EVALUATION OF ALTERNATIVE SOIL FUMIGATION METHODS FOR USE IN STRAWBERRY PRODUCTION IN SOUTHERN CALIFORNIA

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Alternative fumigation methods to replace methyl bromide are urgently required to avoid the eventual economic impact on strawberry production in southern California. The combination of methyl bromide/chloropicrin (MBr/PIC) has been highly effective in the past 30 years as a broad spectrum biocide in the control of weeds, nematodes and important soilborne fungal pathogens such as *Verticillium*. The best alternatives to MBr/PIC are likely to be other chemical fumigant treatments such as chloropicrin alone (PIC), TeloneII/chloropicrin (TeII/PIC) or possibly methyl isothiocyanate and its derivatives e.g., Vapam (VAP) since all these materials have broad spectrum biocidal activity.

The main objectives of our research are to evaluate the relative efficacy of these alternative fumigation strategies. Soil microbial populations are monitored in a systematic manner over the duration of the growing season in order to evaluate the long term biocidal activity of the fumigants. A range of non-selective media have been developed and tested for this purpose. In addition, potential fungal and bacterial strawberry pathogens are screened using specific isolation techniques for roots, crowns and petioles. Finally, strawberry yields are taken on a twice weekly basis throughout the picking season from early February to early June.

In the first year of our research program a site at Oxnard in Ventura County was chosen which had been under continuous strawberry production using MeBr/PIC for at least twenty years. Treatments consisted of MeBr/PIC (67%-33%) at 381 lb/acre, PIC at 353 lb/acre, TeII/PIC (70%-30%) at 496 lb/acre and VAP at 98 gal/acre. There was also a non-fumigated treatment (NONE). Soil fungi populations were reduced significantly by all fumigant treatments but particularly by MeBr/PIC, PIC and TeII/PIC. A wide variety of different fungi were isolated from strawberry roots including *Pythium* spp., *Alternaria* spp., *Fusarium* spp., *Monilia* spp., and *Cylindrocarpon*. A lower level of *Phytophthora cactorum* was found, but not *Verticillium*. One current research emphasis is on evaluating the importance of *Pythium* spp. in causing root disease. Differences in the visual appearance of plants were detectable from as early as 7 to 8 weeks after planting; the MeBr/PIC, PIC and TeII/PIC treatments containing the majority of plants with good vigor. In contrast, the VAP and NON treatments already contained many plants with stunted growth. This was also reflected in strawberry fruit yields and size from the beginning of the production season in February. Cumulative fruit yields were 3731, 3463 and 3845 cartons/acre for the MeBr/PIC, PIC and TeII/PIC treatments, respectively. In marked contrast, the VAP and NON treatments produced fruit yields of 2809 and 2120 cartons/acre, respectively. Comparing the industry standard MeBr/PIC with the non-fumigated (NON) treatment, this represents a yield loss of 43 percent. Similarly, fruit weight was greater in the effective fumigant treatments. For instance, MeBr/PIC had an average of 19.7 g compared to the NON treatment of 17.9 g.

The fumigation trial at Oxnard is now being repeated on the same site for a second year to evaluate the longer term effects of alternative fumigant treatments. In addition, it is anticipated that the non-fumigated sites will show even more dramatic losses due to root damage. A major effort is being made to try and identify the principal pathogens involved in these root losses. Neither *Verticillium* nor *Phytophthora* appeared to have a significant role in the root disease complex during the first year of this experiment.