RESEARCH REPORT 03-6

EFFECTS OF FUMIGATION TREATMENTS ON LOBLOLLY SEEDLING GROWTH AT THE TAYLOR FOREST TREE NURSERY IN SOUTH CAROLINA

by
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INTRODUCTION

Six pre-sow soil treatments were evaluated at the Taylor Nursery during the 2002-2003 season for their effects on growth of loblolly pine seedlings. Two rates of Methyl Bromide (MBr) plus chloropicrin were applied in a carrier (paraffin) intended to reduce initial volatility and increasing post application residence in the soil. In addition, methyl iodide and Telone® were evaluated as substitutes for MBr. These treatments were compared to not fumigated plots and to the standard treatment of 350 lbs/ac of MC2.

Formulating MBr with carriers so that it is liquid at normal fumigation temperatures was tried in the 1960's with products such as Brozone® in which MBr and Chloropicrin were dissolved in kerosene. Applying the MBr was made safer and the initial rate at which it escaped from the soil was reduced by dissolving the fumigant in the petroleum. Although tested in forest tree nurseries (Hodges 1960), Brozone was never used extensively there. However, as the EPA reduces MBr availability and the need to reduce use rates increases, it becomes more important to use smaller amounts by increasing soil activity.

Methyl iodide (MI) was evaluated as a pest control fumigant as far back as the 1930's from which its efficacy was reported to compare favorably with MBr (Sims et al 1995). However, due to considerably greater production costs, MI could not compete with MBr and it may not have been tested as a soil fumigant. However, with the phaseout of MBr for regulatory reasons a potential role for MI has been recognized and it now seems that it may soon be registered.

Telone® (1,3 dichloropropene) has recently cleared a large potential hurdle and completed its re-registration process. This compound (1,3-d), is among the best nematacides but has not been particularly effective against weeds. We evaluated 1,3-d in the early 90's and found that weed control was enhanced with the addition of chloropicrin. The product we evaluated in the present study (Telone C35®) contains 35% chloropicrin. Telone C-35® and the other products evaluated here need additional data for forest tree nurseries.

METHODOLOGY

The six treatments listed in Table 1 were applied in a randomized complete block design similar to those used for most studies since 1997. Treatments were randomly assigned to a position in each of three, three-bed-wide blocks across the nine beds between adjacent risers. Application was on October 20, 2001 by Hendrix and Dail using electronically regulated application equipment. After fumigation, the study area was fallow over the winter and beds were prepared and loblolly seed

were sown in the study area in early April (the 4th) of 2002. On November 21, 2002, all live seedlings in one linear foot of bed (4 ft^2) were counted near the center of each treatment plot and approximately 30 seedlings were carefully hand lifted from the center of each counted plot. Harvested seedlings were taken to Auburn and measured to determine mean size (RCD) and mass (root and shoot weights) which were converted to values per square foot of bed using the seedbed density counts.

Table 1. Treatments applied at the Taylor Nursery in the fall of 2001.

Treatment	Description (lbs are per acre)	Tarp
Control	No fumigant	No
MC33	235 lbs MBr + 115 lbs chloropicrin	Yes
MBr / solvent High	308 lbs MBr + 6 lbs chloropicrin + 136 lbs solvent	Yes
MBr / solvent Low	241 lbs MBr + 5 lbs chloropicrin + 104 lbs solvent	Yes
Methyl Iodide (MI)	340 lbs Methyl Iodide	Yes
Telone C35®	260 lbs 1,3-dichloropropene + 140 lbs chloropicrin	Yes

RESULTS AND DISCUSSION

Seedbed density, and means for seedling size and mass are presented by fumigation treatment in Table 2. The mean of no measured variable differed from those of the control. Lack of difference between the control and MC33 for such variables as seedling mass, is rare but not unprecedented in our fumigation studies. Variability (as a comparison of means to lsd's) was larger and total mass per unit area was less than normal. Nevertheless, the reason for the lack of differences is not known although it appears likely that seedling growth was reduced by environmental conditions not related to fumigation. The soil and other conditions during the application of fumigants were adequate. Both the most and least seedlings per square foot were in plots where the treatment was MBr plus chloropicrin in solvent.

Two blocks of sweetgum seedlings were to be part of this study. However, although fumigated plots were sown twice, with sweetgum seed, at the time pines were sown, no sweetgum seed germinated. It is considered important that the MBr with "solvent" be evaluated with an endo-mycorrhizal hardwood such as sweetgum to assess the impact of that treatment on those fungi. Unfortunately that assessment will have to be part of a future study.

Table 2. November seedbed densities and seedling size by fumigation treatment at the Taylor Nursery in 2002

Treatment†	lbs/ac	Seedlings/ft2*	RCD mm	Ones*	Twos	culls	Shoot gm	Root gm
None	0	18.1	4.1	3.9	12.5	1.6	51.3	3.7
MC33	350	19.9	4.0	3.3	13.3	3.3	51.0	3.0
MBr Solvent	450	16.2	4.0	2.9	10.1	3.2	42.4	3.2
MBr Solvent	350	20.8	4.4	6.9	11.6	2.2	67.8	3.7
MI	340	18.6	4.1	3.9	12.0	2.8	50.7	3.3
Telone C35	400	17.2	4.4	5.5	9.5	2.3	51.2	3.7
	lsd	*3.5*	*0.4*	*3.7*	*4.1*	*3.3*	*17.3*	*0.9*

† More details of treatments are in Table 1.

* Seedling variable are per square foot of bed. Ones = the number of seedlings with rcd's > 4.8 mm and culls = the number with rcd's < 3.2 mm.

MANAGEMENT IMPLICATIONS

To put the best face on these results one could say that all the alternatives performed as well as the standard application of MC33. Realistically, there was no clear benefit from any treatment in terms of seedling numbers and sizes, and were these results truly indicative of the benefit of fumigation the practice would not be economically justified except for control of recognized and established soil disease problems. In this study we did not monitor for treatment effects on soil microbes and normal weed control practices were carried out on the study site.

LITERATURE

Hodges, Charles S. 1960. Effect of soil fumigation in the nursery on growth of loblolly pine seedlings and control of weeds. TPN 45:23-27.

Sims, James J., N. M. Grech, J. Ole Becker, M. McGiffen Jr., abd H. D. Ohr. 1995. Methyl Iodide: A potential alternative to Methyl Bromide. 44-1 In. Ann. Int. Res. Con. on MBr Alternatives and Emission Reductions. Nov 6-8, 1995. San Diego, CA.