SOLARIZATION AND ANAEROBIC SOIL MANAGEMENT PRACTICES AS ALTERNATIVES TO METHYL BROMIDE FOR VEGETABLE PRODUCTION IN FLORIDA

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Biologically based alternatives are viable options for replacing the imminent loss of methyl bromide as a soil fumigant for control of soil borne pests. Since none of these have the broad spectrum of activity as methyl bromide, its implementation will probably be dependent on the specific site, crop and target pest. A large portion of vegetables in Florida are grown in sandy high water table soils. The climatic and edaphologic conditions in the central part of the state are conducive for testing techniques such as solarization, flooding, and organic amendment for control of plant parasitic nematodes and weeds.

Experiments were conducted for 12-wk periods in the summer of 1996 and 1997 in an Arredondo fine-sand in North-Central Florida in microplots. The organic amendment treatments consisted of incorporating and mixing equal portions (v/v) of commercial yard-waste compost (YWC) and soil. Flooding was performed by ponding municipal tap water 5 cm over the soil surface. Solarization was performed by covering the top of the micro-plots with bubble wrap overlain by a clear IR-absorbing plastic.

Soil flooding induced anaerobic conditions with redox potentials near –200 mV during the experiments in both years. Solarization resulted in higher average daily maximum soil temperatures in 1997 than in 1996 probably due to the time of year the experiments were conducted. Solarization also resulted in higher daily maximum soil temperatures than the control treatments at all depths studied. In solarized soils, flooding increased soil temperatures in 1996 but not in 1997.

In 1996, the combination of continuous flooding with or without solarization resulted in lowest nutsedge densities at the end of the experiment with values <5 propagules/m^2, but solarization increased nutsedge densities relative to non-solarized soil. Amending soil with YWC had no effect immediately after the flooding-solarization period but significantly increased nutsedge densities 6 months later. In 1997, aboveground biomass (dry weight) and below ground tubers actually increased as a result of flooding and amending with YWC the previous year. After flooding in 1997, nutsedge tuber densities increased in the order of: non-flooded < intermittent < continuous, with solarization reducing nutsedge tuber densities at each flooding level. Planting rice (cv. Lamont) and YWC treatment did not affect tuber densities in continuously flooded, non-solarized soil. Results suggest that that solarization could be an effective management tactic for nutsedge control during the warmest days of the year only. The reduction in nutsedge population densities as a result of flooding in 1996 may still not be sufficient for establishment of a subsequent commercial vegetable crop. Nutsedge plants seem to survive a 12 week flooding period because of some arenchymatic mechanism.

In 1996, flooding reduced soil RKN in the order of: continuous ≤ intermittent < non-flooded with values of 9, 10, and 36 J2/100cm^3, respectively. In 1997, the same pattern was observed with values of 5, 23, and 212 J2/100 cm^3 after the flooding treatment, and values of 20 and <1 J2/100cm^3 after a tomato crop was planted. Soil ring nematode (*criconemella* spp.) and stubby root nematode (*paratrichodorus* spp.) populations were also reduced as a result of flooding. In both years continuous or intermittent flooding reduced galling (# galls/root system) in tomato test plants to values <1. In 1996, solarization was only effective in fallow, non-flooded plots decreasing RKN numbers by 83% compared to non-solarized soil, although any flooding-solarization combination reduced RKN numbers relative to the control (non-flood, non-solarize). In 1997, solarization alone or in combination with other treatments was very effective in reducing soil RKN numbers. Higher daily maximum soil temperatures detected in 1997 appear to be responsible for this phenomenon. Planting rice as a cash crop (cv. Lamond) during the flooding period or amending soil with YWC was not a good alternative as soil RKN, ring and stubby root nematode increased with these activities. The combination of flooding continuously with solarization during the warmest days of the year, deserves further study as a tool for nematode control under field conditions.