DIRECT-SEEDING THE SOUTHERN PINES 1/

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Nothing would be more gratifying to me today than to be able to tell you how to direct-seed each of the southern pine species. Unfortunately this is not yet possible although we firmly believe the answers are close at hand. I will tell you, however, our present prescription for seeding longleaf pine and will briefly summarize our progress with loblolly and slash pine.

First let me quickly review why direct seeding is so important. Basically it promises a quick, cheap substitute for planting. But there are other potential advantages that are not generally recognized. Successful methods of direct seeding should give more trees per acre than can be economically planted. This suggests that seeded stands can be made to produce higher quality trees than are normally grown in plantations. High initial stocking also offers assurance that acceptable stands will be achieved even when drouth kills many of the individual seedlings.

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A vigorous 5-year old longleaf seedling stand established by direct seeding on a one-year old grass rough.

Direct seeding can be the means of bringing back longleaf pine. This valuable species is difficult to plant successfully. In Louisiana, where there are 1. 6 million acres of barren, cutover longleaf land, less than 100 acres were planted to longleaf during each year of the past 5. In contrast, about 8, 000 acres of longleaf were direct-seeded last November alone--the equivalent of planting more than 12 million seedlings.

The Southern Forest Experiment Station's research center at Alexandria, Louisiana, began direct-seeding research in 1947. Since 1951 it has been the center's major project. The work has been facilitated by cooperation from the Louisiana Forestry Commission, the U. S. Fish and Wildlife Service, the Kisatchie National Forest, and several private landowners.

Longleaf Pine

Time of Sowing

With longleaf pine, one of the most important factors is to sow in the fall as soon as soil moisture is adequate for prompt germination and when maximum air temperatures are below 80 degrees F. To put it another way, seeding must be done after the fall drouth is broken. Usually two inches of rain is enough. In central and southern Louisiana, fall rains may begin anytime from late October to late November. Any delay in sowing after ample rain has fallen is dangerous because seedeating birds and animals are more numerous in December, while their natural foods become less abundant. In addition, progressively lower temperatures delay germination, thereby leaving the seed exposed longer than is necessary. Premature sowing--as in early October--is equally hazardous because high temperatures may cause seed deterioration or faulty germination.

Seedbed Preparation

On most sites, seeding should be done in a light grass rough, obtained by burning in the spring of the year in which the sowing is to be done. Burning destroys the accumulation of dead grass and enables the pine seed to reach mineral soil; it also reduces the rodent population. If burning is done before April or May, however, the regrowth of grass will be heavy and will form a favorable habitat for rodents. Burns in late summer or early fall should also be avoided, for fresh burns are highly attractive to birds.

On dry, sandy sites, it may be desirable to follow the spring burn with a disking in late summer. Disking has many pros and cons, and no flat recommendations can be made. Its chief advantage is that, by reducing competition from grass, it may improve pine survival and growth the

first year after seeding. Double-disking is usually necessary, either as two separate operations or by using tandem disks. If disking is confined to strips 8 feet wide and 6 to 8 feet apart, costs can be held to about $2.50 per acre.

Disking also has several disadvantages. Disked strips are attractive to both birds and rabbits, and are subject to silting and flooding. The top few inches of soil on the strips dry out very quickly. Thus, in a dry winter, germination may be prevented or prolonged. The new grass on the disked strips is highly attractive to cattle, which may trample the young pines. If only the strips are seeded, there is also a strong possibility that early pulpwood yields will be decreased.

Predator Control

Until recently, seed-eating birds have been the greatest single obstacle to successful fall seeding of longleaf pine in Louisiana. Large flocks of migrants begin to arrive in November and, with the aid of resident birds, can cause heavy seed losses and even failure in a short time. Meadowlarks, several species of sparrows, juncos, and robins have been the most troublesome. Blackbirds have not taken much seed from light roughs,. but they are attracted to fresh burns and disked sites.

In the past, patrolling was the only practical method of reducing seed losses to birds. A one-man shotgun patrol, assigned to each 200 acres for at least 8 hours a day through the 5-week germination period, costs $1.25 to $1.75 per acre. Even this expensive measure has not always been effective.

Now there is a chemical bird repellent called Morkit 2/ which is put on the seed. Morkit gave such spectacular results in. field tests in 1953 and 1954 that Louisiana landowners used it in 1955 to protect almost 10 tons of longleaf seed. It is a German product containing anthraquinone, a compound used in the manufacture of dyes, laxatives, and photographic materials. This grey powder is cheap and easy to apply. One pound costs $0.40, and treats 4 pounds of longleaf seed.

Asphalt emulsion, a roofing compound, is used to make the Morkit stick to the seed. Some asphalt compounds are unsatisfactory; the most effective one used so far is C13-HPC, manufactured by the Flintkote Company. The asphalt is diluted with water--one part asphalt to 3 parts water, by volume. The seed is dipped in this mixture, stirred for a minute or two, drained momentarily, and then put in a rotating drum containing Morkit. Two men

2 / For information on Morkit, a chemical bird repellent, see "Not for the Birds," by W. F. Mann, Jr. and H. J. Derr, U. S. Dept. Agr. Tree Planters' Notes.No. 20, 3-6 pps. , ills. June 1955.

can treat 1, 000 pounds of seed daily, with only two steel drums and a fine meshed heavy wire basket for equipment. The total cost for treating longleaf seed--including labor and materials-- is about 15 cents per pound.

The asphalt-Morkit treatment has no noticeable effect on the viability or the rate of germination. It does not appear harmful to humans or animals. It does not kill birds--they just won't eat seed coated with it. (Even with Morkit, however, it appears best to avoid seeding fresh burns--there is no point to inviting trouble.)

Good as it is on birds, Morkit is no protection against the numerous animals and insects that relish pine seed or newly germinated seedlings. Fortunately, only a few of these other predators do enough damage to warrant control measures.

Rodents and shrews are voracious seed eaters, but in Louisiana they have not been numerous enough to endanger fall seeding on a light rough. Apparently, burning 5 or 6 months in advance of seeding helps to check them. So far, they have been relatively scarce in November and early December, but have increased in late winter and spring. They eat some newly germinated seedlings in December and January, but by and large the best way to minimize rodent losses is to seed as early in the fall as the weather permits.

Reports, particularly from the southeastern States, indicate that losses to rodents may be more severe in other regions than they have been in Louisiana. Where trouble is anticipated, some estimate of the rodent population should be made before seeding is attempted.

Town ants and hogs will destroy seed and seedlings. They must be eliminated from the area before sowing, just as would be done in advance of planting.

Rabbits, racoons, and opossums will also eat large quantities of seed, but ordinarily they cause only minor, local damage. An example of a high rabbit population, which almost caused failure in a 275-acre trial seeding, was encountered two years ago. Soon after the seed was sown, severe rabbit damage was found over the entire area. Hunting was started immediately, under a special permit, and 120 rabbits were killed. Not all rabbits were controlled at that, as light damage continued through January. This type of damage often can be prevented by a careful pre sowing examination of the area, at night as well as in the daytime, to determine how numerous the animals are.

Millipedes, small ants, and other insects have been observed eating seed and seedlings. These losses have never exceeded 5 percent, so control measures do not seem necessary.

Livestock, while not in the predator category, should be excluded from the seeded area until height growth starts because they trample and browse seedlings. Disked strips and fresh burns are particularly attractive to livestock.

Rate of Seeding

The minimum recommended sowing rate for longleaf is 10, 000 viable seeds per acre. With fresh, cleaned, and dewinged seed, this means 3 pounds of untreated seed or about 3. 8 pounds of Morkit-coated seed per acre. Fresh seed is preferred, but stored seed can be used if proper precautions are taken. Stored seed should be secured from competent sources and the germination percent should be determined by sand-flat tests before sowing is done. If viability is less than 70 percent, the seeding rate should be proportionately increased. It is important to remember, also, that even fresh seed spoils quickly under improper handling.

Methods of Sowing

On a light grass rough, seed can be broadcast by airplane or by hand-operated grass seeders. Airplanes can seed large areas fast, with a minimum of labor. The main drawback is the difficulty in skipping over small areas not requiring seeding. Planes for distributing fertilizer have been used successfully in seeding longleaf. To permit the seed to flow freely, the opening in the seed hopper, must be modified from a long, narrow slit to several larger openings. This is easily accomplished by placing a plate with rectangular openings in the bottom of the hopper. Airplane seeding was done last fall at a total cost of $0. 60 an acre, including about $0.10 per acre for flagging the flight strips.

Hand-operated "cyclone" grass seeders are well adapted for seeding areas up to 300 or 400 acres in size. An unskilled crew can be quickly trained to distribute seed uniformly over the area. One man can sow about 20 acres in an 8-hour day.

Disked strips can be seeded by hand at the rate of 20 gross acres per man-day. One Louisiana company seeds them with a tractor-mounted seeder which covers 40 acres per day.

Inspections of Seeded Areas

A careful examination of the seeded area should be made each week throughout the germination period. These inspections can be facilitated by establishing 50 well-distributed, staked and numbered observation plots, each sown with about 50 extra seed. The plots should be very small, and the seed should be placed right around the stake. So that field germination can be determined, some seed on each plot should be covered with a small cone of wire screen for protection from larger predators.

A systematic seedling count should be made about 12 months after seeding. Longleaf seedlings are difficult to see and areas classed as "failures" are sometimes revealed as "successful" by such inventories.

Costs

The cost of direct-seeding longleaf pine depends on the price of seed, the type of seedbed preparation, and the individual labor and equipment-use rates. Seed ranges from $1. 00 per pound in bumper years to $2. 00 in lean seed years. With seed at $1. 50 per pound, seeding on a light rough will cost about $6.00 per acre, including all inspections. Sowing 3 pounds of seed per acre on disked strips will cost about $8.50 per acre. These costs compare favorably with planting costs, which average between $12. 00 and $15. 00 per acre.

Loblolly Pine

On open areas, loblolly pine is probably more difficult to seed than either longleaf or slash pine. This statement may seem strange in view of the relative ease with which natural loblolly reproduction is obtained, but there are several reasons for it. First, because cotyledon-stage seedlings are easily frozen, germination must occur in the spring rather than in the fall. Consequently, the seed is exposed just when rodents are most numerous-and we have not yet found a practical method of controlling rodents. Second, mechanical seedbed preparation is needed on open cutover areas with a heavy grass sod. Loblolly seedlings normally grow only 3 or 4 inches in the first year, so they are quickly overtopped and eventually smothered by the rank growth of a well-established stand of grass. This loss is primarily due to competition for light, as loblolly seedlings have remarkable ability to withstand drouth. Finally, loblolly seed is slow to germinate and should be stratified for about 60 days. Even then it germinates much slower than longleaf seed.

At present, we believe that the best method is to sow one pound of 60-day stratified, Morkit -coated seed per gross acre on disked strips in late February. The disking should be done on a light rough in January or early February so the soil will be loose enough to wash and cover same of the seed.

We do not recommend large-scale seeding of loblolly pine at this time because the risk of failure due to rodents is too great. An effective rodent repellent must be found to assure consistent success. We are working on this problem in cooperation with the U. S. Fish and Wildlife Service, and have several excellent leads.

Seeding loblolly pine under a canopy of low-grade hardwoods seems much easier and cheaper than seeding it on open land. Hardwoods shade out the grass, making disking unnecessary. Furthermore, seeding on a fresh burn in November permits: the seed to reach mineral soil immediately. Later, much of the seed is covered and concealed by falling leaves. The new leafcast also helps to mask the burn from birds. Germination starts in February, when daytime temperatures reach 70 degrees F. Since overwinter exposure stratifies the seed thoroughly, no presowing treatment is required. A rodent repellent is needed for, seeding hardwood areas, too, because seed losses are heavy in January and February despite the covering of leaves.

Overtopping hardwoods should be deadened during the first summer, after a seedling survey indicates that there is enough pine reproduction to justify the work.

Slash Pine

Slash pine seeding research has been limited to open areas. Indications are that slash seedlings can withstand freezing temperatures, so fall sowing and fall germination are possible. This is highly desirable because bird and rodent depredations are less severe in the fall than in the spring. It also appears that disking is required to prevent excessive drouth losses in the first year. Slash seedlings can outgrow competing grass, attaining a height of 7 or 8 inches the first year, but they die quickly when soil moisture becomes critical. Stratification of the seed is needed to assure prompt germination. Morkit should be used for protection against birds. Because germination extends into January, even with stratification, a rodent repellent probably will be necessary before commercial seeding of slash pine can be undertaken.

Summary of Recommendations for Longleaf Pine

1. Prepare a seedbed by burning in late April or early May- -a light rough will develop by fall and will partially hide the seed from birds. In addition, on dry sandy sites, disk in late summer in- strips 6 or 8 feet apart. The object of disking is to remove competing grass and thus to reduce heavy first-year drouth losses.

2. Seed between late October and early December, as soon as soil moisture is adequate for prompt germination.

3. Treat seed with Morkit to repel birds.

4. Sow 10, 000 viable seed per acre. If stored seed is used, test it before sowing and make any necessary allowances.

5. Preliminary work should include control of town ants, the exclusion of hogs and cattle, and a careful inspection for heavy concentrations of seed-eating animals.

6. After seeding, examine the area carefully once each week until germination is complete.

7. Make a systematic seedling count after the seedlings are a year old.