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METHYL IODIDE A REPLACEMENT OF METHYL BROMIDE AS A SOIL FUMIGANT FOR TOMATOES

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Abstract. **The purpose of this field study was to determine if methyl iodide when applied under plastic mulch, would reduce or eliminate the effects of soil pathogens, nematodes, and provide weed control. Five soil fumigants, methyl-bromide, MC33 (67% methyl bromide + 33% chloropicrin), chloropicrin, methyl iodide (MC2) and methyl iodide + chloropicrin were evaluated for control of soil-borne diseases, root knot nematode, yellow nutsedge weed control, and for fruit yield on 14 March 1995. Methyl bromide (MC2) and MC33 were injected into soil beds at 250 lbs/acre and methyl iodide was applied at 375 lbs/acre. The intention was to inject methyl iodide on an equal molar rate with methyl bromide (MC2). Chloropicrin was injected at 75 lbs/acre. All of the fumigants were injected at 71% of commercial fumigation rates. Methyl bromide(MC2), MC33, methyl iodide + chloropicrin, and methyl iodide provided statistically significant control of corky brown root rot, *Pyrenochaeta lycopersici*, rootknot nematode, *Meloidogyne incognita*, and yellow nutsedge, *Cyperus esculentus*. Methyl bromide and methyl iodide + chloropicrin provided significantly more fruit than the other treatments, including the control.**

Fresh market tomatoes have been grown in Dade County, Florida for over 40 years (Agricultural Experiment Stations Annual Report, 1954). There has been no virgin agricultural soils in South Florida for over 25 years. Most of the land has been used for tomato production, alternately or consecutively for over 45 years. Tomato production declines on these old soils mainly due to soil-borne pathogens, nematodes and competition from weeds (Volin and McMillan 1973).

The soil fumigants were primarily designed for the control of plant pathogenic nematodes and insect pests in the soil. These chemicals were later found to be effective in the control of soil-borne fungi and bacteria. Some of the early preplant fumigants were: D-D, ethylene dibromide, ethylene dichloride, carbon disulfide, propylene dichoride, hydrocyanie, sulfur dioxide, tetrachloroethane, ethide, and others (Averre et al., 1965; Geraldson et al., 1965; Jones et al., 1971; Stakman and Harrar, 1957; Volin and McMillan, 1973). However, the most effective and universally used fumigant has been methyl bromide with its companion fumigant for fungi and bacteria, chloropicrin (Anonymous, 1993).

The proceedings of the Montreal Protocol of 1991 and its 1992 amendment, categorized methyl bromide as an ozone depleting chemical (Albritton and Watson, 1992). Having been designated as such, all production, importation and use of the substance in the United States must be phased out by the year 2001 (Ohr et al., 1996).

The purpose of this field study was to evaluate methyl iodide as a potential replacement for methyl bromide and to determine if methyl iodide, when applied under plastic mulch, would reduce or eliminate the effects of soil-borne corky brown root rot, *Pyrenochaeta lycopersici* (Alfieri et al., 1991), rootknot, *Meloidogyne incognita* and yellow nutsedge, *Cyperus esculentus.*

Materials and Methods

The field trial was conducted in Rockdale sandy loam-limestone on 19 December 1994. Prior to fumigation, soil beds were formed 48 inches wide and 6 inches high on 6 ft centers. Each treatment plot was 25 feet long and replicated five times. Fertilizer at 210N-240P-240K lbs/acre was banded and rototilled into the bed.

Five soil fumigants, methyl bromide(MC2), MC33(67% methyl bromide + 33% chloropicrin), chloropicrin, methyl iodide and methyl iodide + chloropicrin were used. Methyl bromide (MC2) and MC33 were injected into soil beds at 250 lbs/acre and methyl iodide was applied at 375 lbs/acre. The intention was to inject methyl iodide on an equal molar rate with methyl bromide. Chloropicrin was injected at 75 lbs/

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Table 1. Effect of fumigant on the 'Sunny' tomato yields.

Treatment	Tomato yield			
	Large no.	Large wt. (lb/100 ft)	Medium no.	Medium wt. (lb/100 ft)
Control	78.75 b[z]	31.2 b[z]	39.50 b[z]	9.8 b[z]
Iodide	158.25 ab	62.3 ab	78.00 ab	19.7 ab
Iodide plus chloropicrin	196.75 a	75.1 a	98.00 a	23.3 a
MC33	140.75 ab	56.6 ab	68.75 ab	20.2 ab
Methyl bromide	174.00 a	72.1 a	99.25 a	24.7 a
Chloropicrin	167.00 ab	68.7 ab	69.25 ab	17.1 ab

[z]Mean separation by Waller-Duncan k-ratio t-test, $P < 0.05$.

Table 2. Effect of fumigant on corky brown root rot, *Pyrenochaeta lycopersici* and rootknot, *Meloidogyne incognita.*

Treatment	Root rot	Rootknot nematode
Control	8.63 a[z]	4.05 a[z]
Iodide	8.64 a	0.68 b
Iodide plus chloropicrin	0.78 b	0.71 b
MC33	0.66 b	0.71 b
Methyl bromide	8.61 a	0.61 b
Chloropicrin	0.73 b	4.15 a

[z]Mean separation by Waller-Duncan k-ratio t-test, $P < 0.05$.

Table 3. Effect of fumigant on yellow nutsedge, *Cyperus esculentus.*

Treatment	Number of sedges/100 ft of row
Control	404.50 a[z]
Iodide	7.33 b
Iodide plus chloropicrin	10.00 b
MC33	5.67 b
Methyl bromide	2.17 b
Chloropicrin	438.50 a

[z]Mean separation by Waller-Duncan k-ratio t-test, $P < 0.05$.

acre. All of the fumigants were injected at 71% of commercial fumigation rates. The fumigants were injected through three shanks, spaced 9 inches apart, at a depth of 4 inches.

Immediately following injection of the fumigants, 1.5 mil polyethylene film was placed over the beds. After seven days the plastic was perforated to allow venting and 12 days later commercially greenhouse raised tomato cultivar 'Sunny' transplants were planted at a spacing of 12 inches in the row.

Nutsedge plant counts from each of the plots were made throughout the study. All of the fruits from 25 plants from each replicate were harvested 11 March 1995. Following the fruit harvest the plants were pulled for root evaluation.

Results and Discussion

All replicated treatments resulted in a significant increase in control of root rot, nematode, nutsedge and an increase in marketable tomato yields (Tables 1, 2, and 3).

Methyl bromide (MC2), MC33, methyl iodide + chloropicrin, and methyl iodide provided statistically significant control of root rot, root knot nematode and nutsedge (Tables 1, 2, and 3). Methyl bromide (MC2), and methyl iodide + chloropicrin provided significantly more fruit than the other treatments including the control (Table 1). Methyl bromide (MC2) and methyl iodide alone provided significant control of nematodes and weeds, whereas these chemicals when combined with chloropicrin provided significantly better control of the root rot (Table 2). Chloropicrin alone provided no control of rootknot and yellow nutsedge (Tables 2 and 3). There was no apparent phytotoxicity in any of the treatments.

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