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TREE PLANTERS' NOTES

A Publication for Nurserymen and Planters of Forests and Shelterbelts

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U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

WASHINGTON 25, D. C.

This issue of Tree Planters' Notes presents eight articles on the cost and use of tree-planting machines. Their titles and authors are:

A list of tree-planting machines now commercially available in the United States and Canada has been compiled by the U. S. Forest Service. In it each machine is briefly described by giving in a uniform order simple information on the similar points of each and also its manufacturer, price as of 1950, and weight. Sixteen manufacturers offering 25 models are listed. Copies of this list are available free from the U. S. Forest Service's regional offices or its Washington office.

Invitation

All persons who work in reforestation, or who are interested in it or some allied field are invited to send in material for publication in Tree Planters' Notes. If their material is not yet in final form for publication, they are invited to at least send a letter to Tree Planters' Notes and tell what they are doing and what manner of information should be published. The address is: Chief, Forest Service, U. S. Department of Agriculture,Washington 25, D. C.

COSTS OF MACHINE PLANTING IN NEW YORK

A Consulting Forester, New York

This company has planted over 1,000,000 trees in the past two years, using the TreeP planting machine, Maximum distance from headquarters was 115 miles. Areas planted ranged from 1 to 30 acres.

The figures given below are for spring planting in 1950, and include hand planting 86,000 trees, since the accounting system used did not separate costs between machine and hand planting.

The costs include preplanting inspection; conferences; share of office rental and other overhead; overhaul, painting, storage, and other costs for machines. Travel expenses for supervisory personnel and for employees were paid, with staff ranging from 8 to 11 men.

Due to the short season (only 6 weeks), some extra expense was necessary to complete contracts by June 1.

Costs of Planting- 720,000 Trees

Item		Cost per M
Supervision (2 men)		1.60
Labor (6 to 9 men)		4.44
Living expense (all men)		2.95
Two tractors:	Operation	.35
	Repairs	.61
	Depreciation	.90
Two TreePs:	Operation	.02
	Repairs and plow replacement	.16
	Depreciation	.39
One 1½-ton truck:	Operation	.09
	Repairs, tires	.21
	Depreciation	.35
Auto travel		.60
Overhead		.10
Insurance and taxes:		
	Compensation insurance	.34
	Unemployment insurance	.15
	Social security and corporation taxes	.10
Total cost per M		$13.73

These trees, and about 8,000 shrubs, were planted on contract at rates of $12.00 to $15.00 per M, depending upon sites and number of trees. It is hoped to reduce 1951 costs on 825,000 trees by more

COSTS AND USE OF MACHINES IN TENNESSEE

Paul B. Davis

Forester, Roane-Anderson Company,
Oak Ridge, Tennessee

Since 1947, the Roane-Anderson Company, as agent for the Atomic Energy Commission, has planted 6,305,000 tree seedlings in the Oak Ridge area. These trees have been planted on approximately 6,550 acres, using a 6' x 6' spacing except for certain areas which were interplanted.

Three Lowther tree planters were purchased in the winter of 1947-43 and have been in use when and where feasible in planting operations. These machines have been used to plant almost one-half of the seedlings planted. During the '48 season, some 65% of the trees planted were machine planted. About 50% of the trees planted in '49 were machine planted. Only 23% were planted by machine in 1950 and 20% were planted by machine in 1951. The last two years we planted only 1,0r.)0,000 and 1,250,000 respectively. During the '48 and '49 seasons, 2,000,000 trees were planted each year. Common labor was utilized for hand planting during weather not suitable for machine planting.

The tree planting machines have been used in the better type soils as found in old fields on the Oak Ridge area. Soil types found in the area cover a wide series. The common soils encountered are Fullerton, Clarksville, Dewey, Leadvale, Talbott, Nolichucky, Sequatchie, Pope, Allen, Roane, and Lehew. These come in every combination from sandy loam in the bottoms to chesty clay and bare rock on the ridges. The most common types found where machine planting was done were Fullerton and Clarksville in the clay loam mixture. This was found where broomsedge was abundant and blackberry briars were taking over the old abandoned fields. The Lowther machine plants exceptionally well in all soil types found here as long as weather conditions are favorable. Gully-eroded areas and exceptionally rocky areas were left to be hand planted. But with these exceptions machines have been used profitably in all soil types present in the area.

Machine planting, to be successful, must be done when the soil is the right tilth to plow. Thus, the operation has been limited by weather conditions prevailing during the winter months. Too much freezing weather, as well as too much rain, stops machine planting. However, due to the vegetative cover present in most areas here, we have been quite successful in planting during some weather of 20 - 30 degrees temperature.

The main species planted by machine have been shortleaf, loblolly and white pine as well as black locust, white ash and tulip poplar. Machine operators liked the larger seedlings for machine planting, since they handled easier and did not become entangled (the roots) as did some of the smaller size plants. Also, the larger trees had stiffer roots which facilitated the planting operation. In this respect, the loblolly pine seedling was favored by machine planters since the roots were straighter and stiffer than those of the shortleaf or white pines. The black locust and tulip poplar also had such root systems but we had very few hardwoods to plant. All trees could be planted very well by some adjustments and skill on the part of the operator.

We found that second gear (on the D-4 Caterpillar which we used for power) is the optimum operating speed in most cases for tree planting with the Lowther planter. This pertains to planting when weather and soil conditions are correct for planting. First gear was used when the soil was too wet or on very steep slopes. We have also tried third gear, but found that speed too fast except with a particularly good and fast operator. We also found that in locations where the grade was 15 percent or more it paid us to plant up and down hill rather than on the contour. No erosion problem has resulted in using this method. This may be because of the vegetative cover present on our hillside plantings. Gullied and bare areas on hillsides have been planted by hand and thus such a problem was avoided. Tree planters are now available with a hydraulic lift to change wheel levels for hillside planting.

Each year we have had some breakage on the tree planters. Generally this has consisted of breaks in the frame of the planter caused by excessive twists in crossing ditches or other field obstacles. After planting season each year, the planting machines have been thoroughly overhauled, painted, and generally put in good shape for the following year. We have used some twelve extra plow points (for the three planters) during four planting seasons. Other than points we have had practically no replacements on our Lowther machines. It is estimated that these machines can be operated 6 more years, thus making a 10-year life for the planters.

Our experience at Oak Ridge proves machine planting to be much more economical than hand planting. The accompanying table shows the very appreciable difference in cost. For the four-year average on unit costs of machine versus hand planting, the cost of machine planting is just one-half that of hand planting. We have utilized excess labor during the winter months in our hand planting operation and therefore have planted by hand some areas which could very well have been machine planted. Machine planting has shown higher survival in most cases than hand planting. Survival percent on machine planting has ranged from 72.24 to 87.95. With conditions right there is no question about the superiority of machine planting over hand planting. Hand planting, of course, has its place in gully planting and interplanting. Properly integrated, however, on large-size operations, the machine planters are definitely a great boon to the tree planting job.

TREE PLANTING - OAK RIDGE

Date Year	MACHINE PLANTING Number	Cost/M*	HAND PLANTING Number	Cost/M*	ALL PLANTING (TOTAL) Number	Cost/M*
1947			55,000	$15.70	55,000	$15.70
1948	1,262,000	$ 7.20	718,000	14.20	2,000,000	9.70
1949	978,800	9.70	1,021,200	16.70	2,000,000	13.30
1950	277,000	13.40	723,000	21.00	1,000,000	18.50
1951	251,000	11.50	999,000	19.70	1,250,000	18.10
(Averages) Totals	2,788,300	$ 8.90	3,516,200	$17.90	6,305,000	313.90

The above table gives total trees planted and planting cost per thousand trees.

The steady rise in planting cost is due to two things: 1. The improvement of the planting operation and 2. The steadily rising cost of labor and equipment.

The year of 1951 shows a decrease in cost - this leveling off shows that efficiency of the planting operation is off-setting the increased costs.

* Costs include the following items: Labor @ $.90 to $1.20 per hour; Foreman $1.65 per hour; Forester's supervision @ $1.00 per thousand. Tractor operation and maintenance $2.00 to $4.00 per hour; Planting machine depreciation, maintenance, etc. @$100.00 per machine per year; and Overhead Expense @ 10 percent of total yearly costs.

Planting rates:--Average of 3,300 per man day with machines (3 man crew). Average of 900 per man day using hand planting labor (14 man crew).

COSTS AND USE OF A MACHINE IN SOUTH DAKOTA

E. K. Ferrell

Extension Forester, South Dakota
State College, Brookings, South Dakota

In the spring of 1949, ten shelter belt-planting demonstrations were put on by the Extension Service in 4 widely separated South Dakota counties. A tree-planting machine built by the Lowther Manufacturing Company of Joliet, Illinois was mounted on a Willys-Overland 4-wheel drive Jeep and this combination was used to put on the demonstrations.

The tree-planting machine was very similar in design to one developed by the Soil Conservation Service in Nebraska. The planter is a 2-man machine. A full crew consisted of 2 planters and a driver. However, it was found that one experienced planter could do a good job of planting even at the closest spacing used (4 feet apart in the shrub row).

The machine was designed to fit on the hydraulic lift of a Ford tractor. A Monroe hydraulic lift adapts the Jeep for pulling the planter, since the 3-point implement suspensions on both hydraulic lifts are identical.

In addition to the hydraulic life, the Jeep was equipped with a front bumper weight and a governor. Experience showed that overload springs are also desirable, since the weight of the planter was more than the standard rear springs on the Jeep are designed to carry.

A row marker was mounted on the rear of the Jeep. This marker was adjustable for 8, 10, or 12-foot spacing between rows. Only the first row of a planting was staked. Each subsequent row was marked by the row marker as planting progressed.

When ready to move from one site to the next, a short section of one and one-fourth inch pipe was inserted and secured in place between the center of the drawbar and the upper connection of the planter. The purpose of this pipe was to prevent any chance of the planting machine dropping while in transit from one site to the next.

Advantages of the Lowther-Jeep Combination

The Jeep proved to be a dependable and efficient power unit, but the greatest advantage of this combination was its mobility. The outfit could be moved over surfaced highways at 40 miles per hour without difficulty. Upon arrival at the planting site, it was only necessary

to stake the first row, load the stock box, and start planting. Mobility of planting equipment is extremely important in South Dakota since plantings are generally rather widely scattered.

Explanation of Costs

An allowance of 5 cents per mile has been made for travel. This is the amount the State of South Dakota allows for use of personally owned cars and does not necessarily indicate the exact cost of operation of the Jeep with planter attached. However, operation records indicate that this mileage allowance is very close to the actual operation costs of the Lowther-Jeep combination. No allowance has been made for depreciation of equipment. This item would need to be taken into account by a commercial operator.

Labor has been figured. at $1.00 per hour because that was the prevailing wage rate at the time the plantings were made. Actually, the demonstration plantings were made with farmers and spectators doing the planting. This is the chief reason for the comparatively low output of 559 trees per hour. With two experienced men riding the planter, there is little doubt that an output of close to 1,000 trees per hour could be attained. Another factor contributing to the low output was the small size of the plantings (average size slightly over 3 acres). This required frequent turning because of the short rows. The plantings varied in size from 1/2-acre to 11 acres. Cn the 11-acre planting an output of 929 trees per hour was attained using inexperienced help.

Two of the plantings were check rowed to permit cross cultivation. This required considerably more time because the plantings had to be crossed marked first. This was done by staking the first row and running the machine over it with the plow set shallow and the row marker out. Each row was covered in like manner and the planting was then marked in the opposite direction following the same procedure. The planters then set the trees on the intersecting marks.

It will be noted that allowance for travel time includes the time of only one man. The writer drove the Jeep from one planting to the next and depended upon the farmers to provide the planting assistance. Anyone planning to do custom planting would need to figure travel time of the crew.

Cost Analysis : Lowther Planter - Jeep Powered

Total number trees planted	19,000
Total number acres planted	31.75
Average number trees per acre	598
Total number plantings made	10
Travel time (hours)	29
Total number miles traveled	1,203
Total hours planting time	34

Average number trees planted per hour	559
Average number acres planted per hour	.93

Costs

1,023 miles @ 5 cents	$ 51.15
29 hours travel time @ $1.00	29.00
34 hours planting time E $3.00	102.00
Total	$182.15
Planting cost per tree	$ 0.00959
Planting cost per acre	$ 5.74

RENTAL CHARGES AND USE OF A MACHINE IN NORTH CAROLINA

P. A. Griffiths

Assistant Forester, State Forester's Staff,
Raleigh, North Carolina

The North Carolina Division of Forestry operates 2 Lowther tree planters on a custom basis. A charge of $4.50 per acre (based on 1,000 trees) is charged the landowner for the use of the machine and. machine operator. The landowner furnishes a tractor and driver and pays for the seedlings. This past year we have endeavored to have the landowner furnish a machine operator also, charging $3.00 per acre for the use of the machine. The Forestry Division furnishes technical supervision free of charge and trains the machine operator for the landowner. To date, a good many landowners have availed themselves of this service and say that if this service had not been available they could not have planted their land. Wages of labor in the better agricultural and industrial sections of North Carolina are too high for hand planting).

e have here in North Carolina one consulting forester who does machine planting and is kept quite busy during the planting season. Needless to say, we try to turn all machine-planting jobs over to him, taking the ones that are surplus.

Of interest on machine planting is a job undertaken by the State's machine last February for Victor King of Sanford, North Carolina. On the initial inspection, the broomsedge-covered field looked like a natural for machine planting. Some rocks were noticed but not much attention was given to them. On the date agreed for planting, we started the job and found that under the thin layer of top soil there wore rocks of all sizes and degrees of firmness. Those

familiar with the Lowther machine will visualize how the coulter kept the plow out of the ground meet of the time so that only when a soft place was hit could a seedling be planted. This was so seldom that only about 100 seedlings to the acre would have been machine planted. An attempt to hand plant tree area was given up when it was found that the labor of getting the planting bar down and then closing the hole would have run the cost much too high. Taking advantage of the machine's rugged nature, we took the coulter off so the plow could go into the soil and went ahead and did the job. Although a ragged split was opened, the seedlings were firmed in satisfactorily.

Thirteen acres were planted and although it is too early to chock the survival, we feel that the job will be satisfactory. Taking the coulter off slowed the planting a great deal as much care had to he taken to avoid the large rocks end stumps. We do not advocate this procedure under normal circumstances as there is great risk of doing a lot of damage to the planting machine. However, if care is taken to avoid the worst spots and in making turns, it can be done. In planting this area we feel that land that 'would never have been used otherwise was put into production, d the good will we have gained with this landowner was worth the risk.

Felix Dowdy

Division Forester International Paper Company

The advantages of mechanical tree planters are well known to those who operate them and to others who have inquired into their operation. n view of this I feel more inclined to comment on the faults and disadvantages and what we have done to alleviate them.

The sharp sand of tee coastal area takes a heavy toll of coulters, middle busters and bearings. So far we merely replace ports as necessary. The small packing wheels at one time prevented pleating in areas that were only slightly boggy -- a fault which we cured on one of the machine by installing, wheels with 600 x 1:1 tires on an axle which supports packing wheels in soft, areas. To protect the man on the planter from limbs and broken brush, we have extended a protective plate around his working area. Because most machines are cumbersome to turn at the end of the row, we try to lay out our planting with rows as long as possible. This saves considerable operating time. Our immediate problem is to cut down on machine repair costs, but our long-range problem is to find some way to machine plant among dense stumps the year after cutting. The middle-buster type planter has definite limitations in such areas for it is difficult to operate satisfactorily in an area where stumps are so

dense as to prevent maneuvering. It could be that a dibble-type planter is the answer to this problem. We need something to obviate the long wait for stumps to decay.

We have used three types of power units to pull the macnines, a smh Cletrac crawler-type tractor, a wheel-type, and a TD6. When the planting was done on dry, well-drained areas, the wheel-type tractor proved most efficient and was steadier in maneuvering through scrub oak and other brush. When the planting was done on low, wet soil or in areas which had been stumped, the track-type tractor worked to advantage.

Our results from machine planting are generally good. There have been cases of poor survival, but I believe this can be attributed to other factors such as site and climatic conditions.

USE AND MODIFICATION OF TWO MAKES!

Dan C. Royal

Forester, Miller and Company, Inc.,
Selma, Alabama

At present this Company has two planting machines, a Lowther 1949 model, and a Purdue-ICRR 1950 model. Their use, after suitable modification, has given such excellent survival that we do not plan ever to plant by hand again.

We have planted in all types of soil, ranging from Rushton, fine, sandy loam to a mucky, prairie-type soil of the toughest kind. Pulling the Lowther with a D-4 tractor, we plant any soils, except the lightest sands, the roughest terrain, and c t or burned-over lands. For the easier going on more level terrain with light and solid soils, we use the ICRR planter pulled by a dual-wheel Ford tractor. To go where and when we wish, we have found this combination to be unbeatable.

Our machines use a 3-man crew; a driver, a planter, and a man to supply trees to the machine. The 3 men alternate on these jobs which makes for more efficiency.

Our survival, we believe, on about 2 million trees, is better than 90%, except on longleaf pine. On most areas, it is difficult to find skips or misses. So far, we have had little success with longleaf pine and we are still experimenting with its planting.

Both. machines needed some modification before they would work satisfactorily under our conditions. Neither performs too well in fine sand, for a "trench" is left which we have found impossible to avoid. We have cut off the "shoes" on both machines, leaving a planting slit 2 inches wide. We also lengthened the Lowther 4 inches to allow more time for the soil to fall back in place before the rear wheels passed. This was necessary in heavy sod or grass.

The Lowther Machine does not perform satisfactorily for us in light sands but does well on all other types, after the above-mentioned modifications. It packs well and rides well, and plants equally well uphill or down and on the contour of a slope. On lighter soils with better cover, it may be desirable to remove some weight and a larger frame was found necessary. A certain amount of lost motion results when turning around and the machine is heavy and difficult to move from one area to another, but the results offset the time lost.

The ICRR planter was constructed too light for the conditions under which we use it We rebuilt it with 1/2- to 5/8-inch metal, replaced the plow with some armor plate from an old Army weapons carrier, cut off the "shoe", and made some other changes. Great trouble was had with the wearing of bolt holes on the after part of the machine and, where possible, we substituted 15- to 20-inch bolts running through. We now find it ideal for light soils, level lands, and fairly sharp curves. It will not plant satisfactorily on slopes. We use a 4-inch mill shaft as a weight on the tractor's bumper to hold the front end down. One of the best features of this machine is its maneuverability and ease of moving.

MODIFICATIONS REQUIRED ON A MACHINE IN MISSISSIPPI

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Mississippi National Forest, Gulfport, Mississippi

The Biloxi Ranger District of the Mississippi National Forests is located within convenient fishing distance of the Gulf of Mexico. In this flat coastal plains area there are some 16,000 acres of wide, open, wet "savannah" lands. Unlike true savannahs which are characterized by the presence of saw-palmetto or bunchgrass, these openings are low meadowlike areas which remain wet a large part of the year. The higher ground in them runs heavily to sandy soils.

Machine planting of slash pine on this type of ground began three years ago, employing the Lowther tree-planting machines. Different kinds of mechanical trouble were encountered and corrective action

had to be taken. Perhaps the most outstanding weakness was the speed. with which the plow points and mouldboards wore out as a result of the abrasive action of the sandy soils, and delays for this reason were numerous.

In overhauling one of the planting machines one summer, mechanics at the central machine shop at Forest, Mississippi, welded hard steel over the plow point and mouldboard of the plow, making it a solid unit. The planting machine manufacturers frankly felt that this modification would not be of any practical value. However, the Biloxi District Obtained one of these modified machines and tried it out. Les trouble with the modified machine was encountered than with the others. When the three machines were overhauled the following summer they were all built up with a "stoody self-hardening steel" and converted to solid units. During the entire 1950-51 planting season just completed, not a single breakdown from this cause occurred on any one of the 3 planting machines. Two of the machines, kept on the job full time, planted an average of around 600,000 seedlings each during the season.

Careful overhaul of the machines following each of the 3 planting seasons has just about eliminated lost time from mechanical failure The correction described is not recommended for the planting of any other species than slash pine in so-called savannah, although a modified machine has been used to plant some longleaf on high ground with good success.

USE OF MACHINES BY PUBLIC, PRIVATE, AND INDUSTRIAL FORESTERS IN SOUTH CAROLINA

E. B. Price

Assistant State Forester, Columbia, South Carolina

Private (Contract) Operator

I pick up seedlings at nursery in lots of 50M to 100M depending on whether using only one planter or more than one; heel seedlings in without breaking the bundles. Am sure that with seedlings tied 100 to the bundle, it would be better for the seedlings to break the bundles in the heel-in beds, but have found that when handling a large quantity for custom planting, it is just too hard, or impossible, to keep the count straight if the bundles are broken for heeling in. Also seedlings heeled in in the trailer for transport to the field often get an unexpected had jolt which throws them out of place. If they are in bundles, order can quickly be restored while if they are loose, much time and a good many seedlings are sure to be lost in the straightening up. I am much in favor of

having seedlings tied 50 to the bundle so that they can be heeled in with soil closer around the roots without breaking the bundle. (North Carolina State Nursery does this).

I carry seedlings into field heeled in (not bedded down) in sawdust in a 2-wheel trailer. High sides are kept on the trailer to protect seedlings from wind. Under unfavorable conditions (warm or windy weather, long drive to field, or necessity of parking trailer in open, sunny place during the day) I try to keep a cotton sheet stretched across the top of trailer to shade seedlings and protect from wind.

With only one planter operating, I use a 2-man crew. With more than one planter, one extra man supplies seedlings and water to the planter. Crews rotate on all jobs to avoid fatigue.

Under most conditions I find it better to pull only one planter behind a tractor. However, in large, open fields I have used a double tow very successfully. A 25 hp tractor (John Deere B, Farmall) can pull 2 Lowther planters easily in a light, well-settled soil, such as in an old field that has been uncultivated for some time. Soft fields, recently cultivated, give trouble to the tractors, as well as the planters. The double tow arrangement is more maneuverable than would be expected and has a number of advantages, but has the disadvantage that if any one of the 3 units breaks dawn (tractor or either planter), time is lost on the whole operation.

I seldom load my equipment on trucks to move; have found it cheaper and usually quicker to drive the tractors, even up to 40 or 50 miles or more.

Thorn punctures in packing-wheel tires have caused much trouble. If tire is once allowed to get slack (which is bad from standpoint of packing seedlings too) it seems to pick up thorns much worse than when properly inflated.

Consider the Lowher planter a good machine, but it (my model, at least) is just not adapted to some soils. On soft sands or recently cultivated fields, it often does not work as well as the newer type planter which works off the tractor hydraulic lift. These latter can be lifted slightly so that the packing wheels do not bog in the soil so badly and then too, they are not as heavy on the back end to start with. Also, on wet savannah soils and other sticky soils, the Packing Wheels often get so clogged with mud and debris that they stop turning. A local machine shop made a set of wheel scrapers to try to stop this, but not much luck. I also rigged up an extra set of 4.00 x 8 packing wheels on back to cope with soft soils, but not much luck there either. I have not tried the new large-diameter Lowther packing wheels, but believe they should largely correct both the above troubles.

On wet savannahs much less trouble with wheel clogging is experienced if the area is net burned over prior to planting; the grass cover keeps the wheels off the sticky earth. However, with the heavy grass cover on the ground, there is great danger to the tractor tires from hidden sharp lightwood stobs in the ground.

I also have a Chapman planter that fits on the hydraulic lift of a Ford tractor. I consider it good for some planting conditions , but less suited to general custom work, with all sorts of planting conditions, than the Lowther. The most serious fault is the fact that the packing wheels are on a rigid frame with the rest of the planter. The back end of the planter should be hinged to the front so that the packing wheels are free to ride up and down over irregular ground and especially so that they will ride on the ground and pack the seedlings in soils where the trencher runs fairly shallow. With the rigid arrangement, the planter simply will not work in many heavy soils, for the trencher does not run deep enough to let the packing wheels do their job. Another objection to the Chapman and similar planters is their generally light construction. They just can't take it like the heavier Lowther. For one thing, mine is continually getting twisted so that the coulter does not run directly in front of the center of the trencher. In light soils this is often not serious, but in heavy soils the planter will not pack the seedlings properly if the coulter is off center more than a very small amount.

The design of the coulter and its relation to the trencher are very important features of the planter. Under some conditions (light soils and recently cultivated fields with no large roots) these factors are not so important. On the old Lowther machines, such as mine, the coulter bearing consists of a brass sleeve in stead of ball bearings. when this sleeve becomes worn, the coulter tilts to one side and again causes trouble in heavy soils. In the flamer ball-bearing-mounted coulters, I have not noted any trouble in this respect.

In areas where roots and other underground obstructions are frequently encountered, it is very important that the coulter blade be large enough to run well below the trencher point and that the clearance between the blade and the trencher point be kept to a minimum. Otherwise, much time will be lost removing roots, wire, old cans, etc., from the front edge of the trencher. Also, now and then, the coulter blade will ride over a large root and let the trencher drop back immediately and catch under it. Sometimes considerable time is lost freeing the planter caught in this *way.* *In the* newer Lowther planters the coulter is large and the clearance between coulter and trencher point so small that when the coulter fails to out a root or other obstruction, it rides over and carries the trencher Blear too. With many of the newer type light planters the coulter blade is small and the clearance large and the point much too long, so that much trouble is encountered

with roots, etc., fouling the trencher. Also, the coulter blades on nest of these planters that I have seen are not rugged enough. Large roots and lightwood knobs give the coulter of a tree planter a rough time and I have had the coulter on a Chapman machine break into a half dozen pieces. At present my Chapman machine is equipped with an old-type coulter from a Lowther machine cut down to fit in the assembly. The newer Lowther coulter blades are very expensive, but highly satisfactory in every respect. The old ones were too soft.

Another trouble 1 have encountered with the light planters is that the packing wheels are not always properly lined up when the macnine is built. If properly aligned to start with, they can get out of line due to the twisting of the trencher assembly. I have lost a good deal of time in the field trying to keep all the elements of my light planter - coulter, trencher and packing wheels properly lined up.

On both the Lowther machines that I have used the packing wheel bearings require a good deal of attention because the grease seal does not exclude dirt effectively. In soft soils anything that increases the resistance to the turning of the packing wheels (such as a dirty bearing) causes more trouble with the wheels pushing up dirt in front and makes proper planting more difficult.

Some of the soil conditions which have given me trouble in planting are:

1. Very light sands. Packing wheels bog down. Chapman-type planters often work better here than Lowther.

2. recently plowed fields. Same trouble as above.

6. Wet, sticky soils. Packing wheels foul up.

4. Dry, heavy soils. Sometimes so hard that even the Lowther coulter and trencher will not go deep enough for planting. In other soils the coulter and trencher go down all right, but the soil breaks up in clods and does not pack uniformly.

5. Field cultivated in past few years with high beds. Cannot plant across beds, as packing wheels bog. Cannot plant in bottom of furrow because the tractor wheels (and the large wheels on tee Loather planter) run high up on the beds so that the trencher assembly will not penetrate deep enough to plant the seedlings with the roots straight. In such cases, I run the machine slightly off center with the furrows and plant on the sides of the beds as near the bottom of the furrow as I can.

State Forest Director

7;e first started machine planting of pine seedlings on the Forest in 1947-48 using a Lowther tree planter borrowed for us by Mr. H. F.

Bishop. That year we planted 150,300 trees. The machine was pulled by a Ford-Ferruson tractor and planting was done on 8-foot rows. For the 1948-49 season we bought a Lowther planter and planted 418,850 seedlings. Because checks on the previous year's planting had showed that on 8-foot rows we got only about 100 trees per acre because of spaces left while the man planting reached for more trees, we changed to 6-foot rows and got nearly 1,000 trees per acre. For the 1949-50 season we used both the Lowther planter and the small planter built by H. T. Hunter to operate on the hydraulic lift of a Ford-Ferguson tractor. Altogether we planted 628,050 seedlings. *We* found the small planter was more maneuverable and therefore was quicker and easier to use in small openings. For the 1950-51 season we used only the Hunter planter and planted 140,000 trees.

Remarks

Small planter operated on hydraulic lift of tractor is much bettor in our light sandy soils.

1. Not being so heavy does not make a deep trench in sand.

2. If planter starts to sink, tractor operator can raise planter with hydraulic lift and not stop planting.

3. Planter can be picked up clear, enabling tractor to make short turn at rows end.

4. Planter can be picked up easily for transportation from one planting site to another.

5. Light weight and small size of planter makes replanting at end of first year easy.

6. Light Planter can be built for about 1/8 of the cost of Lowther and maintenance is easier and cheaper.

7. By using hydraulic lift on tractor to raise and lower tree planter, the man on planter has both hands free at all times to handle trees.

8. Tractor and small planter pan be walked up ramp onto truck and transported to planting site. Fire plow can also be carried on truck. And in event of getting a fire call, a quick change in the field will send the tractor to the fire already equipped, thus saving much time on fire.

9. We have planted successfully slash, loblolly and longleaf.

10. We have planted successfully in 'new ground' clearings with the small hunter planter. The tractor operator can dodge or run around stumps, picking the planter up quickly and easily when any obstruction is sighted,

Industrial Company

Both the Lowther machine and the new Webster planter were put to use Each has its peculiar advantages and disadvantages which recommend it. for some jobs and disqualify it for others.

The Lowther machine was used at Georgetown, where it planted in old fields, cut-over woods, and open savannah. It surprised even its admirers with a demonstration, of ability to plant well on a day-in day-out basis under these rough conditions. Pulled. by a Farrell II wheeled tractor and manned by a steady 3-man crew, it wove its way among the stumps, roots, boards, bombs, ditches, and other obstructions to plant 125 Y seedlings on 184 acres in 25 working days. The seedlings were well planted and packed in spite of the rough nature of the job, which made riding the planter difficult and ruined the coulter, The production average of 5L per day is not spectacular and falls considerably below claims made for the machine, but the volume was a welcome contribution to the overall job, the trees were better planted than those set out by hand, and the cost was lower by machine than by hand. The bell and tapper system provided uniform spacing, and the pneumatic-tired packing wheels set the trees firmly behind the pica. The record day's production was 8M.

The Webster machine was used only at the end of the planting season at Summerville, and would have planted a considerably larger acreage except that the tractor gave trouble. The single rear wheels of the Ford tractor pulling the planter cut into the dry, sandy soil of the fields and bogged down. As greater flotation would correct this, arrangement was made at once for purchase of a set of dual rear wheels for the tractor. Delivery on these was promised for the following day, but more than 2 weeks passed before they arrived, Equipped in this way, the tractor pulled the planter nicely until motor trouble forced its withdrawal from the work. By this time the season was almost over, so the job was finished by the hand. crew.

Although the Webster machine planted only 17 acres, its performance could be observed, The experience produced an improved technique and suggested mechanical improvements which can be made, The Planting machine operators ride directly behind the tractor exhaust which must be extended to the side so that the fumes will be blown away instead of into their faces, Also, if the plow wings can be spread farther apart, correct placement of the seedlings will be facilitated. And perfection of a tapper device to provide uniform spacing will relieve the men of paying constant attention. to obtaining good spacing and allow the tractor to proceed at a faster. pace.

The Webster machine is well adapted to planting in fields, as it can make short, quick turns. It can also be used for planting on

curves, which allows perimeter planting and avoids the need for lost time on turns. It does not appear to be sturdy enough, however, for use in the woods.

The planting machines work very well when operating conditions are just right. The difficulty, though, is to find conditions which are just right and which remain so. Thus far, the Lowther planter has worked successfully under the widest range of conditions. The Webster has planted well in only loamy sand and sandy loam soils. In lighter soil (sand) it bogs and in heavier soils (sandy clay loam and heavier) it loses traction and can operate only with partially raised plow. All of this fault, 'however, lies with traction and flotation, both of which could be overcome through use of a standard half-track assembly and perhaps by use of mule cleats.

The problem of signalling the plant setter when to set trees to maintain a constant spacing was solved this year for Webster machine. An electric bell was mounted on the rear of the machine, with a power wire extending to the battery terminal on the tractor. The bell is activated by an electric brush which makes contact each time a large gear makes a complete rotation. Because the spacing desired is 8 feet and the circumference of the tire en the packing wheel is 4 feet, a small gear having one-half as many teeth as the large one was installed on the axle near the packing wheel, and when the gears are meshed , its size requires that it (and the 4-foot packing wheel) must make 2 full revolutions to rotate the large gear once. The bell then rings every time the packing wheel turns over twice, and signals the planter to plant at 8-foot intervals.

Operation of the planting machines is a problem not readily solved under company planting conditions. If the units are to be operated efficiently, trucking capacity must be available to move them from place to place when needed, and not when or if it is convenient to somebody else. Supervision is also a problem, but is vitally necessary to successful planting by machine, If the supervisor is required to servo as a crew member, his ex←ense runs up the operating cost. If he does not serve in the crew and operates only one or two machines, his expense is completely nonproductive in seedling establishment on a job which will plant less than 20M trees per day. At the same time, this same man could supervise a hand crew of 30-40 men who would plant twice as many trees per unit of time as the 2 machines or about 4 times as many as one machine. This is of critical importance in our supervisor-short planting work.

The machines operate quite efficiently in large, contiguous areas Where tney can be used close to a hand crew and a single supervisor can oversee both jobs. But on small, scattered tracts, they are a problem.