NUTSEDGE, ROOT-KNOT NEMATODE, AND FUNGAL CONTROL WITH FUMIGANT ALTERNATIVES TO METHYL BROMIDE IN POLYETHYLENE MULCHED TOMATO

S. J. Locascio, D. W. Dickson, and T. A. Kucharek, Horticultural Sciences, Entomology and Nematology, and Plant Pathology Departments, University of Florida, Gainesville, FL 32611

Tomato (*Lycopersicon esculentum* Mill.) is the most valuable vegetable grown in Florida. During the 1992-93 season, the crop was grown on 19,600 ha with an on farm value of $626 million. The crop is grown very intensely with the use of broad-spectrum fumigants, polyethylene mulch, adequate rates of fertilizer, irrigation, and with the use of pesticides to control foliar insects and diseases. Soil pests that commonly inhabit typical tomato production sites include nematodes, fungi, bacteria, insects, and weeds. The fumigants of choice, because of their high level of effectiveness at an economical cost, are methyl bromide and methyl bromide-chloropicrin combinations. It is apparent that no other available chemical provides this spectrum of control of pests. Studies were conducted with polyethylene mulched tomatoes to evaluate possible preplant fumigants or combinations of chemicals as alternatives to methyl bromide as one of five similar studies in Florida.

Tomatoes were grown on an Arrendondo fine sand in Gainesville, FL during the spring of 1994 on a site known to be heavily infested with purple and yellow nutsedge (*Cyperus rotunbus* L. and *Cyperus esculentus* L.) and moderately infested with root-knot nematode *Meloidogyne incognita* (Kofoid &White) Chitwood. The two nutsedge species are very serious weed pests and can easily grow through polyethylene mulch if not controlled. After soil preparation, beds 1.8 m apart were made and part of the fertilizer was applied in the 0.9m bed along with soil applied fumigant and herbicide treatments. Drip tubing for water, fertilizer, and fumigant application and polyethylene mulch were then applied.

Soil injected treatments were chloropicrin (390 kg·ha^{-1}), chloropicrin + pebulate (390 + 4.5 kg·ha^{-1}), (pebulate was applied on the bed and incorporated 15 to 20 cm before fumigants were injected with three chisels per bed), 1,3-dichloropropene+ 17% chloropicrin (327 liter·ha^{-1}), 1,3-D+C17 and pebulate (327 liter·ha^{-1} + 4.5 kg·ha^{-1}), methyl bromide-chloropicrin (450 kg·ha^{-1} 98-2%), and methyl bromide-chloropicrin (392 kg·ha^{-1} 67-33%). Dazomet (448 kg·ha^{-1}) and metham sodium (935 liter·ha^{-1}) were applied on the bed surfaces and incorporated. Dazomet was also watered into the soil with 16 mm depth of water before mulch application. Metham sodium (935 liter·ha^{-1}) and enzone (1870 liter·ha^{-1}) were applied through the drip irrigation system through two drip tubes per bed. Three weeks after fumigant application, tomato was transplanted into the treated soil. Additional applications of enzone (2 applications of 18.7 liter·ha^{-1}) were made through the drip irrigation system during the crop growth period.

In this study, nutsedge and root-knot nematode were major pests. Tomato fruit yields were closely related to the degree of nutsedge and root-knot control provided by the various treatments. Counts of emerged nutsedge seedlings were made approximately 5 and 10 weeks after transplanting tomato. On both dates, nutsedge population densities were high and were higher on the drip tubing side of the bed than on the opposite and drier side of the bed. Nutsedge counts on the tubing side of the bed at the two evaluations were 24 and 30 plants 0.095 m^2), respectively, with no treatment. Nutsedge counts at the earliest evaluation were low per 0.095 m^2 (number in parenthesis) with methyl bromide 98-2 (2), methyl bromide 67-33 (3), chloropicrin + pebulate (4), and with 1,3-D + C17 + pebulate (5). Counts were slightly higher with chloropicrin (9) and 1,3-D + C17 (12) alone. Nutsedge control was poor with the other treatments and emerged numbers were similar to those obtained with no treatment. At the second evaluation, counts averaged 8/0.095 m^2 with the two methyl bromide treatments and 13/0.095 m^2 with the two pebulate containing treatments and 28/0.095 m^2 with the other treatments.

Root-knot galling indices were lower (P=0.05) on tomato roots in plots treated with methyl bromide and 1,3-D + C17 than in plots treated with chloropicrin, metham sodium (drip), dazomet + water and the untreated control. Marketable fruit yield was negatively correlated (P=0.01) with the root knot galling index.

Fruit were harvested at the breaker stage and were graded into marketable size categories of extra-large, large, and medium fruits. Relative fruit yields were 100% with the two methyl-bromide treatments, 86% with the two pebulate containing treatments, 60 to 70% with chloropicrin, 1,3 D + C17, dazomet, and metham sodium drip applied, 45% with soil applied metham sodium, 47% with enzone, and 40% with no treatment.

Three predominate pathogenic fungi, *Rhizoctonia solani* Kuhn, *Macrophomina phaseolina* Tassi (Goidanich), and *Fusarium* spp., were recovered from tomato roots assessed in mid-May, and mid-June. Negative correlations between marketable fruit yield and fungal counts were significant (P=0.01) for *R.. solani* at the mid-June sampling and for the combined total of fungi recovered at the mid-May (P=0.05) and mid-June (P=0.01) sampling. At the first sampling, all treatments except dazomet + water significantly reduced the combined total of fungi . However, at the later sampling, total fungal counts were reduced significantly only with chloropicrin or methyl bromide containing treatments.

These studies indicate that no one pesticide can provide the broad-spectrum control provided by methyl bromide. Where nutsedge is present, pebulate provided partial control of this weed and apparently allowed sufficient plant growth to obtain a 86% relative yield. This is probably not adequate for long term tomato production. These data indicate that with further work, a more effective treatment may be found.