EFFECT OF SOIL SOLARIZATION COMBINED WITH SOME AMENDMENTS AND THE EVALUATION OF CHEMICAL PRODUCTS FOR THE CONTROL OF *Meloidogyne incognita* (Chitwood) Kofoid and White.

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Uruguay has 400 hectares of protected vegetable crops in the north of the country dedicated to early production. In this area, there are two zones where the nematode problems are very important since crops, such as tomatoes and peppers almost have a ten-month of harvest period. In one zone, soils are heavy while in other major places soils are sandy loam. In the heavy soil area, farmers do not use more methyl bromide. This product is used in greenhouse crops to disinfect the soil and to control nematodes and soil borne diseases. Farmers need rapid treatments for soil disinfection because their greenhouses are in production throughout the year. That is why sometimes they are not agree in using soil solarization alone or combined with a low rate of chemicals.

The root-knot nematode, *Meloidogyne incognita* (Chitwood) Kofoid and White, is a major limiting factor to vegetable production in Uruguay. Pre-plant soil fumigation with methyl bromide is the primary method for controlling this nematode.

Heat is one of the oldest methods of managing nematode population densities by physical means. Most plant parasitic nematodes are killed at temperatures between 44ºC and 48ºC (Christie,1959). Various organic amendments have been added to soil and investigated for their suppresive effects on plant parasitic nematodes. Most explanations suggest that amendments or their degradation products are either directly toxic to nematodes, or serve to enhance the proliferation of soil-borne antagonists that kill or weaken nematodes (Duncan and Noling, 1998).

Chemical alternatives that are available in Uruguay and have known broad-spectrum activities in soil are methyl bromide and methyl isothiocyanate (MITC) generators such as metam sodium. Each are used individually, but not are used as mixtures or in sequencial applications. Among the chemical alternatives that are not registered and therefore require further research in Uruguay are methyl iodide and 1,3-dicloropropene alone or in mixture with chloropicrin (67-33). Methyl iodide stands out for having good information on its level and broad spectrum of activity in soil that are similar to those of methyl bromide (Ohr et al., 1996). The many other chemical alternatives proposed have either insufficient activity or feasibility for soil fumigation.

The objective of this study was to determine suitable alternatives to methyl bromide for use in protected horticulture cultivation in Uruguay, to implement pest managment and seeking sustainability of agricultural practices emphasized in long term production, maintaining the productivity of natural resources.

Materials and Methods

Two experiments were made in two highly infected farms on two different sites.One greenhouse used is in the heavy soil area and the other is in sandy loam soil.
Both greenhouses has a long history of nematode and some soil borne diseases. All treatments were repeated three times in a random block design. Estimation of root-nematode infestation was evaluated using a rating chart (Bridge and Page, 1980). In the case of soil solarization, beds were covered with transparent nylon of 50 microns widht. During the period of solarization, soil thermometers were installed at a depth of 10 cm.

Experiment I. Heavy soil farm. The greenhouse was used since 2003 and the treatments were applied in the same places. In this experiment tomato plants cv."Coloso" were planted. When this research started, the population of larvae J_2 of *Meloidogyne incognita* (Chitwood) Kofoid and White was very high (1865 larvae / 100 cc of soil). Last year, soil solarization was done from 1/26/2005 to 3/15/05 covering all the surface inside the greenhouse. Each plot consisted of three beds 1.5 m wideby 10 m long. There were two rows of tomatoes per bed. The distance between rows was 45 cm. Plants in rows were 35 cm. Transplanting date: 3/21/2005. Beginning of harvest: 6/21/2005. End of harvest: 12/20/2005. Treatments: 1. Rests of corn cob 5 Kg / m^2 + Solarization 2. Rests of pepper plants 5 Kg / m^2 + Solarization 3. Solarization alone 4. Control. Remains of corn cob and pepper plants, were incorporated into the soil.

Experiment II. Sandy loam soil farm. In this experiment tomato plants cv."Coloso" were planted. When this research started in the year 2005, the population of larvae J_2 of *Meloidogyne incognita* (Chitwood) Kofoid and White was very high (1214 larvae / 100 cc of soil). This greenhouse had many years of cultivation. Each plot consisted of three beds1.5 m wide by 10 m long. There were one row of tomatoes per bed. Plants in rows were 15 cm apart. Transplanting date: 3/8/2005. Beginning of harvest: 6/27/2005. Evaluation of harvest could be done until 9/27/2005 but the crop ended 12/27/2005. Treatments: 1. MIDAS, Methyl Iodide 98 %, Chloropicrin 2%; 30 g / m^2 ; 2. Methyl bromide 98 %; 70 g / m^2. Each treatment was applied in 750 m^2.

Results and Discussion

Experiment I. Remains of corn cob or pepper incorporated into the soil plus solarization had very good perfomance the same as solarization alone. Antagonist reproduce efficiently in plots amended with these products and improves physical and chemical properties in adition to yield. On july, in the control treatment, yellowing of tomato plants was already detected due to the high infection of nematodes on roots. On november all plants died. Yield was also very low compared with the other treatments.

Experiment II. Methyl bromide showed better yield than MIDAS but nematode control in roots was slightly superior with methyl iodide. Phytoxicity was detected in tomato plants in the treatment with MIDAS. This damage did not kill the plants but in some cases a strong yellowing of leaves was observed. Farmers need a rapid treatment and MIDAS may become an important alternative to methyl bromide for soil fumigation.Like Methyl bromide , methyl iodide controlled *Cyperus* spp, and appears to have some synergy with chloropicrin in killing fungi according with data obtained by others researchers in California.

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Ohr, H.D., Sims, J.J., Grech, N.M., Becker, J.O. and McGiffen, M.E. Jr. 1996.Methyl iodide, an ozone-safe alternative to methyl bromide as a soil fumigant. Plan Dis. 80:731-735.

Experiment I.

Fig.1. Effect of different treatments on yield of tomato (cv. Coloso).

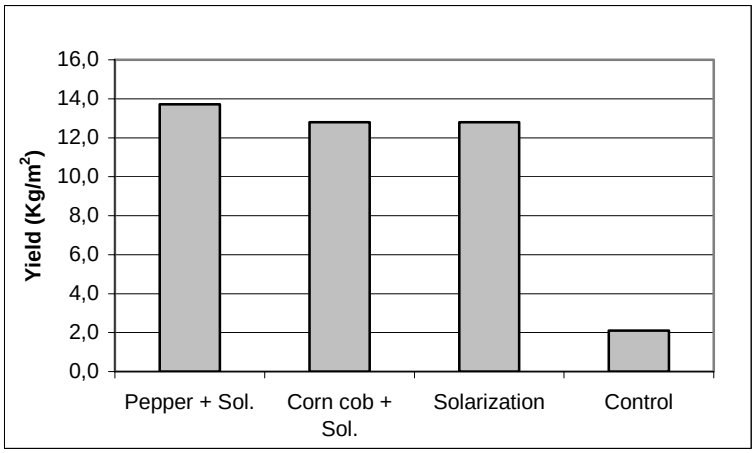
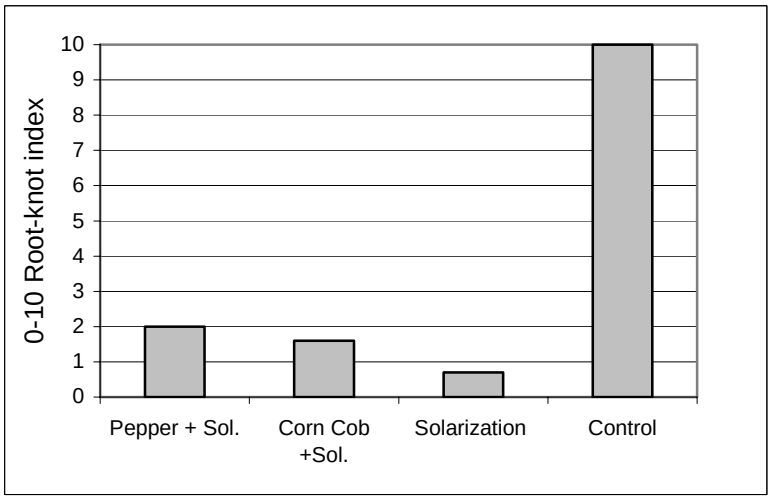


Fig. 2. Effect of different treatments on nematode control on tomato roots (cv.Coloso).



* Estimation of root-nematodes infestation in tomato roots was evaluated using a rating chart (0-10 root-knot index) (Bridge and Page, 1980).

Experiment II.

Fig.3. Effect of chemicals on monthly yield of tomato (cv. Coloso)

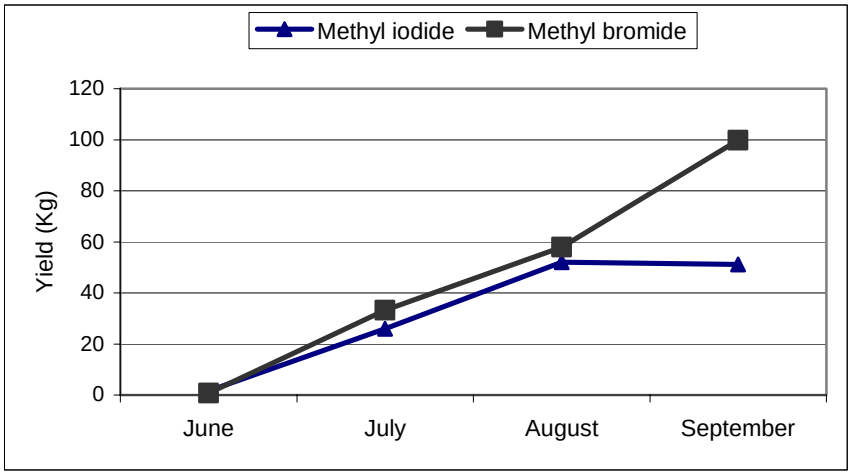
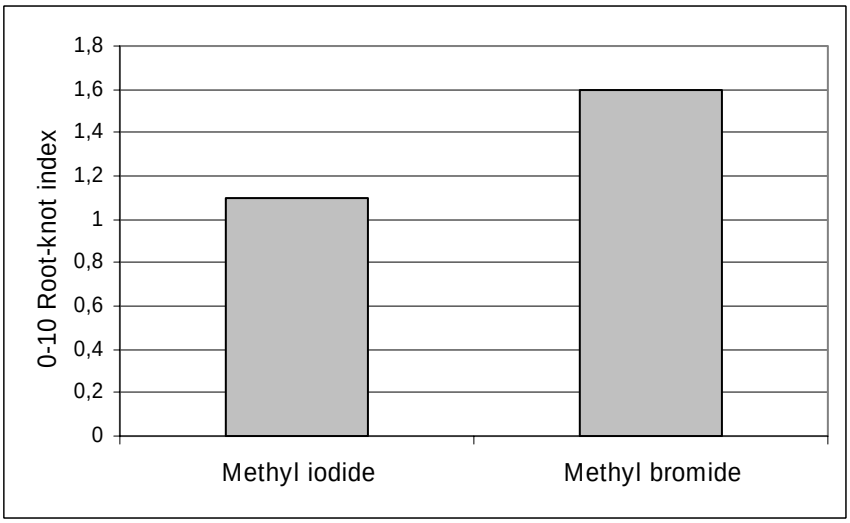


Fig.4. Effect of different treatments on nematode control on tomato roots (cv.Coloso).



* Estimation of root-nematodes infestation in tomato roots was evaluated using a rating chart (0-10 root-knot index) (Bridge and Page, 1980).