THREE YEARS OF SOILBORNE PEST CONTROL IN TOMATO WITH 1,3-D + CHLOROPICRIN AND SOLARIZATION

J. P. Gilreath[1]*, J. W. Noling[2], J. P. Jones [1], S. J. Locascio[3] and D. O. Chellemi[4]
IFAS, University of Florida
Bradenton, FL 34203[1], Lake Alfred, FL 33850[2], and Gainesville,FL 32611[3]
and
USDA, ARS
Ft. Pierce, FL 34945 [4]

A three year study was conducted at the Gulf Coast Research and Education Center in Bradenton, FL during the fall of 1998, 1999 and 2000 and the spring of 1999, 2000 and 2001. This study compared standard methyl bromide soil fumigation to the best chemical alternative, a mixture of 1,3-dichloroporopene (1,3-D) and chloropicrin used in combination with pebulate, and the best nonchemical alternative, soil solarization, for soilborne pest control and crop response in both fall tomatoes and spring double-cropped cucumbers over multiple years on the same site. Pebulate was applied broadcast, preplant incorporated at 4 lb.a.i./acre, then 35 gal/acre of a mixture of 1,3-D + chloropicrin (83/17%) was applied through three chisels to the soil in 8 inch tall raised beds during the summer of 1998, 1999 and 2000. Methyl bromide + chloropicrin (350 lbs/acre of 67/33%) was applied at the same time and in a similar fashion. Solarization proceeded for 7 weeks during the summer of 1998 and for 8 weeks during 1999 and 2000. Seven days prior to transplanting tomato, all solarization and nontreated control plots were sprayed with paraquat (0.5 lb./acre) to dessicate existing weed cover. Six week-old >Solamar= tomato plants were transplanted in mid September of each year. Tomato plants and weeds were sprayed twice with paraquat after the last tomato harvest in the fall and before planting spring cucumbers.

Nutsedge populations varied from year to year, but the relative differences remained fairly similar. Both fumigants and soil solarization reduced nutsedge compared to the nontreated throughout the season and there were no statistically significant differences in the number of nutsedge plants between either fumigant or between the fumigants and soil solarization, due in large part to the early desication of nutsedge in solarization plots.

The soil in the test area had a low population of root knot nematodes at the beginning of the experiment in 1998, but this increased greatly in the nontreated control plots in 1999 and declined significantly in 2000. Rootknot populations remained low and fairly stable over the three years during the tomato crop with methyl bromide and 1,3-D. There was an increase in rootknot nematode population from 1998 to 1999 with soil solarization, but the population declined slightly during 2000. The most severe galling of tomato roots was observed with soil solarization and the nontreated control in each of the three years. Methyl bromide resulted in no gall formation during the first year, but gall formation increased over the next two years. Galling on plants grown in soil treated with 1,3-D was intermediate during the first year, similar to methyl bromide during the second year and the least of all the treatments during the third year. Both fumigants were superior to either soil solarization or the nontreated control in reduction of the incidence of Fusarium wilt of tomato. Soil solarization reduced the incidence compared with the nontreated control in each of the three years, but the level of infestation in the second year was over 20% which would be commercially unacceptable and by the third year the level had increased to greater than 50% and resulted in many dead plants by the time of harvest, thereby reducing yields significantly.

Tomato production generally declined each of the three years from the levels in the first year. The most extra large and total marketable tomatoes were produced with methyl bromide and 1,3-D + chloropicrin + pebulate in 1998. There was no difference in tomato production among alternatives in 1999. During 2000, tomato production was comparable with methyl bromide and 1,3-D + chloropicrin + pebulate, but solarization reduced yields to a level intermediate between that of the fumigants and the nontreated control.

Nutsedge populations in the spring cucumber crop varied from year to year, apparently affected by the prolonged drought through which Florida suffered from the spring of 2000 to summer of 2001. The number of nutsedge plants increased greatly from 1999 to 2000 but declined in 2001. In the spring of 2000, there was more nutsedge in 1,3-D + chloropicrin + pebulate plots than was present in methyl bromide or solarization plots and there was a trend for this again in spring 2001, although this difference was not significant in 2001.

Rootknot nematode populations were the highest in the nontreated control during the first spring cucumber crop and declined after that, possibly due to the effects of the prolonged drought. Methyl bromide and 1,3-D reduced rootknot populations equally well in all three years of the spring cucumbers.

There was little difference in the numbers of rootknot juveniles recovered from any of the treatments in spring 2001 (year 3).

Cucumber production declined each year in the nontreated control plots, but remained fairly constant with methyl bromide and 1,3-D + chloropicrin + pebulate. Yield fluctuated quite a lot with soil solarization, ranging from the lowest producer in 1999 to comparable to the fumigants in 2000 then dropping back to a point intermediate between fumigants and the nontreated control.