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News & Reviews

What Nutrients Do Pines Need?

Farmers fertilize their corn crops. Stockmen provide supplemental food for their range cattle. Having seen the benefits from these practices, forest managers are asking if they should be fertilizing their pine trees.

Adding fertilizer to bring soil nutrients into balance probably will improve growth and vigor of pine trees if done right. That is the opinion forest scientist Eugene Shoulders expresses as he talks about his work to develop land management practices to maximize growth and quality of southern pines on the Coastal Plain soils of the Gulf region.

In the past, physical properties such as texture, depth. and available moisture were the soil characteristics most often used to estimate site productivity, said Shoulders, a Southern Forest Experiment Station researcher at the USDA Forest Service laboratory at Pineville, Louisiana. But land managers now want to know if they can greatly improve tree growth by adopting agronomic practices. such as fertilization.

Forest fertilization is a proven and acceptable management practice in limited areas of the South. But for most of the area, general use will probably have to wait until exact amounts and specific kinds can be reliably prescribed for individual soils. Shoulders said. He and his fellow researchers are on the way to providing at least some of the prescriptions.

In certain areas of the South, a single nutrient, usually phosphorus, is very deficient in the soil. There have been pronounced responses where supplemental feeding has been tried. Often, though, a combination of nutrients is needed rather than a single element. Loblolly pine may require a slightly higher level of nutrients than slash pine.

In their response to mineral nutrients, trees are influenced by their physiological condition and genetic make up, and also by various environmental conditions. Fertilization at planting time may be ineffective unless competition from grasses and other vegetation is controlled. Shoulders said researchers find the complex responses difficult to anticipate. Spectacular gains from fertilization may depend as much on developing strains of southern pines that are unusually responsive as on solving other problems in pine nutrition.

In a new publication, Shoulders and his coworker William H. McKee, Jr.. consider both soil and plant aspects of the problem. They summarize knowledge of chemical properties that determine the ability of soils to hold nutrients added for pines, and they evaluate results of a number of greenhouse and field studies. They also outline areas where additional information is needed. Their discussion is concerned chiefly with pine growth on the Coastal Plain soils of Arkansas. Louisiana. Mississippi, and Texas. Much of it, however, applies equally well to other parts of the South.

Copies of "Pine Nutrition in the West Gulf Coastal Plain: A Status Report," are available from the Southern Forest Experiment Station, 701 Loyola Avenue, New Orleans, Louisiana 70113. Ask for Forest Service General Technical Report SO-2. (Front Forest Research News for the South.)

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seedling size and fertilization have been observed for 8 years. The test site was an abandoned forest nursery characterized by a well-drained loam soil with a cover of fescue sod. Applications of ammonium nitrate were made during the first 2 years, and after the third growing season, all trees except controls received a commercial fertilizer (15:15:15) at a rate of 570 pounds per acre. After 4 years, the combined effects of seedling selection and fertilization produced plants which averaged 5.6 feet in height: controls averaged 2.4 feet (table 2). Height differences due to these treatments have continued through 8 years with the effect of the fertilizer outweighing that of seedling size. However, some differences at 8 years probably reflect increasing competition among plots, which had limited buffer zones.

Mixed hardwoods and pine

Response of established pine and hardwood stands to nitrogen (300 lbs./acre) and phosphorus (66 lbs./acre) amendment was observed at 37 locations in the Tennessee Valley (3). Of the 37 tests, 13 which exhibited the best response to nitrogen during the first 5 years were selected for measurement after 10 years. Three were in southern pine *(Pinus taeda L., P. echinata Mill.)* stands in northern Alabama, and 10 in mixed hardwood stands distributed throughout the Valley. Initial basal area in these tests averaged 80 feet per acre for hardwoods and 90 for pine. In the hardwoods-predominantly yellow-poplar and red and white oaks-nitrogen amendment stimulated a basal area increase about 50 percent greater than that of controls (table 3) during the first 5-year period after application, followed by a consistent decrease in response during the second 5-year period to around 20 percent. The decrease in response of pine was more dramatic than in hardwoods, and no significant difference between controls and treatments was noted during the second measurement period.

Conclusions

In the plantings of yellow poplar and northern red oak, the growth advantage gained from nitrogen fertilization has persisted well beyond the establishment phase. The degree of this total advantage at 8 to 10 years suggests that fertilization used in combination with large planting stock can he profitably incorporated into establishment procedures. On the other hand, diameter increment response to fertilization in natural stands was relatively short-lived, and further application will be required between 5 and 10 years if continued growth stimulation is desired. Whether such application is economically feasible will depend largely on stand composition and quality and soils, with the best returns probably being obtained from fertilization of species such as yellow-poplar and northern red oak on good sites.

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Rootability of Hybrid Poplar Clone NE-222: Another View!

Dr. Ernest J. Schreiner, formerly with the Forest Service and now a forest genetics consultant at Durham. New Hampshire, questions the conclusions reached by Dr. R. D. Shipman in his report on hybrid poplar clone NE-222 which appeared in Vol. 25, No. 1 of Tree Planters' Notes. Dr. Shipman is Associate Professor of Forest Ecology at the Pennsylvania State University, Park, Pennsylvania.

Dr. Schreiner states that experience at the Northeastern Forest Experiment Station, USDA, FS, indicates that this hybrid has excellent rooting ability *without any chemical treatment.* Clone NE-222 is one of the 40 hybrid poplar clones distributed by the Station and is reported in the Proceedings of the Northeastern Forest Tree Improvement Conference, Volume 19: 108-116, 1971. The following quotations are from p. 110 of that publication:

"The most important criteria for the selection of clones for commercial poplar culture are rooting ability, rapid growth (volume production), and sufficient pest resistance to predict an early and profitable harvest.

"The 240 clones included in these tests had met the requirement for 95100 percent nursery rooting. This was based on 50 graded cuttings (12 inches in length and 3/16- to 1/2-inch middle diameter) derived from 1-yearold growth on nursery stools."

Clone NE-222 rooted 91 percent on an upland terrace site and 98 percent on an upland slope site without any chemical treatment of the cuttings.

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cloudy skies. and a temperature of 75^{0}F.

We used a dibble to plant 150 seedlings of each species. The "2" size styro-plugs were planted at a rate of 150 seedlings per hour: the "8"'size styro-plug. at a rate of 100 per hour. In Canada. up to 360 seedlings ("2" size) per hour have been planted (5).

Results

Seedling survival. vigor, and stem dieback were checked 3 months after planting. Seedlings of all species had over 95 percent survival and over 90 percent of them had high vigor (table 1). None of the seedlings died back. The results obtained with saligna eucalyptus were particularly encouraging because this species generally suffers high mortality when planted bare-root. Survival rates of only about 30 percent have been noted (6, 7) and planting shock is generally great. In one study. about 85 percent suffered dieback (8). Koa is generally considered to be more difficult to establish in field plantings than saligna eucalyptus, so the results on survival. vigor, and dieback are encouraging. Queensland-maple and Australian toon are considered to be easier to establish than saligna eucalyptus. Therefore, the results are not unexpected.

TABLE 1.-Surcical. rigor. and dieback of styro-plug seedlings of four tree species 3 months after field planting. University of Hawaii Hamakua Experiment Farm. Hawaii

Species	Survival	High vigor	Dieback
	Percent	*Percent*	
Koa	100	90	0
Saligna eucalyptus ..	100	95	0
Australian toon	100	90	0
Queensland-maple	95	90	0

Root development of seedlings was examined 4 weeks after field planting. By then, the roots of vigorous koa. saligna eucalyptus, and Australian toon had increased in radius by about 21/ inches. Roots of Queenslandmaple seedlings had increased radially about 2 inches.

I determined that the dibble could be used to prepare planting holes in other soils common to Hawaii forest lands, including a volcanic ash, an organic soil, and lava rockland. Between 50 and 100 planting holes were made in each type of soil. We found that preparing the planting hole with the dibble was easier and faster than the usual method of using a mattock. The number of holes prepared per hour were: Volcanic ash. 225: organic, 180: and lava rockland. 100. Preparing planting holes in the rockland was a slower process because we had to probe to find a niche where the dibble could be fully inserted into the soil,

Conclusions

The results of these tests are decidedly promising for each of the four species and four soils tried. Additional information is needed. however, to make optimum use of Styroblocks in Hawaii. Studies are being developed to learn more about seedling requirements, optimum time for outplanting. and optimum values of seedling height. diameter, shoot/root ratio, and age needed for high survival and growth rates. But even now, managers can exploit the potential of Styroblocks in their reforestation work.

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Bicentennial Trees

American Forest Institute has prepared a Bicentennial project "Trees from the Nation's History" and a brochure to describe the project, they report. Program will furnish to groups kits which include seeds from four historical trees, planting instructions, and booklet with stories on role of wood in development of Nation. Kits are available from AFI in orders of 24 only.

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the system. The resulting gain is demonstrated in the figures below, expressed in cost/thousand (M) containers:

This results in a total saving, per

Operation	Cost: Hand method	Cost: Mechanical method
Filling	$5.64	$1.14
Seeding	2.81	1.73
Total	$8.45	$2.87

thousand cavities, of $5.58

This cost is based on runs of 500 M cavities, at $3.00 per hour average wage.

Our savings for the container program of five million seedlings this year will be $27,500.00. With continued work at this nursery in improving the efficiency of other production areas, we hope that savings can be increased a great deal more.

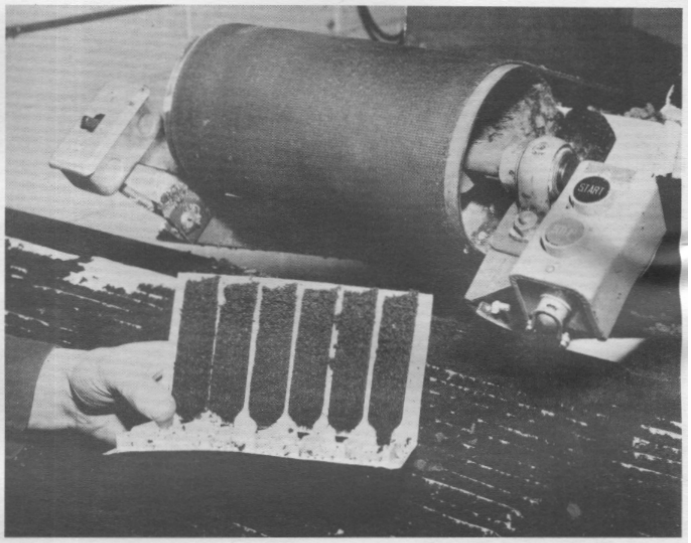

Figure 7.—With this new process moisture can be kept at optimum more easily than the previous method. All peat is used. Maximum distribution of micro and macro sized peat fragments is assured.

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Pines Monitor Air Pollution

Eastern white pines are tattletales where air pollution is concerned. Their needles change color or even die when exposed to airborne pollutants such as fluorides, oxidants, and sulfur dioxide. Not all white pines respond in the same way to the same pollutant. however. Some trees are injured by only one of these three pollutants but are resistant to the other two. Such trees may soon be enlisted as detectives to spot areas of air pollution and even to identify which pollutant is on the loose.

Dr. Charles R. Berry of the Southeastern Forest Experiment Station recently conducted a study in which the same seedlings of white pine were exposed for 1-year periods to sulfur dioxide from a power plant in east Tennessee, fluorides from a fertilizer plant in north Alabama, and oxidants (such as ozone) from a metropolitan area in south Maryland. These multiple exposures revealed that some of the seedlings were susceptible only to fluorides, some only to oxidants, and some only to sulfur dioxide. Furthermore, some of the susceptible seedlings were injured only in winter, some only in summer, and others during both seasons. Each of these groups is being propagated to serve as bioindicators of a particular pollutant. Trees susceptible during only one season can even be used to determine when the pollutant is present. Other seedlings in the study proved to be resistant to all three gases. These seedlings will be used to establish resistant lines for seed orchards.

Because they are evergreens, eastern white pines can serve as semipermanent. year-round monitors of air pollution from industrial and other sources. The only maintenance they require is a small application of fertilizer and light pruning once a year. Unlike man-made instruments. they need no electrical power. Such bioindicators will be particularly useful to those who wish to monitor local trends but cannot afford a more complex system.

Details of Dr. Berry's study are reported in an article entitled "The Differential Sensitivity of Eastern White Pine to Three Types of Air Pollution" in a recent issue of the *Canadian Journal of Forest Research.* Reprints are available on request from the Southeastern Forest Experiment Station, P.O. Box 2570, Asheville. North Carolina 28802. (From Forest Research News for the South.)

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show that husking and cleaning walnut seed prior to sowing is better than sowing unhusked seed. His recommendations should be useful to landowners who collect their own seed and sow it immediately. Nurseries that husk their walnut seed before stratification and sale should continue to do so. Much further research is needed, however, to confirm that thorough cleaning is as effective as claimed.

I˙se of high-quality seedlings plus intensive early culture have restored landowners' confidence in the potential of walnut planting: a shift to use of seed over seedlings as a result of limited field observations would be risky at this time. Direct seeding of walnut will always entail a risk of failure, but several proven techniques may help to improve success. For instance. use of protective screening can reduce some of the risks. Wire screen cones or squares and per. forated tin cans have all been used successfully, but they are hardly practical for large-scale seedings.

Several studies, such as the one by Engle and Clark [6] have shown that sowing walnut seed in the spring rather than in the fall increases chances of seedling establishment. Seeding late in the spring reduces the time, and thus the opportunity. that the rodents will have to find the seed before it germinates.

Most of the successful direct seedings of black walnut we have seen have been large areas. A possible ex.

planation has been provided by personnel of the Ohio Division of Wildlife who have studied gray and fox squirrel movements adjacent to and within clearcut forest areas ranging in size from 9.5 to 34 acres. During the summer months, only one of 13 squirrels captured on one study area had penetrated as far as 5 chains inside a clearcut opening during the first 2 years after clearcutting. Thus, squirrel predation of planted seed can perhaps be minimized if the seed is sown at least 6 chains from the edge of adjacent stands. In winter. however, squirrels traveled farther into the openings. especially during the January-March breeding period. when they tended to range over a greater area. This further substantiates our findings that spring seeding can help to reduce squirrel predation.

[6] *LaMont G. Engle and F. Bryan Clark. New* rodent repellents fail to work on acorns and walnuts. USDAA For. Serv., Cent. States For. Exp. Sin. Note 138: 2 p.. 1959.

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Woodsman, spare that kenaf

A 10-foot tall member of a type of hibiscus may provide pulpmills and paper manufacturers with the "tree" of the future. The kenaf doesn't look like a tree or act like a tree, but USDA Agricultural Research Service researchers believe that the hardy hibiscus may share one very important characteristic of some trees: it provides an excellent fiber for paper manufacture. Growing to maturity in 4 months, compared to 20 years for many trees, the kenaf (pronounced kuh-NEF) produces five to seven times more pulp per acre per year than the pine tree. After 16 years of research effort to locate a suitable fiber substitute for trees. USDA scientists have zeroed in on the kenaf: honeysuckle and milkweed were two alternatives that were found unacceptable. Now scientists are working to eliminate a root parasite-the root-knot nematode-from the kenaf. If the parasite can he eliminated, the kenaf has the potential to supply some of America's increasing paper needs while preserving forest lands.
(From Soil Conservation, June 1974.)

Containerized Tree Seedlings

Tree seedlings grown in green. houses in containers were the subject of three separate articles received in the W.O. recently. Seattle Times Sunday pictorial section had a story on Coeur D'Alene (Idaho) Nursery with pictures of containerized seedlings in the greenhouse which it says are being raised for planting on difficult sites. Sandpointe (Idaho). News-Bulletin story on containerized tree seedlings says new technique shortens seed-to-tree time from 3 years to 5 months. CSU research magazine for Jan.-Mar. 1974 says Colorado State Forest Service nursery at CSU drew upon research conducted by FS's Dr. Richard Tinus at ShtJterhelt Laboratory in Bot tineau, N.D., to set up a year-long trial of growing tree seedlings in greenhouse.

'Shigometer' Developed

Dover (N. H.) Daily Democrat reports NE Station. in cooperation with U. of New Hampshire has developed a portable, electronic meter which detects hidden decay in living trees and wood products. It has been named the "Shigometer" for Dr. Alex L. Shigo of the NE facility at Durham,

Helicopter Topping Used

The Everett Daily Herald reported on Forest Service use of helicopter on Mt. Baker NF to prune top branchlets from superior but inaccessible Douglas fir trees for grafting onto young containerized trees. Method results in about 50 scions an hour as opposed to the former method (climbing tree or shooting branchlets down) which brought in only about 10 a day.

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ready to face a harsher environment. Remove the kraft bag in late afternoon or on a cloudy day and water frequently for several days to bring the plants through this change in growth environment. Remove the polyethylene bag about 2 days after the kraft bag has been removed.

Carefully check each successful graft at regular intervals until it is transplanted to the seed orchard. Prune overly vigorous branches of the stock plant to permit the scion to remain dominant. Promptly control any harmful insects or diseases that appear.

Time for transplanting the grafts from the nursery bed to the seed orchard is somewhat dependent upon the environment of the seed orchard site. In the Lower Coastal Plain where summer rainfall is usually plentiful, the grafts are often transplanted in late July or August. If summer droughts can be expected, the grafts should be transplanted during the normal fall or winter tree planting season. Transplanting mortality will be minimized if a 5- to 6-inch. diameter transplanting tool-either manual or machine operated-is utilized. These devices lift a ball of nursery soil with the graft. To keep the ball of nursery soil intact and prevent root damage. we place the lifted grafts in kraft bags in No. 10 cans.

One more precaution: The CSP seed orchard should be established on a well-drained sandy soil.

If the procedures described here are followed. the manager can anticipate having a CSP seed orchard as trouble free as any well-managed southern pine seed orchard.

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Urban People Need More Plants UCD Scientist Finds

People have a psychological need for contact with plants.

"One cause of the flight to the suburbs and dramatic increase in wilderness recreation use is a basic desire for contact with vegetation" according to Dr. Seymour M. Gold, an urban planner in the Department of Environmental Horticulture at the University of California, Davis.

Research by behavioral scientists, Gold added, indicates that the current popularity of indoor and outdoor gardening is a result of this same frustrated desire as well as an attempt to modify the sterility and ugliness of most cities.

The human response to plants in urban environments. Gold added. provides a frontier for research to link the plant and the social scientist in new ways to solve environmental problems.

Research on the use of plants in cities to satisfy human needs, Gold said, could result in several social benefits:

-Less need to escape from cities just to enjoy plants and green landscapes. "With the prospect of prolonged fuel rationing or shortages, it is essential to make our cities and suburbs more enjoyable. attractive. and diverse places." Gold said. "For example, 30 percent of all automobile use is for leisure and outdoor recreation. Some of this use could be reduced by providing better local public and private recreation opportunities that could give people the same perceived sense of relief or natural character that they now seek in regional parks and wilderness areas."

-Better use of existing local parks, which are often sterile because they lack adequate landscaping. Gold said his research indicates that fewer people are using neighborhood parks in many cities. and there is a strong relationship between nonuse and the lack of trees, shrubs, and flowers.

-More stable property values and less change in neighborhood populations because of the type and quality of landscape plantings. Gold suggests that "people are attracted to and more reluctant to leave the well landscaped areas of most cities. Property values are higher and more stable for houses near well landscaped parks and on streets with mature shade trees." He also notes that "these well landscaped areas usually have less neighbor conflict and higher degrees of social interaction and identity."

Gold said, "Perhaps no single item could dramatically change the physical and social character of urban America more quickly, and be less controversial and costly, than plants. At the same time, this massive application of plants could save substantial amounts of gasoline because people would learn to enjoy cities and rely on urban parks instead of traveling long distances to wilderness areas or vacation homes for simple contact with vegetation."

(From a cooperative extension report, University of California. Davis.)