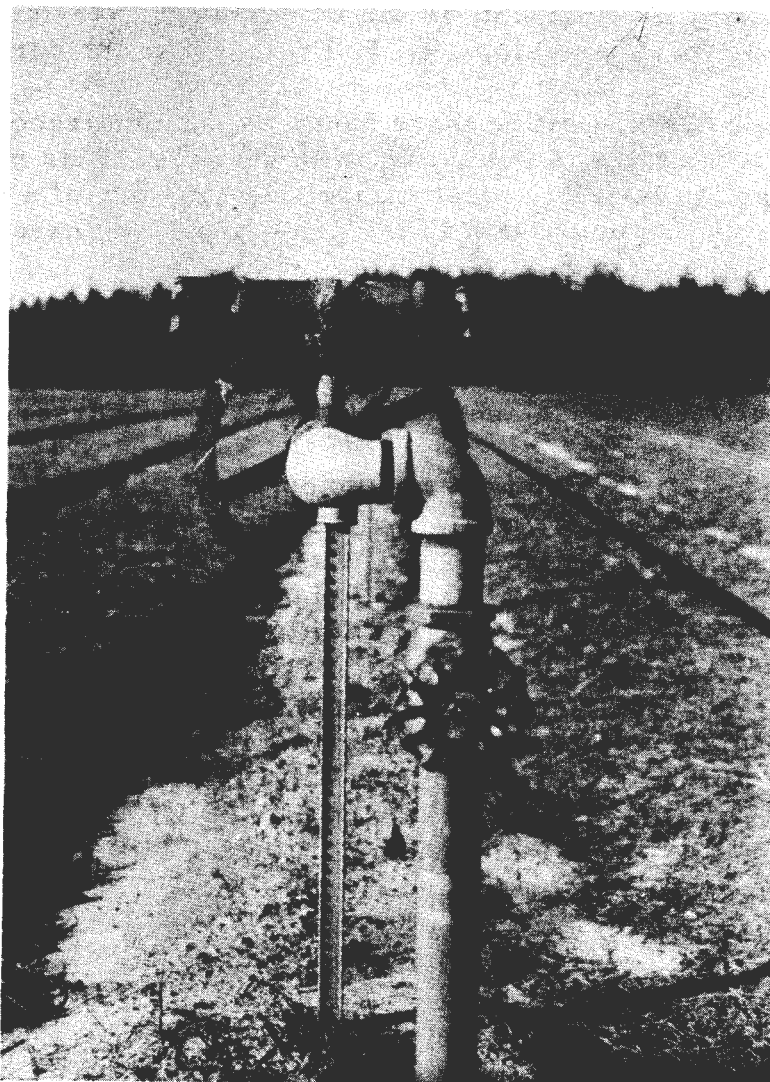


METHOD OF INSTALLING OVERHEAD LINES ON A SLOPE

G. F. Erambert

Nurseryman, Ashe Nursery, U. S. Forest Service Brooklyn, Mississippi

Would you like to run an overhead irrigation line down hill? D. J. Walters, Nursery laborer at Ashe Nursery, found a simple solution to the problem Offset the line and its oscillator and connect it to the riser line with a street ell and a regular ell as shown in the picture. Your line can then be placed at any desired angle without unusual strain on the oscillator.



SAFETY AND NURSERY OPERATION

To quote a phrase recently used on safety posters -

"Safety is no accident"

One nursery, where the planning to avoid injuring workers has been so complete and successful that it has operated for more than 51, 000 man days without a lost time accident, is the U. S. Forest Service's Ashe Nursery at Brooklyn, Mississippi. G. F. Erambert is the nurseryman.

On the wall of the nursery office there hangs an accident record meter used for the reason stated in the explanation below it. This meter with its three dials set at zero is a most compelling evidence of a successful safety program; and a record that is the pride of all who have had a part in it.

As is readily seen from a visit to the nursery, this record did not just happen-it came about because of the never-ceasing forethought and action taken by the Nurseryman and his helpers at Ashe Nursery.

"Safety is no accident"

Roland Rotty
Editor, Tree Planters' Notes



THIS METER HAS NEVER BEEN USED IT REGISTERS ONLY 999 DAYS SINCE THE LAST ACCIDENT. WHEN IT WAS INSTALLED SEPTEMBER 1949, WE HAD WORKED MORE THAN 1000 ACCIDENT FREE DAYS. THE TOTAL, DECEMBER 31, 1954, WAS 50061 WORKING DAYS WITHOUT A LOST TIME ACCIDENT TO EACH OF YOU GOES THE CREDIT FOR THIS SPLENDID RECORD. LET US KEEP THE METER AS A REMINDER OF OUTSTANDING SAFETY PERFORMANCE AND AN INCENTIVE TO GREATER EFFORT IN THAT DIRECTION. KEEP IT NEW-UNUSED-IT IS A SOURCE OF PRIDE. ONCE IT IS PUT IN USE IT WILL TAKE 999 ACCIDENT FREE WORKING DAYS TO PUT IT OUT OF COMMISSION.

SEED SOWING MACHINE

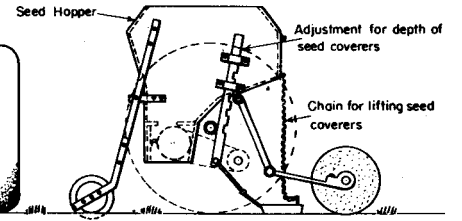
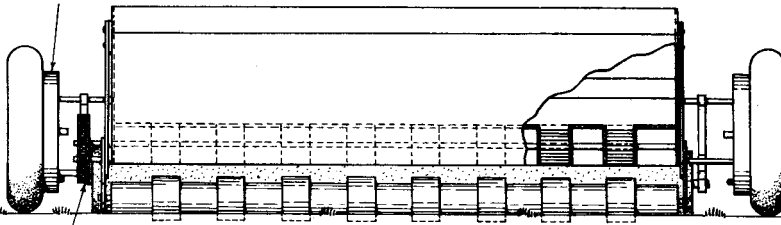
Karl B. Lanquist

Nurseryman, Mt. Shasta Nursery, U. S. Forest Service
McCloud, California

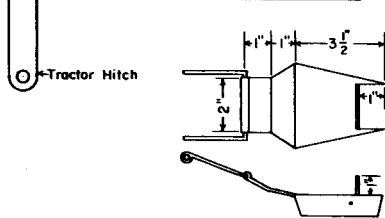
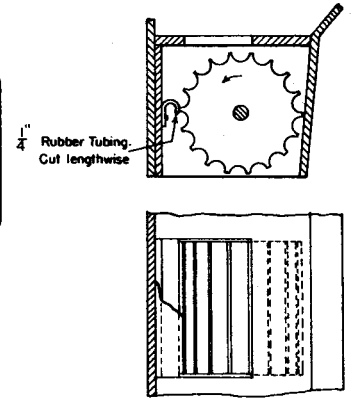
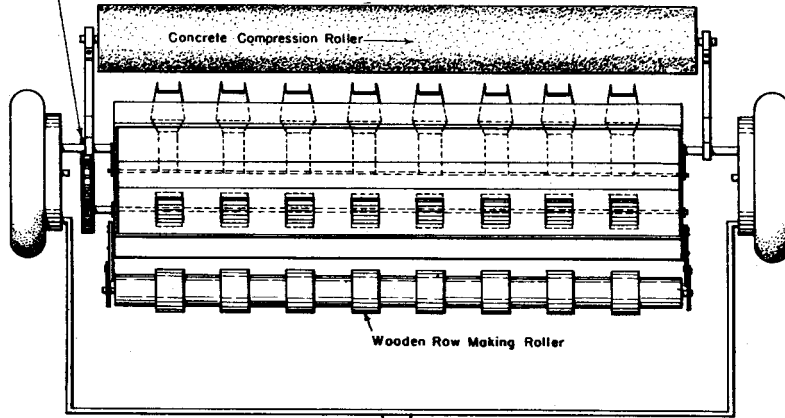
Here at Mt. Shasta we use an eight-row seeding machine which we built in our own shop. Some features of the machine which are not shown in the drawing are as follows:

1. The front roller or row maker makes 8 rows 2-1 /2 inches wide.
2. The rubber bumper in front of the fluted seed dispensers allows sowing of almost any seed from the largest size such as sugar pine down to the smallest size such as Douglasfir.
3. The covering devices are mounted and hedged independently of each other. This allows for differences in the roughness of seed beds and will do a good job of covering the seed.
4. The amount of seed to be sown per square foot is governed by changing the gear ratio. The machine is pulled with a wheeled tractor and will sow a 400 foot bed in 20 minutes.

Wheels, Axels and Shafts from old
Lawn-mower



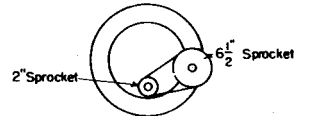
Chain and Sprocket drive for seed dispenser



SEED COVERS

SEED SOWING MACHINE

DESIGNED BY KARL B. LANDQUIST
MT. SHASTA NURSERY
U.S. FOREST SERVICE



CHAIN and SPROCKET

Size of sprocket may be changed as this
governs seed out-put

Drawn U.S.F.S., W.O., 1954

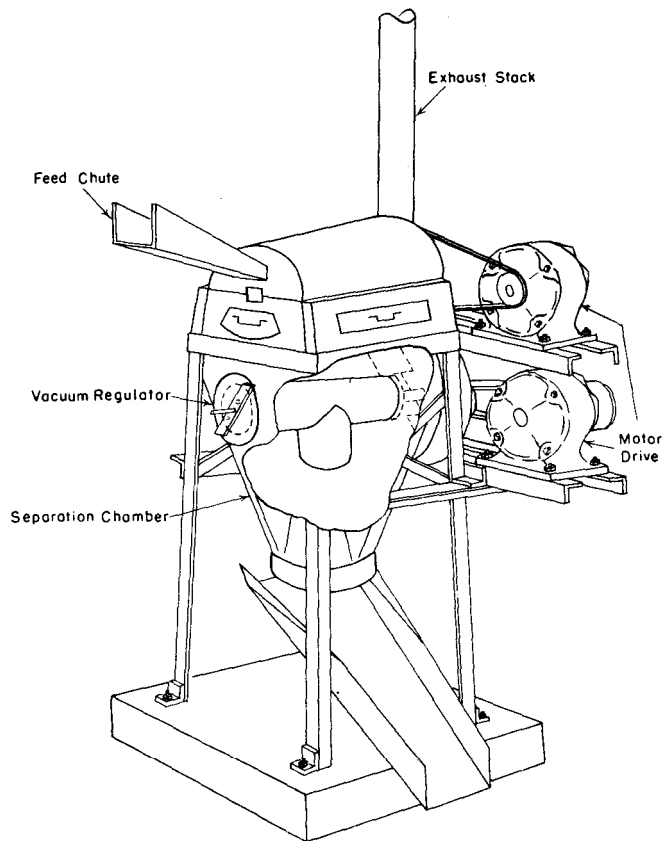
SEED CLEANING AND DEWINGING MACHINE

Karl-B. Lanquist

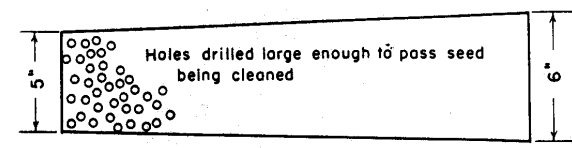
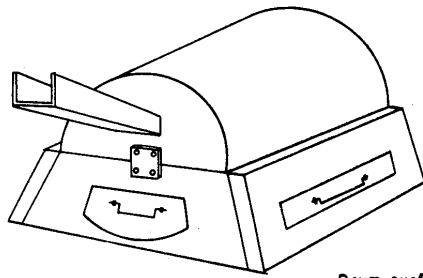
Nurseryman, Mt. Shasta Nursery, U. S. Forest Service
McCloud, California

The seed cleaning and dewinging machine shown in the following drawings was adapted from the "dustless hammermill" designed by the Soil Conservation Service. The basic hammermill assembly was replaced by a brush arrangement for removing the wings from seed of conifers. The main features are the brush housing and the mounting of the brushes. The corrugated rubber mat inside the housing adds much to the effectiveness of the machine. If properly regulated, the vacuum carries chaff and wings away from the seed, and the machine is dustless.

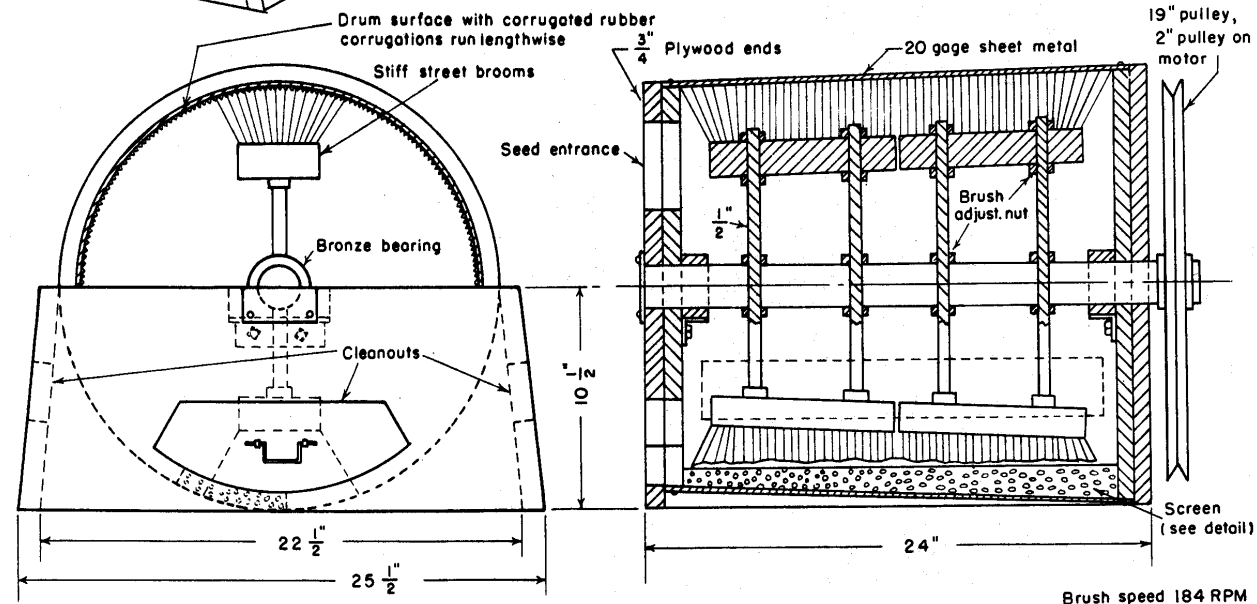
The machine removes the wings almost 100% in one operation. It is necessary to use different sized screens for the various sizes of seed to be dewinged and cleaned. The cost of seed processing with this efficient machine is reasonable.



Blower and Separation Chamber, adapted from "Dustless Hammer Mill",
designed by Soil Conservation Service, Region 4, Fort Worth, Texas



SCREEN



Brush speed 184 RPM
 1/3 H.P. motor speed 1750 RPM

SEED CLEANER
 DESIGNED BY KARL B. LANDQUIST
 MT. SHASTA NURSERY
 U.S. FOREST SERVICE

Drawn U.S.F.S., WO, 1953

AGITATOR TYPE MECHANICAL TREE LIFTER

Robert O. Sowash

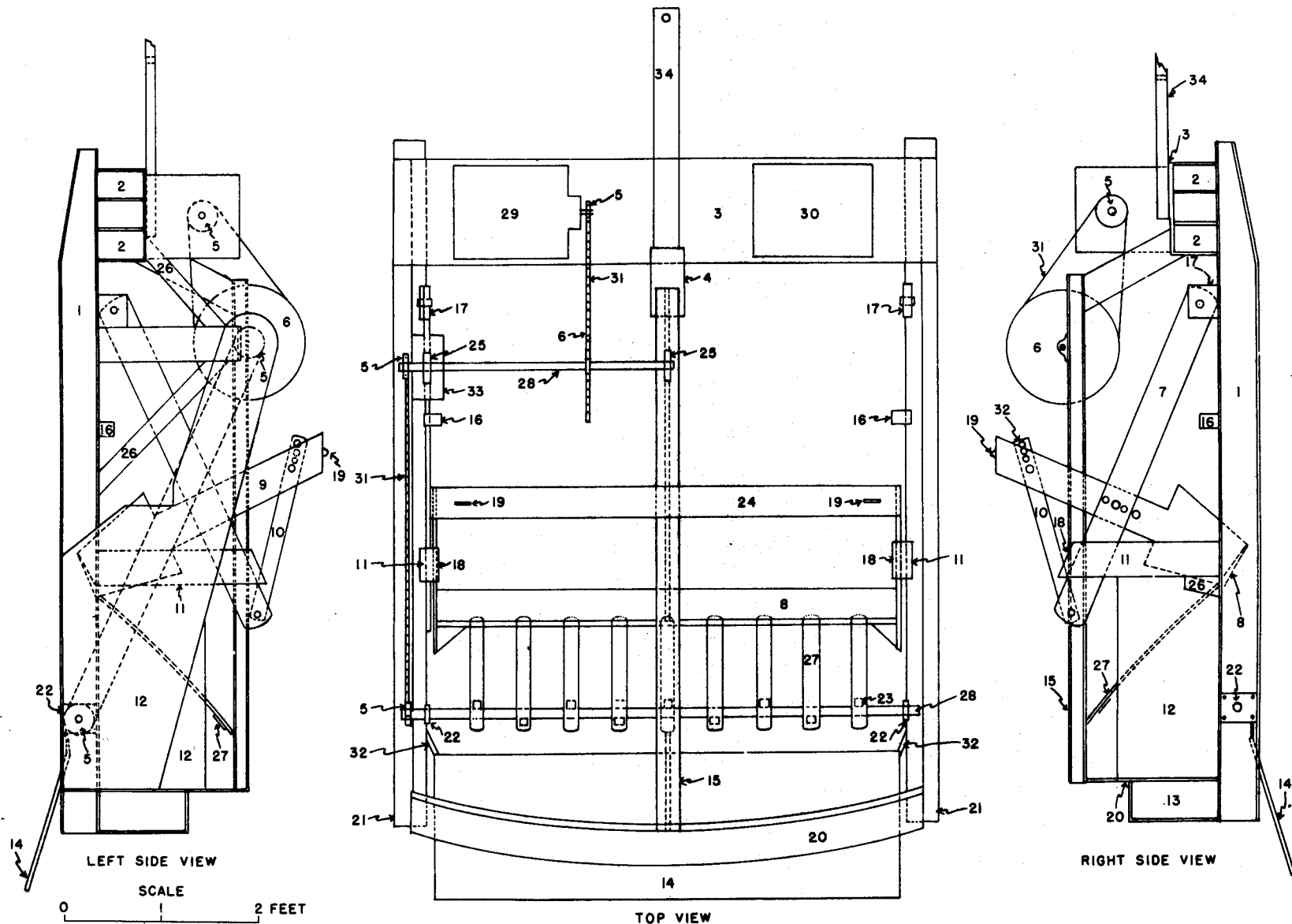
Forest Ranger, Wayne-Hoosier National Forest
Brownstown, Indiana

This tree lifter was developed at the Eveleth Nursery by Mr. Robert O. Sowash while he was in charge of that nursery. It was designed from the common pull type lifter used in many nurseries. It varies from the standard model by the addition of an "agitator attachment" and has the advantages of; (1) Almost complete pulverizing of the soil down to the depth of the tree roots; (2) Leaves the trees standing upright in the loose soil with no roots exposed; (3) Trees can be pulled easily resulting in good production per man day; and (4) Loose soil allows pulling without injury to the roots.

It was pulled at Eveleth with a D-4 Caterpillar. As the blade is held in the ground more by the weight of the lifter than the angle of the blade, it is probably not practicable to cut the weight too much. Local soil conditions might dictate whether a wheel tractor will handle it.

This lifter was used through 1952 and gave good results at considerable saving in time and money. The only change recommended after a full season's experience is an increase in the size of the cam shaft from 1-3/16" to 1-1/4" or 1-5/16".

Details of construction are shown on the following sketches.



MECHANICAL TREE LIFTER - AGITATOR TYPE

Designed and drawn by R. O. Sowash
Nursery Superintendent, Evelett Nursery 7-28-52

MECHANICAL TREE LIFTER
"Agitator Type"

Parts List

<u>No.</u>	<u>Name</u>
1.	- 5" channel - 2" webb
2.	- 4" channel support
3.	- 3/8" plate
4.	- 4" channel
5.	- 3" sprocket - 1-3/16" bore #C-15-T
6.	- 14" sprocket - 1-3/16" bore - #C-70-T
7.	- 5/8" x 4" lifting arm
8.	- 6" grader blade - shown in raised position
9.	- 5/8" x 6" blade supporting arm
10.	- 3/8" x 2" adjusting arm
11.	- 5/8" x 4" plate
12.	- 3/16" plate guard - for sprockets and chain
13.	- 5" channel - 2" webb
14.	- 1/4" slide plate - used on small stock
15.	- 3" - "I" beam - center support
16.	- 1-1/4" square iron - Z-1/2" long - depth control stop
17.	- 9/16" x 4" x 4" plate - lifting arm support
18.	- 1-1/4" square iron - lifting arm catch
19.	- Eye - for lifting cable to tractor
20.	- 5" curved angle iron - 3" webb
21.	- 4" shoe on bottom of channel
22.	- Roller bearings - 1-3/16" - #L.C. - Minn. Bearing Co.
23.	- Cams, case hardened, 1-1/4" long - 1" high, welded to shaft on opposite sides for every other tine
24.	- 4" channel - 2" webb
25.	- Roller bearings, 1-3/16" - pillow block - #LAK - Minn. Bearing Co.
26.	- 1/4" x 2" brace
27.	- 1/4" x 1-3/4" x 24" - car spring leaf (9 used)
28.	- 1-3/16" cold rolled shaft - speed 400 RPM
29.	- Gas engine - 2 HP - 1500 RPM
30.	- Counter-balance for engine
31.	- Roller Chain - #RC-50 - Minn. Bearing Co.
32.	- Hinged support for slide plate
33.	- 1/2" x 4" x 8" plate - Bearing support and chain adjustment
34.	- Draw-bar to tractor

Nursery Superintendent, Oregon State Forest Nursery
Corvallis, Oregon

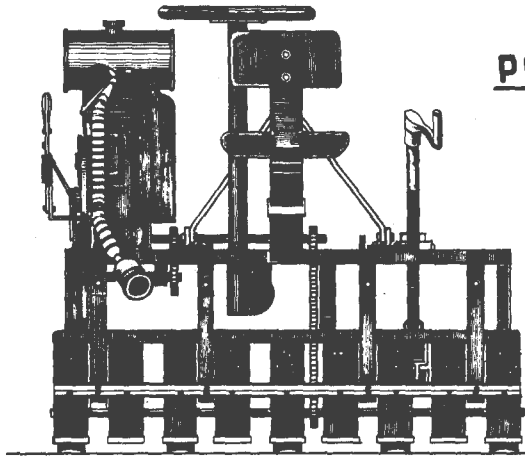
At forest nurseries of the Pacific Coast the weed control problem has always been and will continue to be the most expensive nursery operation. This is because weed growth is especially favored by the long growing season, mild winter temperatures, heavy winter rainfall, and heavy soil. If seedbed mulching was practiced, as it is at nurseries east of the Cascade Mountains; there would be less of this since mulch combined with freezing weather will keep down weed growth. However, since this is not the case at nurseries west of the Cascades, many weeds - especially annual bluegrass - grow throughout the wet winters and early spring months and thereby create an especially troublesome and costly weed control problem.

The Oregon State Forest Nursery near Corvallis, Oregon has a fairly heavy soil - Olympic clay loam. The usual weed control measures of spraying with chemicals, hand weeding, and cultivating with machines are used to cope with the problem. As a supplement to the use of Stoddard solvent and hand weeding, the Forestry Department personnel has developed an 8 row roto-tiller cultivator that has proven very successful in cultivating both conifer and broadleaf nursery stock. Trees up to 7 or 8 inches tall can be cultivated. This special machine is used on the rear on a tractor equipped with a hydraulic power lift. Two men, a tractor operator and a cultivator operator, are required. Construction details for this machine is shown in the accompanying drawings.

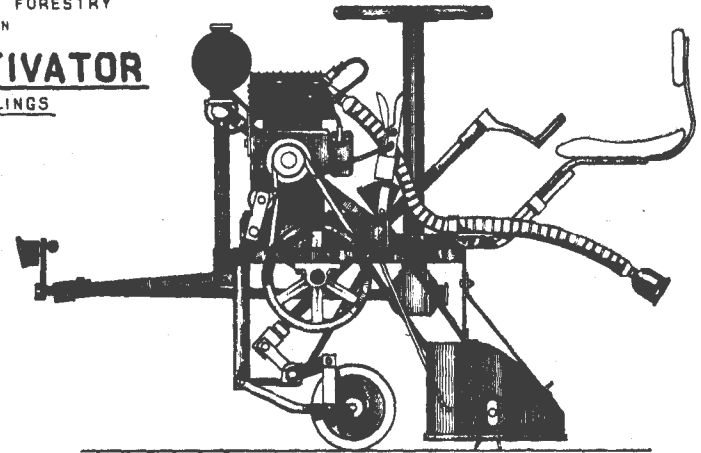
(See also Tree Planters' Notes Number 16 for a description of another rotary cultivator.)

OREGON STATE BOARD OF FORESTRY
SALEM, OREGON

POWERED CULTIVATOR
FOR DRILLED SEEDLINGS

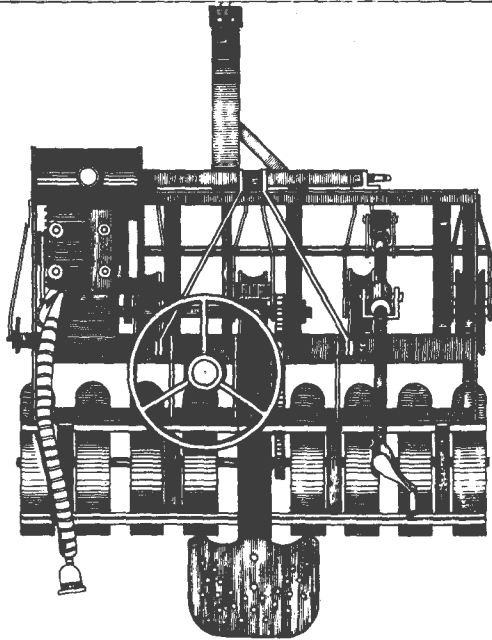


R E A R E L E V A T I O N

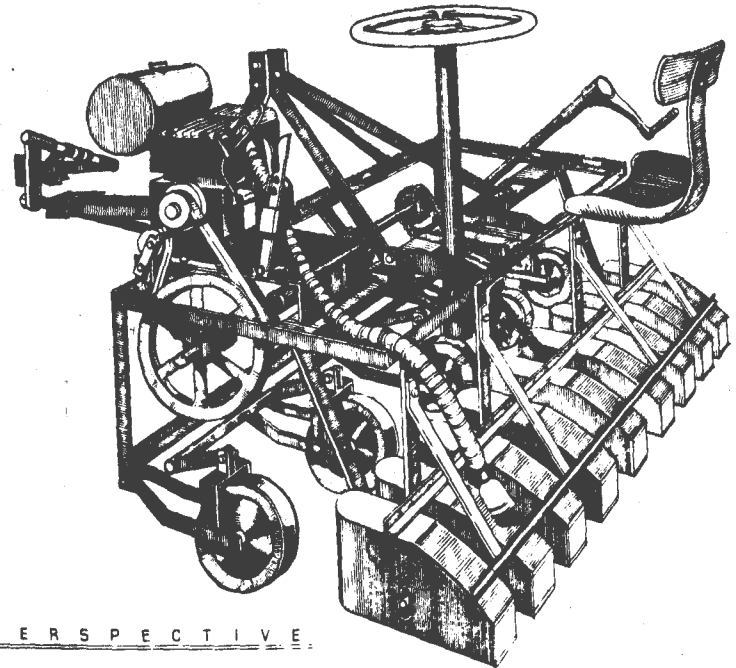


S I D E E L E V A T I O N

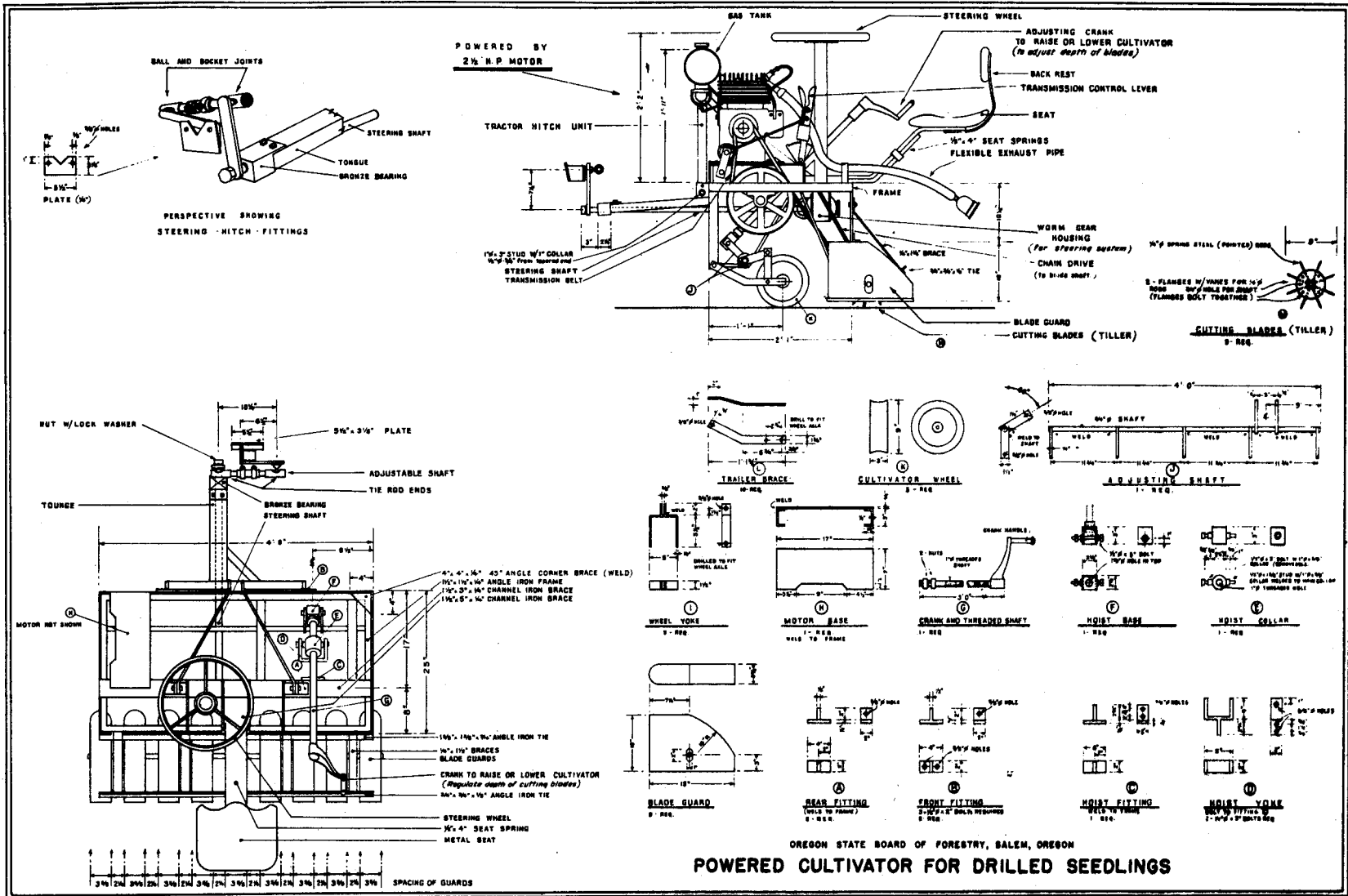
14



P L A N V I E W



P E R S P E C T I V E



SIMPLE METHOD OF RECORDING SEEDBED TREATMENTS

Floyd M. Cossitt

Forester, U. S. Forest Service Atlanta, Georgia

Nurserymen in the South generally have difficulty in maintaining a suitable record of seedbed treatments. Usually, these are kept in diary form for the nursery, consisting of notes highlighting the essential treatments given individual beds or blocks. Many have found this unsatisfactory because it is necessary to recompile the notes if an analysis is needed of any particular section.

G. F. Erambert at the Ashe Nursery, Brooklyn, Mississippi, has developed an ingenious method of recording these data. He uses large tabulation sheets, 16" x 18", and colored crayons to show diagrammatically the type of work performed on each seedbed. One sheet per month per block is used. These, together with the notes on the form, give a complete picture covering all essential treatments for the entire season. Essentially, the form is used as a diagrammatic map of the seedbed block. Vertical lines represent seedbeds and water lines. Groups of horizontal lines are numbered to correspond to the days worked during the month. The method is outlined in abbreviated form.

The data are summarized and used in the annual report. For example, the number of waterings is easily compiled from which close estimates can be made as to the quantity used. Likewise, the amount and frequency of oil applications are readily available. Number of hand weedings, fertilizer and other information are recorded as desired.

The simplicity of the record is a distinct advantage. Daily posting requires only a few minutes time of either Erambert or the nursery foreman. I find such a record highly useful in reviewing the work done at the nursery, particularly in spotting unusual conditions such as poor growth of seedlings, chlorosis, or canker disease. The record does not provide for diagramming partial bed treatments. Data on these are kept in note form attached to the sheet.

The form can be expanded or changed to suit almost any set of conditions peculiar to a given nursery block. Pre-sowing treatments, rates of sowing, dates, and other pertinent data can be noted on the record if desired.

MADE IN U. S. A.

RECORD OF SEEDBED TREATMENTS

Month April 1955

Waterline Nos. 1 2 3 4 5

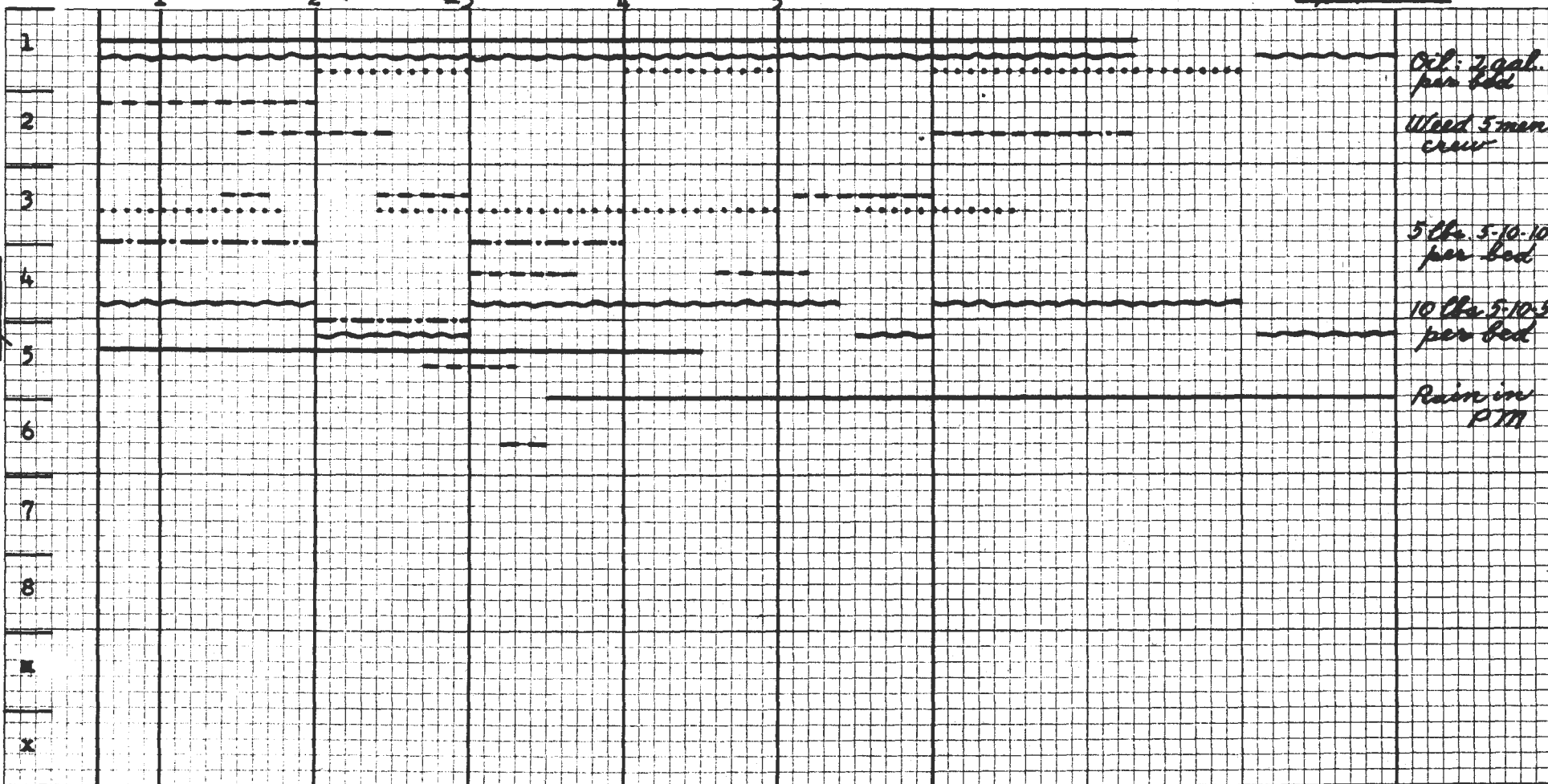
Block No. A

Species Loblolly Pine

Lot 2A

Date sown 3/20/55

Month April



Oil: 2 gal. per bed

Weed 5 man crew

5 lbs. 5-10-10 per bed

10 lbs. 5-10-5 per bed

Rain in PM

- Irrigation
- Oil
- Hand weeding
- . - . - Fertilizer
- ~~~~~ Fernate

Editor's Note: For purposes of reproduction several styles of black lines were used but in actual nursery use it would be simpler to substitute various colored pencil lines.

RUBBER BANDS FOR BUNDLING SEEDLINGS

Jack T. May

Professor, A. P. I. Agricultural Experiment Station
Auburn, Alabama

Many nurseries count and bundle seedlings into units of 50 or a multiple thereof. Generally, bundles are held together with twine that may be applied either by hand or with a tying machine. Hand tying and machine tying have many disadvantages. Hand tying is slow and costly. Machines frequently get out of adjustment.

N. D. Pearce, of the Auburn Nursery, found that rubber bands were as effective as twine in securing the bundles. In 1951-52, a 2 foot section of 6 inch stove pipe was mounted on the grading table. A supply of rubber bands was stretched over the pipe. Roots of the seedlings in a bundle were inserted into the pipe and a rubber band was pulled off the pipe onto and around the bundle.

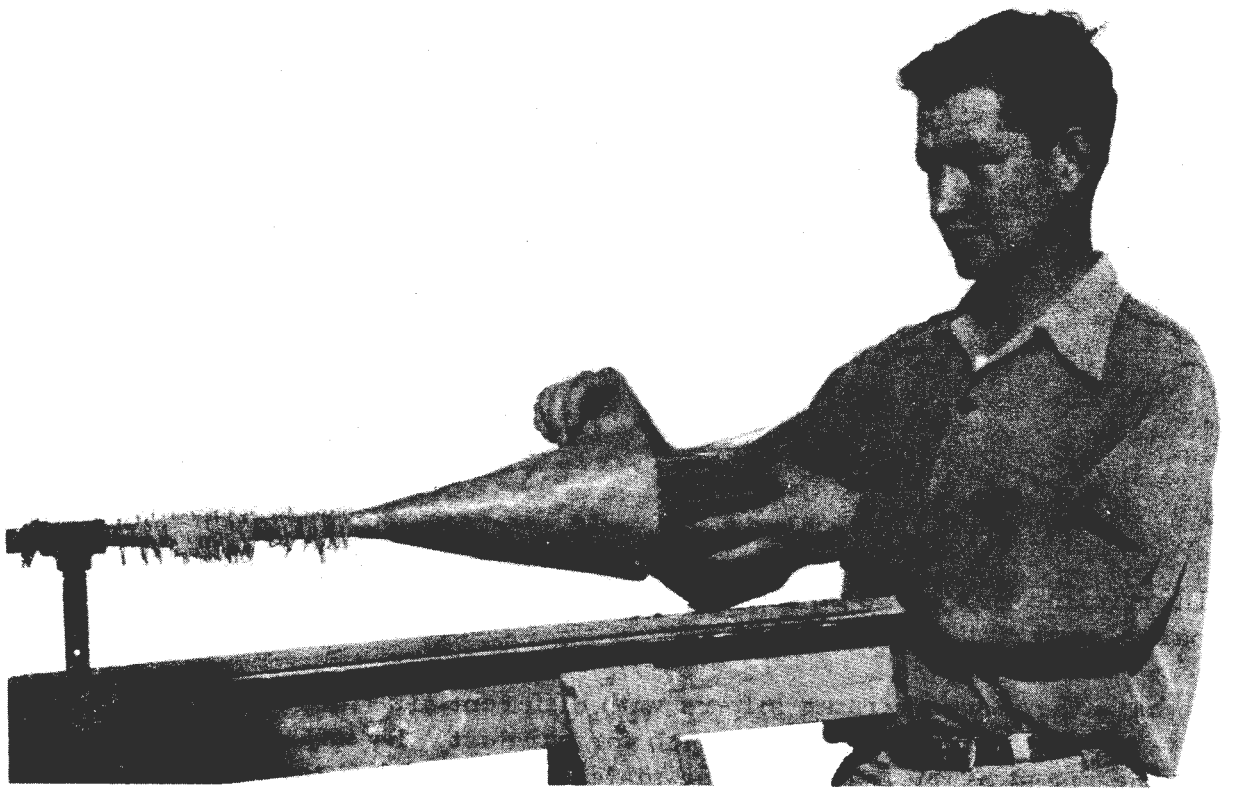
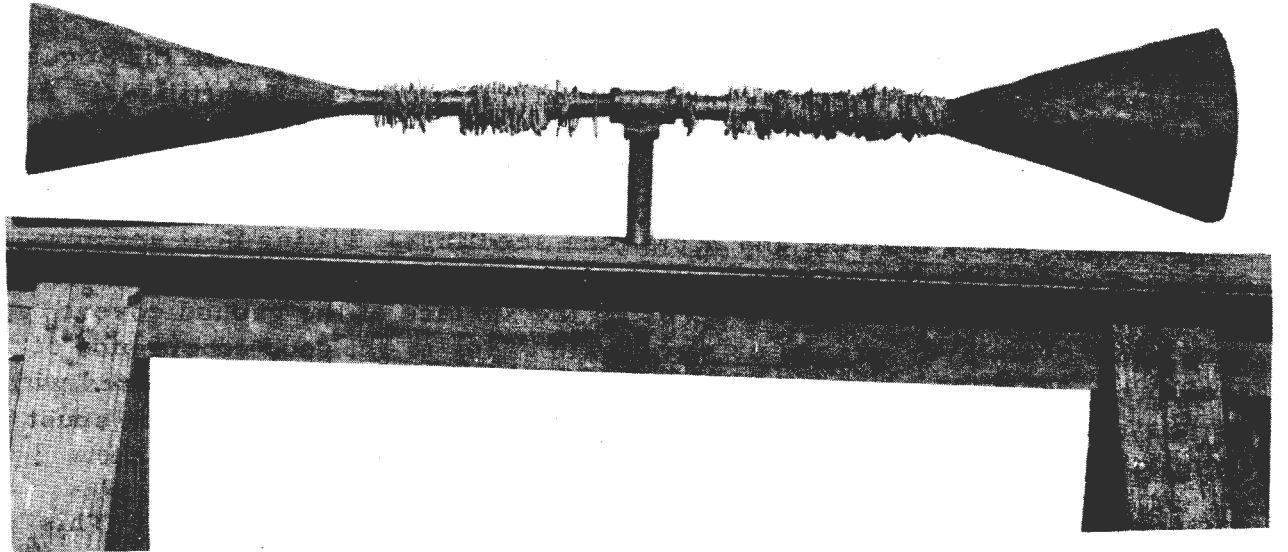
In 1953, a section of galvanized sheet iron was shaped into a funnel and welded to a short section of one inch pipe. The other end of the pipe was screwed into a tee mounted distance above the grading table. Several hundred rubber bands could easily be placed on the pipe within a few minutes.

At the Auburn Nursery each grader, working individually, grades and counts full bundles. A rubber band holder is available for each grader. When a bundle is filled, the grader puts the roots into the funnel, pulls a rubber band over the stem, and sends the bundle on to the packer.

During the 1953-54 season, the Edward A. House Nursery substituted rubber bands and holders for twine and tying machines.

A size 14, 16, or 18 rubber band is sufficiently large and strong for most bundles of seedlings.

Planters have been satisfied with the bands. Most of those asked say they prefer rubber bands to twine.



MACHINE FOR APPLYING SAND OR SAWDUST TO SEEDBEDS

W. Ira Bull

Associate Professor, Michigan State College East
Lansing, Michigan

Conifer seed germination difficulties have been experienced at both the Bogue and Russ nurseries operated by the Michigan State College. The Hillsdale fine sandy loam soil at the Bogue nursery and the Fox sandy loam at Russ both become compact and form a crust on the surface after a rain. The packed soil and surface crust creates considerable resistance to emergence of jack pine, white spruce, red pine and Scots pine seedlings. Tilling peat and sawdust in the soil has improved the physical character of the soil, but it still is necessary to sow these smaller seeds on the surface of the ground covered with a thin even layer of sand or sawdust in order to get good emergence of seedlings. White pine, Austrian pine, and Douglas fir seeds are covered with nursery soil, then mulched with 1/4-inch sawdust to prevent a surface crust from forming.

A few years ago hand labor was used to sift sand over new seedlings. This was hard, time consuming work. With the high labor rate of recent years it became necessary to design and build a mechanical sifter. This machine consists of a tractor-trailer with a box large enough to hold the sawdust or sand needed for one seedbed. In front of this box a sifter is suspended to cross members in the trailer frame by four pieces of strap iron 8-inches long. The sifter frame is made of one and a half-inch angle iron fourteen inches wide and four feet long. Inside the frame resting on the angle iron is a removable wood frame sifter on which hardware cloth is fastened. The sifter is filled by two men who ride on the trailer and scrape the sawdust or sand into it. Since the sifter frame lies loose on the angle iron it may be removed to clean the coarse material collected in it.

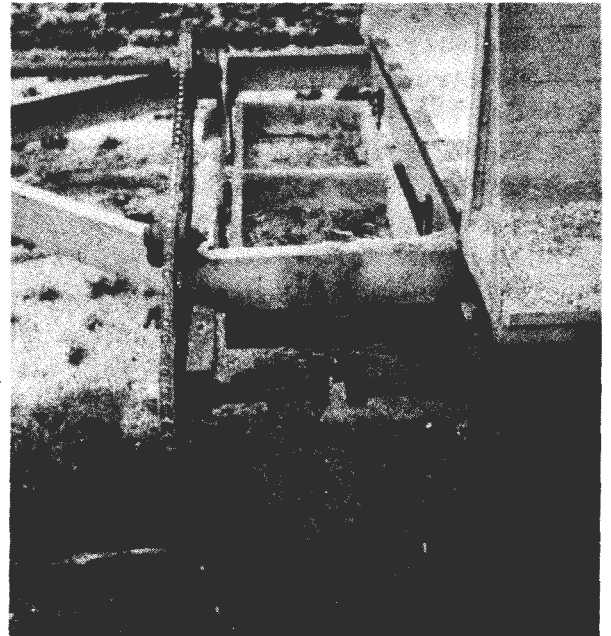


We have three wood frame sifters with different size mesh hardware cloth 1/4-inch for sand, 3/8 and 1/2-inch for sawdust. By adjusting the screen and the speed of the tractor to the material to be sifted the desired thickness of cover can easily be obtained.

A shaft with two universal joints transmits the power from the power takeoff of the tractor to the sifter. This makes it possible to turn at a sharp angle to enter the seedbeds without disconnecting the drive shaft. The universal shaft connects to a short rigid shaft two-feet six-inches long mounted on the front of the trailer frame. A Velos V-belt is used to transmit the power from the shaft to a pulley on the end of a crankshaft which oscillates the sifter. A Velos belt can be used without a tightener because links can be removed from or added to the belt depending on the length desired. A crankshaft and piston rod salvaged from a one-cylinder gasoline engine is used to oscillate the sifter.

The speed of the sifter in relation to the speed of the R. P. M. of the power } take-off can be regulated by the size of the pulleys used. We use a 4-inch pulley on the shaft that is mounted on the trailer frame, and an 8-inch pulley on the crankshaft.

This machine can also be used to mulch 1-0 seedlings with a half-inch of sawdust to prevent frost heaving. It is inexpensive to apply, it conserves soil moisture, and it improves the soil when it is worked into the ground after the trees are lifted. A straw mulch is costly to apply, it has to be raked off in the Spring, and it leaves weed seeds in the beds.



TIME-SAVING USE OF AN AUTOMATIC SCALE

J. H. Stoeckeler

Northern Lakes Research Center, Lakes States Experiment Station

Rhineland, Wisconsin

One can save up to 75 or 80 percent of time expended in weighing soil samples, seedlings, and seed and other small quantities of materials in the range of 3 to 1, 000 grams by using an automatic dietetic scale which recently came on the market, at a cost of \$9.95. Many drug stores carry them in stock.

One merely places the object to be weighed on the scale and reads the weight on the circular dial scale to the nearest one-half gram. This is much faster than any type of scale or balance where weights must be removed or added and where a rider may be used for the finer adjustments. The scales are especially adapted in weighing amounts in the range of 5 to 500 grams.

The scales come in at least two types - one of 500 gram capacity and one of 1, 000 gram capacity. The scales have the further advantage that they can speedily be set to the zero mark by a knob which moves the circular dial.

There is also sufficient adjustment to allow setting the pointer back to "zero" when a light aluminum or plastic scoop is used for containing material to be weighed.

On one recent job of weighing seedlings, we liquidated the cost of the scale about three times in the time saved in weighing.

Lake States Forest Experiment Station Employees Suggestion Case No. 58
submitted by J. H. Stoeckeler, 3/11/54.

SKILLFUL LIFTING TECHNIQUE INCREASES SEEDLING SURVIVAL

O. Gordon Langdon

Southeastern Forest Experiment Station Asheville, North Carolina

Nursery lifting of pine seedlings may have considerable influence in survival of field plantings. A cooperative study¹ in south Florida has demonstrated that lifting technique can be an important factor in getting good survival under adverse weather conditions. Unfortunately, damage done in lifting often is difficult to detect and usually is overlooked. Performance of machine lifters should be checked frequently to assure that seedlings are not being damaged in this operation.

The south Florida study compared machine and shovel-lifted seedlings from a single nursery bed and showed a substantial advantage for the latter. Of the seedlings carefully lifted by shovel, 60 percent were alive one year after planting, whereas only 41 percent of the machine-lifted seedlings had survived.

The explanation of this highly significant difference lies in the condition of the short, feeder roots after lifting. The roots of the shovel-lifted seedlings were cut off sharply and most of the secondary rootlets on the lifted portion were intact. The machine-lifted seedlings generally were toppled over and pulled slightly through the soil during the lifting. This stripped off many of the secondary feeder rootlets. These secondary rootlets are important during the initial establishment of the seedling after field planting. Their loss may contribute directly to the mortality of the seedling.

Although the seedlings carefully lifted with a shovel survived better than machine-lifted ones, a return to lifting by shovel is not advocated. Instead, this study points out the importance of and the need for close supervision of the lifting operation.

Observations in south Florida indicated that when one or more of the following conditions exist, the seedlings are being poorly lifted:

1 Cooperators in the study were the Atlantic Land and Improvement Company, The Collier Enterprise, The Florida Board of Forestry, and the Forest Service, U. S. D. A.

- (1) Lifter blade not sharp.
- (2) Lifter blade not set at correct depth (about 11 inches) or depth variable, with blade having tendency to ride to the surface.
- (3) Lifter blade not set at correct angle.
- (4) Tractor pulling lifter traveling too fast.

When any of the above conditions exist during lifting, many feeder rootlets are being lost, which ultimately may cause lower survival in field plantings.

Soil conditions vary from nursery to nursery so that it is difficult to generalize or set specific rules which will hold in all nurseries. The best test to determine whether seedlings are being lifted properly is to compare root systems of normal machine-lifted seedlings with several lifted carefully by shovel from an adjacent bed. If there are fewer secondary feeder rootlets on the machine-lifted seedlings, check the performance of the machine lifters.

AN ANALYSIS OF NURSERY STOCK PRODUCTION COSTS IN RELATION TO THE USE OF
MINERAL SPIRITS

H. B. Wycoff, Superintendent

Mason State Tree Nursery Topeka, Illinois

The use of mineral spirits at the Mason State Tree Nursery was a very important factor in meeting the postwar demand for planting stock for reforestation.

The area producing nursery stock at the Mason State Tree Nursery was increased from 85,800 feet of 4-foot-wide bed in 1946 to 189,673 feet in 1951. The first year, conifer seedbed area was increased from 30,500 lineal feet to 66,420. Annual grasses will destroy first year conifer seedbeds in central Illinois unless they are controlled promptly. The shortage of labor for hand weeding during the critical period would have prevented such a great increase of production area. This large increase was possible only through the use of mineral spirits.

This use for weed control commenced in 1947 in the Mason Nursery and increased very year until 1952. Methods of application have improved from the use of 3-gallon hand sprayers to that of a power sprayer with an 18-foot boom. Control of the spray has improved with better equipment, resulting in less injury to nursery stock, savings in material used due to more uniform application, and a reduction in labor required to apply the mineral spirits.

As a matter of record and interest I have compiled some cost data relating to our use of mineral spirits from 1947 through 1951. These data may give some indication of the value of mineral spirits used under similar circumstances. As already mentioned, some achievements would not have been possible without this chemical. Since 1951 methyl bromide soil fumigation has been used extensively. Mineral spirits are still important to the nursery program, but values are more difficult to assign.

It is unfortunate that area and cost records are not available for operations at the Mason State Tree Nursery prior to 1946, which was the last year before spraying with mineral spirits was introduced. The labor cost of producing the various classes of stock upon which mineral spirits were used is shown in table 1. The labor cost per foot of 4-foot seedbed represents all production activities such as bed preparation, seeding or transplanting, shading, shade removal, damping-off control,

fertilizing, taking inventory, and weed control by hand weeding, cultivating, and weed spraying. It will be noted that wages increased from 53 cents per hour in 1946 to 73cents per hour in 1951.

Table 1 - Labor cost per foot of tree bed

Year	Mineral spirits	Seedlings		Transplants		Average wage in June
		First year	Second year	First year	Second year	
1946	None used	.15	.05	.16	.04	.53
1947	Used	.10	.08	.10	.03	.55
1948	"	.11	.03	.09	.01	.54
1949	"	.06	.03	.13	.03	.60
1950	"	.08	.04	.14	.01	.72
1951	"	.08	.02	.15	.04	.73

Unit costs were reduced about 50 percent in spite of the 38-percent increase in wages, except for transplant stock. It is known that as transplants were put out on new areas that had been idle or in cover crops a dense growth of biennials and annual lespedeza, which are resistant to mineral spirits, developed in a number of places. These resistant weeds were costly to control by hand weeding.

Savings were achieved during the 5-year period through the use of more equipment and improved methods of performing various operations. This saving was possibly offset to some extent by the increased cost of more intensive methods and greater care in producing the stock. This, in turn, resulted in better stands and greater production per unit of area and lower costs per thousand plants.

I have attempted to determine the theoretical savings effected. In calculating the labor cost of caring for the areas in production each year I used 1946 costs, when mineral spirits were not used, adjusted for periodic wage increases from year to year. This gave the theoretical yearly labor cost based on the larger areas, 1946 methods, and prevailing wages. I then subtracted the actual labor cost when mineral spirits were used from the theoretical labor cost without mineral spirits. The difference represents the saving in labor. A large part, if not all, of this saving can be attributed to the use of mineral spirits. I then deducted the cost of the mineral spirits used. This gave the net amount saved. Table 2 summarizes these data for the major classes of stock on which mineral spirits were principally used during the 5-year period.

Table 2 - Effect of mineral spirits on classes of stock and theoretical savings during the 5-year period

Year	Class of stock	Feet of bed	Labor cost per foot of bed 1946	Average wage in June	Wage increase factor	Labor Cost			Cost of mineral spirits ^{1/}	Net savings due to mineral spirits
						Without mineral spirits	With mineral spirits	Saved through mineral spirits		
1947	1-year seedlings	30,500	\$0.15	\$0.55	1.0377	\$ 4,747.48	\$ 2,996.15	\$ 1,751.33	- - - - -	- - - - -
	2- & 3-year seedlings	28,100	.05	.55	1.0377	1,457.97	1,833.15	- 375.18	- - - - -	- - - - -
	1-year transplants	39,600	.16	.55	1.0377	6,574.87	5,832.55	742.32	- - - - -	- - - - -
	2-year transplants	16,200	.04	.55	1.0377	672.43	726.15	- 53.72	- - - - -	- - - - -
	- - - - -	114,400	- - -	- - -	- - -	\$13,452.75	\$11,388.00	\$ 2,064.75	\$386.58	\$ 1,678.17
1948	1-year seedlings	40,700	.15	.54	1.0188	6,219.77	4,320.60	1,899.17	- - - - -	- - - - -
	2- & 3-year seedlings	25,500	.05	.54	1.0188	1,298.97	863.36	435.61	- - - - -	- - - - -
	1-year transplants	42,900	.16	.54	1.0188	6,993.04	3,915.11	3,077.93	- - - - -	- - - - -
	2-year transplants	26,100	.04	.54	1.0188	1,063.63	232.77	830.86	- - - - -	- - - - -
	- - - - -	135,200	- - -	- - -	- - -	\$15,575.41	\$ 9,331.84	\$ 6,243.57	\$450.84	\$ 5,792.73
1949	1-year seedlings	61,900	.15	.60	1.1320	10,510.62	4,544.25	5,966.37	- - - - -	- - - - -
	2- & 3-year seedlings	36,600	.05	.60	1.1320	2,071.56	1,025.85	1,045.71	- - - - -	- - - - -
	1-year transplants	19,100	.16	.60	1.1320	3,459.39	2,492.30	967.09	- - - - -	- - - - -
	2-year transplants	45,700	.04	.60	1.1320	2,178.77	1,178.90	999.87	- - - - -	- - - - -
	- - - - -	163,300	- - -	- - -	- - -	\$18,220.34	\$ 9,241.30	\$ 8,979.04	\$465.40	\$ 8,513.64
1950	1-year seedlings	58,300	.15	.72	1.3584	11,879.21	4,583.30	7,295.91	- - - - -	- - - - -
	2- & 3-year seedlings	57,100	.05	.72	1.3584	3,878.23	2,392.38	1,485.85	- - - - -	- - - - -
	1-year transplants	37,580	.16	.72	1.3584	8,167.78	5,133.43	3,034.35	- - - - -	- - - - -
	2-year transplants	13,440	.04	.72	1.3584	730.28	156.34	573.94	- - - - -	- - - - -
	- - - - -	166,420	- - -	- - -	- - -	\$24,655.50	\$12,265.45	\$12,390.05	\$657.22	\$11,732.83
1951	1-year seedlings	66,420	.15	.73	1.3773	13,722.04	6,140.65	7,581.39	- - - - -	- - - - -
	2- & 3-year seedlings	61,125	.05	.73	1.3773	4,209.37	1,301.32	2,908.05	- - - - -	- - - - -
	1-year transplants	21,328	.16	.73	1.3773	4,700.01	3,248.94	1,451.07	- - - - -	- - - - -
	2-year transplants	23,800	.04	.73	1.3773	1,311.19	309.86	1,001.33	- - - - -	- - - - -
	- - - - -	172,673	- - -	- - -	- - -	\$23,942.61	\$11,000.77	\$12,941.84	\$753.36	\$12,188.48
Total net savings due to mineral spirits - - - - -									\$39,905.85	

^{1/}Gallons of mineral spirits used in 1947, 1,740; 1948, 2,084; 1949, 2,204; 1950, 2,640; 1951, 2,915.

There was an estimated net saving in wages of \$39, 905.85 for the 5-year period after deducting the cost of the mineral spirits. This saving is equivalent to 41.6 percent of the estimated labor cost of growing the stock without mineral spirits.

The total estimated saving in labor amounts to \$42, 619. 25. This saving is 44.5 percent of the estimated labor cost had mineral spirits not been used. Actually wages would have had to be much higher to attract sufficient labor to care for the large area involved. Sufficient labor probably would not have been available at any wage. This may offset the fact that the basic 1946 figures may not be typical, and the fact that all of the saving claimed may not have been due to mineral spirits. At any rate, this is the best estimate that can be compiled because of the lack of cost figures prior to 1946 and the lack of figures for labor costs of weed control alone for the period covered.

BETTER LONGLEAF SEEDLINGS FROM LOW-DENSITY NURSERY BEDS

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In south Mississippi, longleaf pine planting stock from nursery beds with not more than about 24 seedlings per square foot were larger at lifting time, survived better in the field, and began height growth sooner than seedlings from denser beds.

The seedlings were raised in the nursery of the Harrison Experimental Forest, Saucier, Mississippi. Four different seedbed densities were tested -12, 24, 36, and 48 seedlings per square foot of bed. The beds were sown in March 1950 and thinned to the required densities in May. Each density was replicated three times.

The nursery beds were well fertilized. Just before sowing they received the equivalent, per acre, of 4,000 pounds of super-phosphate, 300 pounds of muriate of potash, and 10 tons of sawdust. Three months after sowing, they were given a liquid application of nitrogen equivalent to 100 pounds ammonium nitrate per acre.

Nursery Results

The seedlings were lifted, weighed, and measured in December 1950. Table 1 summarizes the measurements made at this time.

A higher percentage of plantable seedlings were produced in the lowdensity beds. With lower bed densities fewer seedlings died during the summer and there were less culls (seedlings too small to plant). The total loss from these two causes was only one seedling per square foot for the lowest density, but 16 seedlings for the highest density.

The effect of bed density on seedling growth showed up most clearly in seedling weight. The lower the bed density the heavier were the seedlings. The seedlings grown at the lowest density were almost three times as heavy as those grown at the highest density.

Seedlings from the two lower densities were larger in diameter at the root-collar. There was no difference in root-collar diameter between stock from 36- and 48-seedling beds, but the tap roots of the seedlings at the latter density had a very abrupt taper about an inch below the ground line.

The needles at the lowest density were shorter and stiffer than those of the other seedlings.

TABLE I

Effect of seedbed density on nursery production of longleaf pine seedlings

Seedlings per square foot of bed			Green weight per seedling	Root-collar diameter
After thinning in May	When lifted in December	Plantable		
----- Number -----			Grams	Inch
12	12	11	29	0.39
24	22	19	20	.33
36	33	27	15	.28
48	42	32	11	.28

Field Results

Seedlings from this test were planted on a moderately severe site. In the second year after planting, the seedlings were sprayed twice with Bordeaux to control brown spot.

Large longleaf seedlings from bed-run stock usually survive less well than smaller seedlings (1, 2, 3) but start height growth sooner (1).. In this test, seedlings grown at low densities survived, better than those grown at high densities, despite the fact that the low-density seedlings were larger (table 2). However, it is possible that, among seedlings grown at the same density, the large ones survived less well than the small ones. This point was not tested.

TABLE 2

Longleaf seedling development two years after planting

Seedbed density	Survival	Proportion of planted pines over 2-1/2 inches tall	Average height of living seedlings
	Percent	Percent	Inches
12	96	73	4.7
24	94	54	3.3
36	77	29	2.6
48	76	22	2.3

Seedlings from the low-density beds also began height growth sooner than the rest. Thus after two years, nearly three-quarters of the pines from the 12-seedling beds were starting out of the grass. Three years after

planting, these same seedlings averaged 27 inches in height, as against 15 inches for the high-density stock. The difference in the field is impressive (fig. 1). The seedlings from the intermediate densities averaged 21 and 16 inches respectively. Early height growth of longleaf seedlings is important because it reduces the period when the seedlings can be killed by brown spot, hogs, and fire.

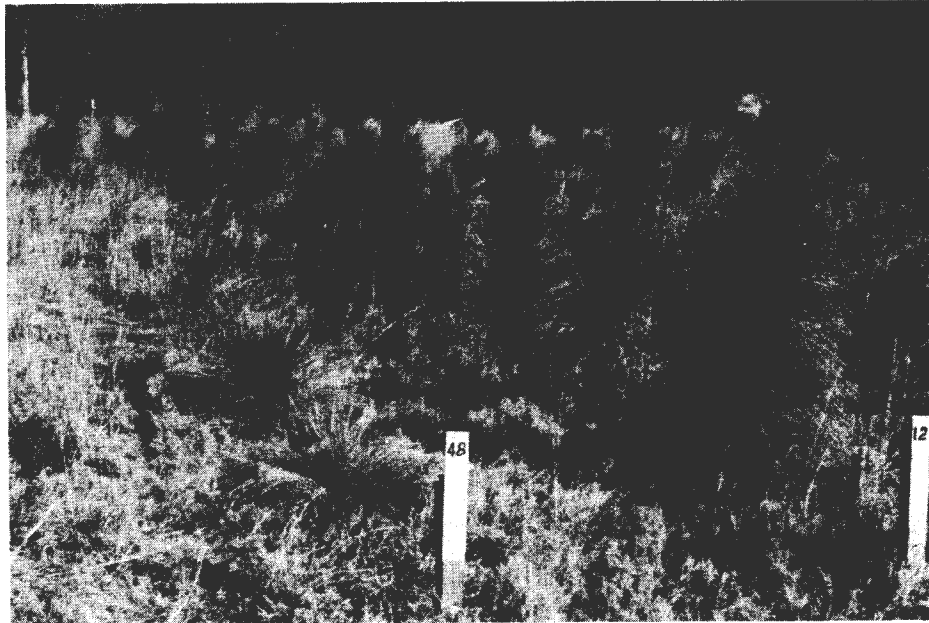


Figure 1 - Effect of nursery seedbed density upon longleaf seedlings three years after planting. The seedlings in the row on the right were grown at a bed density of 12 per square foot. Those in the row on the left were grown at a density of 48 per square foot.

In another test, seedlings grown at a seedbed density of 39 per square foot averaged only 2.6 inches in height after two years in an old field, and only 32 percent of the original number planted were over 2.5 inches tall. Seedlings grown at 21 per square foot averaged 4.6 inches in height with 58 percent starting height growth in two years. Extra large seedlings from beds with a density of 12 per square foot had an average height of 6.2 inches and 79 percent had started height growth.

Suggestions

The seedlings in all of these tests were grown in good nursery soil which had been well fertilized. On poorer soils with minimum fertilization, reduction of seedbed density has not stimulated seedling growth in the nursery as much as in these tests.

Longleaf seedbed densities" cannot be reduced safely on some nursery soils without getting considerable mortality from sandsplash. Low seedbed densities should not be tried on such soils unless some protective mulch is used. Also, on soils which have a tendency to crust, lowering the density will aggravate the condition.

The optimum density will be that point where increased nursery production costs, brought about by the reduction in seedbed density, will be offset by increased field growth and survival. This point has not been determined, and will probably vary with different nurseries. However, nurserymen should avoid raising longleaf at densities above 30 per square foot and should investigate the possibilities of lowering the density to 20 or 25 seedlings per square foot.

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