BIOFUMIGATION AND BASAMID - AN ALTERNATIVE INTEGRATED APPROACH TO METHYL BROMIDE FOR VEGETABLE AND FRUIT PRODUCTION IN LEBANON

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Biofumigation is a non-chemical approach to control disease, nematodes and weeds by planting the trap crops, which produce the chemicals from the root against the pest or pathogen. Potential green manure crops include barley, buckwheat, castor bean, horse-bean, mustard, oil radish, sudangrass, rape seed and velvetbean. Cropping systems for Lebanon that includes green manure crops for management of nematodes have been developed. Green house studies indicated that nematode population decreased as a result of trap crops oil radish (Adagio). In addition to reducing soil densities of nematodes, other benefits of using green manure trap crops include increased yields of subsequent crops, improved soil tilth and water holding capacity, reduced nitrogen leaching into groundwater, weed suppression, and potential suppression of seedling diseases.

The most likely alternatives to methyl bromide in the short term are alternative fumigants 1,3–D, chloropicrin, and methyl isothiocyanate. Water-soluble formulations of these alternatives can be applied with irrigation water through the same irrigation systems that are later used to irrigate the crops. For high-value crops strawberries, tomatoes and cucumber many growers fumigate the soil to rid it of various soilborne root pathogens, harmful nematodes and weeds before planting their crops. Basamid is a broad spectrum biocide in vegetable and strawberry production against soil borne pests including nematodes, fungi and weeds. It offers advantages over existing soil sterilizing procedures or chemicals because it is relatively safe, economical, and easy to use. Results of the demonstration project on strawberries in Lebanon proved that basamid is effective as compared to the control. However yield was 85% of the Methyl bromide treatment. Soil edaphic factors are one of the reasons for the reported low yield. Many environmental factors can positively or negatively affect the activity of biofumigants. Soil type, soil temperature, soil moisture, organic matter content, pH, and certain soil cations can affect the rate of chemical conversion, distance moved and the rate of movement depending on the type of fumigant used.

In addition to soil fumigation implementation of the following integrated approach not only benefit the fruit and vegetable production but also provide safety to the environment.

- Reducing the power of soil borne pathogens to cause disease can be accomplished by starting the crop with pathogen-free planting material, avoiding fields known to be pathogen infested, allowing time for a natural decline of pathogens from crop rotation or by using soil solarization or short-term flooding.

- Management of microenvironment includes instituting practices that improve soil drainage, adjust temperature or water potential, and raise or lower soil pH, whichever produces an environment less favorable for the pathogen than for its natural enemies.

- Introduction of naturally occurring biocontrol agents can be achieved by adding composts or other properly processed organic materials to the soil that can make it inhospitable for some plant parasitic nematodes and some fungal pathogens. Seeds and seedling transplants are ideal for introducing antagonists to biologically control specific pathogens because they allow the antagonist to be placed where it is most needed and the antagonist's growth can be supported by the plant it protects.

- Application to target specific pathogens singly or as mixtures, selected fungicides like metalaxyl, difenconozole, triadimefon, propiconazole, and imazalil can control soilborne pathogens.

- Genetically increase the resistance that has been found in plants to most, if not all, vascular pathogens such as *Verticillium dahliae* and *Fusarium oxysporium*, and to parasitic nematodes such as root knot and cyst.

Futuristic approach

The existence of many alternatives to the use of methyl bromide for soil fumigation was amply demonstrated. Many of the methods and technologies are directly applicable to broad areas of the world including the developing countries. Futuristic approach to enhance the feasibility of the practical approach includes the following.

- For strawberries, tomatoes and cucumber production there is need for further research and extension work to adapt existing alternative technologies so that they represent technically and commercially acceptable methods for control of soil-borne pests.
- In the developing countries there is a need for research programs to adapt known alternatives to specific crops and localities. Research should be participatory involving from the very beginning researchers, producers and others involved in production and marketing and should be coordinated among research groups in the developed countries.
- Emphasis should be given to research involving integrated pest management systems. Research should encompass methods for transference and dissemination of information. The aim of these activities should be to promote quick acceptance of alternatives by farmers.