Auburn University Southern Forest Nursery Management Cooperative

RESEARCH REPORT 05-02

HERBICIDE TRIALS WITH FLUMIOXAZIN AND DIMETHENAMID

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 is currently registered for use on corn, soybeans, peanuts and grain sorghum. 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 Frasier 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. Soils varied from a sand to a sandy loam (Table 1).

METHODOLOGY

Two loblolly pine studies and two oak studies were installed during the 2004 growing season. At the Elberta Nursery in Alabama, pine seed were sown on April 18 (using pine bark mulch) and seedlings were treated 9 weeks later on June 23. At the Shubuta Nursery in Mississippi, pine seed were sown on April 15 (using Agrilock) and seedlings were treated 8 weeks later on June 8. Each pine study was installed as a randomized complete block design with five replications. The oak studies involved three replications. At the Atmore Nursery in Alabama, Nuttall oak (*Quercus nuttallii*) and sawtooth oak (*Quercus acutissima*) were sown on November 20, 2003 and seedlings were treated on June 23. Plot size was one bed wide and 10-feet long for pines and 5-feet long for hardwoods. Each study involved five herbicide treatments plus an untreated control. Herbicides 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 125 and 250 lbs of product/acre. This is equivalent to 350 and 700 g of flumioxazin per ha. Seedlings were treated when their foliage was dry. Seedling densities (i.e. number of seedlings per square meter) were recorded on October 10 (Shubuta Nursery), November 2 (Elberta Nursery) and December 6 (Atmore 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

Treating loblolly pine seedlings with dimethenamide 9 weeks after sowing did not affect RCD, height, or dry weight of seedlings at the Elberta Nursery (Table 2). However, this herbicide did result in shorter seedlings with smaller diameters at the Shubuta Nursery (Table 3). At both pine nurseries, flumioxazin reduced stand density and reduced height growth (Tables 4 and 5). This suggests that the pine seedlings were too young to be treated with this granular herbicide.

At the Atmore nursery, oaks were not injured by either herbicide (Tables 6 and 7). For sawtooth oak, the dimethenamide treatment slightly increased root mass and RCD (Table 8). There was no effect of dimethenamide on morphology of Nutall oak (Table 9).

MANAGEMENT IMPLICATIONS

BroadStar® is a promising herbicide for use in horticultural nurseries (Fausey 2003; Sellmer et al. 2003) 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 (8-9 weeks from sowing) can be stunted by either the granular or WDG formulation of flumioxazin pines. Testing of this herbicide in oak seedbeds resulted in no injury to either Nutall or sawtooth oak. Apparently the root systems of these species were large enough at the time of treatment so the seedlings were not injured.

Initial tests with dimethenamid suggest that stunting can occur at sandy nurseries with low organic matter. This herbicide will be tested again in 2005 to determine if tolerance is increased when nursery soils have more than 1% organic matter and less than 90% sand.

REFERENCES

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

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

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

Nursery	Texture	Sand	Silt	Clay	OM	pH
		----------(%)----------				
Atmore	sandy loam	69	23	8	2.0	4.5
Elberta	loamy sand	86	10	4	1.0	5.6
Shubuta	sand	95	4	1	0.9	4.5

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	0.2137	0.2381	0.0065	0.0065	0.0170
Treatment	5	0.0006	0.0001	0.0002	0.0001	0.0001
dimethenamid effect	(1)	0.2137	0.9903	0.7073	0.1594	0.3484
flumioxazin effect	(1)	0.0007	0.0001	0.0004	0.0001	0.0001
Error	18					

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	0.2897	0.0189	0.0189	0.7356	0.2221
Treatment	5	0.0193	0.0001	0.0099	0.5883	0.0565
dimethenamid effect	(1)	0.6554	0.0145	0.0300	0.7159	0.5554
flumioxazin effect	(1)	0.0112	0.0001	0.3643	0.2946	0.1391
Error	18					

Table 4. Morphological characteristics for loblolly pine seedlings lifted on November 2, 2004 at the Elberta Nursery (seedlings treated 9 weeks after sowing).

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	195	32.5	4.7	0.67	4.38
Dimethenamid	315	174	32.7	4.7	0.67	4.30
Dimethenamid	630	187	32.2	4.6	0.62	4.07
Dimethenamid	1260	167	32.6	4.6	0.61	4.19
flumioxazin	350	157	27.3	4.4	0.51	3.27
flumioxazin	700	104	22.2	4.2	0.45	2.33
	lsd	36	2.8	0.2	0.07	0.52

Table 5. Morphological characteristics for loblolly pine seedlings lifted on October 10, 2004 at the Shubuta Nursery (seedlings treated 8 weeks after sowing).

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	327	30.3	3.7	0.27	2.76
Dimethenamid	315	328	29.2	3.3	0.27	2.73
Dimethenamid	630	310	29.7	3.5	0.26	2.78
Dimethenamid	1260	329	29.2	3.5	0.26	2.64
flumioxazin	350	309	27.5	3.7	0.29	2.79
Flumioxazin	700	287	26.6	3.9	0.31	2.94
	lsd	25	0.9	0.25	0.06	0.17

Table 6. Analysis of Variance for 1-0 sawtooth oak seedlings as affected by herbicides at the Atmore Nursery in 2004.

Source	df	Density	Height	RCD	Root	Shoot
		---------- Probability of a greater F-value ----------				
Replication	2	0.0354	0.7426	0.5384	0.1958	0.2875
Treatment	5	0.2671	0.0339	0.3783	0.3528	0.0111
dimethenamid effect	(1)	0.4780	0.2070	0.0662	0.1547	0.0079
flumioxazin effect	(1)	0.3729	0.3764	0.3921	0.9618	0.6822
Error	10					

Table 7. Analysis of Variance for Nutall oak seedlings as affected by herbicides at the Atmore Nursery in 2004.

Source	df	Density	Height	RCD	Root	Shoot
		---------- Probability of a greater F-value ----------				
Replication	2	0.4630	0.5068	0.7101	0.0588	0.4069
Treatment	5	0.8946	0.9793	0.6745	0.9160	0.5715
dimethenamid effect	(1)	0.7562	0.4940	0.5645	0.7548	0.5275
flumioxazin effect	(1)	0.8079	0.4672	0.9419	0.7230	0.5989
Error	10					

Table 8. Morphological characteristics for sawtooth oak lifted on December 6, 2004 at the Atmore Nursery.

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	49	41.4	4.8	8.2	2.8
Dimethenamid	315	48	41.4	5.1	9.0	3.3
Dimethenamid	630	43	42.0	5.1	10.1	3.6
Dimethenamid	1260	49	42.0	5.0	9.2	4.2
flumioxazin	350	51	41.6	4.9	8.5	3.1
flumioxazin	700	52	40.5	4.9	8.0	2.8
	lsd	8	0.9	0.4	2.1	0.7

Table 9. Morphological characteristics for Nutall oak lifted on December 6, 2004 at the Atmore Nursery.

Treatment	g a.i./ha	Density	Height	RCD	Root wt	Shoot wt
		#/m^2	(cm)	(mm)	(g)	(g)
Control	0	43	41.6	5.5	0.27	2.76
Dimethenamid	315	47	42.4	5.5	0.27	2.73
Dimethenamid	630	46	42.2	5.6	0.26	2.78
Dimethenamid	1260	41	43.4	5.7	0.26	2.64
flumioxazin	350	40	42.3	5.3	0.29	2.79
flumioxazin	700	42	42.6	5.6	0.31	2.94
	lsd	15	2.8	0.5	0.06	0.17