Soil Treatment with Destabilized Lignocellulosic Compost and Solarization Provides an Alternative to Fumigants

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Overview

Knowledge-based application of organic materials (e.g., anaerobic soil disinfestation/biological soil disinfestation) and soil solarization can be useful as pre-plant treatments to eliminate soil pests, without using synthetic chemical fumigants. With the goal of making both approaches more effective, predictable and flexible, we tested mortality of *Brassica nigra* (black mustard) seeds in solarized field soil amended with mature green waste compost, and destabilized with wheat bran, as compared to non-amended field soil. The soils were treated in the field at Parlier, CA for 22 days or 15 days in two summer experiments. Mortality of seeds buried in compost-amended soil was significantly higher than in non-amended soil in both trials. Additional laboratory and field studies showed that amended and destabilized soil was initially phytotoxic to lettuce seedlings. However, phytotoxicity was eliminated by subsequent solarization treatment. Amended soil resulted in maximum temperatures 2-4 ^{o}C higher than in soil alone, and ~85% of total organic carbon in amended soil was exhausted within 22 days of heating by solarization. Bacterial community structure in solarized soils were measured by 16s rDNA sequencing. Community structure changed based on soil amendment and solarization. Also, bacterial communities varied with soil depth, indicating possible enrichment of thermophiles and other niche-specific taxa.

Fig. 1. Biosolarization in California

Fig. 2. Researchers and students preparing samples and monitoring equipment for field trials.

Fig. 3. Preparing field microplots at UC Kearney REC.

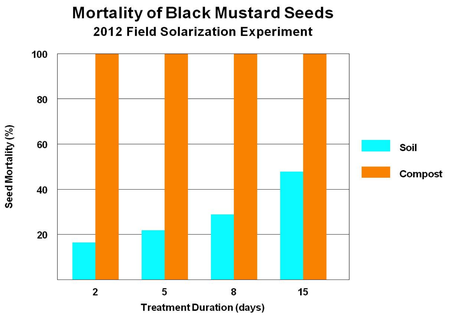

Fig. 4. Representative *Brassica nigra* seed mortality after treatment by field solarization in compost-amended or non-amended soil (at UC Kearney REC).

Partial Summary of Results:

- Amending soil with mature, destabilized compost resulted in microbial respiration that increased soil heating and raised soil temperature during treatment.
- The majority of biological activity was exhausted in amended soil during solarization treatment.
- Soil amendment with mature, destabilized compost was initially phytotoxic, but phytotoxicity was eliminated by solarization.
- Amendment of solarized soil with destabilized compost increased mortality of black mustard seeds.

Selected Research Products for Additional Information:

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Simmons, C.W., et al. 2013. Managing compost stability and amendment to soil to enhance soil heating during soil solarization. *Waste Management* 33:1090-1096.

Simmons, C.W., et al. 2014. Characterization of bacterial communities in solarized soil amended with lignocellulosic organic matter. *Applied Soil Ecology* 73: 97-104.

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