Miller, J.H. 1984. Soil-active herbicides for single-stem and stand hardwood control. In: Proceedings, 37th Annual Meeting Southern Weed Science Society; 1984 January 17-19; Hot springs, AR. [Champaign, IL]: Southern Weed Science Society. 173-181.

SOIL-ACTIVE HERBICIDES FOR SINGLE-STEM AND STAND HARDWOOD CONTROL?

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ABSTRACT

Four studies examined soil-active herbicides for control of hardwoods both as single-stems and in stands. The first study found that comparable control of sweetgum (Liquidambar styraciflua) was achieved both by tree injection using 2,4-D + picloram (Tordon 101R®) and by soil spot applications, using hexazinone (Velpar L®) and picloram (Tordon K®) liquid formulations. Crown reduction for these treatments averaged 30 to 36 percent, which was low due to drought conditions. A placement-spacing study showed that sweetgum control using tebuthiuron pellets (Spike 20P®) was better when applications were placed within 5 ft of the tree boles. Another placement-spacing study found that spot treatments with hexazinone liquid (Velpar L) around 2 yr old loblolly pine seedlings resulted in excessive mortality when soil-spots were placed within 2 ft of the stem. A comparison trial between formulations of hexazinone showed that comparable control of hardwood stands was achieved using either grid-pattern applications of liquid or pelleted formulations.

INTRODUCTION

The objectives of four studies examined soil-active herbicides for hardwood control and were aimed at answering the following questions:

Study 1. What formulations of soil-active herbicides applied as soil spots show the most potential for cost-effective substitutes for tree injection?

Study 2. What is the most effective distance from pole-size sweetgum boles to place soil-active herbicides?

Study 3. What is the safest distance from pine seedlings wherein the soil-active herbicide hexazinone can be applied with minimum pine seedling mortality?

Study 4. How does the effectiveness of grid applications of hexazinone as liquid spots compare to hexazinone pellets applied in the same manner?

The answer to this final question can aid in bridging research findings using these two formulations.

[1/] Discussion of herbicides in this paper does not constitute recommendation of their use or imply that uses discussed here are registered. If herbicides are handled, applied, or disposed of improperly, there is potential for hazards to the applicators, off-site plants, and environment. Herbicides should be used only when needed and should be handled safely. Follow the directions and heed all precautions on the container label.

Use of trade names is for the reader's information and convenience. Use in these studies does not constitute official endorsement or approval by the U.S. Department of Agriculture to the exclusion of any other suitable product.

treatments for controlling sweetgum. One hundred seventy sweetgum trees measuring 4 to 14 in DBH were tagged and randomly assigned to 17 herbicide treatments (Table 2). Thus a completely randomized design with 10 replications was used. Injection with 2,4-D amine + picloram (Tordon 101R) represented the check treatment and was performed with a tubular injector and applications of 1 miiiiiiter per equally-spaced incision at the following rates: trees 4-5 in DBH, 2 incisions; 6-8 in DBH, 4 incisions; and 9-14 in DBH, 6 incisions. Rates of soil-active spots did not vary by tree size (Table 2), to test the hypothesis: spot applications can be as cost-effective as injection treatments.

The low rate of each soil-active herbicide was selected to approximate the cost of tree injection (herbicide plus labor costs) and the high rates were 2 times the low rate. From previous injection trials of mixed-sized stands of hardwoods in 1979, it was calculated that the "per tree costs" averaged 2.04 for herbicide (Tordon 101R) and 2.4¢ for labor ($3.20/hr). The total of 4.4¢ was used as a criteria for setting the low test rates. Labor rates for applying the spots were not considered because estimates of rates for operational applications are not known, but should be considerably less than those for injection. The potential benefits for spot applications are labor savings.

All spot applications of the soil-active herbicides were made at three evenly-spaced spots on a circle 18 in. from the tree boles. Pellets were placed on the humus layer after moving aside the litter layer. Liquid applications were diiuted to make three 20-ml spots which were injected into the soil at a depth of 6 inches. Trees numbered 1 to 100 were treated on May 30, 1980, and trees 101 to 170, on June 16. No rainfall occurred between these dates. Between June 16 and July 21, 3 inches of precipitation were recorded. An additional inch, occurred by July 28. Thus, activation of the pellets was complete by July 21, which is now considered late for maximum effectiveness.

Assessment of control was made in September 1981. Crown reduction was estimated to the nearest 5 percent for treated sweetgums and nearest-neighbor hardwoods or pines. The percent values in this and the following study were transformed to arcsioe $\sqrt{\text{proportion}}$. Each spot treatment was compared to the injection treatment by using t-tests.

Results Study 1. Eleven treatments provided sweetgum crown reduction statistically comparable to the injection treatments (Table 2). Of these, hexazinone and picloram liquid formulations gave greater than 30 percent mean crown reduction, with the hexazinone liquid exceeding mean control by injection. The hexazinone liquid also yielded the highest amount of dead trees, 30 percent, and was 5.4¢ less costly than the liquid picloram treatment. Injection treatments resulted in only 31 percent mean' crown reduction. This low efficacy probably was due to the drought conditions that occurred during the summer of 1980 and the prior summer. These drought conditions should have reduced effectiveness of both the spot applications and the injection treatments.

Picloram pellets at 1 gm a.i. and dicamba liquid at 4 gm a.i. gave the highest injury to nearest-neighbor trees. Other herbicide/rates yielded some degree of injury or death of nearest-neighbors which points to some limitations of applying soil-active spots for selective tree control.

Study 3

Procedures Study 3. At the North Auburn area, 40 pines were selected and tagged; these pines were starting their second growing season in the field. Ten trees were each randomly assigned to four treatments. A 1:1 (v/v> dilution of hexazinone (Velpar L) was applied as three Z-ml spots around each tree. Three distances were tested: 1 ft, 2 ft, and 3 ft from the seedling. Treatments were applied on May 4, 1983, and pine mortality was assessed on October 6, 1983.

Results Study 3, Mortality of loblolly pine seedlings during the second growing season in the field was influenced by hexazinone spots as follows: 1 ft from the seedling, 80 percent mortality; and at 2 ft, 3 ft, and nontreated checks, 10 percent. Thus, it appears relatively safe to treat as close as 2 ft from seedlings of this size on such sites. Also, a closer placement of hexazinone spots nearer to the pines resulted in a release from the more intimate hardwood competition.

Study 4

Procedures Study 4. This trial represented an initial examination of the potential of pre-harvest site preparation treatments for natural regeneration using grid-applications of hexazinone. Groups of three l--acre plots were established at the Auburn, Tallassee, and Camphill study areas. Each plot measured 132 x 330 ft (2x5 chains) and encompassed very similar parts of the same stands (Table 1). Hexazinone was applied to randomly assigned plots according to the recommended rates specified on the Velpar Gridball ½ cc label for site preparation (Table 4). Equal rates were applied at each site to the pellet treated and liquid-spot treated plots. Applications were on April 1 and 2, 1982, Complete inventories were made of each plot for all hardwoods greater than 1.5 in by 1 in diameter classes and crown reduction was assessed in September, 1983. Basal-area reduction was calculated by multipling the crown reduction (percent x .01) times the basal area for each tree in a plot and summing all the corrected basal areas for each plot. An analysis of variance was performed on the basal area reduction percents using study sites as replications.

Results Study 4. Hardwood basal-area reduction was similar with grid applications of liquid spots and pellets (Table 5). Best control was achieved on the deep loamy-sand site at Auburn and the lowest-degree of hardwood basal-area reduction on the Tallassee site. At the Tallassee area ephemeral streams were located on side boundaries (2 chain boundaries) of the liquid-spot and pelleted-formulation plots. Hardwood control lessened when moving downhill from the ridges towards the streams. The same declining control towards streams was also evident at Camphill. This appears to be one of the main factors for the lowered control at Tallassee and Camphill. Moreover, a high proportion of hickory, a hexazinone-resistant species, also caused a lowering of mean control at Tallassee.

Red oaks and sweetgum were the most dominant species on these study areas (Table 1) and were effectively controlled at each location (Table 6), except within 60 ft of the drainages where control declined. The more resistant species to hexazinone appear to be hickories, dogwood, tulip poplar, maples, huckleberries and persimmon.

Table 2. Crown reduction of treated sweetgum trees after two growing seasons and the fate of nearest neighbors.

Treatment	Active Ingredient per stem	Herbicide costs 1980	Mean Crown Reduction	Dead Trees	Nearest-Neighbor Injured	Nearest-Neighbor Dead
	(gm)	($)	----percent----			
Injection with 2,4-D + picloram (Tordon 101R)	-	.01-.03	31	10	20	0
Hexazinone liquid (Velpar L)	2	.08	36*[1]	30	10	0
	1	.04	7	0	20	0
Hexazinone pellet (Velpar Gridball)	2	.14	14*	10	10	0
	1	.07	9	0	0	0
Piclcram liquid (Tordon K)	2	.14	30*	10	10	0
	1	.07	19*	10	0	0
Picloram pellet (Tordon 10K)	2 / 1	.06	22*	10	10 / 30	0 / 10
Tebuthiuron WP (Spike 80W)	1.5	.05	13*	20	10	0
	.75	.02	5	0	20	10
Tebuthiuron pellet (Spike 20P)	1.5	.05	21*	10	10	0
	.75	.02	4	0	0	0
Dicamba liquid (Banvel)	4	.14	13*	0	30	10
	2	.07	13*	10	10	0
Dicamba pellet (Banvel XP)	4	.18	18*	10	10	10
	2	.09	13*	0	20	0

[1] Means in this column followed by asterisks do not differ ($p = .05$) from the injection treatment when compared using t-tests.