CHARCOAL FAILS TO PROTECT PLANTED LOBLOLLY PINE FROM SOIL HERBICIDES

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The development of soil-applied herbicides for preplant site preparation has been sought for 30 years and is now essential for the loblolly-shortleaf pine type where steep slopes can make the costs of mechanical methods excessive and soil disturbance may result in compaction and severe erosion. Impending regulations on nonpoint pollution may stop many mechanical operations, but most soil-applied herbicides are nonselective and persistent in the soil. This can delay pine planting for 2 or 3 years.

Activated charcoal has been reported to reduce the phytotoxic effects of herbicides on crop species in both forestry and agriculture (*1, 2, 3*). Dipping the roots or slips in a slurry of activated charcoal protects them from herbicides because the large surface area of charcoal has very good adsorptive abilities. This study attempts to capitalize on these earlier findings by planting charcoal-dipped loblolly pine (*Pinus taeda* L..) seedlings on plots treated with herbicides.

Methods

Three pellet herbicides—hexazinone, picloram, and tebuthiuron[1] were tested with an untreated check. The herbicides were broadcast March 22, 1977, on 1/40-acre plots at 6 lb. a/acre, a rate effective in past studies for killing mixed brush on sandy soils in central Louisiana.[2] The test site was a well-drained, Ruston fine sandy loam with a 7 to 12 percent slope. The hardwood brush ranged from 3 to 30 feet in height with stem diameters of 1/2 to 3 inches. Fifty hardwood stems per plot were randomly selected from among the 19 different species present. No stems were tagged within a 3-foot buffer zone on the plot perimeter to protect against root extension into untreated soil. Visual evaluation 2 years after treatment indicated that the buffer was sufficient for these field conditions. Species were primarily flowering dogwood (*Corpus florida* L.), blueberry (*Vaccinium* spp.), sweetgum *(Liquidambar styraciflua* L.), shining sumac *(Rhus copallina* L.), and red maple (*Acer rubrum* L.).

Charcoal-treated, bareroot,1-0 nursery-grown loblolly pine seedlings had their entire root system dipped in a slurry of 2 pounds charcoal powder per gallon of water. Twenty charcoal-treated and 20 untreated seedlings per treatment replication were then planted on March 22,1977, following herbicide treatment and on January 4,1978, 9 ½ months after herbicide treatment.

Treatments were replicated three times in a randomized split-plot design.

Final observations on pine survival and hardwood topkill were made in the fall of 1978, one and two growing seasons after the final and initial planting dates. Differences among treatments were tested by analysis of variance and Duncan's multiple range tests (0.05).

Results

Pine survival was similar on check (73 percent) and hexazinone-treated (70 percent) plots when planting immediately followed herbicide treatment. Survival was less than 30 percent on the picloram- and tebuthiuron-treated plots (table 1). The charcoal dip did not affect pine survival on the check and hexazinone plots. Charcoal did improve survival on the picloram and tebuthiuron plots, but not significantly.

Pine survival was excellent on check (86 percent), hexazinone- (94 percent), and picloram-treated (95 percent) plots when planting was delayed for 9 ½ months. Tebuthiuron still resulted in poor survival, 62 and 45 percent, and although charcoal apparently improved survival, there were no statistical differences.

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[1]Hexazinone (3-cyclohexyl-6-(dimethyl-amino)-1-methyl-1, 3, 5-triazine- 2, 4 (IH, 3H) dione) as Velpar DPX-3674-10P; picloram (potassium salt of 4-amino-3, 5, 6-trichloropicolinic acid) as Tordon 10K; tebuthiuron (1-(5-tert-butyl-1, 3, 4-thiadiazol-2-yl)-1-3-dimethylurea) as EL-103.

[2]a-acid equivalent (picloram), active ingredient (hexazinone, tebuthiuron).

Table 1.—*Survival of charcoal-treated and untreated seedlings in November 1978*

Planting date/herbicide	Dipped	Undipped	Combined
	Percent		
March 22, 1977			
Check	73	73	73.0 a[1]
Hexazinone	70	70	70.0 a
Picloram	30	18	24.0 b
Tebuthiuron	30	23	26.5 b
January 4,1978			
Check	87	85	86.0 a
Hexazinone	97	92	94.5 a
Picloram	97	93	95.0 a
Tebuthiuron	62	45	53.0 b

[1]Percents followed by the same letter are not significantly different at the 0.05 level. None of the differences between dipped and undipped seedlings were significant.

The poorer survival among checks planted on March 22, 1977, than among those planted January 4,1978, might be explained by differences in environmental conditions during seedling establishment in 1977. and 1978, differences in seedling quality, and the longer period of field exposure received by the March 22,1977 seedlings.

Picloram, at 87 percent topkill, gave better brush control than either hexazinone at 55 percent, or tebuthiuron at 58 percent (table *2).*

Picloram controlled flowering dogwood, blueberry, sweetgum, and shining sumac, with fair results on red maple, among the primary species. Hexazinone and tebuthiuron only controlled shining sumac and had fair results on sweetgum and flowering dogwood. Control of the remaining brush species varied, but picloram still outperformed hexazinone and tebuthiuron.

Plots treated with picloram were visually more open than other plots, but grass competition increased, enclosing the seedlings. However, seedlings planted 9 ½ months after picloram treatment were vigorous in appearance and free to grow after one growing season.

Discussion

The low toxicity of hexazinone and picloram was the most important finding in this study. Hexazinone pellets were applied simultaneously with pine planting without decreasing pine survival, even though the 6 pounds a/acre rate used was three times the manufacturer's recommended rate.

Although picloram decreased pine survival when planting immediately followed treatment, loblolly pine was successfully planted 9 to 10 months after the application of picloram at 6 pounds a/acre. Because of this fact and its excellent topkill perormance, picloram may be a promising prospect for site preparation. Of course, one growing season will be lost, but this is also normal with mechanical methods.

Table 2.—*Topkill of hardwood species after two growing seasons*

Species	Topkill		
	Hexazinone	Picloram	Tebuthiuron
		Percent	
Primary species:			
Corpus florida L.	65 (52)[1]	100 (31)	70 (44)
Vaccinium spp.	5 (10)	79 (25)	35 (21)
Liquidambar styraciflua L.	70 (24)	96 (39)	61(20)
Rhus copallina L	81 (21)	90 (8)	100 (6)
Acer rubrum L.	28 (12)	68 (9)	50 (20)
Beech family:			
Quercus stellata Wang.	100 (1)	35 (4)	—[2]
Q. alma L.	—	100 (1)	—
Q. marilandica Muenchh.	55 (3)	46 (4)	100 (2)
Q. falcata Michx. var. *falcata*	—	89 (6)	100 (3)
Carya spp.	25 (6)	98 (6)	49 (4)
Fagus grandifolia Ehrh.	100 (1)	—	—
Minor species:			
Diospyros virginiana L.	11 (4)	—	5 (4)
Primus serotina Ehrh.	—	100 (1)	100 (3)
Sassafras albidum (Nutt.) Nees	5 (1)	—	4 (5)
Crataegus spp.	—	84 (11)	100 (2)
Callicarpa americana L.	19 (7)	25 (1)	22 (2)
Viburnum dentatum L.	49 (5)	—	45 (1)
Nyssa sylvatica Marsh.	37 (3)	81(4)	62 (12)
Magnolia virginiana L.	—	—	0 (1)
Average	55 (150)	87 (150)	58 (150)

[1]Number of stems treated is in parentheses.
[2]No data.

Literature Cited

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