SOILBORNE PEST CONTROL IN TOMATO FOLLOWED BY CUCUMBER 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]

Previous research has demonstrated the efficacy of 1,3-D (1, 3-dichloropropene) + chloropicrin when combined with pebulate as an alternative package for soil fumigation in tomato production. In most cases, this combination has resulted in tomato yields similar to those achieved with methyl bromide. Soil solarization has been proposed as an alternative to methyl bromide. Most research conducted to date has focused on the effects of alternatives on a first crop, mostly tomato, and little work has addressed the residual effects on a double-crop, such as cucumber. The purpose of this research was to compare standard methyl bromide soil fumigation to fumigation with 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.

The experiment was conducted at the Gulf Coast Research and Education Center in Bradenton, FL on an EauGallie fine sand soil during the fall of 1998 and 1999 and the spring of 1999 and 2000. Treatments were assigned to 3 bed plots 210 ft in length arranged in a randomized complete block design and replicated 6 times.
Pebulate was applied broadcast, preplant incorporated at 4 lb.a.i./acre to the soil prior to bed formation, 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 three or more weeks prior to planting during the summer of 1998 and 1999. Methyl bromide + chloropicrin (350 lbs/acre of 67/33%) was applied at the same time and in a similar fashion but without pebulate. The nontreated control plots were created at the same time as the fumigant plots. Solarization was allowed to proceed for 7 weeks during the summer of 1998 and for 8 weeks during 1999. Treatments were situated on the same spot each year in order to study the long term effects of each alternative over multiple years. Tomato plants were transplanted in early to mid September of each year and cucumbers were planted in late February of 1999 and 2000. Seven days preplant, all solarization and nontreated control plots were sprayed with paraquat (0.5 lb./acre) to dessicate existing weed cover (primarily yellow and purple nutsedge) so it would not interfere with early tomato plant growth. Methyl bromide and 1,3-D treated plots were not sprayed because there was no nutsedge emerged. Six week-old >Solamar= tomato plants were transplanted 2 ft apart into the beds in mid September of each year. Tomato plants and

weeds were sprayed with paraquat after the last tomato harvest in the fall and a second application was made 2 weeks prior to planting the spring cucumbers to kill any weeds which had emerged in plant holes and row middles.

Tomato plants were more vigorous in soil treated with methyl bromide and 1,3-D + chloropicrin + pebulate than in soil which received no chemical treatment. Solarization did not improve tomato plant vigor over the nontreated control during the first year, but was superior in the second year. Prior to planting the tomatoes each year, nutsedge had begun to emerge and penetrate the mulch in all of the plots, but there were more plants in the nontreated and solarization plots than in the fumigant plots, necessitating an application of paraquat to desicate the foliage. 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. After the final tomato harvest in 1998 and 1999, the most severe galling of tomato roots was observed with soil solarization and the nontreated control. Methyl bromide resulted in no gall formation while galling on plants grown in soil treated with 1,3-D was intermediate. 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 no treatment but the level of infestation was over 20% which would be commercially unacceptable.

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.

Although all of the nutsedge was desicated with paraquat after the final tomato harvest and again shortly before seeding cucumbers, by April, nutsedge was once again present in all plots but with no difference in numbers emerged through the plastic with either fumigant treatment or with solarization. Significantly more crabgrass was present in the beds of solarization plots than in fumigated plots in spring 1999, but there was no difference in 2000.

Methyl bromide was the only treatment to significantly reduce gall formation relative to the nontreated control treatment in 1999, but in the spring of 2000 there was no difference in the severity of gall formation with either fumigant or solarization. Cucumber yield followed the same trend as gall formation.