat of old pine needles and forest debris.

This helps put the jackpine seeds in direct contact with soil so they will germinate.

Innovations in Tree Planting Machine Reported

Reynolds Research and Manufacturing Corporation is producing dual coulter and split axle models of the Reynolds-Lowther tree planter. The dual coulter consists of a large coulter to open a trench and a diagonally mounted coulter to close the furrow ... split axle models have separate hydraulic controls to each trailer wheel to maintain the planter in a vertical position. Manufacturer reports that dual coulter is designed for tight root packing in top soils to avoid leaving air voids. Details are available from the company, P. O. Box 550, McAllen, Tex. 78501.

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