COMBINING SOLARIZATION AND FUMIGANTS AS FEASIBLE ALTERNATIVES TO METHYL BROMIDE.

A. Gamliel*[1], A. Grinstein[1], and J. Katan[2]; [1]Inst. for Agricultural Engineering, ARO The Volcani Center, Bet Dagan 50250 Israel; [2]The Hebrew University of Jerusalem, Faculty of Agriculture, Rehovot, 76100 Israel;

Chemical fumigants provided great advantage to agricultural production for many years. These are strong eradicants by nature, resulting in simultaneous control of a variety of pests. However, negative effects, i.e. eradication of beneficial organisms, and negative shift in biological equilibrium in the soil, are also possible. Soil fumigation with methyl bromide (MB) is a common practice in Israel and essential to control several soilborne diseases in many crops. However, concern regarding this fumigant's possible role in ozone depletion and the regulations to reduce its consumption or phase it out, altogether, raise a need for development of methods to reduce emission of MB and effective alternatives. Soil solarization is a nonchemical approach for soil disinfestation. Under suitable climatic conditions, solarization can effectively control a wide range of soilborne pests, including fungi, bacteria, weeds, nematodes and insects. As does any control method, solarization has both advantages and limitation, such as the occupation of the soil for 4-6 weeks and climate dependency. Moreover, solarization does not control all pathogens. Certain diseases in Israel e.g. Fusarium crown rot of tomato, sudden wilt of melons, and Fusarium wilt of carnation are not effectively controlled by solarization. Thus, improving solarization by combination with fumigants might enable the use of solarization under a wider range of conditions, and might even shorten the solarization period necessary for pathogen and pest control. Several benefits are expected from combining solarization with fumigants: capturing the fumigant under the plastic tarp; the increased soil temperature may activate biocidal activity of the fumigant and increased susceptibility of propaguls to the fumigant, leading to an important benefit of reduced dosages of the fumigant used.

The effect of Combination of MB at reduced dosage with solarization was studied in small field plots and in commercial fields. In small plot MB at a rate of 15 gr/m^2 combined with short solarization gave effective control of propgules of *Fusarium oxysporum* f. sp. *melonis, F. O. f. sp basilici, Sclerotium rolfsii* and *F. o.* f. sp *radicis-lycopersici*. Pathogen control was further improved by first weakening the pathogen by short sublethal solarization, and afterwards applying MB.

Combinations of MB or metham sodium with solariztion were tested for controlling crown rot of tomatoes and sudden wilt of melons in the southern part of Israel. The fields in this area are heavily infested with these pathogens and the current standard procedure is MB fumigation since solarization or other fumigant were found ineffective in controlling these diseases. MB at 25 gr/m^2 combined with solarization gave effective control of crown rot of tomatoes compared with the standard fumigation at a rate of 70 gr/m^2. Similarly, MB at 15 and 20 gr/m2 followed by

solarization gave effective control of sudden wilt of melons compared with standard fumigation at a rate of 50 gr/m^2
Metham sodium at reduced dosage of 30 ml/m^2 was applied through drip lines under strip plastic mulch followed by solarization for 4 weeks. This combination resulted in control of propagules of , *Fusarium oxysporum* f. sp. *melonis,* and *F. o.* f. sp *radicis-lycopersici* to a depth of 40 cm. The combined metham sodium - solarization treatment gave effective control of sudden wilt of melons and crown of tomatoes over the whole period of crop growth and production. The efficacy of the combined treatment was similar to the effect of the standard MB fumigation treatment.

The combination of solarization with formaldehyde was tested to control wide spectrum of potato and peanut diseases. Solarization is very effective in controlling Verticillium wilt but is only partially effective in controlling Potato scab and peanut pod wart caused by *Streptomycetes.* In contrast, formaldehyde is effective in controlling bacteria but does not control Verticillium. Combination of formalin at 1000 l/ha with solarization reduced scab incidence in potato tubers to 4.1% compared with 65.6% in the nontreated plots and 15.3% in the solarized plots. The combined treatment was effective in reducing pod wart of peanuts in a second crop, whereas formlin alone gave only partial control. The long-term effect of the combined treatment together with the extended spectrum of pathogen which were controlled support the feasibility of application of such treatments on larger field scale.