



The Effects of Soil Solarization and Methyl Iodide Chemigation On Soil Bio-Chemical Properties and Nematode Survival



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Introduction

- Soil fumigants have been widely used to control weeds, plant-parasitic nematodes, soil-borne fungi, and other disease organisms.
- However, fumigants are known to have a broad biocidal activity and also kill non-target beneficial microorganisms in the soils.
- The concern of non-target effects of soil fumigants has led investigators to study non-chemical and/or reduced-chemical pest control methods.
- Soil solarization has been proposed as an alternative to soil fumigants, based on the observations that above a certain temperature many pests and pathogens are suppressed.

Objective

The objective was to determine the impacts of soil solarization, Methyl iodide(Mel) and their combination on soil microbial biomass (MBC), dissolve organic carbon (DOC), N dynamics and nematode survival under different treatments.

Methodology

Treatments:



Passive solarization (covered by virtually impermeable film)



Hot water system for active solarization



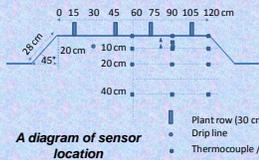
Sensor installation



Chemigation through drip lines



Emission measurements

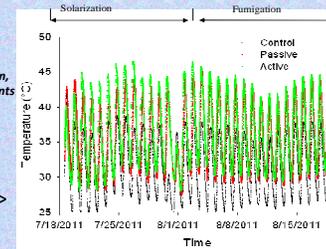


- 1)Control (C),
- 2)Solarization (covered with film for 4 weeks) (S),
- 3)Fumigation only (100% Mel application rate during 3-4 weeks) (100% Mel),
- 4)Passive solarization (two-weeks film coverage) + fumigation (70% Mel application rate during 3-4 weeks) (Sp+F),
- 5)Active solarization (two-weeks film coverage plus drip-applied hot water) +fumigation (70% Mel application rate during 3-4 weeks) (Sa+F).

Results and discussion

Soil temperature

Fig. 1, The maximum soil temperatures during week 0-4 for the active solarization, passive solarization, and control treatments



Temperatures:
Active solarization (S_a) > passive solarization(S_p) > control

Bio-chemical properties

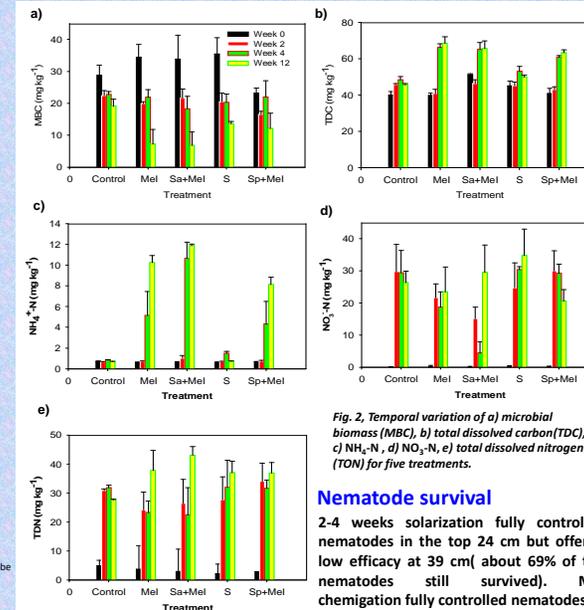


Fig. 2, Temporal variation of a) microbial biomass (MBC), b) total dissolved carbon(TDC), c) NH₄-N, d) NO₃-N, e) total dissolved nitrogen (TDN) for five treatments.

Nematode survival

2-4 weeks solarization fully controlled nematodes in the top 24 cm but offered low efficacy at 39 cm(about 69% of the nematodes still survived). Mel chemigation fully controlled nematodes.

Conclusion

- Mel chemigation reduced soil MBC, increased DOC and NH₄-N from mineralization of killed soil microorganisms, and influenced the nitrification processes due to the depression of nitrifying bacteria.
- Compared to Mel, solarization is a much milder disinfection method, slightly impacting these properties.
- The side effects of Mel on soil bio-chemical properties may be a concern for long-term soil health