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TOLERANCE OF YOUNG LOBLOLLY PINE SEEDLINGS TO MSMA: PART II

by
David B. South and Tommy Hill

INTRODUCTION

Monosodium methanearsonate (MSMA) is an organic arsenical herbicide and has been used in cotton for decades to control annual grasses and sedges. It can be used in non-cropland around pipelines and fencerows. In 1999, tests at Auburn University indicated that a single application (2 lbs active ingredient per acre) was effective in controlling flathead sedge (*Cyperus compressus*) (Belcher et al. 2002). Webber (2003) reported that MSMA (at 2 pounds ai/acre) provides better control of nutsedge (*Cyperus spp.)* than glyphosate at the same rate.

When attempting to control nutsedge, repeated applications of MSMA are often needed to provide effective control. For example, one study found that 60 days after applying MSMA (2 pounds active ingredient per acre) the number of nutsedge shoots was reduced by 68% for yellow nutsedge sedge (*Cyperus esculentus*) and 48% for purple nutsedge (*Cyperus rotundus*) plants (McElroy et al. 2003). In 2004, the Nursery Coop began to screen MSMA and in 2005, three MSMA trials were conducted on newly emerged loblolly pine seedbeds (South and Hill 2006). Since the results from these trials were promising, three additional tests were established in 2006.

METHODOLOGY

Three 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 (xx weeks after sowing). At the Rock Creek Nursery (AL), slash pine seeds were sown on April 18 and the seedlings were treated on June 27 (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 (10 weeks after sowing) Agrilock was used to stabilize beds at the Taylor and Rock Creek Nurseries and these nurseries operationally top-pruned seedlings. Pine bark was used as at Flint River where the study seedlings were not top-pruned.

Plot size was one bed wide and 10-feet long (except for the top-pruned plots that were 5-feet long). The studies included either four herbicide treatments plus an untreated control (replicated five times). MSMA (48% formulation plus a surfactant) was applied using a CO_2-backpack sprayer calibrated to apply 22 gallons per acre. Treatments included rates of either 21.3 or 42.6 fluid ounces of product/acre (6 lbs a.i. per 3785 ml). This is equivalent to 1 or 2 pounds of MSMA per acre (1.12 to 2.24 kg of MSMA per ha). To test the hypothesis that top-pruning prior to MSMA treatment increases the risk of injury, one treatment was top-pruned (using a hedge-trimmer) an hour or so

prior to herbicide treatment. To test the hypothesis that spray volume affects pine tolerance, one treatment involved a 2X spray volume (i.e. 44 gallons per acre).

Seedling densities (i.e. number of seedlings per square meter) were recorded in October to 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 was similar and ranged from 82 to 86% 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). Seedlings that were top-pruned and then treated with 2.24 kg MSMA were not significantly different that intact seedlings treated with 2.24 kg MSMA (Table 2). However, the root-collar diameter of top-pruned and treated seedlings was slightly less than that of untreated seedlings (Table 3). Applying twice as much water per acre was not detrimental to the pine seedlings and might have increased tolerance of the pines to MSMA.

At the Flint River Nursery, none of the not-pruned treatments were significantly different from untreated seedlings in regards to stocking, root-collar diameter, root weight or shoot weight (Table 4). However, the top-pruning contrast (i.e. MSMA 2.24 vs cut-MSMA 2.24) indicated the top-prune treatment was effective in reducing shoot height (Table 5). There were also significant block effects on density and seedling size (Table 4). Density values were 167, 172, 177, 193 and 199 for blocks 1, 2, 3, 4, and 5, respectively. Block 1 produced the smallest seedlings (2.27g shoots and 0.16 g roots) while block 5 produced the largest seedlings (2.8 g shoots and 0.28 g roots). Shoot height values were 29.0, 29.4, 29.8, 31.9 and 34.0 cm for blocks 1, 2, 3, 4, and 5, respectively.

At the Rock Creek Nursery the MSMA treatments were not significantly different from untreated seedlings in regards to height, root-collar diameter, root weight or shoot weight (Table 6). However, all MSMA treatments produced fewer seedlings than the untreated control (Table 7)

MANAGEMENT IMPLICATIONS

These findings indicate that loblolly pine is tolerant to MSMA at rates of 1.12 to 2.24 kg a.i./ha. Although greenhouse trials indicate that recently top-pruned seedlings could be injured (South and Hill 2005), nursery trials did not show similar results. It appears that at some nurseries (i.e. the Taylor Nursery), spray volume can affect tolerance to MSMA. Slash pine production might be reduced after applying MSMA to young seedlings, but this finding is tentative and needs to be supported by further research. Research needs to be conducted to determine if applying MSMA in multiple applications will adversely affect seedling growth.

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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
		---------- (%) ----------				
Rock Creek	loamy sand	82	13	5	1.4	5.1
Taylor	sand	86	12	2	0.9	4.7
Flint River	loamy sand	84	8	8	1.8	6.1

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

Source	df	Density	RCD	Height	Shoot	Root
		---------- Probability of a greater F-value ----------				
Replication	4	0.6277	0.0092	0.0050	0.3097	0.5351
MSMA Treatment	4	0.5804	0.0335	0.6176	0.3466	0.5641
Prune vs. no prune	(1)	0.7952	0.6880	0.3148	0.9306	0.8915
0 vs. 2.24 kg/ha	(1)	0.2188	0.3748	0.1863	0.8379	0.9311
1X vs. 2X water	(1)	0.4706	0.0345	0.8940	0.1042	0.9079
Error	16					

Table 3. Morphological characteristics for loblolly pine seedlings lifted on October 3 at the Taylor Nursery.

Treatment	Rate kg a.i./ha	Density (#/m^2)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	228	4.43 ab	29.5	4.10	0.55
MSMA	1.12	214	4.44 ab	29.3	4.47	0.64
MSMA-1X	2.24	213	4.31 bc	29.5	4.59	0.55
MSMA-2X	2.24	220	4.45 a	29.3	3.78	0.55
Cut+MSMA	2.24	215	4.29c	29.5	4.63	0.56
(LSD)		*12.8*	*0.13*	*0.37*	*0.99*	*0.14*

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

Source	df	Density	RCD	Height	Shoot	Root
		---------- Probability of a greater F-value ----------				
Replication	4	0.0003	0.0612	0.0001	0.0011	0.0265
MSMA Treatment	4	0.6874	0.9889	0.1102	0.6892	0.7896
Prune vs. no prune	(1)	0.3437	0.9736	0.0141	0.4172	0.3813
0 vs. 2.24 kg/ha	(1)	0.4246	0.9933	0.3174	0.5405	0.2903
1X vs. 2X water	(1)	0.4882	0.7963	0.7083	0.8508	0.8042
Error	16					

Table 5. Morphological characteristics for loblolly pine seedlings lifted on December 12 at the Flint River Nursery.

Treatment	rate kg a.i./ha	Density (#/m^2)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	186	3.8	30.8 ab	2.41	0.23
MSMA	1.12	182	3.8	31.7 a	2.52	0.23
MSMA 1X	2.24	184	3.8	31.0 ab	2.48	0.20
MSMA 2X	2.24	179	3.7	31.4 a	2.51	0.21
Cut+MSMA	2.24	178	3.8	29.4 b	2.35	0.22
(LSD)		*12.8*	*0.21*	*1.74*	*0.47*	*0.05*

Table 6. Analysis of Variance for slash pine seedlings as affected by MSMA at the Rock Creek Nursery.

Source	df	Density	RCD	Height	Shoot	Root
		---------- Probability of a greater F-value ----------				
Replication	4	0.0363	0.0230	0.1500	0.3954	0.0017
MSMA Treatment	4	0.2576	0.6673	0.4530	0.4868	0.2130
Prune vs. no prune	(1)	0.3793	0.6675	0.2148	0.4086	0.3116
0 vs. 2.24 kg/ha	(1)	0.0331	0.6129	0.7191	0.8808	0.2853
1X vs. 2X water	(1)	0.7670	0.2775	0.4232	0.2667	0.2216
Error	16					

Table 7. Morphological characteristics for slash pine seedlings lifted on November 8 at the Rock Creek Nursery.

Treatment	rate kg a.i./ha	Density (#/m^2)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	234	4.9	31.1	3.52	0.49
MSMA	1.12	226	4.8	30.6	3.34	0.40
MSMA 1X	2.24	217	4.8	31.2	3.41	0.42
MSMA 2X	2.24	215	4.9	30.9	3.58	0.47
Cut+MSMA	2.24	225	4.9	30.7	3.54	0.47
(LSD)		*18.9*	*0.24*	*0.72*	*0.32*	*0.09*