Biofumigation of Tomato Plots Alters Soil Microbial Community Structure

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Introduction:

Effective management of the soil microbial ecology is important in sustainable production. During an ongoing study at the University of Tennessee, biofumigation, as an alternative pre-plant treatment had higher tomato yields and lower incidence of Southern Blight than controls. Phospholipid fatty acid (PLFA) analysis of the soil showed that this treatment produced an enhanced microbial biomass and a shift in the community composition. High bacteria:fungal ratios in the treated soils correlated with the disease suppression.

Objectives:

The objectives of this investigation were to; 1) Establish field experiments to assess the ability of biofumigation treatments to control the fungal pathogen *Sclerotium rolfsii*, 2) Evaluate changes in the soil micro ecology using PLFA, and 3) Link microbial profiles with disease suppressive conditions.

Materials and Methods:

A field with a confirmed heavy infestation of Southern Blight was selected and pre-plant treatments were established as follows; 1) Biofumigation cover using ISCI-20 mustard cover crops (*Brassica juncea*), 2) Biofumigation using incorporation of mustard seed meal, 3) Fumigation with dazomet granular (Basamid®), and 4) Rye cover crop as an untreated control. Twelve reps of each treatment were planted in a randomized complete block. 'Celebrity' tomato plants were planted in raised beds in each of these treatments with black plastic mulch covers with drip tape irrigation and fertigation. Tomato yield and incidence of Southern Blight were recorded for each treatment. Soil samples from each treatment were collected and total lipids were extracted. The lipids were fractionated by silicic acid column chromatography and methylated to form phospholipid (PL) fatty acid methyl esters (FAMES). PL-FAMES were analyzed by gas chromatography mass spectrometry.

Results and Discussion:

Tomato fruit yields were higher (30%) and the incidence of Southern Blight lower (60%) in biofumigated plots compared to the Rye cover control plots. Yield and incidence of Southern Blight were not significantly different between biofumigated and dazomet treated plots. Mean microbial biomass of biofumigated plots (0.90×10^{-5} pmol/g dry wt.) was higher than rye control plots (0.77×10^{-5} pmol/g dry wt.) Monounsaturates (representing Gram negative bacteria) were 10 percent higher in biofumigated soils than in soils from the Rye cover treatments. Fungal lipid biomarker 18:2w6 was proportionally lower (4%) in biofumigated plots. Ordination models indicated a statistically significant linkage of monounsaturates with higher yields.