Auburn University Southern Forest Nursery Management Cooperative

RESEARCH REPORT 99 - 2

A COMPARISON OF CHLOROPICRIN, METHAM-SODIUM, AND EPTC COMBINATIONS AS METHYL-BROMIDE ALTERNATIVES AT THREE NURSERIES

by
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INTRODUCTION

The effects of fumigation with chloropicrin and combinations of chloropicrin with metham sodium and or with EPTC were investigated at three nurseries. Although primarily used to increase seed efficiency and seedling quality, fumigation remains important for reducing purple (*Cyperus rotundus L*) and yellow nutsedges (*C. esculentus* L) which have been poorly controlled by other fumigants than MBr (Carey 1994). Therefore, the preemergent herbicide EPTC was included to increase the activity of chloropicrin for nutsedge.

METHODOLOGY

Similar studies were installed at three nurseries (see Table 1 for treatment rates); the Georgia Forestry Commission's Flint River Nursery in 1997, and the Louisiana Department of Agriculture and Forestry's Beauregard Nursery and Rayonier's Glennville Regeneration Center in 1998. All fumigants were applied by Hendrix and Dale Inc. a few weeks before sowing. The four treatments all contained chloropicrin. Seed sources, seedbed densities, fertilization, irrigation and post emergent herbicide regimes were those of the host nursery.

Seedbed densities and seedling sizes were determined in the fall for four-square-foot plots near the center of each fumigation plot. Seedling numbers and oven dry weights were transformed to values per square foot to separate treatment effects from that of seedbed density. Comparisons between nurseries are for loblolly only and for the treatments common to all nurseries.

Comparisons among means are from SAS Duncan's (α 0.05).

At Flint River in 1997, purple nutsedge occurred in the study area and this was assessed in November by collecting all rhizomes ("nuts") within each seedbed density plot. At Beauregard the nutsedge was mostly yellow and this was assessed by hand weeding the entire study area mid season. At Glennville there was too little nutsedge to evaluate.

RESULTS AND DISCUSSION

Chloropicrin plus metham sodium (CMS) significantly increased seedling numbers and growth compared to controls. Averaged for all nurseries, mean RCD increased from 3.6 to 4.4 mm, biomass increased from 0.14 to 0.20 lb/ft^2 and there were seven more plantable seedlings and 6.5 more grade-1 seedlings/ft^2 in CMS than in not fumigated plots. Differences between treatments were remarkably similar within the three nursery comparisons presented in Table 1. Total seedlings (Stems), an indication of survival, were similar between treatments and differed only at the nursery with the highest seedbed densities. In all cases, non-fumigated plots contained a smaller average seedling and fewer large seedlings. Although fumigation treatments seldom differed significantly for sizes or numbers of seedlings, treatments with both chloropicrin and metham sodium (CMS) always contained the largest and the most seedlings.

The only significant differences for nutsedge were those between fumigated and control (not fumigated) treatments. Nevertheless, treatment means and trends at both nurseries (Table 1) make it seem reasonable to conclude that both EPTC and metham sodium increase nutsedge control compared to chloropicrin alone.

Seedbed density influences individual seedling and unit area biomass (Mexal 1980). At more than 20 seedlings /ft^2, each additional seedling increases plot biomass less as some maximum limit of about 0.39 lb/ft^2 (Mexal 1980) is approached. In this study, biomass per square foot increased as seedbed density increased from 19 at Glennville to 24 at Beauregard but not as it increased again to 28 at Flint River.

Larger differences in mean seedling mass should occur at lower bed densities. At Flint River and Glennville, respectively, 29 and 20 seedlings /ft^2 in the CMS plots indicate management target densities. At Flint River, there was 22% more total biomass and mean seedling weight was 14% greater. At Glennville, fumigation increased total seedling biomass by 53% and mean seedling weight by 30%. CMS produced four more plantable seedlings (from 18 to 22) and 3.6 more grade-1's (from 0.6 to 4.2) at 29 seedlings per ft^2 and five more plantables and 11.5 more grade-1's at 20 seedlings /ft^2.

MANAGEMENT IMPLICATIONS

Seedbed surfaces occupy about 66% or 29,000 ft^2 of fumigated acres. At a sale price of $35/M seedlings, this makes each plantable seedling per square foot of bed worth potentially $1,010/ac. Based on the three nursery average (Table 1) in this study, fumigation increased potential sales $8,100/ac

Seedlings grown at 20 /ft^2 have been sold at 66% more than similar stock grown at 25 /ft^2. The purchaser of such seedlings should be as interested in fumigation history as in bed density. Lowering bed density from 26 to 20 seedling /ft^2 increased the number of grade-1's per thousand by 129 and by 505 in not fumigated and in fumigated beds, respectively. Buying the low density seedlings from fumigated beds was a much better value.

The treatment averages in Table 1 indicate that in the short term, with no loss of nursery acreage, not fumigating might cost southern nurseries a 33% loss in plantable seedlings per ft^2 (from an average 21 to 14) or about 330 million seedlings that could sell for about $11 million. However, even if total seedling production remains adequate there might still be reduced plantation growth associated with a reduction in seedling size. Using the estimates of South and Mexal (1984) fumigation increased PV's (based on expected growth increases associated with the additional grade-1 seedlings) by $25,900 per nursery acre.

LITERATURE CITED:

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Mexal, John G. 1980. Seedling bed density influences seedling yield and performance. In. Proceedings Southern Nursery Conference. Lake Barkley, KY. September 2-4 1980. Tech. Pub. SA-TP17. 123 pp.

South, D. B. and J. G. Mexal. 1984. Growing the "Best" seedling for reforestation success. Ala. Agric. Expt. Stn. Forestry Dpt. Series No. 12. 11 pp.

Table 1. Effects of pre-sow soil treatments on seedling production and nutsedge control within nursery and averaged by nursery and by treatment for the Flint River Nursery, the Beauregard Nursery and the Glennville Regeneration Center.

Within Nursery by Treatment

Treatments[1]				Seedlings Parameters[2]					Nutsedge[3]
MBr	CHL	MS	EPTC	rcd	Mass	Stems	Plants	Ones	
Flint River Nursery									
0	0	0	0	3.5 c	72 b	26 b	18 b	0.6 b	8.5 a
0	300	0	0	3.6 bc	83 a	29 a	22 a	1.8 ab	4.0 b
0	300	0	6	3.8 ab	87 a	29 a	23 a	3.1 a	1.5 b
0	300	336	0	3.9 a	88 a	28 ab	22 a	4.2 a	0.5 b
0	300	336	6	4.0 a	90 a	29 a	24 a	3.8 a	1.5 b
			lsd	*0.2*	*9*	*2*	*2.5*	*2.2*	*4.0*
Beauregard Nursery									
0	0	0	0	3.3 b	70 b	23 a	14 b	0.7 b	485 a
0	250	0	0	3.8 ab	86 ab	24 a	20 ab	1.4 ab	35 b
0	250	0	6	3.6 ab	89 a	24 a	18 ab	0.9 ab	2 b
0	250	253	0	4.1 a	109 a	26 a	23 a	4.9 a	10 b
			lsd	*0.7*	*18*	*3.6*	*7.8*	*3.6*	*326*
Glennville Regeneration Center									
0	0	0	0	3.8 c	49 b	17 a	14 b	2.5 b	
0	250	0	0	4.8 ab	71 a	19 a	18 a	10.6 a	
0	250	0	6	4.7 b	70 a	20 a	19 a	9.5 a	
0	250	253	0	5.2 a	75 a	20 a	19 a	14.0 a	
340	7	0	0	5.1 ab	79 a	19 a	19 a	12.2 a	
			lsd	*0.4*	*13*	*3.6*	*3.1*	*4.7*	
By Soil Treatment n=9									
None				3.6 c	65 c	22 b	14 b	1.5 c	
Chloropicrin				4.1 b	80 b	24 ab	19 a	4.5 b	
" + EPTC				4.1 b	84 ab	24 ab	20 a	4.9 b	
" + Metham Sodium				4.4 a	93 a	25 a	21 a	8.0 a	
			lsd	*0.3*	*11*	*2*	*3*	*2.7*	
By Nursery n=12									
Flint River				3.7 b	86 a	28 a	21 a	3.2 b	
Beauregard				3.7 b	90 a	24 b	18 b	1.9 b	
Glennville				4.6 a	67 b	19 c	17 b	9.2 a	
			lsd	*0.3*	*9*	*1.8*	*2.6*	*2.7*	

1) All rates in lbs ai per acre, MBr = methyl bromide, CHL = Chloropicrin 100, MS = Metham Sodium 4.2 lbs ai/ gal, EPTC = Eptam 7EC. Treatments containing Metham Sodium are drum-rolled and others are plastic tarped.

2) Seedling parameters except rcd are per square foot of bed. Mass is grams oven-dry weight, Stems is total seedlings, Plants is Grade 1 plus Grade 2 seedlings and Ones is number of grade one seedlings.

3) Nutsedge at Flint River is rhizomes /ft^2 and at Beauregard is air dry biomass in lbs/ac.