VAPAM AS AN ALTERNATIVE TO METHYL BROMIDE FOR SOUTH FLORIDA TOMATO GROWERS

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Fresh market tomatoes have been grown in Miami-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 bean, squash, sweet corn, cucumbers, peppers and 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 (Volion and McMillan, Florida State Hort. Society 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, proplene dichloride, hydrocyanie, sulfur dioxide, tetrachloroethane, ethide, and others (Averre et al. 1965, Geraldson et al. Soil and Crop. Sci. Soc. Fla. Proc. 1965, Jones et al, PDR 1971, Stakman and Harrar, 1957, Volin and McMillan, Proc. Fla. State Hort. Soc.1973). More recent studies of methyl iodide have shown promise as a replacement for methyl bromide for the control of soil-borne pathogens, nematodes and weeds on tomato and peppers (McMillan, Bryan, Ohr and Sims 1995, 1996 and 1997). However, the most effective and universally used fumigant has been methyl bromide with its companion fumigant for fungi and bacteria, chloropicrin (anonoymous, 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 chemical in the United States must be phased out by the year 2001 (Ohr et al., Plant Disease 1996). In Florida the tomato farmer's most serious production problems are nematode, soil-borne fungi and nutsedge. Many of the alternative fumigants do not adequately control all of these pests. There are five soil fumigants; metam sodium (VAPAM), chloropicrin, propargyl bromide, sodium and potassium azide and methyl iodide, which have been tested on a limited basis but have been shown to have significant activity with nematodes, soil-borne fungi and weeds. However, metam sodium and chloropicrin are the only fumigants with a label for use on tomato and would provide tomato growers in south Florida with an alternative to methyl bromide. This report addresses VAPAM field trials conducted on tomato in previous years as well as 1996 through 1998.

The field trial was conducted on Krome gravely loam in the fall of each year. Prior to fumigation, soil beds were formed 38 inches wide and 6 inches high on 6 ft centers. Each treatment plot was 0.25 acres and replicated four times. Fertilizer at 30% of recommended N and K and 100% of P was banded and rototilled into the bed and 70% of N, K fertilizer was fertigated through drip irrigation tubing.

Two soil fumigants, metam sodium, and methyl bromide plus chloropicrin were applied. Methyl bromide plus chloropicrin was be injected at 250 lbs/acre. The methyl bromide plus chloropicrin was injected through 3 chisels, spaced at 9 inches apart. The number of chisels for metam sodium and metam sodium plus chloropicrin was 3 and 4 to determine

soil bed coverage. The spacing distance between the chisels for the metam sodium, was 5 in, 8 in, 10 in and 24 in to determine the most effective spacing for these fumigants. Metam sodium was injected at two rates, 25 and 50 gal/acre. In addition metam sodium at 50 to 60 gal per acre was applied as a drench, which was immediately covered with plastic mulch and also injected through drip irrigation tubing previously laid under plastic mulched beds.

Immediately following the injections of the fumigants, 1.5 mil polyethylene film was placed over the beds. After 72 hours the plastic was perforated to allow venting and 14 days later commercial greenhouse raised tomato transplants were planted at a spacing of 20 inches in the row.

Nutsedge counts were made periodically throughout the trial. Nematode counts were made prior to the fumigant of the beds, plant roots were evaluated for root knot and a soil sample taken at the termination of the trial. Soil samples were taken prior to fumigation; soil-borne fungi counts were made and an additional soil sample was evaluated for nematode populations and soil-borne fungi counts made at the termination of the field trial. Yields of marketable, large and US No. 1 fruits were evaluated for treatment effects.

All treatments of metam sodium provided statistically significant control of soil-borne fungi and nematodes as compared to the untreated control but not always significantly equal to methyl bromide and chloropicrin.. The higher metam sodium rate of 60 gals/acre provided significantly better control of nutsedge as compared to the control. However, a lower rate of metam sodium, 25 gal/acre, injected in the soil under plastic mulch was significantly better than the metam sodium, 60 gal/acre rate applied as a drench. Metam sodium applied at 60 gal/acre through the drip irrigation tube was significantly effective for the control for soil-borne fungi and root knot nematode as compared to the untreated control but was not consistent in repeated field trials. Tomato yields of marketable, large and US No. 1 fruits fruit of the metam sodium shank injected field trials was consistently equal to the methyl bromide treatment. The shank spacing at 5 and 8 in were significantly better than the 24 in spacing. Marketable fruit yields of metam sodium injected through the drip irrigation line and drenched in the beds were statistically significant but were not consistently so.