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Nursery Management
Cooperative

RESEARCH REPORT 05-05

THE EFFECT OF TOP-PRUNING ON TOLERANCE OF GREENHOUSE-GROWN LOBLOLLY PINE SEEDLINGS TO MSMA

by
David B. South and Tommy Hill

INTRODUCTION

Monosodium methanearsonate (MSMA) is an organic arsenical herbicide (Hiltbold 1975). MSMA has medium to low mobility in sandy soils and might leach 20 inches in a Norfolk sandy loam. It is strongly adsorbed to soil particles and the reported half-life averages about 6 months in non-irrigated soils. Under high irrigation the half-life in California was about 55 days. MSMA causes cell membrane destruction and rapid desiccation. Uptake by roots is limited and the primary pathway into plants is through the foliage.

MSMA has been used in cotton for decades to control annual grasses and sedges. It can be used in non-cropland around pipelines and fencerows. Our tests indicate that a single application in June (¾ pound active ingredient per acre) can control flathead sedge (*Cyperus compressus* L.) with no injury to loblolly pine (*Pinus taeda* L.). At some nurseries, this annual sedge is difficult to kill using traditional nursery herbicides.

When attempting to control nutsedge, repeated applications of MSMA are often needed to kill nutsedge. 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 (*Cyperus esculentus* L.) and 48% for purple nutsedge (*Cyperus rotundus* L.) plants (McElroy et al. 2003). Follow-up applications would be needed to provide greater control.

MSMA has been used to kill conifers in forests for more than 40 years. About 36 years ago, J.P. Fulmer (1969) reported that weekly, directed applications of MSMA (applied using a shielded applicator) controlled nutsedge (*Cyperus spp.*) in an ornamental holly (*Ilex spp.*) nursery. However, there is no published record of it being tested in southern pine seedbeds. We and others assumed that since it was labeled for killing conifers (as an injection treatment), MSMA would likely kill young pine seedlings. Fortunately, a few managers learned that young southern pines were tolerant of

broadcast applications of MSMA. They spread the word, and in 2004 the Nursery Coop established tests in pine seedbeds. In 2005, a greenhouse trial was conducted to test the hypothesis that an interaction exists between top-pruning and MSMA.

METHODOLOGY

Seed were sown in Ray leach containers on April 20, 2005. In late May and on June 20, seedlings were fertilized with a liquid solution of 30-10-10 (N-P_2O_5, K_2O). On June 27, 200 seedlings were approximately 8 cm tall and half of the trees were top-pruned. Approximately 3 cm of the shoot was removed by clipping with a hand shear. Within an hour of top-pruning, seedlings were treated with MSMA. Eighty seedlings were not treated (i.e. were not treated with MSMA) while forty were treated with 12 oz of product per acre (6.6 pounds active ingredient per acre). This 1X rate was equivalent to 672 g a.i./ha of MSMA (or 0.6 lb a.i./acre). Another 40 seedlings were treated with a 2X rate and the remaining trees were treated with a 4X rate.

An experimental unit consisted of ten seedlings. On September 7, seedlings were extracted from the containers and heights and root-collar diameters were measured on 200 seedlings. Oven-dry weights of shoots and roots were recorded for each 10-seedling sample.

RESULTS

The null hypothesis was rejected. There was a significant interaction between MSMA treatment and top-pruning for height, RCD, and shoot dry weight (Table 1). The MSMA apparently had no significant effect on the number of forked seedlings or on the dry weight of roots (Table 2). To test the effects of top-pruning in the absence of MSMA, a separate analysis was conducted (Table 3). Top-pruning increased forking and reduced root mass but did not significantly affect shoot height, RCD, or shoot dry weight.

MANAGEMENT IMPLICATIONS

These preliminary findings suggest that herbicide injury to young pine seedlings can be increased when freshly cut small pine seedlings are treated with MSMA. This suggests that MSMA should either be applied before top-pruning or the herbicide treatment should be delayed until seedlings have healed and have initiated new shoot growth. This test also supports previous findings that indicate multiple top-pruning is required to effectively control seedling height.

REFERENCES

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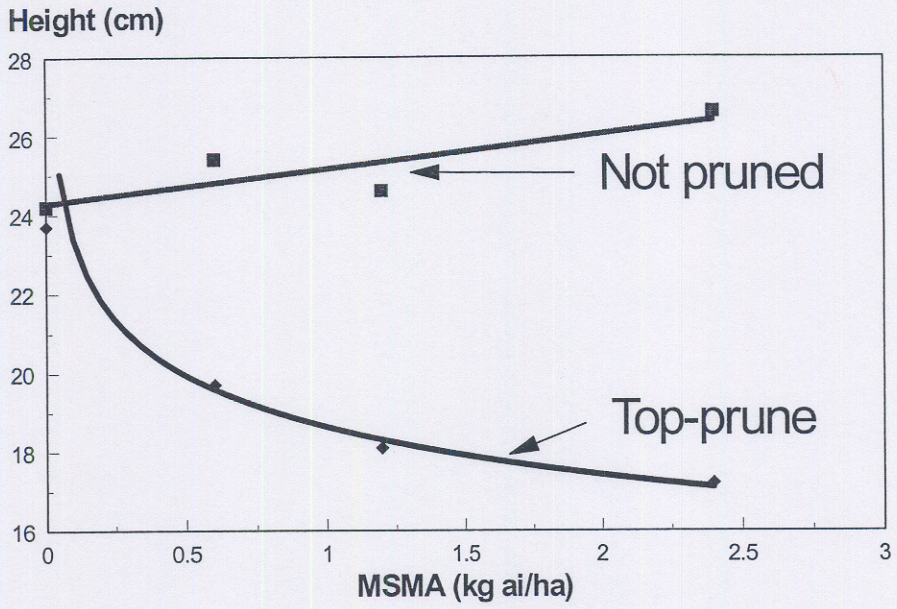

Figure 1. Interaction between top-pruning and treatment with MSMA. Stunted seedlings only occurred when seedlings were top-pruned seedlings.

Table 1. Analysis of Variance for loblolly pine seedlings as affected by top-pruning and MSMA in a greenhouse study.

Source	df	Height	RCD	Root	Shoot	Forks
		---------- Probability of a greater F-value ----------				
Replication	3	0.5915	0.0919	0.4375	0.2851	0.4664
Top-prune	1	0.0001	0.0001	0.0001	0.0001	0.0001
MSMA Treatment	3	0.0441	0.0660	0.1902	0.0039	0.6406
Treatment x Top-prune	3	0.0003	0.0055	0.8266	0.0049	0.4470
Error	9					

Table 2. Morphological characteristics for loblolly pine seedlings. Shoot and root dry weight represent means for 10 seedlings.

Treatment	Forks (#/seedling)	RCD (mm)	Height (cm)	Shoot (g)	Root (g)
Control	0	2.3	24.0	2.94	0.37
MSMA 1X	0	2.4	25.4	3.58	0.42
MSMA 2X	0	2.2	24.6	2.66	0.34
MSMA 4X	0	2.4	26.6	3.04	0.33
---------- top-pruned ----------					
Control	1.7	2.2	24.3	2.09	0.21
MSMA 1X	1.8	2.0	19.7	1.69	0.21
MSMA 2X	2.3	2.0	18.1	1.51	0.17
MSMA 4X	1.8	1.9	17.2	1.47	0.18
(LSD)	*0.49*	*0.11*	*1.67*	*0.26*	*0.07*

Table 3. Analysis of Variance for loblolly pine seedlings as affected by top-pruning.

Source	df	Height	RCD	Root	Shoot	Forks
		---------- Probability of a greater F-value ----------				
Replication	1	0.2048	0.5475	0.6366	0.9866	0.5000
Top-prune	1	0.6051	0.4356	0.0963	0.1304	0.0285
Error	3					