

Plant Pathology Seminar Series

“Biological Soil Disinfestation: An alternative approach to controlling soilborne pathogens”

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Abstract

Soilborne pathogens are a major constraint to the production of several economically important crops, and have warranted considerable use of chemical soil fumigants. The most popular soil fumigant has been methyl bromide (MB), which has broad spectrum activity over several soil pests and pathogens and been in use for more than 40 years. However, phase-out of methyl bromide in industrialized countries was implemented in 2005 as awareness of the damaging effects of methyl bromide on the earth's protective ozone layer became known in the early 1990s. This action resulted in a shift towards the use of other fumigants such as 1,3 dichloropropene, chloropicrin, metam sodium, and dazomet; these have been used in combinations as mixtures or sequentially (5, 16). Given environmental and human health concerns associated with using chemical soil fumigants, research and development towards practical, safe and effective non-chemical alternatives has now become imperative. Alternative candidate methods include steaming (7); solarization (1, 7, 8); biofumigation (1, 4, 9); crop rotation (1, 7); biological control (1, 10); use of resistant cultivars (7); composting (1, 7, 10); applying organic amendments via animal manure and animal by-products (10) or industrial and municipal wastes (15); and, incorporating green manures (10). One relatively new method, developed in Japan (12, 13) and the Netherlands (2, 3, 6, 11), makes use of old concepts but integrates them into a practice called biological soil disinfestation (BSD). Sometimes the practice is referred to as anaerobic soil disinfestation (ASD) or redox potential (12, 13). Using BSD to kill soilborne pathogens requires the incorporation of a carbon source into the soil, irrigation to obtain saturated conditions, and covering the area with an oxygen-impermeable tarp as used in soil solarization, to achieve anaerobiosis for a sufficient period of time (17). BSD has been shown to have broad-spectrum activity against many soilborne fungi including *Fusarium* (2, 3), *Verticillium* (3, 6), *Rhizoctonia* (3), certain plant-pathogenic bacteria (11, 12, 13), and some nematodes (6). The exact mechanisms by which BSD suppresses pathogens are not yet fully known. Anaerobic soil conditions (1, 3, 6), production of organic acids (11, 13) and other volatile compounds from fermentation of organic matter (3), and induction of antagonistic microbial populations (3, 11) are some of the modes of action implicated in the suppression of soil pathogen populations using BSD. BSD is a promising non-chemical alternative method to control soilborne plant diseases. It is now being used in temperate regions like Spain and France, and in certain areas of the U.S. such as California and Florida.

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