NURSERY SEEDING MACHINE

C. Ingersoll Arnold

Chief, New Hampshire State Nursery

Gerrish, New Hampshire

In an effort to reduce seeding costs and extra labor involved in rolling broadcast sown seed and covering them with sand or sawdust, we have designed a broadcast seeder combination which seems to do as good a job as any we have seen. Future modifications may improve the quality of the sowing.

The rig is designed for use on an Allis-Chalmers Tractor hydraulic lift mechanism but could be easily designed to fit other types of hydraulic lifters.

Essentially it consists of a frame upon which is mounted a roller made from an old water tank. In front of the roller, mounted in such a manner as to be free floating, is a Gandy Nursery Special Fertilizer Spreader and Seeder. The frame is constructed so as to permit removal of either the Gandy (if one just wants to roll an area) or the roller (if one wishes to sow fertilizer on growing stock without rolling the stock down)(figs 1-3).

Bed preparation consists of forming the bed with a tractor-drawn bed shaper behind which is dragged a scratcher to loosen the top 1/8 - ¼” of soil. A board filled with nails served us well as a scratcher; a section of Page fence also serves very well. We also propose to try mounting a roller with small discs just ahead of the Gandy to do the scratching. The action of the roller behind the Gandy moves enough soil to cover the seeds with about 1 /8 - 1/4^{11} which in our sandy soil is sufficient. On heavy soils, this might be too much of a covering, in which case it might be better to not use the scratcher and cover the seeds with sand or sawdust.

The frame and roller was constructed by a local welder at a cost of about $150.00, for all labor, material and parts except for the Gandy.

In the first season of operation, the cost of sowing seed in the nursery using this piece of equipment resulted in a saving in labor costs compared to the old method equal to the cost of construction and materials. The end of the second season should see the entire cost liquidated.

When the soil is moist, it is necessary to have the roller filled with water, but where the soil is dry, the weight is so great as to cause a rolling or piling action in front of the roller composed of loose soil particles and tree seeds.

The machine still needs improvement - the roller could be modified or replaced by a double roller mounted in tandem constructed similar to the roll on a Brillion seeder, also it might be advisable to mount some sort of rig in front of the splash tray of the seeder to make a better seed bed condition for the seed to insure more complete covering of the seed.

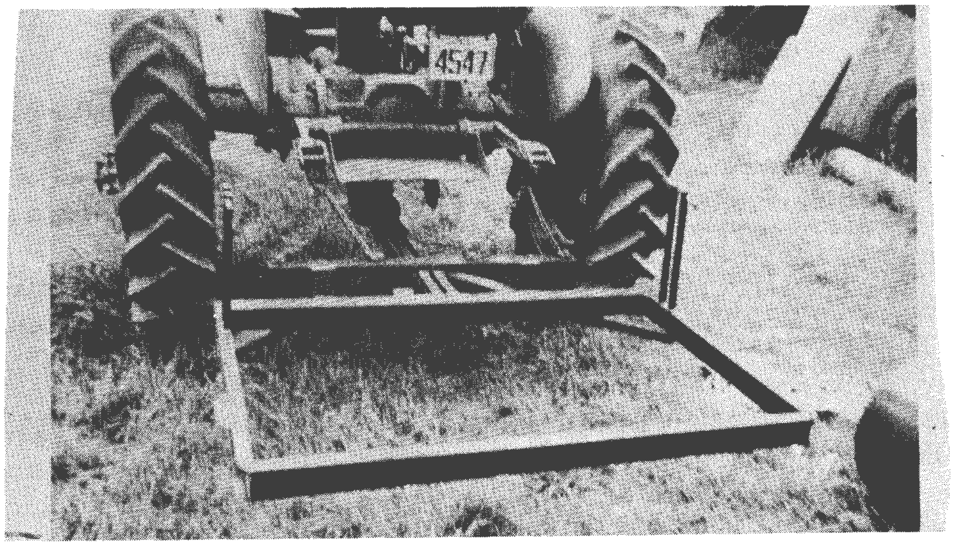


Figure 1. The frame alone. Note uprights to hold axles of Gandy, and flange and holes to hold bushings of roller axle.

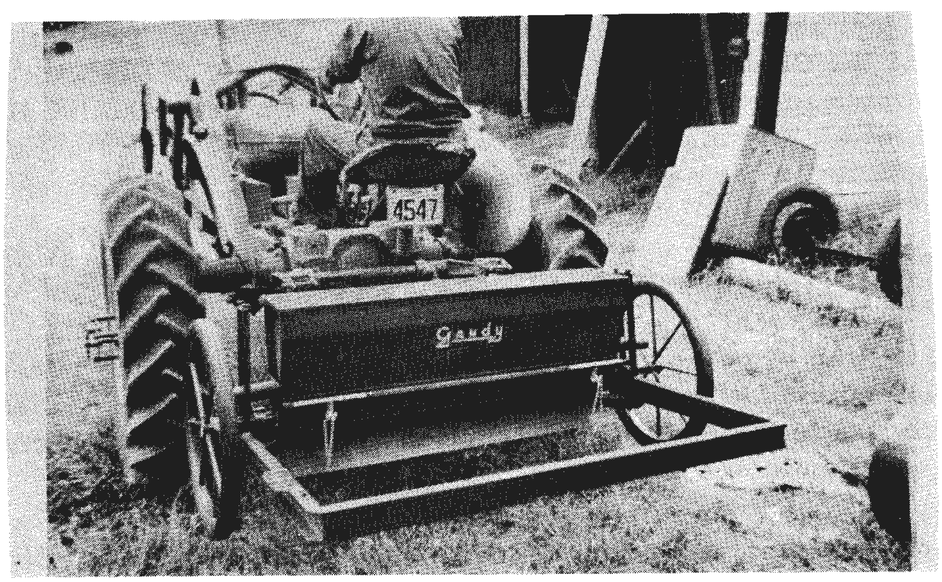


Figure 2. Gandy seeder set in place.

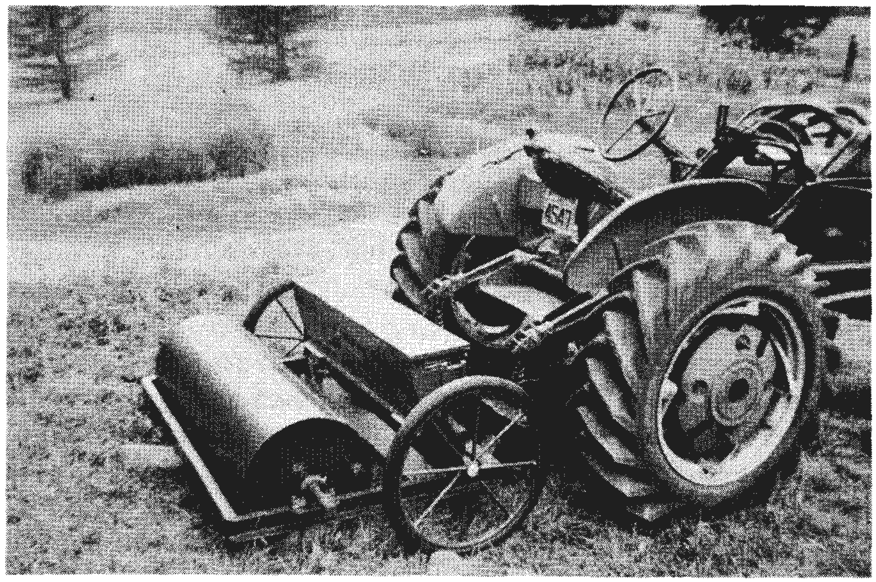


Figure 3. Gandy and roller in place.
(A 2" block of wood between the frame and the roller bushing was required to insure that the Gandy's wheels were always on the ground even though uneven bed surfaces raised the roller and frame a little higher than normal.)

OBLIQUE ROOT PRINING BLADE

Rex Eide and John Grimm

Nurseryman and Assist. Nurseryman, Col. W. B. Greeley Nursery
Nisqually, Washington

More than ninety percent of the planting stock shipped by the Col. W. B. Greeley Forest Nursery is 2-0 which is commonly root pruned in the early spring of its second season in the seedbeds. Heretofore, root pruning has been accomplished with a blade oriented perpendicularly to the direction of travel. In 1954, on a visit to the Green Timbers Nursery of the British Columbia Forest Service at New Westminster, B. C., we observed a sledmounted root-pruning blade mounted obliquely to the direction of travel.

The bunching up or folding over of rootlets on the perpendicular root-pruning blade previously caused a thickening of the blade so that instead of shearing off the roots it has more of a lifting effect. This also necessitated time consuming cleaning of the blade after passing through each seedbed. The oblique blade mounted on a frame with a three-point hook-up has a general tendency to cut the roots with a more slicing effect and to clean itself as it passes under the seedbed.

For greater convenience, an oblique blade and carrier was designed for attachment to a standard hydraulic three-point hook-up (fig. 1).

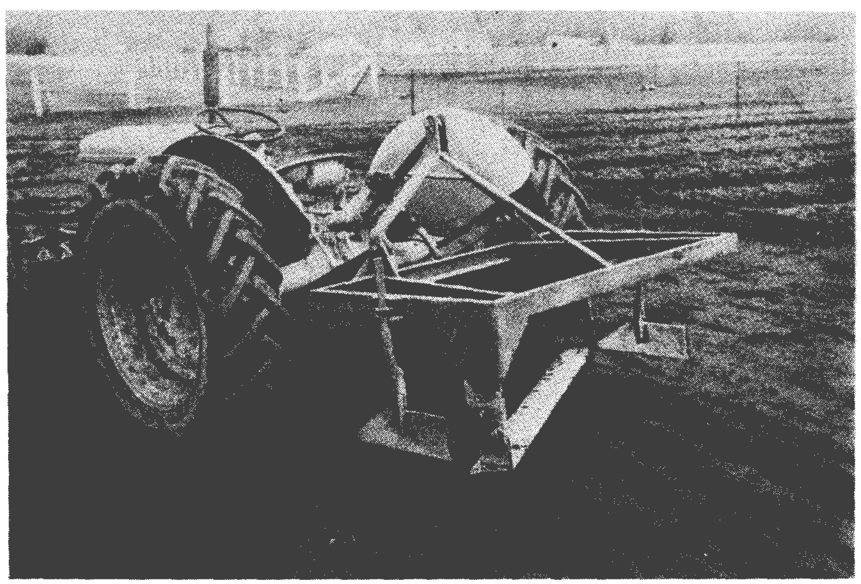


Figure 1. The oblique root pruning blade ready for work at the Col. W. B. Greeley Nursery.

In designing such a blade and carrier, it must be borne in mind that pivoting the front of the carrier about its horizontal axis moves the leading end of the blade less than the trailing end. This is considerably minimized by the type of lifting action produced by a three point hook-up. Nevertheless, it is well to design the blade and carrier so that the blade is truly horizontal in two dimensions when it is held at normal root-pruning depth. Since side pressure on the blade is sometimes developed from the blade being drawn through the ground diagonally it is necessary to fasten stabilizing fins to each side of the blade carrier (fig. 1).

The use of a stabilizing bar that is standard equipment with most tractors with a three-point hook up will also help to control the side-slipping or swaying of the blade carrier. If the seedbeds are raised to any height the stabilizing tins will also help to hold the shoulders of the bed intact as the blade passes through the ground. After an operator becomes experienced with this blade he can easily root prune twenty-five to thirty 250-foot seed beds per hour with a tractor speed of two to three miles per hour.

In the past five years many different experiments in root pruning have been tried at the Greeley Nursery with the result that it is now common practice to root prune in the early spring the 1-0 seedlings being held for 2-0. This is usually done in March while the ground is still firm enough to hold the seedlings but dry enough so the blade will pass through the ground easily without gumming up. It is desirable to root prune just before a rain so that the beds will settle back into place and any cracks in the beds caused by the pruning will be sealed so as to minimize loss of seedlings. The over-head sprinklers can always be used to moisten the pruned beds if rain doesn't materialize.

Over twenty-eight million seedlings, eight million in the spring of 1955, four million in the spring of 1956, and sixteen million in the spring of 1957 have been root pruned with this blade with a loss of very few seedlings.

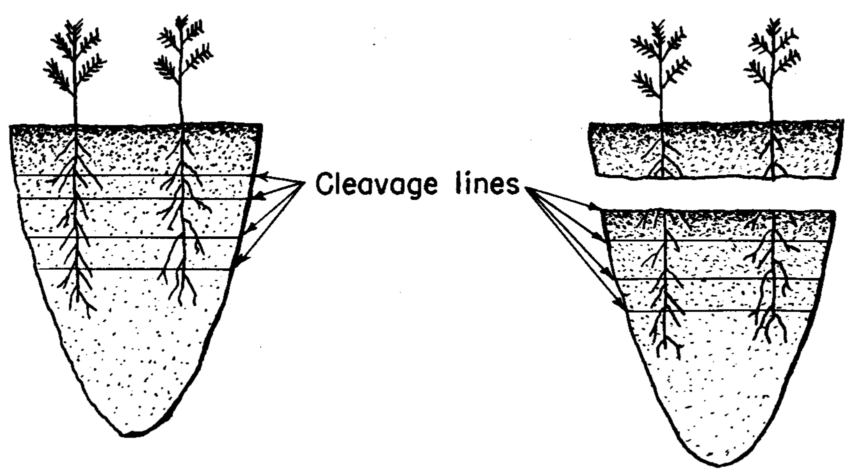
FROST DAMAGE

C. Ingersoll Arnold

Chief, New Hampshire State Forest Nursery
Gerrish, New Hampshire

In midsummer of 1957 severe losses in beds of two year old balsam fir and white spruce were noted despite adequate irrigation. At first the loss was attributed to insects, because the roots were cut off at a depth of approximately 1 1/2 inches but no one could identify the insect by the damage, and no culprits could be found in the soil. So many trees were dying that the insect population would have had to be tremendous and operating at a constant depth. Mr. Charles Clement, U. S. F. S. Forest Tree Nursery Specialist, on his visit to the nursery, thought we should do some investigating by digging up samples of the soil. The soil is a light loamy sand.

Several samples were dug to the depth of the shovel and removed with care so as to disturb the soil as little as possible. Definite cleavage lines could be seen in the soil profile running horizontally, and at the depth of the most pronounced cleavage line, about 1 1/2 inches, the seedling roots had been snapped off (fig. 1). It was possible to separate the layers of soil along the cleavage lines.



This phenomenon can be explained as follows: A severe cold spell with insufficient snow or mulch freezes the soil to a depth dependent upon the degree and duration of the cold spell. Then, with snow absent, a warm spell occurs and the top inch or so of soil thaws. Sometimes the thaw is caused by a rain, but at any rate a layer of water collects on top of the unthawed soil. During a subsequent cold snap the layer of water and the thawed soil freeze, expand, and push the small seedlings up with them. Inasmuch as the lower roots are held fast, the expansion of upper layer stretches the small roots until they break. In beds where the trees were large enough to withstand the stretching without breaking, subsequent thawing of the soil produced trees with a corkscrew or pigtail stem. (Fig. 2)

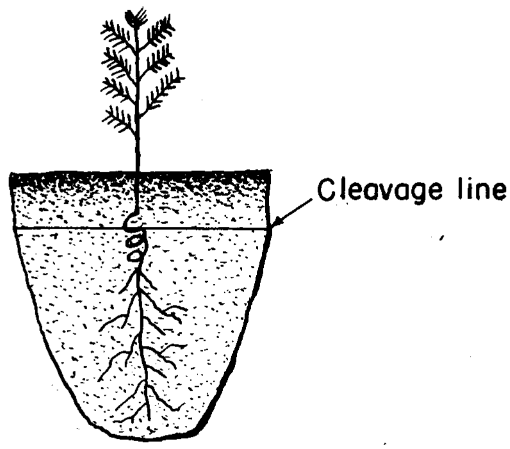


Figure 2

It might be noted that there were several definite cleavage layers indicating more than one period of frost thawing and freezing.

The frozen soil differed markedly from the soil at deeper levels that had not been frozen. Depth of frost penetration could be discerned with little trouble. The frozen soil was more compact and less friable, less crumbly than unfrozen soil. Its structure seemed to have broken down.

Here in New Hampshire we believe such occurrences to be a freak of nature, for there is usually sufficient snow on the ground but the winter of 1956-1957 was unusual in that it experienced a period of freezing and thawing with no snow on the ground. It is believed that such frost action can be prevented by using sufficient mulch. It is also felt that increasing the amount of organic matter in the soil should help control break down of soil structure and therefore reduce the damage.

A TEST TO DETERMINE ACCEPTABILITY OF SAWDUST AS A SEED BED COVER

H. Knight

Research Division, B. C. Forest Service
Victoria, B. C.

Nurseries that use the broadcast method of seeding often have difficulty finding a suitable cover for the seed.

Many materials for a seed cover are recommended. Sand is favored (references 1, 3, 4, 5, 6, 9, 12, 13, 14, 15). Other materials mentioned for use as a seed cover are soil, type not specified (7, 11, and 16); humus (3, 8, and 13); loam (6, 8, and 15); grit and fine gravel (4); sawdust (2, 6, 8, and 10); and various organic mixtures.

The East Kootenay Nursery in the southeastern part of British Columbia started using river-washed sand as a seed cover. However, this sand was not always a good medium as it often contained lumps of calcareous material. This material, if allowed to accumulate, could cause seedling nutritional disorders. Consequently, a satisfactory substitute for the sand was sought. That led to the following trial where sawdust was used for a seed cover on ponderosa pine seed.

METHOD

A Latin square was laid out on four, 4-by 50-feet nursery beds (fig. 1). Each bed was divided into four subplots, 4 by 12. 5 feet. The seed was broadcast (approximately 5, 000 sees per subplot) on to prepared beds and pressed into the soil with a metal roller. The following four treatments were applied as a seed cover: Sawdust, covering depth 1/4 inch; sawdust, 1/2 inch; sawdust, 3 /4 inch; and sand (control), 1/4 inch.

In each subplot a sample area 3. 5 by 2 feet was marked out for germination and survival counts. This provided a 14 percent sample. These areas were positioned at random and set up after the seed was covered. The sawdust used was a mixture of ponderosa and lodgepole pine, douglas-fir and western larch.

RESULTS

The first and second year's results are combined and the data appears in table 1.

TABLE 1

GERMINATION AND SURVIVAL OF PONDEROSA PINE BY FOUR COVER TREATMENTS

Treatment and Subplot No.	Total Germination 1/	Survival	Seeds surviving per 100 seeds sown
Sawdust, 1/4 inch	(Percent)	(Percent)	(Numbers)
4	49.0	84.0	
7	48.1	81.1	
11	56.0	85.7	
16	31.7	74.4	
Mean	46.2	81.3	37.8
Sawdust, 1/2 inch			
1	52.7	82.1	
5	54.9	83.6	
10	59.3	87.1	
14	52.0	81.9	
Mean	54.7	83.7	45.5
Sawdust, 3/4 inch			
3	40.9	85.3	
8	63.3	81.1	
12	47.1	85.8	
15	53.0	90.8	
Mean	51.1	83.7	43.6
Sand, 1/4 inch(control)			
2	37.9	59.2	
6	60.4	80.4	
9	74.6	46.8	
13	36.6	47.7	
Mean	52.4	58.5	30.9
Difference for significance at			
1 percent	24.7	21.6	
5 percent	16.3	14.3	

1/ On the basis of 5,000 seeds per subplot there were approximately 700 seeds sown to each sample area and this figure was used as a basis for calculating the germination percent.

The highest total germination was in the 1/2-inch sawdust treatment. This was 54. 7 percent. This was followed by the 1/4-inch sand (control), 52.4 percent; 3/4-inch sawdust, 51. 1 percent; and 1/4-inch sawdust, 46. 2 percent.

The seed had a 51 percent germination in the laboratory, but apparently germinated better under three of the four treatments in the nursery. This resulted in overcrowding which seemed to reduce the size of the seedlings. However, p no nutritional-deficiency symptoms were evident.

The delayed germination was estimated to vary from 5-30 percent of the total germination.

The highest survival was in the 1/2-and 3/4-inch sawdust treatments, viz., 83. 7 percent. This was followed by 1/4-inch sawdust, 81. 3 percent; and 1/4inch sand (control), 58.5 percent. All the sawdust survival differences were highly significant when compared to the sand.

The mortality was higher in the sawdust treatments than in the sand during the second year. For example, the 1/4-inch sawdust had 20 percent of the total mortality the second year, the 1/2-inch sawdust 25 percent, the 3/4inch sawdust 22 percent, while the sand had only 8 percent. These figures are in direct proportion to the delayed germination numbers.

The figures for the number of seeds surviving per 100 seeds sown, which are provided to give a broader picture of survival, show the same trend as the percent survival.

Observational results show that sawdust will remain in place equally as well as sand. There were no wind-blown bare spots on the 3/4-inch sawdust treatments, and many on the 1/4-inch sawdust and sand treatments. There was no serious soil cracking under the 3/4-inch and 1/2-inch sawdust treatments. Soil cracks 1 /2 inch across at the surface were common on the 1/4inch sawdust and sand treatments. It would seem that the 3/4-and 1/2-inch sawdust applications provide a further service as a mulch.

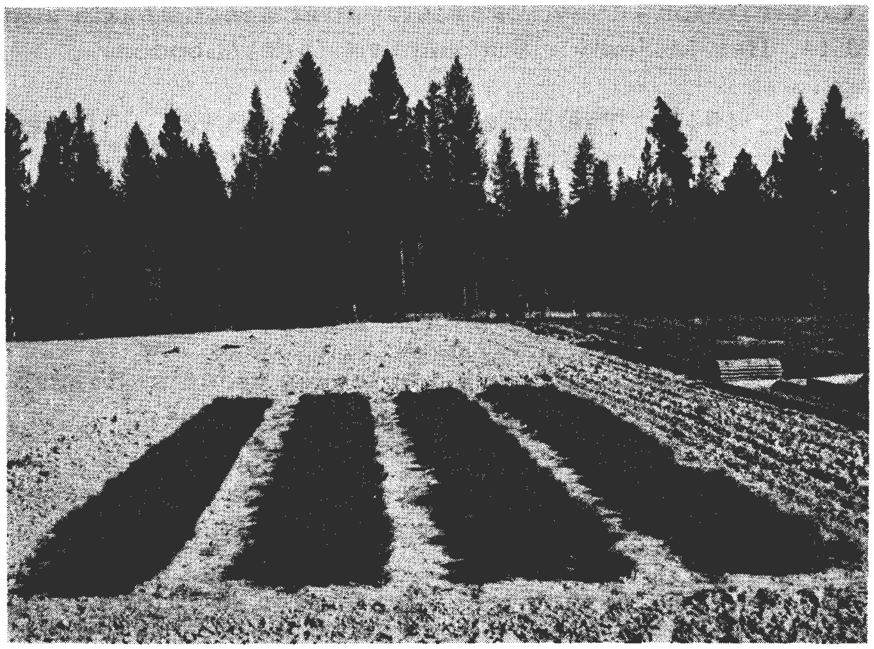


Figure 1. Plot layout after two growing seasons. There are four treatments in each bed arranged as a Latin square.

CONCLUSIONS

1. The results from this study would suggest that sawdust has a use as a seed cover in the nursery, and that wider application should be made on a further exploratory level using 1/2 to 3/4-inch treatment.

2. The Woody Plant and Seed Manual (16), states that ponderosa pine seed ordinarily germinate satisfactorily without pretreatment. The evidence in this experiment showed that delayed germination was high and, therefore, stratification should be tried to improve germination and reduce the number of cull seedlings.

REFERENCES

(1) Brewster, D. R., and J. A. Larsen, 1925. Studies in Western Yellow pine nursery practice. Jour. Agr. Res. XXXI (12): 1101-1120.

(2) Buckland, D. C., 1947. Investigations on the control of Fusarium top-blight of Douglas fir seedlings. Division of Botany and Plant Pathology, Science Service, Canada Dept. of Agric., Victoria, B.C.

(3) Dengler, A., 1925. Uber Die Wirkung Der Bedeckungstiefe Auf Das Auflanfen Und Die Erste Entwicklung Des Diefernsamens. (The Effect of depth of cover upon the germination and early development of pine seed). Zietschrift Fur Forst-Und Jagdwesen. Vo. 57: 385-408. U.S. Forest Service, Translation 204.

(4) Forestry Commission, 1946. Forestry practice. Fourth edition Bull 14, Her Majesty's Stationery Office, London.

(5) Hawley, R.. C., 1947. The practice of silviculture. Fifth edition. John Wiley and Sons Inc., New York.

(6) Kummel, J. F., D. A. Rindt, and Thornton T. Munger, 1944. Forest planting in the Douglas fir region, U.S.D.,A. Forest Service, Portland.

(7) McKinnon, F. S., 1946. Growing coniferous trees in British Columbia, B. C. Forest Service, Publ. T 14.

(8) Murphy, F. T. 1949. Evergreen trees from seed to transplant. Penna. State College Extension Service. Circ. 330.

(9) Olson, D. S., 1930. Growing trees for forest seedlings in Montana and Idaho, U. S. D. A. Circ. 120.

(10) Perry, G. S., 1929. Forestry in Sweden. Published by the author. Mont Alto, Pa., Pennsylvania State Forestry School.

(11) Pettis, C. R. 1909. How to grow and plant conifers in the Northeastern States, U. S. D. A. Forest Service, Bull. 76.

(12) Shaw, S. B., 1930. Forest nursery and planting practice in the California pine region. U. S. D. A. Circ. 92.

(13) Steven, H. M., 1928. Nursery investigations, Forestry Commission Bull. 11.

Her Majesty's Stationery Office, London.

(14) Tillotson, C. R., 1917. Nursery practice on the National Forests. U. S. D. A. Bull. 479.

(15) Tourney, J. W. and C. F. Korstian, 1948. Seeding and planting in the practice of forestry. Third edition. John Wiley and Sons Inc., New York.

(16) United States Department of Agriculture, Forest Service, 1948. Woody plant and seed manual. Mis. Pub. 654.

EXPERIMENTAL TREATMENT OF SAWDUST WITH ANHYDROUS AMMONIA

H. B. Wycoff

Nursery Superintendent, Mason State Tree Nursery
Topeka, Illinois

The need for soil organic matter in an area where acid peat is not available locally has led to the use of sawdust in large quantities as a soil amendment at the Mason State Tree Nursery in central Illinois. It has been used for over eleven years as a winter mulch on first year seedling and transplant beds to prevent frost heaving and later to improve the soil. A sawdustground corncob mulch is spread about 3/4 inch thick, top dressed annually with about 300 pounds of ammonium sulphate, and incorporated with the soil at the end of the rotation.

Heavy applications of sawdust for soil improvement between rotations, with and without attempts at preliminary composting, have been tried periodically. In 1954 information on the use of anhydrous ammonia to impregnate sawdust with nitrogen was obtained from the Soils Department of the University of Wisconsin, where a good deal of work on the subject has been done (1). Their recommendations have been followed to some extent in the work at the Mason Nursery. The physical and chemical characteristics of anhydrous ammonia seem to adapt it remarkably well for treatment of sawdust under favorable conditions.

At the Mason Nursery fresh hardwood sawdust has been treated both in the compost pit and in the field with anhydrous ammonia, phosphoric acid and other fertilizers. Up to 500 cubic yards of sawdust have been applied per acre. Many aspects of these practices need refinement, evaluation and further study, but it is strongly felt that sawdust can play an increasingly important part in nursery soil management. Some progress has been made in evolving techniques and a number of test plots have been established and are under observation. A discussion of our techniques and the tests follows.

The compost pit being used is thirty-five feet wide, fifty feet long, and five feet deep. It is sloped toward the back, with a drain to an outside sump. It was filled with mixed upland and bottomland hardwood sawdust.

Anhydrous ammonia is readily available in Illinois. The dealer from whom we purchased our supply was of inestimable help for he not only delivered the material but he also furnished the delivery hose, 6-outlet valve and six lengths of high pressure hose from field injection equipment; helped set up the equipment; released the anhydrous ammonia; and regulated the amount injected at each point.

In order to space the injections evenly a frame was laid on top of the sawdust. The frame was of 1 /2 x 1 x 2 lumber and was two feet wide, and twelve feet long, made with crosspieces that divided it into two foot squares. An injection was made in the center of each two foot square.

Six injection pipes were constructed from 1/4" galvanized pipe six feet long. A T with two six-inch nipples was placed on the top of each pipe as a handle. One nipple was capped. The high pressure hose was clamped to the other nipple. Each injection pipe was threaded on the inside at the lower end and fitted with a sharp point threaded to screw into the pipe. This point was removable to permit cleaning the pipe with a rod when it becomes clogged with sawdust. Starting two feet from the top of the pipe, 1/8[11] holes were drilled through it at six-inch intervals. Each pair of holes were drilled at right angles to the preceeding pair. These galvanized pipes are cleaned and oiled after each use and have not been seriously affected by ammonia or dilute acid.

The anhydrous ammonia was turned off at the supply tank until the six injection pipes were connected and inserted in the sawdust, which had been thoroughly watered previously, and the workers moved back a safe distance. The control valve was then opened and the anhydrous ammonia, which is under considerable pressure, was allowed to flow through the hoses and injection pipes, escaping into the damp sawdust pile through the 1/8 inch holes in the pipes. Each set of six injections required less than thirty seconds, followed by a thirty second pause after the control valve was closed to allow time for the chemical to diffuse into the sawdust.

Since anhydrous ammonia is very hazardous to handle, an experienced operator should control it. All hoses and fittings should be absolutely safe, and personnel kept at a safe distance when the ammonia is being released from the supply tank. The top holes in the applicator should be eighteen inches below the surface of the pile and the sawdust should be pressed around the pipes. The upper holes can be tapped shut if the pile is not deep enough. Very little gas was detected during or after treatment.

Ten pounds of anhydrous ammonia was injected per cubic yard. Since this treatment raises the pH very high, 85 percent phosphoric acid at the rate of two pounds per cubic yard was injected after two weeks. A Hozon was used to dilute the concentrated acid. The dilute acid was pumped into the pile through the same applicator hose and pipes used for the ammonia by means of a power sprayer. It is not known how uniformly the acid was distributed by this method. Sprinkling the dilute acid on top of the pile and allowing it to drain through would have been less expensive and possibly better, although leaching might occur. One year later the sawdust tested pH6 to 8. 7 at increasing depth. No inoculation was attempted since it was felt that wood destroying fungi would probably be present in the sawdust. They may have been killed by the chemical treatments. Potassium was not added because it is not needed in the nursery fertility program. However, it may be necessary to the development of the fungi in the sawdust. The pile was later covered with about an inch of nursery soil and watered to hold the sawdust in place and possibly inoculate it. The drainage water was also pumped out of the sump and spread over the pile periodically.

With the above treatment little obvious decomposition is noted at the end of a year. It remains to be determined whether sawdust in deep piles can be sufficiently modified in a reasonable time by chemical treatment without actual composting. However, the treated sawdust will decompose in a reasonably short time after being incorporated in the soil.

In the fall of 1955 over three hundred cubic yards of sawdust were treated with ammonia in the pit and with phosphoric acid and sulphate of potash magnesia in the field. It has produced excellent rye and sudan crops for two years without additional fertilizer. However, this sawdust soil mixture in containers during the summer of 1956 required supplemental nitrogen for Taxus liners. Some difficulty with germination and growth of sudan grass has been experienced on very light soil where seeding was done in midsummer within two or three weeks after the application of treated sawdust and acid. Plots which received 300 yards of treated sawdust per acre a year ago were seeded to northern conifers this spring. The seedbeds have developed normally for two and a half months.

The anhydrous ammonia costs 7 1/2 cents a pound or 75 cents per yard of sawdust and the phosphoric acid 12 cents a pound or 24 cents per yard. The dealer charged 70 cents per yard for his equipment and services. Nursery labor was about $1.00 a yard for applying the ammonia and somewhat more for the phosphoric acid injection, which was slower. If the sawdust is not left in the pit to decompose it can be treated more economically in the field.

Direct field application of fresh sawdust followed by chemical treatment is the most economical from the standpoint of labor and decomposition time. Under certain conditions heavy field applications may prove undesirable or keep land out of tree production for too long a period of time.

Test plots using up to 500 cubic yards of fresh sawdust per acre have been established for a year. A skid mounted spreader box was constructed and is pulled behind the dump trucks. They dump the sawdust into it as they pull it along. A very uniform 'layer is applied by this method. Some of these plots have been treated with anhydrous ammonia using agricultural knife injectors on a tractor, and phosphoric acid with a power sprayer, at various rates. It was necessary to make a considerable number of applications with the available injection equipment to get the desired rate of ammonia treatment. Other plots were treated with ammonium nitrate at corresponding rates.

Some of these plots are in seedbeds of northern conifers less than a year after sawdust application. Seedling development has been normal for two and a half months with the exception of a bed next to an irrigation line where nitrogen deficiency developed almost at once. This was easily corrected by a top dressing of ammonium nitrate. Presumably the anhydrous ammonia injection was not heavy enough at the edge of the plot. It may be difficult to get uniform coverage with field injection where numerous applications are required to apply the ammonia. There is some indication of this after three months in seedbeds where 500 yards of fresh sawdust was applied a year ago. Rye and sudan grass made luxuriant growth on all except the plot receiving the heaviest ammonium nitrate treatment. The plot with the heaviest anhydrous ammonia treatment is in first year conifer seedbeds.

Inconclusive tests and examinations indicate reduced pH and good decomposition in one to two seasons after field application, depending on factors such as soil moisture and temperature. Additional tests and observations will be made as time and facilities permit. Present tests suggest lighter fertilizer applications and split applications instead of single heavy applications.

It is felt that in order to keep labor cost at a minimum, direct field application and treatment will be the method used whenever possible. In this way treatment costs are reduced and the cost of filling and emptying the pit is eliminated. The pit method can be used to stockpile sawdust and shorten application time when this is desirable. The more uniform ammonia treatment in the pit may prove to be an important factor in achieving uniform stands where seedbeds closely follow sawdust application. Under Mason Nursery conditions all practical methods must be used to increase organic matter in the soil, and a variety of methods will no doubt continue in use. Much more work must be done before final conclusions can be drawn regarding the heavy applications of sawdust as a soil amendment even under local conditions.

(1). Davey, Charles B., Soil Science Proceedings, Vol. 17, No. 1, Jan. 1953.

SUBSOILING IN A FOREST TREE NURSERY

A. R. Gilmore

Agricultural Experiment Station of the Alabama Polytechnic Institute Auburn, Alabama

Numerous examples have been cited to show that if a tractor travels over the same area for a long period of time, the soil in that area will become compacted. The packing of soil and the formation of dense layers and plow soles by implements and traffic can result in poor growth of plants. To overcome these undesirable soil features in forest tree nurseries, most nurserymen have tried correcting such condition by subsoiling or surface tillage.

Soil in the Auburn Nursery, operated by the Alabama Division of Forestry and located near Auburn, Alabama, has been subsoiled for the past three consecutive years. Feet of the subsoilers were mounted on eighteen inch centers. Effective depth of subsoiling was approximately 16 inches and averaged 3 inches into the subsoil proper. The first year the area was subsoiled twice; the second pass over the field was at right angles to the first. The second and third years the area was covered in a circular method. In all, the area has been subsoiled four times.

To determine the effectiveness of the subsoiling operations, undisturbed soil cores were taken from 40 randomized locations in a 10-acre nursery area and from 10 locations outside the nursery area. The nursery area had been plowed for the past 7 years to a depth of 10 inches. This plowing left a distinct dividing line between the plow horizon and the undisturbed subsoil. A check area outside the nursery had been plowed to a depth of 6 inches and planted in grains and legumes for 10 or more years. The topsoil was removed and a subsoil sample was taken with the Uhland sampler. The core with the undisturbed soil was brought into the laboratory and the bulk density (a measure of compactness) was measured. The higher the bulk density, the more compact the soil.

The average bulk density for the 40 nursery samples was 1.59. The average bulk density for the 10 check samples was 1.62. There was no appreciable difference in bulk density between soils under beds and those under alleys. Samples under beds averaged 1.60, whereas those under alleys averaged 1.59.

Table 1 shows the average bulk density and range in bulk density for the various units within the nursery area. The bulk density of the beds averaged

1. 56 and 1. 64 for compartments I and II, respectively. The bulk density of the alleys averaged 1. 58 and l. 60 for compartments I and II, respectively. Although it would appear that there are differences between compartments, this is not true when the standard deviations are considered.

If the subsoiling operations had been very effective, it would seem that the bulk densities of the 40 samples would be nearly the same. As shown in Table 1, the bulk densities ranged from a low of 1. 35 to a high of 1. 83, whereas that of the check plots ranged from 1.56 to 1.70. This spread in the nursery is too large to be attributed to chance. One explanation for the wide range in bulk density is that some soil samples were taken in the exact location where the subsoiler foot had penetrated while in other instances the samples were taken outside the effective range of the subsoiler foot.

This study suggests that subsoiling as performed in the Auburn Nursery for three consecutive years was not sufficient. For the subsoiling operation to be completely effective, it appears that the methods used in the subsoiling operations should be changed or that subsoiling must be continued for a longer period of time.

Table 1. --Average bulk density and range in bulk density for various units within the nursery area. 1 /

Compartment Number	Bed Bulk Density		Alley Bulk Density	
	Average	Range	Average	Range
I	1.56 ± .11	1.35 - 1.78	1.58 ± .06	1.45 - 1.80
II	1.64 ± .08	1.56 - 1.83	1.60 ± .05	1.49 - 1.64

1/ Ten replications in each unit.

SOIL TREATMENTS MAY INCREASE STAND OF LOCUST SEEDLINGS[1/]

J. D. Wilson and Carl V. Bailey [2/]

The nurseryman frequently experiences considerable difficulty in getting a satisfactory stand of tree seedlings in the nursery bed, or at least in getting as many plants as he should from the number of seeds that are planted.

here may be many factors contributing to a poor stand of plants, such as heavy rains and flooding at the wrong time, bird and rodent damage, etc., but much of the loss in stand is due to the activity of damping-off and rootrotting fungi, which are almost universally present in the soil. Other contributing factors may be certain insect larvae and nematodes. The latter are not too common in Ohio soils but one or two species of both the root-knot (Meloidogyne) and root-lesion (Pratylenchus) nematodes can be found in nursery beds. Weeds are also a serious production hazard at most nursery sites, where their control is costly and the act of weeding the beds and the growth competition they give often results in further reductions in the stand of tree seedlings. Thus, if a single chemical compound, or a combination of two or more could be found that would control fungi, insects, nematodes and weeds in a single pre-planting application, it would be a long step forward in the production of tree seedlings in the forest nurseries of the state of Ohio, and in the United States.

Combinations Work.

It is unlikely that a single compound capable of doing all of these things will be found soon, but it is possible that certain combinations (formulations) of materials can be prepared that will do most of them with at least a fair degree of effectiveness. For instance, dieldrin is proving itself to be a good soil insecticide, and such materials as Vapam and Mylone are capable of giving a considerable degree of control of various soil fungi and of killing many of the weed seeds present in the soil. D-D and EDB are quite effective against root-knot and root-lesion namatodes. Also, chloropicrin and methyl bromide will kill a considerable portion of all four groups of pests, when properly used. However, most, if not all, of these materials have certain specific handicaps that may prevent their coming into general use in nursery beds, such as high cost, difficulty of application, toxicity to the seedlings themselves, etc.

1/ Reprinted from Ohio Farm and Home Research, Vol. 42, No. 306, MayJune, 1957. Ohio Agricultural Experiment Station, Wooster, Ohio.

2/ J. D. Wilson is Professor of Plant Pathology, Department of Botany and Plant Pathology, Ohio Agricultural Experiment Station, Wooster, Ohio, and Carl V. Bailey is Nursery Superintendent, Division of Forestry, Green Springs Nursery, Green Springs, Ohio.

In spite of these possible weaknesses of specific materials it was decided to treat several nursery beds that were to be planted to locust (Robinia pseudoacacia) at the Green Springs nursery in the spring of 1956. Dieldrin was chosen as the insecticide to be used, Vapam and Mylone as fungicides and EDB as the nematacide. Also, Vapam and Mylone were known to be rather effective herbicides. The treatments were applied on May 22nd with a rotovator, and the locust seeds were planted about two weeks later. The data showing the results obtained in terms of seedling stands are given in the accompanying table.

The data in the first column of the table indicate the comparative stands of locust seedlings in each 100 feet of row in the differently treated plots on July 16, or about 2 weeks after the plants had come up. The data in the second (or last) column show the average number of one-year old trees harvested from each square foot of bed area on March 12, 1957.

<u>Some Plants Injured</u>

In July of 1956 there were fewer seedlings in the beds treated with dieldrin and with EDB, as well as in those treated with EDB + dieldrin, than in the untreated check areas. This suggests that both of these materials must have been slightly phytotoxic (injurious) to the germinating seeds and young seedlings of locust. On the other hand, the greater number of plants in the beds treated with Vapam and Mylone indicates that these two materials must have given some degree of control of such damping-off organisms as Pythium, Rhizoctonia and Fusarium. Dieldrin used with Vapam and Mylone (Treatments 6 and 7) again showed a tendency to injure the seedlings by causing a slight decrease in stand below that present in beds treated with Vapam and/or Mylone used without that insecticide.

Vapam and Mylone gave a very noticeable decrease in weed populations in the beds where they were used. This effect was more obvious with broadleaved weeds than with grass. ,Notes on the stand of weeds, taken at the time of the first and second weedings of the experimental area, were as follows:

	First Weeding		Second Weeding	
	Broadleaved	Grass	Broadleaved	Grass
Treatment:				
Vapam	None	None	Few	Scarce
Mylone	None	None	Few	Scarce
EDB	Few	Scarce	Medium	Medium
Dieldrin	Few	Scarce	Medium	Medium
No treatment	Few	Some	Medium	Medium

First weeding 15-18 days after locust seedlings emerged.
Second weeding about two weeks later.

Vapam gave slightly better weed control than Mylone and both eliminated more weeds than did EDB. The dieldrin-treated plot had nearly as many weeds as were present in the untreated checks. It was estimated that Vapam and Mylone reduced the cost of weeding by approximately 65 percent below that for the check plots.

A comparison of the relative numbers of plants harvested in the spring of 1957 with those present in the beds in the previous July indicates that the survival rate was not the same with all treatments. There was a considerable amount of grub damage, caused by the larvae of one of the June beetles (Phyllophaga), in the untreated check plots. This was evidenced by a wilting of the affected plants in mid-August, and by the absence of a tap root in some of the small trees as they were dug in the following March (see Figure 1). This type of injury was scarce in all of the treated plots, whether or not they had been treated with dieldrin. This control of grub damage by most or all of the chemicals used probably accounted for the fact that there were more young locust trees per unit of bed area in March in the plot treated with dieldrin than in the check plots, even though the reverse was true in July before the grubs had damaged and/or killed some of the seedlings in the untreated areas. This change in relative populations between the checks and the treated plots occurred with EDB and with Vapam. However, there was comparatively little change with time where Mylone was used.

The Vapam-treated plots showed fewer plants per 100 feet of row than Mylone in July of 1956 but these populations had shifted by the spring of 1957, with more trees per square foot of bed space in the Vapam plots than in those treated with Mylone. The reason for this is not obvious, but it is possible that Vapam gave better protection against a continuing loss of plants from damping-off fungi than did Mylone.

Development Varies

One of the interesting features of this experiment was the comparative stem size and root development of the plants in the differently treated plots. The plants in the plots with comparatively thin stands such as the untreated checks and those that received only dieldrin or EDB were considerably larger than those in the plots treated with Vapam and Mylone (see Figures 2 and 3) as one would expect, but the greatest difference was in the extent of the different root systems. As is illustrated in Figures 2 and 3, the roots on the plants in the untreated check plots were much larger and more numerous than on the more crowded plants (four times as many per unit of bed area) in the plots treated with Vapam. Actually this larger size of the check plants makes them little if any more valuable to the purchaser since the small plants are easier to handle and set and may even show a higher percentage of survival than the larger ones.

Specific recommendations concerning materials and rates of application cannot be made on the basis of only one experiment in only one season, but the data presented here do suggest that there is a strong possibility that either Vapam or Mylone, or both, will come into use as soil treatment materials to improve the stand of various tree seedlings such as those of locust, and to give an appreciable reduction in weed populations and thus lower the cost of hand weeding the nursery beds. The rate at which they should be used will depend somewhat on soil type but it is likely that Vapam, formulated to contain 4 pounds of the active ingredient per gallon, should be applied at 40 to 50 gallons per acre. Mylone, at 85 percent active, should be used at 150 to 200 pounds per acre. The interval that should elapse between soil treatment and seedling will be regulated to some extent by soil type, temperature and moisture content, but planting should be delayed for 10 to 14 days to avoid chemical injury.

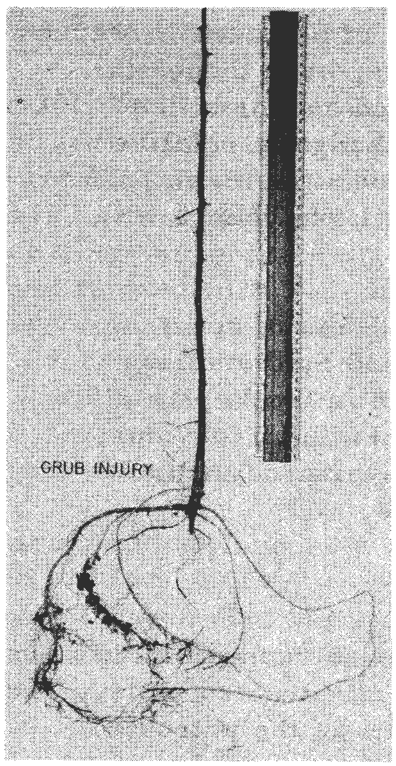


Figure 1. Note absence of tap root which was destroyed by a larva of one of the June beetles, and the strong brace roots developed to replace it. Knots on roots not due to nematode infestation but are the nodules caused by nitrogen fixing bacteria.

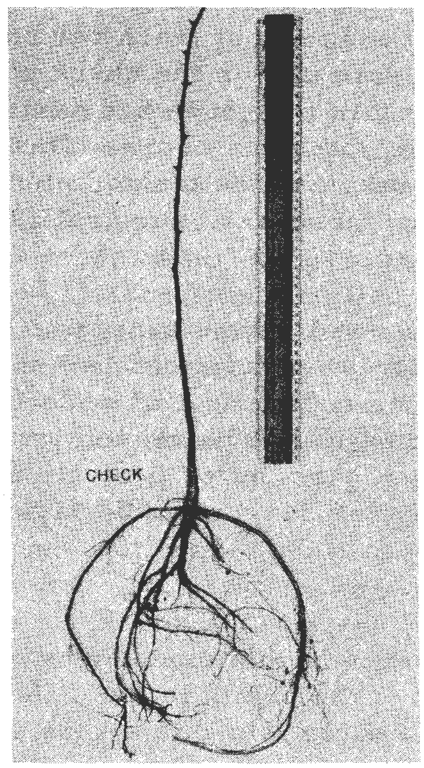


Figure 2. Heavy root development on uncrowded plant in check plot. Some of these plants were almost too large for best use.

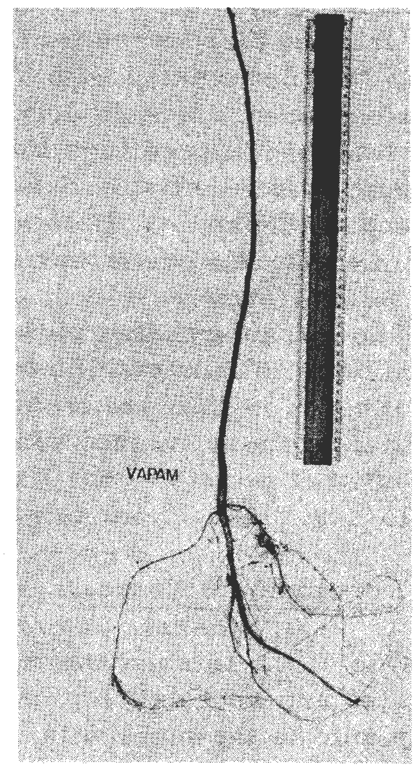


Figure 3. Plant from plot treated with Vapam. Note excellent root system which is less extensive than that on check plant because of some crowding in a quadrupled stand.

Stand of Locust Seedlings in Nursery Beds Treated with Various Compounds at Green Springs in 1956

Treatments	Rate used per acre	Plants per 100 feet of row in July, 1956	Plants per sq. ft. of bed area in March, 1957
1. No treatment	-----	325	4.34
2. Dieldrin	2 gal.	262	6.94
3. Vapam	50 gal.	815	17.51
4. Mylone	150#	1036	14.00
5. EDB (M-731)	12 gal.	202	4.58
6. Vapam dieldrin	50 + 2	732	*
7. Mylone dieldrin	150 + 2	851	*
8. EDB dieldrin	12 + 2	175	*

* Counts not made

WATER SEALING OF VAPAM FOR NURSERY FUMIGATION

Charles B. Briscoe
Assistant Professor of Forestry

Charles W. Stout
Student

Louisiana State University School of Forestry Baton Rouge, La.

During tests of rate of application of Vapam in the LSU School of Forestry nursery in 1955-56 1/, it was noted that although both applications of the Chemical were sealed by 0. 33 inches of water, the autumn treatments were much more effective than the spring treatments at all levels. The most obvious difference in treatments was that a heavy rain had fallen the night following the autumn treatment. Therefore, tests were run in the spring of 1957 to explore the results of varying the amount of water sealer.

The tests were run in the LSU School of Forestry nursery, on a silt loam soil. Vapam 2/ was mixed with water and applied to the beds at the rate of two quarts of Vapam in 12 gallons of water per 100 square feet of bed surface. Following application, the chemical was sealed in by varied amounts of water.

On March 15, Vapam was applied to one-half of sixteen 12 x 4 nursery beds; the other half of each bed was left untreated as a control. Four amounts of sealer were used, each replicated four times: no sealer, one-half inch, one inch, and two inches. Unfortunately several beds were severely disturbed three weeks after treatment and subsequent weed tallies had to be disregarded; this may have contributed to the lack of significant difference between the one-inch and the two-inch sealer.

1 / Briscoe, C. B . , and F. R. Strickland. 1956. Vapam shows promise as a forest nursery herbicide. Tree Planters' Notes 26:3: 3-4

2/ Vapam used was supplied through the courtesy of the manufacturer, Stauffer Chemical Company.

The results in the graph are shown as the cumulative number of weeds in the treated area expressed as a percentage of the weeds in the untreated area.

There was no significant difference in number of weeds following treatment with no sealer and treatment with 1 /2-inch sealer, nor between treatment with 1-inch of sealer and 2-inches of sealer.

In a relatively heavy soil such as is found in the LSU nursery, increasing the sealer coat to at least one inch greatly increased the period of complete control of weeds and improved subsequent control for at least 61 days following treatment. Control of nutgrass was not as complete nor for as long a period as control of the forbs; however, increased sealer had a similarly beneficial effect.

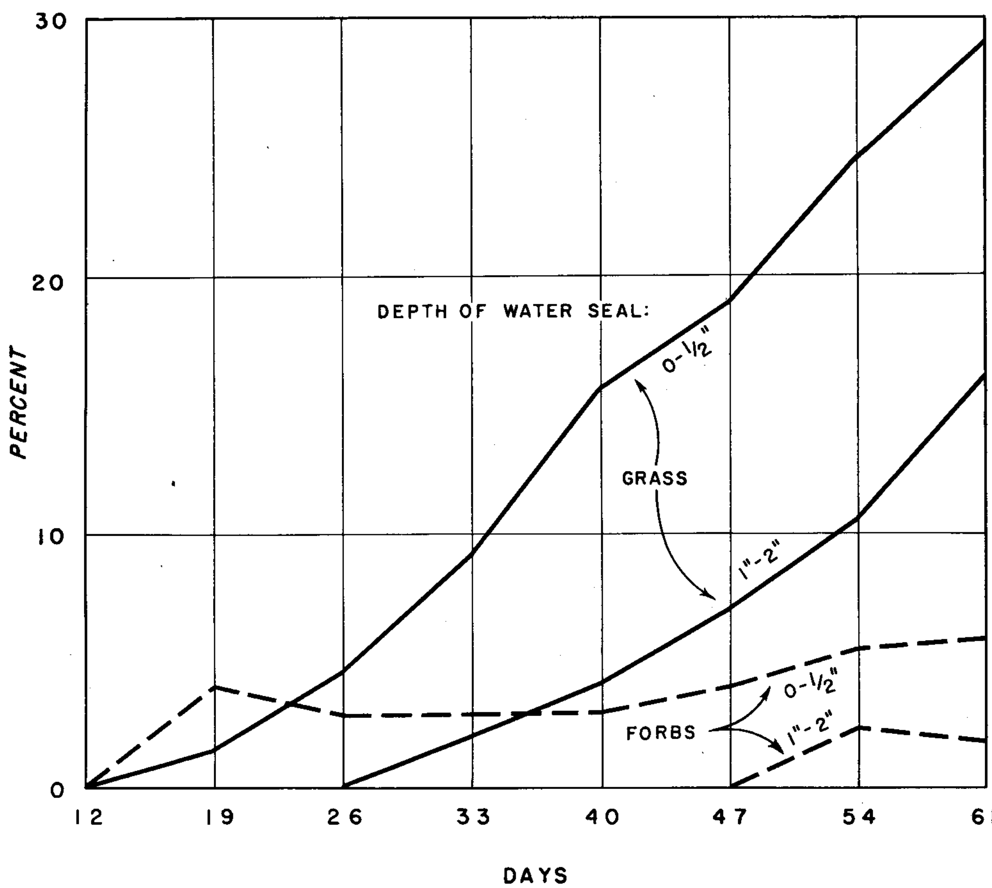


Figure 1. The effect of Vapam sealed with varying amounts of water on germination of weeds in the nursery. The number of weeds which germinated on the treated area is expressed as a percentage of the number of weeds which germinated on the corresponding untreated area.

METHYL BROMIDE DISPERSER

John. W. Andresen

Forestry Department, Rutgers University New Brunswick, New Jersey

The use of methyl bromide (CH_3Br) as a forest nursery soil fumigant is now a recognized and standard practice. It is normally dispensed from a one pound pressurized can with the aid of a puncturing device which incorporates a 1/4-inch diameter plastic tube of variable length that passes from the can beneath an airtight plastic or rubberized seed bed cover. As the liquid leaves the hose it is under considerable pressure which tends to toss the hose end erratically causing the methyl bromide to be improperly dispersed. The several types of dispersing gadgets which have been designed to overcome this shortcoming usually have two disadvantages: the soil immediately beneath the disperser does not receive a sufficient amount of gas to be effectively fumigated and initial vaporization is either too rapid or slow.

A new type of disperser designed by the author to overcome the difficulties of the other dispersers is illustrated in Fig. 1. The model shown was made from aluminum for about $2. 50, exclusive of labor, but probably can be made ~~ of scrap iron and galvanized sheet metal just as easily and at a much lower cost. The following instructions describe how the disperser can be constructed.

1. THE PAN.

   a. With a pair, of tin shears or other type of metal cutter, cut a 12-inch square from a sheet of 1/64-inch aluminum. Score the square 2 inches from the outside edge to form a centered 8-inch square.

   b. Cut a 2-inch slot in each corner so that the slots are parallel to right and left sides of the square and are 2 inches from edges.

   c. After cutting, fold up on the scored lines and bring tabs around to form a square open box 2 inches high and 8 inches wide.

   d. Complete the pan by drilling a 1/8-inch hole in the center of each tab that also passes through the folded edge of pan.

2. THE LEGS AND TOP BRACE.

   a. Cut four 10-inch legs from 1/8 by 3/4 inch aluminum stock and point each leg by sawing with a hack saw and filing rough edges.

   b. Drill a 1/8-inch hole on center 3/8 of an inch and 4 inches from the top edge of each leg.

c. In one leg also drill a 5/16-inch hole at distances of 3/4 and 2-3/4 inches below top edge. With a 1/4-inch round file bevel top hole upward and inward at 45° and lower hole downward and inward at the same angle.

d. To make the top brace, cut a 1 /8 by 3 /4 inch aluminum bar to a 33 1/4-inch length and drill 1/8-inch holes on center at 3/4, 4 1/2, 11, 20 1/2, 27 and 32 3/4 inches.

e. Bend the bar to form inside 90° angles at 4, 11 1/2, 20, and 27 1/2 inches.

3. ASSEMBLY.

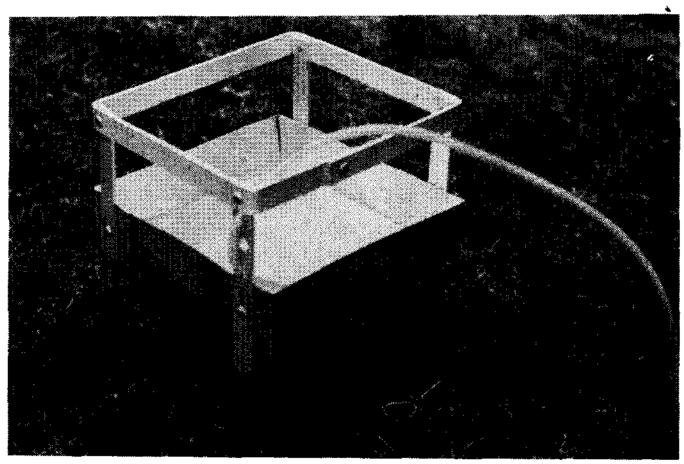
a. Rivet top brace together by placing a 1 /8 by 1/2 inch aluminum rivet (this same sized rivet is to be used throughout) through end holes and peen over.

b. Next rivet legs to pan making sure that leg with tube holes is in correct position (see Fig. 1.). A drop of molten wax placed in the inside corners of the pan will prevent any fluid from leaking through.

c. Finally, rivet top brace to legs, placing legs on inside of brace. It will be necessary to file brace where it comes in contact with upper tube hole to assure ready access of tube through brace and leg.

To use the disperser, set it in center of bed to be fumigated and press legs into soil leaving 1 to 1 1/2 inches of space between soil and lower surface of pan. Insert plastic tube before placing disperser in bed. Be certain to pass tube through inside of top hole and outside of lower hole so that open end lies on bottom of pan. The methyl bromide will then flow into pan and diffuse so that all of the soil surface will receive an equal treatment.

Figure 1. The methyl bromide disperser assembled and ready for use. The black paint on legs indicates depth to which legs should be driven.



FOREST NURSERY PRACTICE IN THE LAKE STATES

How to raise forest tree nursery stock in the Lake States area is the subject of a new book authored by Dr. J. H. Stoeckeler and G. W. Jones of the Forest Service., U. S. Department of Agriculture.

The book describes in detail the site requirements for a forest tree nursery, the buildings needed, and the selection and installation of equipment. It includes also the latest developments on the collection and handling of seed, methods of planting, and the care and shipping of the stock. One section is devoted to protection against diseases and insects and unfavorable weather conditions.

Dr. Stoeckeler, a staff member of the Lake States Forest Experiment Station, has had many years of experience in nursery research. Mr. Jones, until his recent retirement, was in charge of the nurseries of the Forest Service's North Central Region with headquarters in Milwaukee.

"The time is especially opportune for publication of a book on this subject, " commented M. B. Dickerman, Director of the Lake States Station. "The area planted annually to forest trees in the Lake States has risen sharply in the last few years. In 1956 nearly 100, 000 acres were planted, but over 7 million acres of commercial forest land is still in need of planting. Greater planting increases are forecast for the years immediately ahead as use of forest land becomes more intensive and incentives such as the Soil Bank Program take hold."

The book "Forest Nursery Practice in the Lake States" may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is $2.