ALTERNATIVES FOR METHYL BROMIDE FUMIGATION OF TOBACCO SEED BEDS, PEPPER AND TOMATO SEEDLINGS

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Introduction

Tobacco, pepper and tomato seedlings cannot be produced in soil beds without Methyl Bromide. This study investigates the use of alternative materials for Methyl Bromide. Tobacco and pepper, and to a lesser degree tomato, require a long pest-free period to develop into healthy transplants. Alternatives that are being evaluated include chloropicrin, Telone C-17 and Vapam (Metam Sodium) and combinations.

Materials and Methods

The plot area used was planted in vegetables in 1996. The land was turned, disc harrowed and beds formed prior to test initiation. All treatments except Methyl Bromide were put in on 10/30/96. Plastic covers were applied over the area immediately after treating. Methyl Bromide was injected under 3 mil plastic on 10/31/96. Vinyl pouches with isolates of Pythium and Rhizoctonia were placed in each plot and covered by 2-3 inches of soil. Telone II (10 gal/A), Telone C-17 (10 gal/A) and Chloropicrin (6 gal/A) were applied by chisel injection at a depth of 6-9 inches. Metam Sodium (37.3 gal/A) was applied by spraying on the soil surface and incorporating with a power rototiller. Combinations of Metam Sodium + Telone II, Metam Sodium + Chloropicrin and Metam Sodium + Telone C-17 were applied by a power rototiller also. On 12/3/96 the pouches with Rhizoctonia and Pythium were removed by cutting the plastic. On 12/4/96 all the plastic was pulled from the plots. 7-14-7 fertilizer was broadcast at 1 lb/sq yard on 12/11/96. Enide 90W 3 oz/1000 sq ft was sprayed on that date also. On 12/12/96 the beds were tilled and shaped for seeding. The beds were seeded on 12/16/96 with K-326 tobacco (22 seed/ft) and pepper 14 seed/ft.

On 1/21/97 stand counts were taken on tobacco and pepper (2 meter section of 1 row). On 2/18/97 the covers were pulled. On 2/21/97 the beds were recovered. The covers on the beds were pulled the final time on 3/2/97. On 3/4/97 Orthene 75S 1 lb/A was applied. On 3/10/97 and 3/11/97 the tobacco plants were pulled and measured (1 meter/row). Vigor ratings were also made on these 2 dates. On 3/12/97 pepper and tomatoes were seeded. On 3/28/97 stand counts were made on tomatoes (1 meter section). Vigor ratings were done on tomatoes on 4/16/97 and 4/25/97.

Results

The combination of soil fumigants Metam Sodium plus Chloropicrin, Telone C-17 and Telone C-35 tended to be the best for reducing populations of fungi in the soil (Table 1). Most materials except Enide and Chloropicrin eliminated Pythium from the toothpick cultures.

Vigor ratings conducted at different times and by different evaluators suggested that plants in plots treated with mixtures of fumigants and Methyl Bromide had the highest vigor ratings. Stand counts and height measurements for tobacco suggested that the combination fumigants were superior to some of the fumigants alone, and in some instances superior to Methyl Bromide. Nematode sampling during the study indicated that populations at the time of this study were low and seldom did we have differences among treatments. Weed pressure in this test site was low; however, all test materials except Chloropicrin alone were effective in suppression of Corn Spurrey, Cutleaf Evening Primrose, Yellow Nutsedge, Henbit, and Annual Sedge. Stand counts and vigor ratings for tomatoes suggested very little difference among treatments. Peppers were very erratic in performance. Stand counts and vigor ratings tended to be best in treatments where mixtures of fumigants were used.

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Table 2. Fall seed bed fumigation vigor ratings and stand counts

Treatment[1]	Early vigor ratings[2]	Late vigor ratings[2A]	Late vigor ratings[2B]	Stand counts[3]
Chloropicrin 6 gal/A	4.0 bc[4]	3.0 bc	4.5 abc	48.0 b
Metam Sodium 37.3 gal/A (42%)	6.3 a	5.0 a	6.7 a	59.0 ab
Telone C-17 10 gal/A	4.0 bc	3.7 abc	5.0 abc	51.8 b
Telone C-35 10 gal/A	5.5 ab	3.8 abc	5.3 ab	54.7 ab
Methyl Bromide 580 lb/A	5.2 ab	4.7 ab	6.5 a	49.2 b
Chloropicrin 6 gal/A + Metam Sodium 37.3 gal/A	6.0 a	4.7 ab	6.8 a	55.0 ab
Telone C-35 10 gal/A + Metam Sodium 37.3 gal/A	5.3 ab	5.3 a	6.3 a	60.0 ab
Telone C-17 10 gal/A + Metam Sodium 37.3 gal/A	6.0 a	5.4 a	6.8 a	75.2 a
Enide 90W 8 lb/A	2.8 c	2.1 c	2.7 c	24.0 c
Untreated	3.1 c	2.3 c	3.2 bc	40.8 bc

[1]Tobacco plants are Coker-371 Gold. Plots were fumigated 31 Oct. 1996. Methyl bromide injected 1 Nov. 1996, plastic removed 4 Dec. 1996 and seeded 16 Dec. 1996.
[2]Vigor ratings are based on a scale of 1-10, where 1 = poor and 10 = excellent on 19 Feb. And two ratings on 10 March 1997 by two different people (A & B).
[3]Numbers are total of plants from 2 meters of row, 1 meter from each of the 2 center rows, on 21 Jan. 1997.
[4]Means with the same letter are not significantly different according to Duncan's Multiple Range Test ($\underline{P} = 0.05$).

Table 1. Fungi in soil 4 December, 1996 after soil fumigation 30 October, 1996.

Treatment	Rate/A	*Rhizoctonia solani* AG-4 Oat kernels %	*Rhizoctonia solani* AG-4 Soil cfu/[1] 100g	*Pythium* spp. cfu/g	*Fusarium solani* cfu/g	Total *Fusarium* spp. cfu/g	*Trichoderma* spp. cfu/g	Total fungi cfu/g
Chloropicrin 6 gal/A	6.0 gal.	13.3 cde	2.0 b[2]	16.7 b	2,161 a	3,279 a	37,430 a	68,200 a
Metam sodium 37.3 gal/A (42%)	37.3 gal.	6.7 de	4.9 b	ND c	ND c	189 c	870 cd	16,800 a
Telone C-17 10 gal/A	10.0 gal.	26.7 bcd	ND b[3]	ND c	44 b	667 b	89,080 a	92,000 a
Telone C-35 10 gal/A	10.0 gal.	36.7 abc	ND b	0.7 c	29 bc	363 b	60,060 a	70,800 a
Methyl bromide 580 lb/A, 12 lb/100 yd	580.0 lb	10.0 de	ND b	ND c	ND c	116 c	7,830 bcd	7,300 a
Chloropicrin 6 gal/A + Metam Sodium 37.3 gal/A	6.0 gal. 37.3 gal.	0 e	1.0 b	ND c	15 bc	44 c	ND d	1,700 b
Telone C-35 10 gal/A + Metam Sodium 37.3 gal/A	10.0 gal. 37.3 gal.	0 e	ND b	ND c	ND c	ND c	ND d	4,600 b
Telone C-17 10 gal/A + Metam Sodium 37.3 gal/A	10.0 gal. 37.3 gal.	0 e	ND b	ND c	15 bc	44 c	ND d	2,300 b
Untreated (weed control)								
Enide 90W 8 lb/A	8.0 lb	38.3 ab	23.5 a	66.7	1,175 a	3,699 a	15,380 b	83,300 a
Untreated	-	61.7 a	22.5 a	86.3 a	696 a	3,162 a	1,740 b	64,100 a

[1]Cfu = colony forming units per 100 g of oven-dry soil in *R. solani* AG-4, and per gram of soil with other fungi.
[2]Numbers followed by the same letter are not significantly different, P = 0.05.
[3]ND = not detectable. Detection levels were: 1.0 cfu/100 g for *R. solani* AG-4; 0.7 cfu/g for *Pythium* spp.; 15 cfu/g for *F. solani* and *Fusarium* spp.; and 290 cfu/g for all other fungi.