BRASSICA BIOFUMIGATION INCREASES MARKETABLE TOMATO YIELD

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Fresh market tomato (*Lycopersicon esculentum* Mill.) production is economically important in several states including Tennessee. Traditional cultivation has relied heavily on chemicals for control of soil pests. With the phase-out of methyl bromide, alternative commercial practices are needed for control of soil pests. In addition, there is increased consumer concern over use of synthetic chemicals in fruit/vegetable production.

Biofumigation can be defined as the incorporation of biomass into soil, resulting in the release of toxic volatiles that reduce soil pests. Other benefits of biofumigation include: improved soil texture, increased water holding capacity, and improved soil microbial community structure. The Brassicaceae family is a source of potential biofumigation material. Family members contain secondary plant metabolites called glucosinolates, which are believed to be involved in plant defense. When tissues are damaged, glucosinolates are enzymatically broken down by myrosinase to produce nitriles, thiocyanates, isothiocyanates and other products. Isothiocyanates, the predominant breakdown product, have biocidal activity on fungi (1, 3), bacteria (2) and other pests.

The objectives of this study were to investigate the potential for biofumigation for use in plasticulture tomato production. Specifically, we evaluated Indian mustard (*Brassica juncea* L.) and Fall Raab (*B. campestris* L.) as winter cover crops / spring biofumigation treatments. The effects on marketable fruit yield and disease were analyzed.

An experiment was preformed with a randomized block design with split plot treatment assignment. The whole-plot treatments consisted of three soil pH ranges: 5.2-6.0, 6.5-7.0 and >7.0. The subplot treatments consisted of the biofumigation treatments: Indian mustard (PI 458934) sown at commercial density (1X), Indian mustard sown at twice commercial density (2X), Fall Raab sown at commercial density and Rye sown at commercial density (control).

The treatments were sown as winter cover crops Sept 1999 and the resulting biomass was incorporated into the soil May 2000. 'Celebrity' tomato plants were transplanted 3 weeks after incorporation. Harvest data were collected (per 10 plants). Fruits were graded by size (Florida scale) and weight and number of fruit were recorded. Statistical analysis was preformed on marketable fruit (diameter >6.43 cm; tray sizes 4X5, 5X6 and 6X6).

Biofumigation treatments significantly affected both number and total weight of marketable fruit ($P < 0.01$). The soil pH treatments did not significantly affect number or total weight of marketable fruit produced ($P > 0.05$). There was no significant interaction between pH and biofumigation treatments ($P > 0.05$). Due to its high variability, the cover biomass was analyzed as a covariant and was not found to significantly effect marketable fruit yield ($P > 0.50$). Soil carbon, nitrogen, magnesium, potassium, phosphorus and sulfur were determined for each plot and analyzed as covariates. These soil nutrients were not found to significantly effect marketable fruit yields ($P > 0.10$).

The highest tomato yields were produced on plots treated with the 'Fall Raab' biofumigation treatment. Plots with 'Fall Raab' incorporated into the soil had 40% more marketable tomato fruit than plots with the rye (control) incorporated into the soil. The 'Fall Raab' treated plots also produced 19% more marketable fruit than plots with soil incorporated with the Indian mustard cover crop. Plots with Indian mustard incorporated into the soil produced 18 % more marketable fruit yield than plots with the rye (control) incorporated into the soil.

Literature Cited

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2. Delaquis, P. J. and G. Mazza. 1995. Food Technol. Nov. 73-84.
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Advantages:

- Suppresses disease organisms
- Improved soil texture
- Increased water holding capacity
- Improved soil microbial community structure

Disadvantages:

- Does not afford full control
- Field out of production while *Brassica* crop is growing
- *Brassica* can host some disease causing organisms