DIRECT SEEDING: A FAST, RELIABLE METHOD OF REGENERATING LONGLEAF PINE[1]

H. J. Derr

Alexandria Research Center
Southern Forest Experiment Station, U. S. F. S. Alexandria, Louisiana

The urgency to plant cutover areas of upland forest has in recent years created a demand for pine seedlings that far exceeds the capacity of our nurseries and has prompted foresters and landowners to think seriously of direct seeding as a means of getting their land back into production. In the Gulf States the primary interest has been in direct seeding longleaf pine, while in the Southeast there is wide interest in developing techniques for direct seeding slash pine. Today I will discuss recent developments in the art of longleaf seeding -- with particular reference to those techniques which a forester, launching his first seeding trial, should be most concerned about.

First, perhaps, we should discuss the question, why direct-seed longleaf? Aside from costs and other considerations, those who are direct-seeding longleaf today believe they cannot plant this species successfully. The record of nursery production, in Louisiana at least, testifies to the prevalence of this belief. For lack of demand, the State nurseries have not produced a longleaf seedling for several years.

While we at the Alexandria Research Center do not think that planting longleaf is necessarily impractical, we do think that direct seeding offers several advantages. For this reason we have invested nearly 10 years of research effort in the multitude of biological problems associated with direct seeding.

Four reasons can be cited for using this method of regenerating longleaf. First, it is fast, requiring a minimum of labor. Fifteen years ago one man with a planting bar could, if his back held out, plant an acre of pine seedlings a day. Now, with a planting machine, he can put in 5 to 6 acres per working day. With direct seeding, a skilled pilot in a light airplane can sow 180 acres per hour. On several occasions in the past 2 years 1, 000 acres have been seeded from the air in one day. The second reason for seeding is that it's cheaper. While the cost has fluctuated widely with the cost of seed, it has not

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exceeded $10 per acre. Planting costs for longleaf seedlings have ranged up to $15 per acre. In years when seed is plentiful and cheap, direct seeding costs can be held to about $6 per acre. This includes the cost of seed, seed treatment, and sowing.

The third reason for seeding -- and this one applies particularly to longleaf -is that it provides denser stands than are practical with planting. Yearling stands averaging over 2, 000 seedlings per acre are possible in favorable seasons. A dense seedling catch has a margin for losses during the grass stage, and assures a well-stocked stand later on. Finally, direct seeding is a technique that can be expanded rapidly to take advantage of bumper seed crops.

This final reason prompted our early trials in longleaf seeding at Alexandria. It appeared, in 1947, that if we were ever to make progress in regenerating the 2 million acres of open longleaf land in our territory (which includes two counties in Texas) we would have to think in terms of 1, 000- to 10, 000-acre projects. At that time we did not know how to store longleaf seed for the lean years, so we wanted a method that could utilize the vast amount of seed produced in good years. Longleaf's characteristic of rapid germination also seemed especially adapted to direct seeding.

Our early tests, on small plots, were made to determine basic requirements such as site treatment, time and rate of seeding, etc. We were also testing 4t the theory that birds are the principal obstacle during the fall months.

The early trials were successful, and were followed by a 1, 200-acre venture by the Kisatchie National Forest in 1948. This operation succeeded on areas where fresh seed was used. It encouraged other trials in succeeding years, some of which failed because of bird depredations. The first large seeding operation by a private landowner was by Crosby Chemicals in 1952, when the company started its unique method of tractor seeding on disked strips. Birds were a serious problem on that 900-acre tract, and it was questionable then if bird protection by patrolling was practical for large areas.

The following year preliminary field trials were installed to test Morkit, a German-made bird repellent whose active ingredient was an anthraquinone compound. Results were so encouraging that the Hillyer-Deutsch-Edwards Lumber Company at Oakdale, La., agreed to try Morkit on. 180 acres the following year. This test proved conclusively that birds can be repelled with
a chemical seed coating. Although Morkit is no longer available, other chemicals have proven to be as good or better. The problems in longleaf seeding seem to-be minor now in contrast to the threat of complete loss by birds that faced us only a few years ago. Solving the bird problem has modified some of the recommendations that we formerly thought necessary for successful seeding.

RECOMMENDED METHODS

Site Preparation

Of several site treatments that can be used, a light grass rough provides the best surface environment for germinating longleaf seed. It was recommended originally because of the concealment it provides against birds especially against migratory species, which are attracted to burned or disked areas. However, a light rough also benefits germination, especially when rainfall is light during the early part of the germination period. A case in point was a 1954 test in which Morkit-treated seed was sown on a light rough and on a burn. The rough produced 4, 200 seedlings per acre and the burn 2, 800. Most of the difference was due to germination failures on the burned area during a rainless period that lasted for 19 days after seeding. The development of a reliable bird-repellent now makes it possible to seed on a burn, and in some cases that may be desirable or unavoidable, as on areas burned by wildfire. Certainly where the choice of site treatment is between a fresh burn and a rough that is older than 1 year, the burn is to be preferred. On a burn, seeding should be deferred until late November or early December, when frequent rains can be expected.

Intensive site preparation by disking has been tested for several years, and at least one landowner is using this method on an operational scale. On the difficult sites that foresters are now including in their regeneration plans, intensive treatment appears to be essential. For longleaf seeding, the greatest value of disking is its insurance against serious drought losses in the first year. However, the Crosby Chemicals Company at DeRidder has demonstrated that its method of double-disking increases the early growth of longleaf where the brownspot needle blight is not heavy. The company now has 3-year-old seedlings out of the grass stage and 2 to 4 feet high. This cannot be done by seeding on unprepared sites, and few planted stands ever attain this rate of early growth.

The principal disadvantage of seeding on disked soil is the effect of climatic extremes during germination. Disked soils, like burned ones, dry out quickly when .rainfall is scant, and at the other extreme disking interferes with surface drainage and the sites tend to flood when rainfall is excessive. Landowners interested in seeding longleaf should start with broadcast seeding on a light rough, then adopt the disking treatment if it appears essential for survival on their sites.

Seed

Fresh seed was prescribed in our earlier recommendations for longleaf seeding. This prescription resulted mainly from some unsuccessful trials with stored seed and from the experience of nurserymen who were having difficulty in storing longleaf seed for as long as one year.

To exploit longleaf's periodic seed crops fully, a successful storage technique is needed. We have several tests of seed storage under way, and seed research has been intensified elsewhere in the South, too. This past season nearly 5, 000 pounds of properly stored 1-year-old seed were used for direct seeding in Louisiana. Preliminary observations in January 1957 indicated that the stored seed germinated as well under field conditions as did fresh seed from the 1956 crop. Additional work is needed to determine the effect of seed year, collection date, extraction methods, etc. on keeping qualities. But progress has been made, and it appears now that fresh seed is not essential, provided the seed used has been properly stored.

Rate and Date of Seeding

Two other recommendations, made before we had effective repellents, need reexamination in the light of recent developments.

Now that seed losses can be controlled, you may ask, why not reduce the amount of seed per acre? That is a good possibility, but until we can demonstrate that we have excessive seedlings from 3 pounds of seed per acre we should continue to use that amount. There are other limiting factors besides the creatures that fly, walk, or crawl. Adverse weather during germination or in the first summer can reduce stocking, and as more of the poorer sites are seeded, higher initial stocking will be needed to insure a stand.

It was formerly considered essential to seed as early in November as possible. This recommendation was dictated by the migration and feeding habits of birds. It permitted germination before bird pressure became severe. Now, later seeding is possible and often desirable, because in late November and early December we normally have the best weather for germination.

Seed Treatment

Chemical formulations are now available that will either repel or eliminate most animals, afoot or awing, that have an appetite for pine seed. With longleaf we are mainly concerned with birds and for them a repellent is most desirable. The best repellents we have at the present time are sublimed anthraquinone, Arasan-75, and Arasan. Other anthraquinones are effective, but are not so widely available. The Arasan compounds have some rodent repellency and, therefore, may be superior to the anthraquinones. Arasan-75 and Arasan should be applied to longleaf seed at the rate of 15 percent by weight (15 pounds per 100 pounds of seed). Sublimed anthraquinone, which is far less irritating to the eyes and skin than Arasan, should be applied in a 25 percent dosage. All these repellents are applied as an overcoating after the seed is immersed in a 25 percent mixture of asphalt emulsion in water. The asphalt emulsion serves as a sticker, and the most effective one tested so far is a product manufactured by Flintkote, called C-13-HPC.

A continuing program of testing repellents is under way at Alexandria in cooperation with the Denver Laboratory of the U. S. Fish and Wildlife Service. The Laboratory has assigned a man to Alexandria to work on the problem of controlling bird depredations in forest regeneration. He is also working, with others in his Service, on the rodent hazard, which in the South is most acute during the spring months when we are seeding slash or loblolly pine.

Seeding

Several methods of distributing seed can be used. The choice depends on the size of the seeding project, site treatment, topography, and in some cases the seed treatment. For small or irregular areas, seeding with hand-operated or tractor-mounted Cyclone seeders works well. Hand seeders are inexpensive, and can be used for a labor cost of approximately 50 cents per acre. They require a man to walk a half mile for each acre seeded, which limits their use on large areas. Seed treated with irritating or toxic chemicals cannot be used in them because the operator is constantly exposed to the chemical dust.

Seeding on disked strips can be done by hand or with tractor-mounted seeders. Strip seeding requires more than getting the right amount of seed on the disked soil. The seed must be firmed into a stable portion of the strip. Therefore, strip seeding requires machines built for that purpose -- such as those Crosby has been using successfully for the past 5 years.

During the past 2 seasons airplane seeding has been developed to the point where it is as accurate as any other method. Several earlier trials were disappointing because of inaccuracies in the sowing rate. In 1955, Louisiana Flyers, Inc. , at Lake Charles, La. , agreed to try a modification of the conventional seed distributor on a light plane. This modification changed the long narrow opening in the seed hopper to 3 smaller rectangular openings that permitted longleaf seed to flow out at a uniform rate. Since then this firm has seeded several thousand acres with high accuracy. The work also demonstrated that seeding can be done rapidly with a light plane capable of carrying about 120 pounds of seed.

Especially with a light plane it is desirable to have a landing strip available on or near the area for greatest efficiency. Several landowners have graded dirt strips in the center of the area to be seeded, and the cost is largely defrayed by a lower charge for seeding. The cost of aerial seeding during the past season ranged between $0. 50 and $0. 88 per acre, depending on the size of the project and the proximity of a landing strip. (These costs are for seeding only, and do not include supervision or the labor required to load and flag the plane.)

Evaluation

The success or failure of a seeding project is relatively easy to determine. Stocking can be estimated from a regular milacre-plot inventory made during March or April of the first season. A reexamination after the first summer is also necessary to measure the extent of summer mortality.

Finding the cause for failure is often a difficult task. Although birds have been the principal problem in longleaf seeding, other biological agents will cause trouble in certain areas. Unusual numbers of town ants, raccoons, or rabbits can reduce stocking severely. Climatic conditions or poor seed quality may be responsible for some failures. Therefore, we urge foresters who are seeding to examine their areas frequently during the germination period, and to install special observation plots where they can detect any unusual damage to seed or seedlings.

It is timely here to mention the effects of grazing. At present the interest in seeding has outstripped the landowner's willingness to fence. Consequently, some seeding has been done under open range conditions and we are watching these areas with interest. Grazing damage caused the failure of several large seeding projects in the past. The best seeded longleaf stand6 today are on areas that were protected from grazing at least for the first few years. Usually, grazing damage occurs slowly over an entire season, and may easily go unnoticed until heavy losses have been sustained. Therefore, we can only point to the contrast between grazed and ungrazed areas as the best argument for protecting seeded areas from grazing until height growth starts.

CONCLUSION

Through the combined efforts of research foresters, biologists, and landowners, direct seeding has been developed into a reliable means of regenerating long leaf pine. Although some of the difficult problems are behind us, others remain. Rodents, for example, have been discounted as of minor importance in fall seeding. We are learning, however, that their populations build up rapidly during the winter. In recent tests, serious seedling losses were incurred during a short period in January. We are not sure that rodents were responsible. If they were, some method of control must be worked out for is to get optimum stocking from our seed supply.

The demand for longleaf seed will probably exceed the supply for several years to come. We feel sure, however, that if direct seeding creates a steady demand for seed, collectors will have the incentive to set up the facilities needed for handling cones and seed in large quantities.