TREE SEEDLING QUALITY AND WEED CONTROL WITH BASAMID, MBR AND METHYL IODIDE

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The studies reported herein are part of a long-term continuing effort by the Auburn University Southern Forest Nursery Management Cooperative to identify and evaluate alternatives to Methyl Bromide. Fumigation with Methyl Bromide has been the most commonly used method for producing high quality, pest-free forest-tree nursery seedlings in the Southeastern United States. This study is a large production scale trial of three fumigants and two types of tarps managed under normal best management nursery practices.

Experiments and Measurements: A nine section (9 bedrows each) fumigation trial was established at a forest-tree nursery in Glennville, GA to look at alternative fumigants for the production of forest-tree seedlings over a typical two-year rotation. In November 2004, three nursery sections were treated with Basamid (490 lbs/ac), tilled and water applied via irrigation pipeline as per manufactures' recommendations. In April 2005, six nursery sections were fumigated with either Methyl Iodide (MI) or Methyl Bromide (MBr) which were covered with either virtually impermeable film (VIF) or high density plastic (HD). The three MBr sections received two rates; 150 lbs/ac 98:2 and covered with VIF or 350 lbs/ac 98:2 and covered with HD. Three nursery sections were fumigated with MI (150 lbs 98:2) and covered with either VIF or HD. In each of the fumigated section, families of both loblolly pine *(Pinus taeda)* and slash pine *(P. elliottii*) were sown so that each soil treatment received the same pine families.

History plots were placed throughout the 9 sections and seedling data was recorded by Rayonier Regeneration Center nursery personnel. In addition to seedling counts, hand weeding time by bedrow was recorded for all 81 bedrows (9 sections, 9 bedrows). In November 2005, first year final seedling counts were made for each species x fumigation x tarp and seedlings collected for biomass determination. Data from a total of 78 plots were collected and seedlings were measured for RCD's, height and root/shoot dry weight.

In addition to seedling samples, soil samples were collected in both November 2005 and May 2006 from each of the sections, diluted and plated onto media selective for *Trichoderma*. Propagules per gram of soil was determined and recorded by fumigation only.

Results and Discussion: First year seedling crop indicated that MI was as good as MBr in producing seedlings with similar RCD, heights and densities for both loblolly and slash pine (Table 1). However, weed control, as measured by time of weeding and biomass was significantly more in the MI than in the Basamid and MBr plots (Table 2). Basamid plots had smaller RCD's, fewer seedlings per sq foot and were shorter than either MBr or MI. These seedlings never attained a height to require top-pruning. Pruning is an important cultural practice widely used by nurseries to increase the number of quality seedlings for shipping and increase survival of out planted seedlings.

Twelve months after fumigation with Basamid, *Trichoderma* within the plots indicated a significant reduction in propagules per gram of soil (Table 3). Eighteen months following Basamid fumigation, the total number of fungal propagules per gram of soil increased (Table 4). However, Basamid still had significantly fewer *Trichoderma* colonies than MI or MBr (Table 5). *Trichoderma* is a beneficial soil fungal genus that is found in nearly all agricultural soils. Fungi in this genus have been utilized for years as a bio-control for plant diseases. *Trichoderma* has also been shown to increase germination and promote growth in plants.

Key Study Summary Points:

- Methyl Iodide fumigation produced industry standard seedlings when compared to Methyl Bromide.
- Methyl Iodide fumigation had more weeds than either Methyl Bromide or Basamid.
- The high weed count in Methyl Iodide plots may be due to the relatively low rate, 150 lbs/acre of fumigant used.
- Basamid fumigation had fewer and smaller seedlings than either Methyl Bromide or Methyl Iodide and did not produce industry standard seedlings.
- After 12 and 18 months following fumigation, levels of *Trichoderma* in the soil were significantly lower in Basamid plots than either Methyl Bromide or Methyl Iodide.
- VIF tarping reduced significantly more fungal colonies than HD at the second sampling period.
- There were no significant differences between HD and VIF related to fungal genera recovered on selective media.
- VIF tarping of MBr at 150 lbs/acre produced seedlings similar to the 300 lbs/acre MBr under HD plastic.
- There is still no operational method for using VIF in broadcast (flat tarp) system as used in forest-tree nurseries.

Table 1. Seedling characteristics by species and soil fumigant - 2005 Glennville, GA.

	Loblolly Pine		
	MB [1]	MI	BAS
Density (ft^2)	21.6	22.9	20.3
RCD (mm)	4.9 a	4.7 a	4.3 b
Height (cm)	32.0 a	31.0 a	23.6 b
Root Bio (g)	0.65	0.65	0.61
Shoot Bio (g)	4.3 a	4.2 a	3.3 b
	Slash Pine		
	MB [1]	MI	BAS
Density (ft^2)	20.6	20.0	18.5
RCD (mm)	5.3	5.2	5.4
Height (cm)	30.4 a	30.3 a	27.1 b
Root Bio (g)	0.64	0.66	0.78
Shoot Bio (g)	5.0 a	5.3 a	5.9 b

[1] Letters within a row and species indicate significant differences at the 0.05 level.

Table 2. Hand weeding time and weed biomass by soil fumigant - 2005 Glennville, GA.

	Fumigation		
Weeds	BAS [1]	MB	MI
Weight (g/riser)[2]	12.0 a	14.0 a	20.9 b
Time (seconds/riser)	39.1 a	35.2 a	59. 3 b

[1] Letters within a row indicate significant differences at the 0.05 level.
[2] Riser = sections between sprinkler heads.

Table 3. Soil borne fungi populations by soil fumigant - 2005 Glennville, GA.

Fumigant	# of *Trichoderma* Colonies [1]
MB	155.6 a
MI	32.6 b
BAS	15.3 b

[1] Letters indicate significant differences at the 0.05 level.

Table 4. Soil borne fungi populations by soil fumigant - 2006 Glennville, GA.

Fumigant	# of Fungal Colonies [1]
MB	140.2 a
MI	106.4 b
BAS	142.6 a

[1] Letters indicate significant differences at the 0.05 level.

Table 5. Soil borne fungi populations by soil fumigant - 2006 Glennville, GA.

Fumigant	*Penicillium* sp. [1]	*Trichoderma* sp.	Other	Total
MB	12.8 [2] a	6.2 a	1.0 a	19.9 a
MI	10.9 b	9.0 a	1.2 a	21.1 a
BAS	13.0 a	1.3 b	1.2 a	15.5 b

[1] Letters within a column indicate significant differences at the 0.05 level.
[2] Data represents average number of dilutions on a plate with fungal genera.