BENEFITS OF FUMIGATION IN SOUTHERN FOREST NURSERIES

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Seventy-three percent of the forest tree seedlings produced in the United States in 1994 were grown in the South (USDA, 1995), where the average per nursery production averaged over 21 million seedlings (Carey and Kelley, 1993). These nurseries are extensively mechanized and almost all regularly fumigate with methyl bromide (MBr or MC33) (South and Gjerstad, 1980) both to enhance growth and to control specific, persistent, disease and insect pests, problem weeds, and a spectrum of usually unidentified agents that reduce seed efficiency.

Most of the currently available fumigants were tested from the late 1940's through the 70's. In those tests, MBr improved seedling survival and growth better than the alternatives. In the South, the two best fumigants MBr and metham sodium increased seedling survival, respectively, an average of 50% and 37% compared to non-fumigated beds (Carey, 1994). This difference for the current southwide production of 1.12 billion seedlings, would cause an annual loss of 107 million seedlings worth $34 million and sufficient to reforest 165,000 acres.

In the 1990's, fumigation trials at most southern forest nurseries are, for lack of alternative, restricted to beds fumigated few rotations ago with MBr. Common soil-born diseases have been largely eliminated from these beds and survival has seldom differed significantly between treatments. However, treatment differences per seedling remain large and are similar to those from older studies (Table 1).

Because larger diameter seedlings consistently perform better after outplanting (South and Mexal, 1984), seedling size should be as important to the forest industry as seedling numbers are to nurseries. Although increasing bed density normally reduces average seedling size, trials with MBr in the 1950's and 70's recorded increase both in seedling numbers and average size (Table 1).

More recent data indicate that, at equal seedbed densities, beds fumigated four years ago and free of detectable root disease produced seedlings that averaged 17% smaller than those just fumigated with MC33. That is, fumigation increased the total seedling mass 20% without increasing the number of seedlings. Chloropicrin, and a 70/30 mixture of 1-3-dichloropropenes plus chloropicrin (Triform®) both enhanced seedling growth similarly to MC33. However, we

have (fortunately or not depending on viewpoint) been unable to test the efficacy of these alternatives to eliminate or prevent the establishment of soil-born diseases.

In summary, in recent studies the increases in survival that once regularly accompanied MBr fumigation in southern forest tree nurseries were not observed. The logical explanation is that the widespread use of MBr continues to suppress the establishment of once endemic soil-born problems. Several fumigants enhanced seedling growth as much as MBr but their efficacy at preventing or eliminating those one endemic diseases has not been demonstrated for lack of a test case.

LITERATURE CITED

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Table 1. Average percent reduction in numbers and weights of conifer seedlings in not fumigated beds.

Source Literature	Chemical[1]	N[2]	Percent reduction # plants	Mass /plant	Mass /area[3]
"	MBr	36	34	14	41
"	MC33	20	29	1	28
"	SMDC	26	30	5	35
"	EDB	12	28	-2	27
"	MITC	28	14	2	17
"	Formaldehyde	4	15	14	27
"	Chloropicrin	12	16	22	36
"	DD	4	1	6	3
"	Mean	18	25	7	32
1993-94 Trials	MC33	5	0	17	17
"	SMDC	2	4	6	10
"	MITC	6	-6	12	3
"	Chloropicrin	7	0	18	17
"	Triform	3	0	21	21
"	Mean	4.6	2	16	13

[1] MBr (methyl bromide), MC33 (66% MBr 33% chloropicrin), SMDC (sodium N-methyldithiocarbamate ie Metham-sodium etc, EDB (ethylene dibromide), MITC (dazomet, etc), DD (dichloropropenes and dichloropropanes).

[2] Number of comparisons.

[3] Percent difference in products of mass/plant and plants/area for treatment and for controls.