RESEARCH REPORT 07-03

SHIELDED APPLICATIONS OF SULFONYLUREA HERBICIDES IN LOBLOLLY PINE SEEDBEDS: Part III

by
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INTRODUCTION

Several nursery managers have fabricated shielded herbicide applicators for applying glyphosate in between pine drills. This method of herbicide application can reduce the risk associated with herbicide injury. Most directed applicators are used to apply glyphosate in between drill rows of hardwoods (sometimes having 4 drills per bed). Some spray oxyfluorfen (GoalTender®) under the canopy of hardwoods. In some cases, directed applications are made in 6- or 8-drill pine seedbeds.

The herbicides metsulfuron-methyl (Escort® or Ally® or VM Metsulfuron Methyl®) and halosulfuron-methyl (Sedgehammer®) are classified as sulfonylurea herbicides. Metsulfuron-methyl has activity on spurge (*Euphobia* spp.) while halosulfuron-methyl has activity on nutsedge (*Cyperus* spp.). The Cooperative has tested broadcast applications of these herbicides (Carey and South 1998; South and Hill 2001; VanderSchaaf et al. 2002). In 2004 and 2005, directed applications were evaluated (South and Hill 2005; 2006). Trials with the directed method of herbicide application were continued in 2006.

METHODOLOGY

Two studies were installed during the 2006 growing season. At the Taylor Nursery (SC), loblolly pine seeds were sown on April 12 and the seedlings were treated on June 20 (10 weeks after sowing). At the Flint River Nursery (GA), loblolly pine seeds were sown on April 24 and the seedlings were treated on June 19 (8 weeks after sowing). Pine bark was applied to beds after sowing.

Each study was a randomized complete block design with five replications. Plot size was 10-feet long and one bed wide. Each study involved seven herbicide treatments plus an untreated control. Herbicides were applied using a CO_2-backpack sprayer calibrated to apply either 22 gallons per acre (as a broadcast application) or 32.5 gallons per acre (as a directed application). The amount of herbicide applied was the same per acre (i.e. herbicide cost per bed is the same for both methods). However, the rate applied in the 2 inch band is 3 times higher than the rate applied in a 6 inch broadcast band (since 4 inches out of every 6 inches are not treated).

The low rate (1X) of halosulfuron was 15 g a.i./acre and for metsulfuron the 1X rate was 2.55 g a.i./acre. The broadcast herbicide rate (2X) was 30 g a.i./acre of halosulfuron and 5.1 g a.i./acre for

metsulfuron. Only one halosulfuron treatment included a surfactant (0.5% V/V).

Seedling densities (i.e. number of seedlings per square meter) were recorded in October and December using a 1' x 4' counting frame. Seedling samples were hand-lifted from the center of each plot and were transported to Auburn for analysis. Heights and root-collar diameters were measured on 25 seedlings per plot. Oven-dry weights of shoots and roots were recorded for each 25-seedling sample. Data were subjected to ANOVA and treatment effects were compared using contrast statements.

RESULTS

Soil texture at the Taylor Nursery was a sand while the Flint River Nursery was a loamy sand (Table 1). At the Taylor Nursery none of the treatments were significantly different from untreated seedlings in regards to stocking, height, root weight or shoot weight (Table 2). The ANOVA indicated no significant effect on seedbed density but Duncan's Multiple Range test indicated that the broadcast rate of metsulfuron reduced stocking by about 20 seedlings per square meter (Table 3).

At the Flint River Nursery, metsulfuron reduced stocking (Table 4) especially when applied broadcast at the high rate (Table 5). At both the Flint River and Taylor nurseries, this broadcast treatment reduced stocking by about 20 seedlings per square meter. Both halosulfuron and metsulfuron caused a reduction in the root-collar diameter, height, shoot weight, and, to some extent, root weight (Table 5).

From a statistical perspective, the addition of a surfactant had no adverse effect on seedlings treated with the low rate of halosulfuron. Likewise, the directed method of application did not greatly improve tolerance.

MANAGEMENT IMPLICATIONS

These findings indicate that at some nurseries (e.g. Taylor Nursery), young loblolly pine seedlings are relatively tolerant to low rates of metsulfuron methyl and halosulfuron methyl. However, at the Flint River Nursery, rates as low as 5 g a.i./acre of metsulfuron can lower stocking and stunt seedlings. This difference between nurseries might be due to the more basic soil (pH 6.1) at Flint River Nursery. Some sulfonylurea herbicides are more biologically active at pH 6 than at pH 5. However, the greater tolerance at the Taylor Nursery might be due to higher rates of fertilization. Due to additional fertilization, seedlings in control plots at the Taylor Nursery weighed about 2.3 g more than those from the Taylor Nursery. One theory is that stunted seedlings may recover more easily when nitrogen is readily available.

A low application of metsulfuron methyl (e.g. 2.8 to 6 g of product per acre) can control prostrate spurge. To avoid seedling injury, nursery managers who manage sandy soils (with no mulch and with low organic matter content) should realize that some herbicides will likely stunt

seedlings, even when directed between the drills. Stunting might occur on soils when the pH is >6. When stunting is observed during the summer, seedlings might recover if they are fertilized with additional applications of nitrogen.

REFERENCES

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Table 1. Soil texture, organic matter (OM) and soil acidity of the loblolly pine nurseries.

Nursery	Texture	Sand	Silt	Clay	OM	pH
		---------- (%) ----------				
Flint River	loamy sand	84	8	8	1.8	6.1
Taylor	sand	86	12	2	0.9	4.7

Table 2. Analysis of Variance for loblolly pine seedlings as affected by herbicides at the Taylor Nursery.

Source	df	Density	RCD	Height	Shoot	Root
		---------- Probability of a greater F-value ----------				
Replication	4	0.0006	0.0116	0.0001	0.2240	0.0316
Treatment	7	0.2561	0.7725	0.0471	0.2426	0.5820
Halosulfuron effect	(1)	0.8443	0.5000	0.3878	0.1317	0.4829
Halosulfuron low rate	(1)	0.4937	0.5455	0.3045	0.1600	0.6447
Halosulfuron broad	(1)	0.4399	0.5481	0.2444	0.7875	0.9243
Halosulfuron surfactant	(1)	0.3821	0.5276	0.0112	0.2858	0.4760
Metsulfuron effect	(1)	0.2861	0.4157	0.8189	0.0760	0.1955
Metsulfuron broad	(1)	0.3821	0.9664	0.0378	0.0341	0.3524
Metsulfuron low rate	(1)	0.8360	0.1223	0.5949	0.0918	0.0658
Error	28					

Table 3. Morphological characteristics for loblolly pine seedlings lifted on October 3 at the Taylor Nursery. H = halosulfuron; M = metsulfuron

Treatment	rate g a.i./ha	Density (#/m^2)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	223 ab	4.5	29.0 b	5.12 b	0.82
H	37	212 ab	4.4	28.9 b	6.50 ab	0.90
H+surfactant	37	221 ab	4.4	29.7 a	5.66 ab	0.84
H	74	230 a	4.4	29.3 ab	5.16 ab	0.89
H broadcast	74	222 ab	4.4	29.0 b	5.95 ab	0.90
M	6.3	225 ab	4.4	28.9 b	5.32 ab	0.84
M	12.6	213 ab	4.4	28.9 b	5.32 ab	0.84
M broadcast	12.6	203 b	4.4	29.5 ab	7.05 a	0.94
(LSD)		*21.1*	*0.24*	*0.58*	*1.58*	*0.22*

Table 4. Analysis of Variance for loblolly pine seedlings as affected by herbicides at the Flint River Nursery.

Source	df	Density	RCD	Height	Shoot	Root
		---------- Probability of a greater F-value ----------				
Replication	4	0.0347	0.1134	0.0037	0.1518	0.9750
Treatment	7	0.1465	0.1764	0.1368	0.4211	0.4171
Halosulfuron effect	(1)	0.3638	0.0097	0.0222	0.0383	0.0844
Halosulfuron low rate	(1)	0.1674	0.0137	0.0580	0.0526	0.1007
Halosulfuron broad	(1)	0.1745	0.3783	0.1622	0.6876	0.9399
Halosulfuron surfactant	(1)	0.4716	0.3795	0.8547	0.1440	0.2516
Metsulfuron effect	(1)	0.0389	0.0092	0.0068	0.0629	0.0588
Metsulfuron broad	(1)	0.3282	0.4731	0.3691	0.9393	0.5207
Metsulfuron low rate	(1)	0.1745	0.0153	0.0549	0.1093	0.0280
Error	28					

Table 5. Morphological characteristics for loblolly pine seedlings lifted on December 12 at the Flint River Nursery. H = halosulfuron; M = metsulfuron

Treatment	rate g a.i./ha	Density (#/m^2)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	223 a	4.0 a	33.5 a	3.03	0.55
H	37	210 ab	3.9 ab	31.8 ab	2.85	0.52
H+surfactant	37	216 ab	3.8 b	31.6 ab	2.58	0.47
H	74	227 a	3.9 ab	32.1 ab	2.76	0.50
H broadcast	74	215 ab	3.8 b	30.6 b	2.69	0.50
M	6.3	212 ab	3.8 b	31.4 ab	2.73	0.46
M	12.6	211 ab	3.8 b	31.3 ab	2.74	0.49
M broadcast	12.6	203 b	3.9 ab	30.4 b	2.76	0.52
(LSD)		*16.6*	*0.17*	*2.13*	*0.37*	*0.08*