

Reprinted from: Proc. 1978 South. Nursery Conf.
U. S. Dep. Agric. For. Serv. Tech. Publ. SA-TP6,
p. 131-137. Southeast. Area, State and Priv. For. (1979)

SELECTIVE HERBICIDES REDUCE WEEDING COSTS

IN TWO MISSISSIPPI NURSERIES

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Abstract.--In tests conducted from 1974 to 1977, the pre-emergence herbicides, Treflan, Eptam, Dymid, and Dextun^{1/} reduced weeds and weeding costs in seedling beds of loblolly, slash, and shortleaf pine. Velpar and Roundup controlled weeds along riser lines.

Additional keywords: Nursery, weed control, seedling tolerance, cost comparisons, Pinus taeda, P. elliottii, P. echinata.

Introduction

Before 1974, weed control in pine seedling beds at the W. W. Ashe nursery in Brooklyn, Mississippi, and the Mississippi Forestry Commission nursery at Winona was dependent upon two soil fumigants, methyl bromide and Vorlex. Fumigation was expensive, and the control of annual weeds was often inconsistent. Extensive hand-weeding was needed throughout the growing season.

Riser line areas, where fumigation is impractical, were a continual problem. These areas were kept clean by hoeing or were sprayed with mineral spirits, which was effective only on small weeds.

Due to the rising costs of fumigation, it became evident to the nurserymen that selective herbicides were needed to provide more consistent weed control in both seedling beds and riser lines.

From 1974 to 1977 studies were conducted at these nurseries to evaluate several preemergence herbicides for weed control in seedling beds and their effects on production of loblolly (Pinus taeda L.), slash (Pinus elliottii Engelm. var. elliottii), and shortleaf (Pinus echinata Mill.) pine seedlings. Two postemergence herbicides were tested for weed control along riser lines. Highlights of the results on weed control, seedling tolerance, and comparative costs are covered in this report.

^{1/} Throughout this article, mention of trade names is for information only and does not constitute a recommendation by the U.S. Dep. Agric. Before any chemical is applied, the user should make certain that it is registered for the purpose intended.

Materials and Methods

Seedling Beds--Preemergence Herbicides

Preemergence treatment plots ranged in size from 6 X 35 ft. to 6 X 50 ft. with 6-9 replications per treatment (including one control), depending on length of beds and size of study area used in each nursery. Plots were arranged in a randomized complete block design.

In 1974 the following preemergence treatments were applied: trifluralin (Treflan) at 1 and 2 lbs. a.i./A. (active ingredient per acre), diphenamid (Dymid) at 4 and 8 lbs. a.i./A., and perfluidone (Destun) at 1.25 and 2.50 lbs. a.i./A. Treatments were tested on loblolly seedbeds at both locations and also slash seedbeds at the W. W. Ashe nursery.

The 1975 treatments consisted of perfluidone 50 WP at 1 and 2 lbs. a.i./A., perfluidone 4S at 1.5 lbs. a.i./A., and EPTC (Eptam) at 3 lbs. a.i./A. Species treated were loblolly and slash at both locations and short-leaf at the W. W. Ashe nursery.

The 1976 treatments were trifluralin at 1 lb. a.i./A., EPTC at 3 lbs. a.i./A., perfluidone 50 WP at 1 and 1.5 lbs. a.i./A., combinations of trifluralin (1 lb. a.i./A.) with perfluidone 50 WP (1 and 1.5 lbs. a.i./A.) and EPTC (3 lbs. a.i./A.) with perfluidone 50 WP (1 and 1.5 lbs. a.i./A.). Species treated were the same as in 1975.

The 1977 study was conducted only at the W. W. Ashe nursery on loblolly and slash seedbeds. Treatments consisted of perfluidone 50 WP at 1.5 lbs. a.i./A., bifenox (Modown) at 3 lbs. a.i./A., prometryne (Caparol) at 1 lb. a.i./A. and a combination of napropamide (Devrinol) at 1 lb. a.i./A. with bifenox at 3 lbs. a.i./A. (tank mix). Metolachlor (Dual) was used at 1.5 lbs. and 3 lbs. a.i./A.

The Treflan, Eptam, and Dymid treatments were applied before seeding and incorporated with a nursery-bedshaper. All other preemergence treatments were applied after seeding and mulching. Seedbeds were irrigated with 3/4 to 1 inch of water immediately after spraying.

Each year at the time of the first weeding, broadleaf weed and grass counts were made in two randomly selected 1X4-ft. subplots within each treatment replication. Weeds were identified by species and data analyzed to determine which species were being controlled by herbicides. Except in 1974, weeding times were also recorded. In 1975, the time required for two people to handweed two randomly selected 1X4-ft. subplots within each treatment replication was recorded at first weeding. In 1976 and 1977 weeding times were recorded for the entire plot in each treatment replication throughout the growing season.

Riser Lines--Postemergence Herbicides

Postemergence tests for control of established weeds in riser lines were conducted at the W. W. Ashe nursery in 1975 and at the Winona nursery in 1976.

The 1975 treatments were glyphosate (Roundup) at 1 and 2 lbs. a.i./A. and hexazinone (Velpar) at 0.75 and 1.5 lbs. a.i./A. Two lines of 3 X 1,000 ft. were each divided into two equal blocks. Treatment plots (including a control) of 3 X 50 ft. were assigned within each block in a randomized complete block design with 8 replications per treatment.

In 1976, Velpar at 1.5 and 3 lbs. a.i./A. was tested at Winona. Three lines 2 X 1,000 ft. each were divided into four equal blocks. Treatment plots (including one control) of 2 X 80 ft. were randomly assigned within each block in a randomized complete block design with 12 replications per treatment. One complete line and 240 ft. of each of the other two had been hoed 24 hours before herbicide treatment. These areas were free of all weeds except purple nutsedge (Cyperus rotundus) which was already showing regrowth.

Herbicides were applied with a hand-spray nozzle attached to a sprayer mounted on the rear of a tractor. Equipment was calibrated to deliver approximately 40 gallons of mixture per acre. A man walked behind the tractor and applied chemical evenly over the entire plot.

Results and Discussion

Seedling Beds--Comparative Costs

In 1975, soil fumigants were not used in study areas before planting. Weeding times recorded on first weeding date at the W. W. Ashe nursery showed all preemergence herbicide treatments had greatly reduced weeding times. Relative cost figures prepared from data showed a savings of at least \$1,000 per acre compared to control plot data (Table 1). Similar results were obtained at Winona.

In 1976, weeding cost was reduced by approximately \$250 to \$470 per acre at Winona even though Telone C was applied at 30 gal. per acre prior to planting (Table 2). Similar results were obtained at W. W. Ashe nursery where methyl bromide was used as a soil fumigant.

Weed Control--Sedge and Grass

Weed control was most evident in sedge and grass control. The most predominant species at both locations were purple nutsedge (Cyperus rotundus), Cyperus compressus, watersedge (Cyperus erythrorhizos), crabgrass (Digitaria sanguinalis), broadleaf signalgrass (Brachiaria platyphylla), and goosegrass (Eleusine indica). Prairie cupgrass (Eriochloa contracta) was the dominant

Seedling Nutrition

Sometimes it is more important to just get the job done than be overly concerned with efficiency. This type of situation prompted us to undertake a rather intensive fertilizer study. The study is in cooperation with Dr. C. B. Davey of NCSU and Mr. G. W. Bengtson of TVA.

The study measures the response of sweetgum and green ash (Fraxinus pennsylvanica) to seven sources of nitrogen fertilizers applied at three rates of elemental N. The sources are sulfur coated urea, 11% dissolution rate (SCU 11); sulfur coated urea, 24% dissolution rate (SCU 24); isobutylidene diurea (IBDU); ammonium nitrate; nitrate of soda; sulfate of ammonia; and urea. SCU 11, SCU 24, and IBDU are slow release fertilizers and were applied preplant only. The other sources were applied as a top dressing throughout the growing season. The rates of application are 200, 300 and 400 lb/ac of elemental N.

Differences in response to the various sources are pronounced. The poorest treatment appears to be nitrate of soda. The better treatments appear to be sulfate of ammonia and SCU 24. Both of the better treatments are better than the operational fertilization which is ammonium nitrate at the 400 lb N level.

Our intention is to both refine and expand this study. It will be expanded to measure responses of sycamore (Platanus occidentalis), and the willow-water oaks (Quercus phellos & nigra) to various sources and levels of N. It will likely be refined to measure response to timing of applications, and also measure response to combinations of slow release and soluble sources.

When all the data are analyzed, we should know what is best for us, and more importantly what is good enough. We have already concluded that the operational top dress applications can be changed from weekly to bi-weekly. The better treatments appear at least as effective at the 300 lb rate than does the operational treatment at the 400 lb. rate. If this proves to be so, an immediate benefit is a 25% reduction in the N fertilizer required.

Again in cooperation with NCSU, and Abbott Laboratories, we are involved in testing various levels of inoculum of the endomycorrhiza, Glomus fasciculatus. Dramatic responses to this and other inoculations are not apparent at our nursery. The nursery soil has an inherently high level of phosphorous, which ranges above 90 lb/ac. The availability of phosphorus may be reducing or eliminating the seedlings' need for mycorrhizal infection.

The response of outplanted hardwood seedlings inoculated with endomycorrhiza may prove to be of much greater importance than nursery response. With the short rotations contemplated for intensively managed hardwood plantations, relatively small early gains in growth assume importance.

Pest Control

Union Camp recently joined the Auburn Weed Control Cooperative. During the current season, we are participating in the operational nursery herbicide study and herbicide screening tests.

Table 1.--Cost comparisons at first weeding (June 24, 1975) in the W. W. Ashe nursery.

Treatment	Rate lb. a.i./A.	Weeding time Hr./A.	Total cost dollars/A.
Destun 4S	1.5	<u>1/</u> 21.4	<u>2/</u> 182.00
Eptam	3.0	22.4	188.00
Destun 50 WP	2.0	23.5	208.00
Destun 50 WP	1.0	23.6	199.00
Control	None	158.9	1,271.00

1/ Determined from average time required for two people to handweed 1 ft.² of bed surface per treatment plot.

2/ Includes labor--@\$8.00 per hr.; Destun 50 WP--\$5.00/lb., Eptam--\$19.00/gal.; Destun 4S--\$28.00/gal.

species at Winona in 1976. Analysis of data taken on first weeding dates each year and weeding times recorded in 1975 and 1976 showed that all pre-emergence herbicide treatments had significantly reduced the total number of grasses per ft.² and total weeding times.

In areas where Cyperus sp. (particularly C. rotundus) were predominant, treatments with Destun at 1.5, 2.0 or 2.5 lb. a.i./A. gave excellent control.

In 1976 at Winona, treatments of Treflan or Eptam combined with Destun were the most effective.

In 1977, at the W. W. Ashe nursery weed populations were too low in control plots to make valid comparisons.

Broadleaf Weeds

Broadleaf weeds were not a serious problem at either location during the 4 years. Populations in control plots were usually not heavy enough for consistent results. The most predominant broadleaf weeds observed in check plots at both locations were carpetweed (Mollugo verticillata) and yerba-de-tago (Eclipta alba). Eight other species were observed but were not as abundant.

In 1974, control was obtained in the loblolly treatment area at the W. W. Ashe nursery with Treflan at 1 and 2 lbs. a.i./A. and Dymid at 8 lbs. a.i./A. In 1975, Destun 50 WP at 2 lbs. a.i./A., Destun 4S at 1.5 lbs. a.i./A. and Eptam at 3 lbs. a.i./A. reduced total number of broadleaf weeds per ft.² in both loblolly and slash treatment areas at Winona. Combined treatments of Treflan or Eptam with Destun at 1.0 and 1.5 lbs. a.i./A. were the most effective in 1976.

Seedling Tolerance

In 1974, Destun at 2.5 lbs. a.i./A. caused top curl in germinating loblolly pine seedlings at both locations. The symptoms disappeared within 6 weeks after germination and did not affect seedling production.

In 1975, germination of shortleaf pine seed was slightly reduced by Destun at 1.5 and 2.0 lbs. a.i./A. rates. The number of plantable seedlings was not reduced.

In 1976 at the W. W. Ashe nursery, the average height of loblolly and shortleaf pine seedlings in plots treated with a combination of Treflan at 1 lb. a.i./A. and Destun at 1.5 lbs. a.i./A. was 1 inch shorter than control plot seedlings. Also the number of plantable shortleaf seedlings was reduced by 10 per ft.².

In 1977, the number of plantable loblolly seedlings was slightly reduced (3 per ft.²) by Destun at 1.5 lbs. a.i./A. when hydromulch was used as a seed covering. This combination may have been a contributing factor since seedling production had not been reduced in previous tests with Destun at 1.5 lbs. a.i./A. where sawdust or pine bark mulch was used. Dual at 3 lbs. a.i./A. reduced the number of plantable loblolly and slash seedlings by 12 and 14 per ft.² respectively, and by 6 and 5 per ft.² at the 1.5 lb. a.i./A. rate. Both rates had reduced seed germination. Seedling production was not affected by Modown, Caparol, and the combined treatment of Devrinol plus Modown.

Riser Lines--Weed Control

In 1975, at the W. W. Ashe nursery, Roundup at 2 lbs. a.i./A. satisfactorily controlled established weeds for approximately 6 weeks following application. Velpar at 0.75 and 1.50 lbs. a.i./A. controlled all weeds except purple nutsedge. Control with Roundup at 1 lb. a.i./A. was not satisfactory.

In 1976 at Winona, Velpar provided 100% weed control at 1.5 and 3 lbs. a.i./A. in hoed areas and at 3 lbs. a.i./A. in non-hoed areas. Approximately 90% control was obtained with the 1.5 lbs. a.i./A. rate in the non-hoed areas. Purple nutsedge and goosegrass began to germinate 10 weeks following treatment.

Conclusions

Savings in weeding cost in pine seedling beds can be expected with selective preemergence herbicides even when soil fumigants are used. Total savings will vary depending on predominant weed species and herbicides used. For most annual weeds adequate control can be obtained with a preemergence application of either Treflan (1 lb. a.i./A.), Eptam (3 lbs. a.i./A.), Dymid (8 lbs. a.i./A.) or Destun (1.5 lbs. a.i./A.). In some areas a combined treatment may be needed. The combined treatments of Treflan or Eptam with Destun were the most effective at Winona in 1976.

In areas where Cyperus sp. were dominant, Destun was the most effective herbicide tested. However, additional tests should be conducted in shortleaf pine seed beds and in loblolly seed beds where hydromulch is used. Combination of Destun with other herbicides should be further tested.

Preemergence applications of Modown (3 lbs. a.i./A.) Caparol (1 lb. a.i./A.) and a tank mix of Modown (3 lbs. a.i./A.) with Devrinol (1 lb. a.i./A.) did not affect loblolly and slash pine seedling production at the W. W. Ashe nursery in 1977.

Annual weeds can be controlled along riser lines with Velpar or Roundup. A preemergence treatment with Velpar at 1.5 lb. a.i./A. was the most effective. For established purple nutsedge a postemergence application of 3 lbs. a.i./A. will provide total season control. More than one application of Roundup at 2 lbs. a.i./A. will be needed for satisfactory control.