NOT FOR THE BIRDS

Morkit, a chemical bird repellent, solves the most difficult problem in direct-seeding longleaf pine.

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Morkit, a dull gray powder that is repellent to birds, may remove the greatest obstacle to successful direct seeding of longleaf pine.

In the past, many Louisiana landowners have tried to restock their longleaf lands by sowing pine seed directly in the field--in contrast to the usual procedure of planting 1-year-old stock grown in a nursery. Most of these direct-seeding attempts failed, largely because there was no practical way of preventing birds from eating the seed.

Resident and migratory birds concentrate in November, when conditions are best for sowing, and usually cause heavy losses or even complete failure in a few weeks. Patrolling the seeded area during the germinating period reduces bird depredations, but it is expensive and never fully effective. A satisfactory bird repellent that can be applied to the seed would make seeding more reliable and reduce the quantity of seed required to establish a stand.

Tests Give Excellent Results

The Alexandria Research Center of the Southern Forest Experiment Station, working in cooperation with the U. S. Fish and Wildlife Service, has been seeking such a repellent for several years. One of the first tasks was to find a sticker or adhesive--a substance that would make repellents adhere to the seed. The Fish and Wildlife Service solved this problem by suggesting asphalt emulsion, a roofing compound that resists weathering and does not harm the seed.

A long series of tests were conducted with various chemicals and colored seed coatings, mostly suggested and furnished by the U. S. Fish and Wildlife Service. At Alexandria, coloring the seed failed to protect it, even though certain colors have been found highly repellent in other regions of the country. The chemicals most effective were two anthraquinone compounds, Morkit and sublimed synthetic anthraquinone.[1/] Caged meadowlarks repeatedly refused to eat seed coated with these substances.

Anthraquinone is used in the manufacture of photographic formulae, dyes, and laxatives. Morkit, a mixture of this chemical and inert ingredients, is manufactured in Germany specifically as a bird repellent. It has no distinctive taste or odor, and the manner in which it acts to repel birds remains to be discovered. It is not known to be harmful to livestock, wildlife, or humans. There was no sign in any of the tests that it caused the death of birds.

In the fall of 1953, after the trials with caged birds, longleaf pine seed coated with Morkit and the synthetic preparation was sown on 1/4-acre test plots near Alexandria. Sowing rate was the usual one of 3 pounds (about 12, 500 seeds) per acre. The seedbed was a 1-year grass rough. Sowing was deliberately delayed until December, when birds would be numerous. The plots were not patrolled.

The test was a distinct success. Seed treated with Morkit yielded 4, 500 seedlings per acre, and untreated seed only 195. The synthetic anthraquinone, which was tried in a location different from the one where Morkit was used, gave 3, 778 seedlings per acre as against 1, 778 seedlings for untreated seed. Meadowlarks and several species of sparrows were the chief seed eaters. They took more than half of the untreated seed, but ate only 6 percent of that coated with Morkit and 9 percent of the seed treated with the synthetic anthraquinone.

In November 1954, a similar study was conducted to try Morkit and Quinizarine, another commercial anthraquinone compound. Low rainfall during November and December prolonged the germination period, giving birds a greater opportunity to take seed. The two chemicals proved about equally effective, each yielding approximately 3, 000 seedlings per acre. Untreated seed produced only about 250 seedlings per acre, since the birds ate 90 percent of the seed in 1.1 days.

In 1954 also, the Hillyer-Deutsch-Edwards Lumber Company of Oakdale, La., cooperated in testing Morkit on about 200 acres. Sowing was done on a light rough in late November. Only treated seed was used, so no comparison with untreated seed was obtained. Despite dry, severe weather conditions during the germination period, the seedling stand averaged 3,156 per acre with 76 percent stocking. Although many species

1 / The authors are grateful to John Kuprionis of the Louisiana Polytechnic Institute for suggesting Morkit and for furnishing the initial sample. The U. S. Fish and Wildlife Service suggested the other anthraquinone compounds.

of birds were observed in large numbers on this area, seed losses to birds were negligible. Stomach analyses of birds collected on the area showed that only a small proportion had eaten seed, and none in the quantities found in previous tests with untreated seed.

These tests are, of course, not conclusive. More trials will have to be made before all the capabilities and limitations of Morkit are known. Meanwhile, early results are so promising that many landowners are interested in trying the chemical themselves during the fall of 1955.

Suggestions for Using Morkit

Although the anthraquinone compounds so far tested have shown excellent repellent properties, Morkit is the least expensive. It costs 40 cents per pound, in contrast to sublimed synthetic anthraquinone for 88 cents and Quinizarine at $2. 15.

Longleaf seed can be coated with Morkit for 15 cents a pound. This cost includes all labor and materials, including the asphalt sticker. [2/] One pound of Morkit is enough for 4 pounds of seed. The asphalt emulsion costs about a dollar per gallon; one part by volume is mixed with three parts of water, and 6 gallons of the mixture will treat 200 pounds of seed. Labor costs will vary, but two men can treat about 800 pounds of seed daily.

The necessary equipment can be easily made from two 55-gallon steel drums. The picture shows the rig built by the HillyerDeutsch-Edwards Lumber Company. The drum on the right has the top removed and is used to apply the sticker. The fine-meshed, heavy wire basket is about 20 inches deep. It holds the seed (Photo-La. Forestry Comm.) when it is dipped into the sticker.

2/ Not all asphalt roofing compounds are suitable as stickers. The asphalt must have a clay additive. One satisfactory compound is C-13-HPC, manufactured by the Flintkote Company.

The other drum is used to apply the Morkit. It is mounted on an axle so that it tumbles end-over-end when the crank is turned. A single set of baffles is welded inside the drum to help mix the seed and Morkit. A removable, tight-fitting cover is also needed.

The asphalt sticker is first mixed with water in the dipping drum; it has to be stirred until all lumps disappear. Then about 35 pounds of seed (with wings removed) is put into the basket and lowered into the sticker. In 2 or 3 minutes, when the seed is thoroughly coated, the basket is pulled up and the surplus sticker allowed to drain off.

Next, the seed is emptied from the basket into the tumbler and Morkit is poured over it and mixed in with a wooden paddle. The cover is then closed tightly and the drum rotated for about 3 minutes, after which the coated seed is spread out on a canvas to dry for several hours. It can be sown as soon as it is dry enough to handle.

Although Morkit seems very effective against birds, it does not repel other seed-eaters. This means that safeguards against rabbits, rodents, and other animals must be maintained. Moreover, until Morkit is tested more fully in large-scale operations, the recommended longleaf seeding rate of 3 pounds per acre should not be reduced.

AN IMPROVED CYLINDRICAL SEED SPOT SCREEN AND SETTER

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The usual method of protecting seed spots against rodents is by use of cone shaped screens of galvanized hardware cloth. These wire cones are well adapted to Lake States conifers but not to oak and larger leaved or fast growing species, because the cones have very limited space for normal lateral development of leaves and are difficult and slow to set in the field and to keep free of weed growth.

An improved seed spot screen was designed especially for oak. It is made in the shape of a cylinder 8 inches high and about 6. 9 inches in diameter (figure 1). A flat cap of 8- x 8-inch hardware cloth is held in places with two or three 12-inch galvanized wire pins of No. 10 gage.
A special tool was devised for setting the cylindrical screens. The tool consists of a cylindrical band of quarter-inch iron, 3-1/2 inches high, welded to a pipe to make a tool 48 inches long (figure 2). The setter is thrust into prepared ground vertically to a depth of 1 to 2 inches and pulled out, and the screen cylinder is inserted into the circular slot in the ground and firmed by a few tamps of the heel.

The cylindrical screen has these advantages over cones: (1) It permits normal development of leaf and stem of larger seedlings such as oak. (2) It is easier to set to greater depths, with or without a setting tool,
than a cone because of having vertical sides. (3) Examinations, counts and eradication of weeds can be done more quickly and easily by merely pulling out the pins that hold the cap in place. (4) Since the cylinder itself is not disturbed in counts or weeding, it remains firmly seated in the soil. A removed cone, however, must be carefully reset in a scooped-out ring, and the soil again refirmed on the outside after each examination or weeding.

A larger cylinder--19.15 inches in diameter by 24 inches in height--is used in studies of the reproduction of yellow birch and similar species when rodent protection is needed for 3 or more years.

The several types of cylindrical screens discussed here are especially useful in experimental work which has as its objective the appraisal of rodents as a factor in the failure of direct seedings.

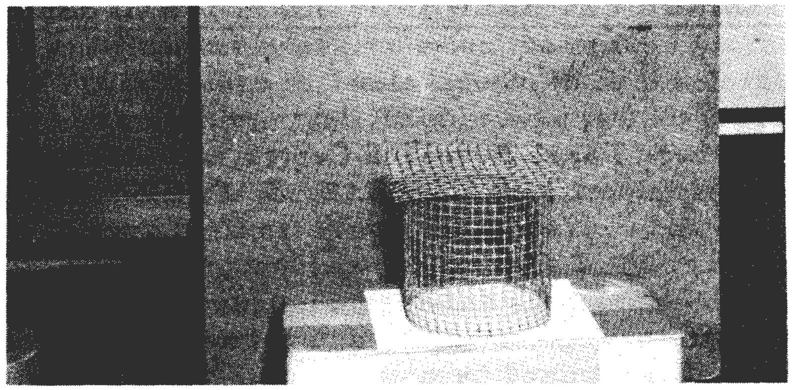

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Figure 1. — The cylindrical seed spot screen with cover.

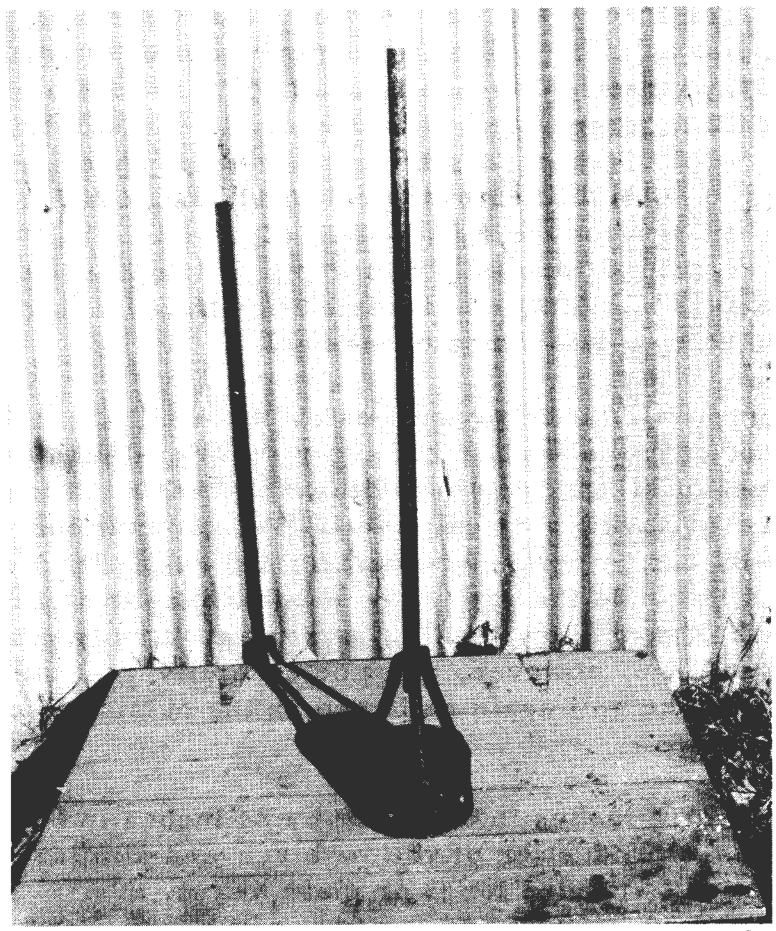

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Figure 2. — Tool for setting the cylindrical screens in the field.

ROOT-ROLLED SEEDLINGS

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The present trend toward increased efficiency in work of all kinds has brought about widespread efforts to improve both machine and hand planting methods. However, an analysis of field planting operations still shows this weak link: the loose roots of the planting stock-particularly coniferous stock--reduce the efficiency of both machine and hand planting. This loss is especially significant in machine planting where the loose roots prohibit automatic feed.

To strengthen this "weak link" why not roll the roots like a cigarette? The writer tried this method in March 1953 near Lafayette, Indiana.

One hundred Scotch pine seedlings (2-0) with 4- to 5-inch tops were "root rolled." The roots were pruned to about 4 inches and rolled with a small amount of moist vermiculite in 5- by 5-inch squares of waxed freezer paper (heavy kraft paper should do as well), much as one would roll a cigarette to form a roll of 1- to 1-1/4-inch diameter. The paper was crimped with the fingers at the top of the roll and folded and stapled at the bottom. After the seedlings were rolled, they were packed erect in a shallow cardboard box in which they were left in a shaded spot for 2 days. During this time no watering was necessary.

Hand planting the rolled stock was simple and fast. A 1-inch pipe with a stop to gage the depth of the hole was forced vertically into the ground, and the rolled seedling dropped into the hole and firmed in place with the heel. As this operation is performed, the imagination is stirred with the possibilities of machine planting the stock with an automatic feed!

As a check 100 unrolled Scotch pine seedlings were planted with a planting bar. These seedlings came from the same lot as the rolled ones.

After one growing season the following were the results: 71 of the 100 rolled seedlings survived; 73 of the 100 unrolled seedlings survived. Statistically the difference probably is not significant.

About ten rolled seedlings that survived the growing season were dug up and examined. In all the paper had rotted away; the vermiculite had somewhat diffused into the soil, and the roots showed normal development.

Although this idea is merely an extension of pot transplanting, the writer believes it has far more possibilities. To fully realize the possibilities this procedure should be followed: 1. Devise an automatic rolling machine to root-roll planting stock. 2. Make a "magazine" that will automatically feed the rolled seedlings (or transplants) on conventional planting machines. (Of course, there are possibilities for developing different, and perhaps better planting machines for handling rolled stock.) 3. Make a semi-automatic hand planting contrivance to plant rolled stock. 4. Investigate the use of nutrient solutions to moisten vermiculite.

A SIMPLE DEVICE FOR MAKING PAPER POTS

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A simple hand-operated machine for making pots from common roofing paper was devised at the U. S. Southern Great Plains Field Station in 1936. Its principal parts are a wooden block to force a previously cut strip of roofing paper (Figs. 1 & 2) into a mold and makes it U-shaped. The parts of the strip protruding above the block in the mold are then creased by folding them over the block (Fig. 3). The device is built permanently into a rough table and has a foot treadle with a spring release for raising the block out of the mold (Fig. 4). After the paper-wrapped block is raised from the mold, the creased paper is slipped off and the overlapping parts are fastened together with a common hand stapler such as can be bought at any stationery store. The bottom of the pot is formed by making at one end a cut of suitable length at each of the four corners with a small rose clipper and then interlacing the four tabs (Fig. 5).

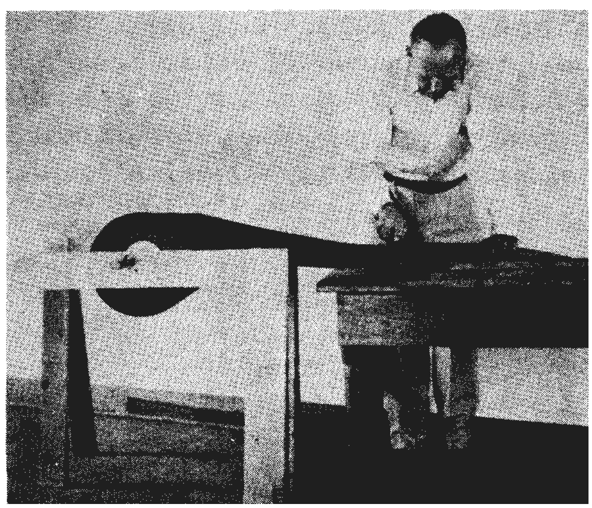

Figure 1. The cutting board has a guide made of two strips of metal spaced so that the paper can be inserted between them and an additional strip spaced so that it will serve as a groove for the point of the cutting knife. A 3/4inch strip of wood serves as a backstop 12 inches from the cutting groove. The photograph shows the 3-foot paper being cut into strips 12 inches wide.

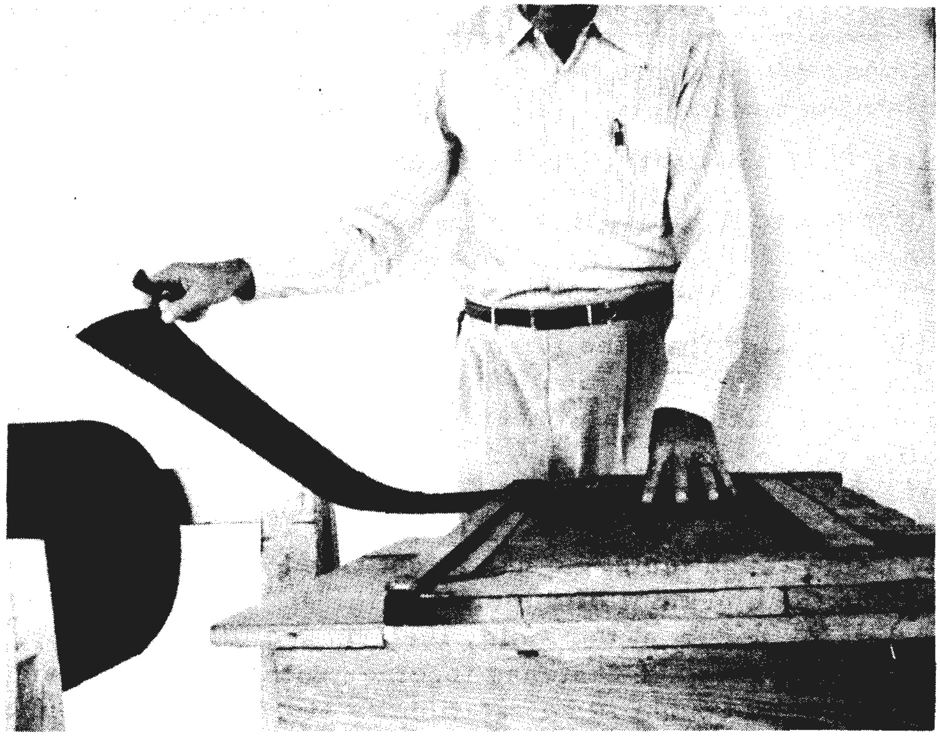

Figure 2. The 3-foot strip of roofing paper inserted into the cutting board ready to be cut into 12- x 12-inch pieces.

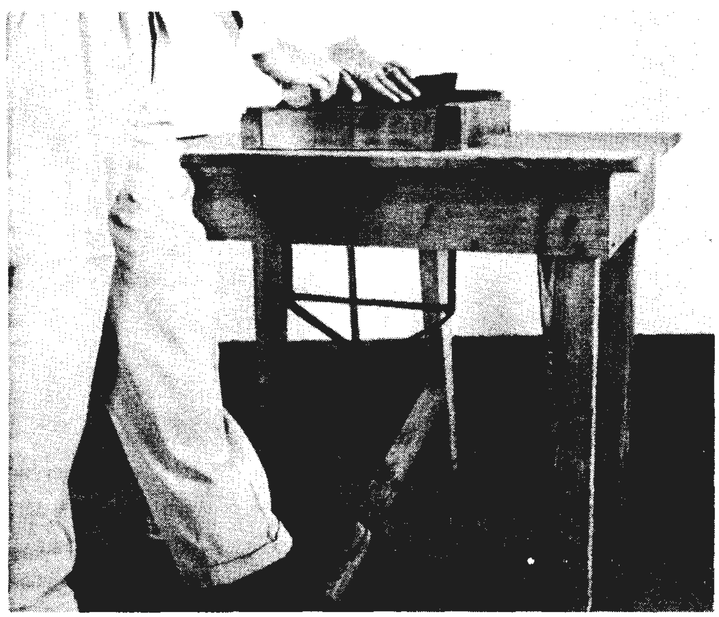

Figure 3. The creasing block in a depressed position. The top creases are being made by folding over the protruding paper and rubbing the creases with a small glass jar. Some other cylindrical object could be used.

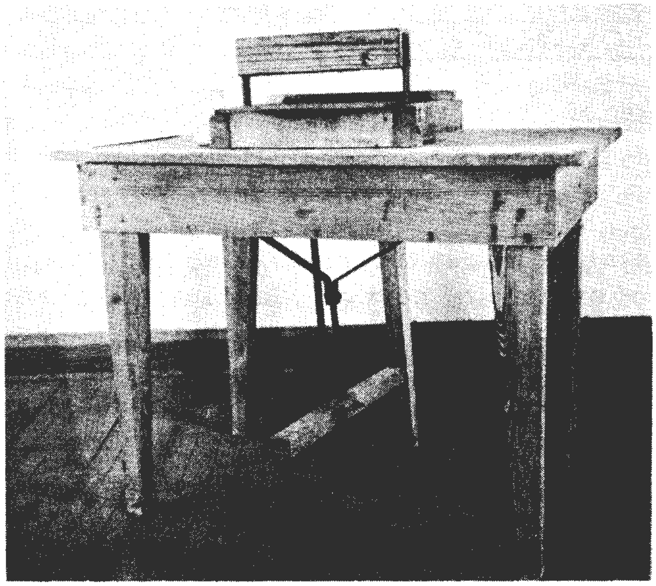

Figure 4. Rear view of the creasing device showing a 12-x12-inch piece of saturated felt in position to be creased. The creasing block consists of a piece of wood 2-3/4 x 2-3/4 x 12-1/2 inches. This block is attached to a "Y" made of 1/4 x 1 inch strip of metal that goes through the table and is attached to the foot lever. The opening on the top of the table is 3 x 3 x 12-3/4 inches to allow for the thickness of the 15-pound paper. In front of the opening there is a 1 x 2 inch strip of wood that serves as a backstop to hold the paper in the proper position for creasing. A door spring is attached to the lever to raise the creasing block.

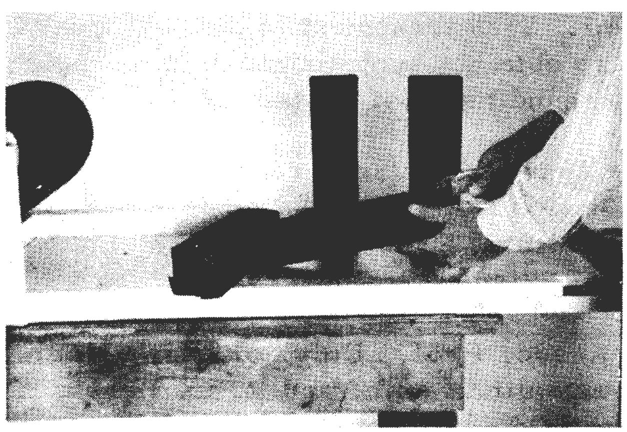

Figure 5. After the edges of the folded paper are stapled, a small rose clipper having a 1-1/4-inch cutting blade is used to make the cuts at one end of the paper form to permit folding to make the base of the pot.

PROTECTING MACHINE TRANSPLANTED TREES FROM WHITE GRUBS [1]

R. D. Shenefelt, H. R. Liebig and R. C. Dosen[2]/

The ravages of white grubs in forest tree nurseries can be readily controlled by applications of any one of several chlorinated hydrocarbon insecticides such as aldrin, chlordane, or heptachlor. These treatments are preventative and should be applied before the damage has started, the treatment being designed to kill the grubs shortly after they hatch (Shenefelt and Simkover 1950, 1951).

White grubs often destroy large numbers of trees set in the field (Stoeckeler and Limstrom 1942, Rudolph 1950), but methods for their control in the planting area are not yet established. Protection of field transplants from attack by grubs presents several unique problems. Some of the differences between field and nursery problems are:

1. In the field the grub population is already established, and the object is to provide the trees with immediate protection against root destruction by voracious second and early third instar grubs. Since the trees may be subjected to immediate attack, the insecticide must be toxic enough to produce a quick kill of large grubs, or it must possess such a high degree of repellency that the grubs will leave the immediate area.

2. In the nursery the high value of the crop and the methods of cultivation allow a broadcast treatment with subsequent working of the insecticide into the soil. Such treatment is not practical in the field where the problem is to obtain a spot distribution of the insecticide in the soil immediately around the root system of the tree as it is set.

1 / Published with the approval of the Director of the Wisconsin Agricultural Experiment Station. Results of a cooperative project involving the Wisconsin Agricultural Experiment Station, the Nekoosa-Edwards Paper Company, and the Wisconsin Conservation Department.

2/ R. D. Shenefelt: Assoc. Prof., Univ. of Wis., Madison; H. R. Liebig: Woodlands master mechanic, and R. C. Dosen: forester, Nekoosa-Edwards Paper Co., Wisconsin Rapids, Wis.

Various methods of treating the grubs in the field have been attempted and include dipping the roots and broadcast treatments. Dipping provides very little carryover of insecticide unless concentrations are high. Furthermore it places the insecticide on the roots only, and thus does not protect the young rootlets that grow out into the soil. In addition, it is difficult to dip the stock in the field, since it requires carrying a bucket for dipping just before planting. If the roots are dipped before the trees are placed on the planter, most of the liquid drains away. Dipping has been quite successful, however, in certain experiments. Broadcast treatments treat much more area than is actually necessary and do not place the insecticide around the root system where it is needed.

Dusts cannot be used satisfactorily in conjunction with a machine planter because of the position in which the planter must sit to do his work. Dust puffs released around the tree as it is being set would swirl up into his face. A properly directed spray, however, does not have this disadvantage.

A simple device, designed to produce a spot distribution of insecticide on the roots of field transplants and in the soil immediately around the roots, is illustrated in the photograph and diagram (Figures 1 & 2).

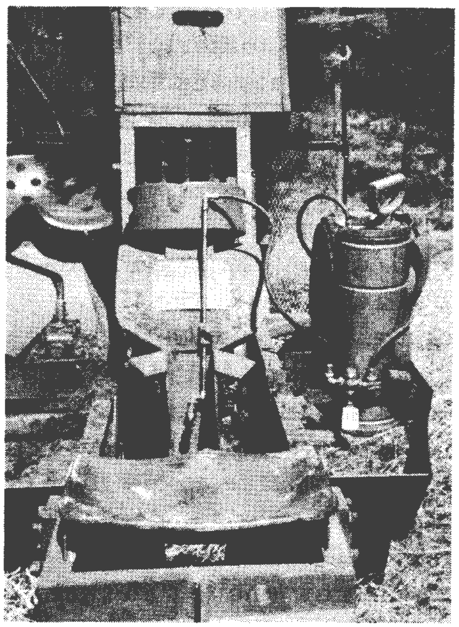

Figure 1. Sprayer ready for operation.

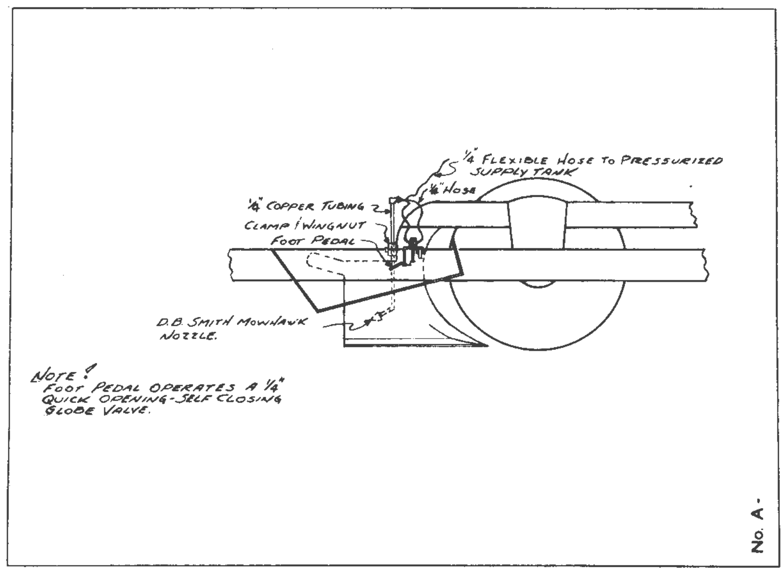

Figure 2. Diagram showing relationship of sprayer and planter parts, drawn from right side. (Courtesy Nekoosa-Edwards Paper Co.)

A 3-gallon pressure type knapsack sprayer was set in the front of the foot box of the planter where it fitted snugly between the brace and the end. (The tank might well be placed above the shoe just back of the planting box in a frame.) The hose of the sprayer was replaced with a flexible, 1/4-inch, oil-resistant hose about 3 feet in length leading to a foot-operated valve. To this valve a tight U-shaped piece was attached with the open end pointing downward so that it might be slipped over the brace to hold the foot pedal in proper position. From the foot valve another hose about 2 feet long was connected to the sprayer rod. This length was sufficient to allow for changes which occurred when the shoe was lifted or lowered. The spray rod was held to the front part of the shoe by two small pieces of metal with a V-shaped groove in each. The first of these was brazed off center to the upper part of the shoe on the front face and had a bolt in it. The second piece had a hole through which the bolt passed. By placing the spray rod in the grooves and tightening a wing nut, the rod was held readily at the desired height and with the nozzle pointing in the correct direction. The nozzle was placed on an offset attached to the lower end of the rod. ,This offset brought the nozzle to about the middle of the shoe and also enabled the vertical angle of the spray to be controlled.

An Indian fire pump nozzle was used since it had the required large output and the width of the spray cone could be adjusted. Nozzles with small bores were found to pass an insufficient amount of material in the time interval required and to have a lag or drool, i.e., the time required for reduction of pressure was too great and a dribble resulted. The nozzle should deliver about 8. 5 m. at a discharge if 2-1 /2 gallons of spray material is to be used per 1, 000 trees.

In practice the sprayer was tested by four men. All four experienced a little difficulty at first in coordinating the foot action with the time of planting and all held the "throttle" down too long at first with the result that only about 400 trees were treated with the first 2-1/2 gallons of spray material. However, it soon became almost automatic to press the foot pedal at the correct time to spray the tree roots and the ground around the space into which the tree was to be set, and the men quickly learned that only a slight, quick pressure was needed.

The nozzle was adjusted to deliver a cone spray narrow enough so that it did not touch the shoe but covered the roots and ground a little in front of the packing wheels. By directing the nozzle downward at the proper angle it was not difficult to avoid getting the spray on the hands. However, rubber gloves were worn as a precaution. It was necessary to repump the tank once during the expenditure of each tank of spray.

The apparatus described is. simple, inexpensive, requires practically no modification of the planter, can be used on any shoe type planter, and can easily be installed or taken off the planter.

The insecticide used in this work was an aldrin emulsion at a concentration of 1/2 of 1 percent.

It is the opinion of the senior author that this spraying device should be used whenever the grub population is one or more per two square feet. "'At two grubs per square foot, the resultant damage has been so great and survival so poor that it was recommended that planting of such areas be delayed (Rudolph 1950). In areas where May bettles are present, which have a life cycle of 2 years or less, it may be advisable to treat the trees even though no grubs are present, since wide spread damage may occur the same year as the flight of such species.

The sprayer described might also be used for other purposes, such as applying fertilizer as the trees are transplanted.

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PROPOSED SAFETY RULES FOR THE OPERATION OF MECHANICAL TREE PLANTERS

Deschutes, Whitman and Fremont National Forests

Region 6, U. S. F. S.

The Deschutes, Whitman, and Fremont National Forests in Oregon have drawn up the following safety rules to govern the operation of mechanical tree planters. Alterations have been made in these rules as a result of suggestions by Regions 6 and 9, and their eventual inclusion in the Forest Service Safety Code is proposed after further testing. Suggestions for additional improvement are invited and should be sent to TREE PLANTERS' NOTES.

The machine shall be provided with foot guards, which will completely cover the bottom and sides of the feet. These guards should be checked frequently for signs of breakage or other damage.

A heavy screen guard shall be attached to the planter, which will protect the operator when planting is being done in heavy brush.

If planting is being done in areas of log, brush, or other rough terrain, the machine that pulls the planter shall be equipped with a blade such as a V-shaped blade or angle dozer.

Signal devices shall be provided, either buzzer type, rope pull, or other effective signal between the machine operator and the tractor driver. The signal for a stop shall be definitely understood by both operators. As an alternative, a device may be installed on the planting machine that allows the machine operator to disengage the master clutch on the tractor pulling it, or that releases the planting machine from the tractor in case of emergency.

Operators shall wear close-fitting clothing, hard hats, and goggles or other adequate eye protection, if the machine is not adequately screened for this purpose.

Operators shall watch for sticks, logs, or brush that my poke up through any openings in the machine.

PLANTING TRIALS WITH TRANSPIRATION RETARDANTS IN CALIFORNIA

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California Forest & Range Experiment Station [1], U. S. F. S.

For at least 20 years foresters have been experimenting with methods designed to reduce transpiration from planted conifers. The object is to decrease the water requirement of the plants until the root systems become adjusted to their new environments and are able to supply enough water for the trees to survive. Despite the fact that relatively few clearcut instances of success have been published, considerable enthusiasm for use of transpiration retardants exists. For example, TREE PLANTERS' NOTES presented an article on the subject a few years ago.[2]

This report describes the results of five experiments with three commercially manufactured transpiration inhibitors--an emulsified wax, a vinyl latex, and lanolin--at the California Forest and Range Experiment Station. Since the results were largely negative or inconclusive, our purpose is to report that we question whether the transpiration retardants as ordinarily applied to lifted trees are consistently beneficial in California.

Experimental Trial

The first four experiments were purposely conducted under difficult conditions--either on difficult planting sites or with stock of low vitality. The last test planting was with good stock on a good planting site. We reasoned that only under rather difficult conditions could beneficial effects of the treatments be demonstrated. On favorable planting sites with good stock we ordinarily expect that 80 or 90 percent of the trees will survive the first year, and hence comparatively little

1/ Maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of California, Berkeley, California.

2/ Maguire, W. P. Some observations on the use of the transpiration inhibitor "Plantcote" on lifted tree seedlings. Tree Planters' Notes No. 12, pages 15-17. November 1952.

further improvement would be expected. The five experiments were as follows:

1. In the spring of 1949, 1-1 ponderosa pine stock was top dipped in mixtures of 1 part emulsified wax to 2 parts water and 1 part emulsified wax to 4 of water. Each treatment and the control contained 500 trees. They were field planted in 10 randomized blocks on a dry south slope in the Plumas National Forest.

2. The next spring 1-1 Jeffrey pine stock, of rather poor quality, , was treated with emulsified wax and with vinyl latex in water at concentrations of 1 to 2 and 1 to 4. There were 125 trees in each of the concentration levels of the 2 compounds and in the control. They were planted in five randomized blocks on a good site on the Stanislaus Experimental Forest.

3. In the fall of 1950 and spring of 1951, 1-1 sugar pine stock was top dipped with emulsified wax and with vinyl latex in concentrations of 1 to 2, 1 to 4, and 1 to 6. This stock had very poor root systems, resulting from damage by white grub and from attempts to control the insects. Each treatment method and the control was represented by 125 trees in the fall and in the spring. The stock was out-planted in a randomized block design on the Stanislaus Experimental Forest.

4. In the fall of 1953, 1-1 ponderosa pine stock was immersed in water containing 4 percent lanolin and 1 percent soap. The soap was used as an emulsifier. The planting test contained 2, 400 trees—half of them were dipped in the lanolin solution and the other half used as controls. The trees were stored over-winter in a refrigerator at 34°F. and field planted the following spring on a difficult site in the Modoc National Forest.

5. The last test, conducted during the fall of 1953 and spring of 1954, was a comparison between 1-1 ponderosa pine stock stored overwinter and spring-lifted stock field planted on a good site on the Trinity-Shasta National Forest. Shortly after lifting, half of the stored stock and half of the spring-lifted stock were immersed in a lanolin solution of the same concentration as in the above experiment. The test planting contained 2, 000 trees in 10 randomized blocks.

Experimental Results

None of the treatments with transpiration retardants were very effective in increasing survival. In the first test, survival of untreated ponderosa pine stock at the end of the first year. was 21 percent; of stock dipped in a 1-2 mixture of emulsified wax, 16 percent; and of stock dipped in a 1 to 4 mixture, 21 percent.

In the second trial the survival of poor quality Jeffrey pine stock appeared to be increased by treatment with each transpiration retardant, as shown in the tabulation below:

Treatment	First-year survival (percent)
Untreated	10
Vinyl latex 1:2	20
Vinyl latex 1:4	28
Emulsified wax 1:2	16
Emulsified wax 1:4	28

However, owing to the great variability within individual treatments, differences as great as these could have resulted from chance alone.

The third trial, with sugar pine stock, showed no consistent responses to the transpiration retardants. The following tabulation suggests that same treatments assisted in increasing survival, but again the differences were not significant.

In the fourth test, with stored ponderosa pine stock, an examination made about 3

Treatment	Survival Fall-planted (percent)	Survival Spring-planted (percent)
Control	14	25
Vinyl latex 1:2	20	27
Vinyl latex 1:4	28	13
Vinyl latex 1:6	16	24
Emulsified wax 1:2	11	23
Emulsified wax 1:4	15	22
Emulsified wax 1:6	16	36

months after planting indicated a substantial benefit from the lanolin treatment--80 percent survival for lanolin-dipped stock compared to only 37 percent for the untreated. However, by the end of the first growing season, even though the lanolin treated trees still showed better survival--13 percent compared to 2 percent, the difference in survival was of no practical importance.

In the last test planting, with stored and fresh-lifted ponderosa pine stock, untreated fresh-lifted stock had the highest survival (75 percent) and stored stock which had been dipped in lanolin had the lowest survival (46 percent),. Survival of lanolin treated fresh-lifted stock was 68 percent--77 percent lower than the untreated control. Survival of the untreated stored stock was 52 percent--23 percent lower than the control.

Negative results such as those reported here, of course, do not prove that transpiration retardants cannot be beneficial if the right materials, methods, or conditions are discovered. The results do indicate, however, that further investigation is needed before general application is warranted.

TESTS OF A TRANSPIRATION INHIBITOR

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The State of Victoria has some 41, 000 acres of exploitable, government owned and administered softwood plantations of which *Pinus radiata* D. Don is the major species.

There are about 12 small nurseries operating at the present time. In the past owing to the inability of a local nursery to supply local departmental and private requirements or because of losses or some other factor, it has been necessary to transfer relatively large quantities of nursery stock. The majority of stock raised for private sale and departmental use is 2 years old (1-year transplants), and seedling stock raised at one nursery may be shipped to another for another year of growth before being planted out in the field.

In the past considerable losses have been experienced in shipping stock. The species *P. radiata* does not stop growing through our relatively mild winter (May-August), and clear, sunny days with air temperatures of up to 68° F. are not rare. The rapid growth phase of *P. radiata* begins in early August. Normally both field and nursery planting begins in May or June and ceases by mid-September but may go on into early October. Thus, it is quite possible that stock may be shipped while in its rapid growth phase, or that stock may encounter periods in midwinter when weather conditions are conducive to rapid transpiration.

Last season two trials were conducted to examine the effects of a transpiration inhibitor S/V Ceremul 'C'. First-year seedlings were used in both trials. In the first trial, stock from Nursery 1 only was used. In the second trial, stock from both Nurseries 1 and 2 was used; the stock from both nurseries was raised from the same seed batch and was sown on the same date. The two nurseries are 3-1/2 miles apart, and differ by 1,450 feet in elevation and also in soil type.

All stock was lifted by hand, graded, counted, tied into bundles of 50 and labeled with aluminum labels. The tops of the treated pines were dipped immediately after bundling into a 1 in 4 mixture of Ceremul 'C' and water, and then removed. The excess solution was allowed to drain while the remaining bundles were being prepared. The stock was then baled in the conventional U. S. Forest Service type bale using wet sawdust as the packing medium. For use in the first trial, four bales were prepared with an equal number of treated and control bundles in each bale.

On 5 July two of the bales were shipped by normal goods rail transport to another nursery. This railed stock was not delivered until 13 July and because of a severe frost was heeled in and not transplanted until the 14th. Also on 5 July the remaining two bales were shipped by road transport to the same nursery. This journey took 5 hours, but the stock was allowed to remain in bales until arrival of the railed stock; then both were transplanted at the same time.

On 25 August the above trial was repeated with the following differences: (1) Only two bales, each containing treated and control bundles, were dispatched; (2) no road transport-was available so the variant from Nursery 2 was added. Stock from this nursery is notoriously difficult to ship, and it was believed that a transpiration inhibitor would be really tested if it could raise the survival figures of this stock.

The stock dispatched in this second trial was received on 3 September and held until the 4th as was the first trial.

On 14 April after a very dry, late summer, the survival of the different classes of stock was assessed. The layout of the two trials had been statistically designed and the results were statistically analyzed. A summary of the results and the significance of these are given below.

	Bale	Survival		Average, all shipments
		Road	Rail	
Trial 1:	(number)	(percent)	(percent)	(percent)
Treated	1	90	88	89
	2	95	82	88
Control	1	95	96	90
	2	87	90	88
Average	-	92	88	89

	Survival		Average, all shipments
	Ex Nursery 1	Ex Nursery 2	
Trial 2:	(percent)	(percent)	(percent)
Treated	90	85	87
Control	87	69	78
Average	88	77	83

In Trial 1 statistical analysis indicates no significant difference in survival of treated or control pines. In Trial 2 survival of treated stock from Nursery 2 was significantly superior to that of untreated stock; however, there was no significant difference in the results of stock from Nursery 1 /

Thus, the use of the transpiration inhibitor was definitely associated with increased survival of the poorer quality stock from Nursery 2 and 4o some degree may have influenced the survival of stock from Nursery 1 .if the second shipment. The survival of stock shipped in midwinter was not influenced by the use of the transpiration inhibitor, and from an understanding of the normal development of the pine during this period, it is that transpiration inhibitors would be of little or no use. This theory may be confirmed or confounded by further trials especially those conducted during spells of warm winter weather.

When the trial was conducted during the early rapid growth phase, it appears at present that if the stock is of good quality and well baled, transpiration inhibitors may be of only moderate benefit. However, because of the low cost of the treatment, any consistent positive benefit may well be worthwhile.

PLANTING STOCK DROPPED BY AIR

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In the spring of 1953 a test was made by the Ontario Department of Lands and Forests to determine the feasibility of air delivery of trees packaged in bales. Burlap covered bales were prepared at the Kemptville Nursery, 1·6 inches in diameter to allow dropping through the camera hatch of departmental aircraft.

Over 10, 000 baled trees were dropped by 3 methods: by using 8- and 11-foot parachutes (figure 1), and by free-dropping (figure 2). In addition baled trees were transported by boat and packed overland to the planting site. These trees were to be used as a "control" planting to compare their survival with that of the trees dropped from the aircraft.

The planting site was laid out in the form of a grid with 16 square plots. The three types of air delivery and the "control" delivery were each assigned 4 plots at random.

To date there is no significant difference in survival of the trees delivered by the different methods.

Free-dropping is better than parachute dropping because it is more accurate and eliminates the cumbersome and apparently unnecessary parachute. Parachutes frequently get caught on trees and are hard to recover. Flying time was reduced to a minimum when parachute handling and fastening of static lines was eliminated.

Figure 1. - Bale and parachute.

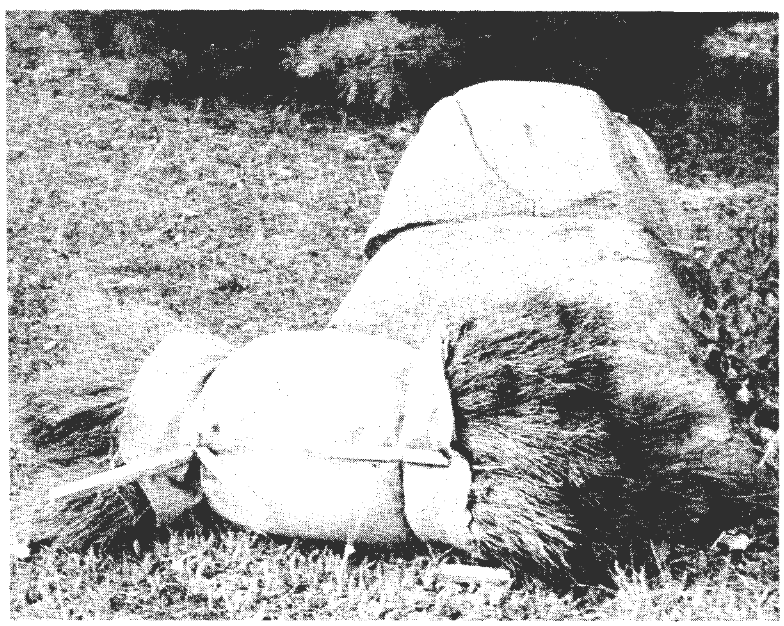

Figure 2. - Free-drop bale in final resting place after hitting base of large stump, bouncing 30 feet in the air, and crashing into rock in background. No trees were broken; almost every tree grew.

SEEDBED DENSITY AFFECTS LONGLEAF PINE SURVIVAL AND GROWTH

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Is the usual nursery bed density of 30 seedlings per square foot too high for spring-sown longleaf? A test in 1953 indicates that there is a substantial gain in survival and first-year growth of outplanted seedlings when seedbed density is decreased from 30 to 10 per square foot. These results are similar to the findings of Scarbrough and Allen-[1]/ in south Mississippi.

A 90-foot section of a bed at the Stuart Nursery, Pollock, La., was thinned to precise densities of 10, 20, and 30 seedlings per square foot soon after germination was completed. The bed then received normal nursery culture. When the seedlings were lifted for outplanting, their root-collar diameters averaged 0.41, 0. 33, and 0.28 inch for the 10-, 20-, and 30-density levels, respectively.

In June the initial survival of outplanted seedlings was exceptionally high, averaging 98 percent for all densities. After the first growing season, however, there were highly significant differences between density levels in both survival and seedling vigor, as shown below:

	Survival		
Nursery density	First-year (percent)	Vigorous (percent)	Vigorous, per 1,000 plantable seedlings (number)
10	77	81	622
20	71	45	319
30	58	28	162

These data indicate that the current practice of growing spring-sown longleaf seedlings at densities of 30 or more per square foot does not produce planting stock capable of highest survival.

Of greater importance, perhaps was the effect of seedbed density on first-year vigor. The yield of survivors with sufficient size and vigor to start height growth in 1 or 2 more years increased twofold when bed density was cut from 30 to 20 per square foot. It nearly doubled again when the nursery density was further reduced to 10 per square foot.

If additional tests now underway confirm these findings, better survival and faster initial growth of longleaf seedlings produced at lower densities may easily offset the higher nursery costs.