RESEARCH REPORT 06-04

HERBICIDE TRIALS WITH FLUMIOXAZIN AND DIMETHENAMID: PART II

by
David B. South and Tommy Hill

INTRODUCTION

The herbicide flumioxazin is registered for use in container and bareroot nurseries and is labeled for use on both pine and hardwoods. A granular formulation [BroadStar® (0.25%)] and a WDG formulation [SureGuard® (51%)] are being marketed by Valent Professional Products. This herbicide is said to be effective against a number of nursery weeds including prostrate spurge (*Euphorbia humistrata*) and birdseye pearlwort (*Sagina procumbens*). Flumioxazin controls weeds by inhibiting protoporphyrinogen oxidase, an essential enzyme required by plants for chlorophyll biosynthesis. Flumioxazin is tightly bound to soil and usually does not inhibit root growth under normal growing conditions.

The preemergence herbicide dimethenamid (Outlook®) is sold by BASF and currently has been registered for use in forest nursery transplant beds in Washington and Oregon. Dimethenamid controls grasses and has activity on some small-seeded broadleaves such as spotted spurge (*Chamaesyce maculata*). It also has some suppressive activity on yellow nutsedge (*Cyperus esculentus*). Outlook® contains 6 pounds of active ingredient per gallon.

In 2003, SureGuard® was tested on young *Pinus taeda* seedlings (unreplicated plots) in Alabama and on Fraser Fir (*Abies fraseri*) in North Carolina. Although growth of birdseye pearlwort and other weeds was suppressed, injury resulted on both the young fir and pine seedlings. Due to injury from the WDG formulation, the granular formulation (BroadStar®) was tested at three nurseries in 2004 (South and Hill 2005). The study was repeated at two nurseries in 2005.

METHODOLOGY

Two studies were installed during the 2005 growing season. At the Shubuta Nursery, loblolly pine seeds were sown on April 27 and the seedlings were treated on June 8 (6 weeks after sowing). At the Elberta Nursery, loblolly pine seeds were sown on May 13 and the seedlings were treated on August 17 (14 weeks after sowing). Agrilock was used to stabilize beds at both nurseries. No mulch was used at Elberta while pine bark was applied at Shubuta. There was a heavy rain that occurred after herbicide treatment at the Elberta Nursery.

Each study was a randomized complete block design with five replications. Plot size was 10-feet long and one bed wide. Outlook® treatments were applied using a CO_2-backpack sprayer calibrated to apply 28.4 gallons per acre. Outlook® treatments included rates of 6, 12 and 24 fluid ounces of

product/acre. This is equivalent to 315, 630 and 1260 g of dimethenamid per ha. BroadStar® treatments included rates of 100 and 200 lbs of product/acre. This is equivalent to 280 and 560 g of flumioxazin per ha. Seedling densities (i.e. number of seedlings per square meter) were recorded on November 8 (Shubuta Nursery) and November 16 (Elberta Nursery) 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. Treatment effects were compared using contrast statements.

RESULTS

None of the treatments resulted in a significantly negative effect on seedling production or growth (Tables 2 and 3). However, flumioxazin treatments at the Elberta Nursery resulted in slightly larger RCD (Table 4). At both pine nurseries, the stand density in flumioxazin plots were lower than in the control plots (Tables 4 and 5), but this difference was not statistically significant in 2005 (although it was in 2004 when slightly higher rates were applied). This suggests that seed efficiency of loblolly pine might be reduced slightly when this granular herbicide is applied to seedbeds.

MANAGEMENT IMPLICATIONS

BroadStar® is a promising herbicide for use in horticultural nurseries (Fausey 2003; Marzena and Altland 2003; Sellmer et al. 2003; Marshall et al. 2005) and has been used to control weeds on large *Pinus palustris* seedlings in 5-gallon containers. However, our limited experience indicates that young loblolly pine might be stunted by either the granular or WDG formulation of flumioxazin. This herbicide may provide more benefits in hardwood nurseries (South and Hill 2005). Apparently, the root systems of oaks were large enough at the time of treatment so the seedlings were not injured.

Tests in 2004 with dimethenamid suggest that stunting can occur at sandy nurseries with low organic matter (South and Hill 2005). This herbicide did not result in injury in 2005. A heavy rain (soon after sowing) at the Elberta nursery may have diluted the herbicide and the pine bark mulch might have provided a buffer at the Shubuta Nursery. Wording included in the 24-c labels in Washington and Oregon includes the statement: "Do not apply to forest tree seedbeds."

REFERENCES

Fausey, J.C. 2003. Controlling liverwort and moss now and in the future. HortTechnology 13: 1, 35-38.

Marshall, M.W., B.H. Zandstra, and R.J. Robertson. 2005. The response of seedling conifers to flumioxazin. Proceedings, North Central Weed Science Society 60:58.

Marzena, M. and J. Altland. 2003. Comparison of oxyfluorfen and flumioxazin for weed control in field nurseries. Southern Nursery Research Conference 48:322-327

Sellmer, J.C., R.M. Bates, T.L. Harpster, D. Despot, and L.J. Kuhns. 2003. Efficacy of fall applied herbicides in pot-in-pot nursery tree production. HortTechnology 13: 4, 729-730.

South, D.B. and T. Hill. 2005. Herbicide trials with flumioxazin and dimethenamid. Auburn University Southern Forest Nursery Management Cooperative. Research Report 05-02. 5 p.

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

Nursery	Texture	Sand	Silt	Clay	OM	pH
		----------(%)----------				
Elberta	loamy sand	80	13	7	1.1	5.2
Shubuta	sandy loam	77	17	6	1.7	5.0

Table 2. Analysis of variance for loblolly pine seed as affected by herbicides at the Elberta Nursery in 2004.

Source	df	Density	Height	RCD	Root	Shoot
		---------- Probability of a greater F-value ----------				
Replication	4	0.9219	0.0116	0.0082	0.0496	0.1736
Treatment	5	0.7567	0.2423	0.1337	0.9239	0.8202
dimethenamid effect	(1)	0.4875	0.2445	0.3842	0.5480	0.2718
flumioxazin effect	(1)	0.6789	0.7687	0.0251	0.6424	0.3770
Error	20					

Table 3. Analysis of variance for loblolly pine seed as affected by herbicides at the Shubuta Nursery in 2004.

Source	df	Density	Height	RCD	Root	Shoot
		---------- Probability of a greater F-value ----------				
Replication	4	0.7451	0.3795	0.1898	0.0001	0.1990
Treatment	5	0.3341	0.7061	0.8051	0.6982	0.5291
dimethenamid effect	(1)	0.5767	0.6226	0.7988	0.1744	0.4145
flumioxazin effect	(1)	0.1452	0.9808	0.5414	0.4985	0.5838
Error	20					

Table 4. Morphological characteristics for loblolly pine seedlings lifted in November 2005 at the Elberta Nursery (seedlings treated 14 weeks after sowing).

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	201	24.5	4.4	0.51	2.50
dimethenamid	315	210	25.6	4.5	0.52	2.60
dimethenamid	630	205	25.8	4.5	0.54	2.70
dimethenamid	1260	214	24.3	4.4	0.54	2.70
flumioxazin	280	198	24.7	4.7	0.51	2.58
flumioxazin	560	192	24.8	4.6	0.54	2.70
	Lsd	32	1.5	0.2	0.08	0.38

Table 5. Morphological characteristics for loblolly pine seedlings lifted in November 2005 at the Shubuta Nursery (seedlings treated 6 weeks after sowing).

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	278	29.9	4.0	0.35	2.83
dimethenamid	315	270	29.4	3.9	0.37	2.57
dimethenamid	630	278	29.9	4.0	0.37	2.83
dimethenamid	1260	278	30.0	4.0	0.38	2.78
flumioxazin	280	265	29.9	4.0	0.37	2.71
flumioxazin	560	273	29.9	4.1	0.36	2.80
	Lsd	15	0.8	0.22	0.04	0.31