Organic Soil Amendments and Plug Plants as Alternatives to Methyl Bromide Fumigation on California Strawberries

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Second year experimentation in replicated field plots with high rates of compost and broccoli mulch were conducted during the 1996 growing season at our privately funded research farm on the California central coast. Past season plant performance and yield data were reported at the 1995 San Diego MBAO conference, and field trials for the 1997 research program are currently underway. A summary of our efforts to date are as follows:

1. 1995 field studies. The site chosen for this study was previously farmed in strawberries for 9 years using methyl bromide/chloropicrin fumigation. Soil microbial biomass present at the initiation of the trial indicated very little biological activity from which to base a non chemical soil management program upon, as would be the case with most intensively managed areas of the California Central Coast where strawberries are produced. We used compost and broccoli mulch each at 56.1 T/ha alone and in combination with one another to amend the soil and establish a suppressive environment for strawberry root pathogens. In addition, Telone + chloropicrin, basamid, and metham sodium were compared to a methyl bromide standard for plant vigor, pathogen establishment and fruit yield. We reported at last year's conference that the organic soil amendments were not effective for increasing fruit yields over untreated soil when planted into successively fumigated fields. Also, we reported that methyl bromide/chloropicrin comparable fruit production and weed suppression occurred with Telone/chloropicrin, in addition to the MIT liberators, Basamid and metham sodium. It was further discussed at that time that in order to achieve natural disease suppression in these biologically unbalanced soils following methyl bromide/chloropicrin fumigation, multiple years of remediation would be required to obtain the high levels of suppressive organisms necessary to protect the disease susceptible strawberry cultivars grown in our state and elsewhere. This was particularly evident from mycorrhizal (VAM) root colonization data, where even in the organic soil amendment plots, root samples showed very poor beneficial VAM establishment. These data are currently under review for publication.

2. 1996 field studies. In addition to the 2 organic soil amendment treatments used in our 1995 studies, the 1996 trials were different in that they were conducted on previously fallowed land (3 years), and included organic soil amendments with and without mycorrhizal (VAM) inoculation, as well as one treatment using strawberry plug plants (We Grow Right Inc., Andrews, North Carolina). These plug plants are container produced daughter plants that were grown in artificial potting media without chemical fumigation, and substituted for commonly used bare root plants in one experimental treatment of this study. At the time of this writing, data are being analyzed from this years yields. However, trends from the individual alternative treatments are as follows:

a) Organic soil amendments. As with our 1995 study, also with the chandler cultivar, neither 56.1 tons/hectare of compost, nor 56.1 tons fresh weight of broccoli mulch/hectare were sufficient to significantly suppress pathogen establishment and prevent reduction in fruit yields. Compared to untreated plots, season totals for fruit were not significantly higher than plots receiving no preplanting soil amendments or chemical fumigation. However, the combination treatment of compost + broccoli (each at 56.1 T/ha + VAM inoculant), performed numerically better than either amendment alone.

b) Mycorrhizal inoculation. Due to the poor naturally occurring VAM colonization observed in the 1995 studies, we inoculated all organic soil amendment plots with a commercial formulation of VAM (Tree of Life Nursery, San Juan Capistrano, CA). One experimental treatment of compost only was used as a control to determine baseline VAM activity from the compost and fallow soil alone. Soil microbial biomass analyses are still being

performed on these samples, however, yields from VAM inoculated plots were numerically higher (8.7%) than the non inoculated compost soil treatment.

c) Alternative nursery plants. Most discussions of strawberry production in the absence of methyl bromide include the impact on the production of disease free nursery plants. The cumulative effect of weak or diseased planting material, in combination with pathogen pressure from a non fumigated fruiting field, is well documented. Thus, the importance of healthy nursery plants for optimal strawberry production cannot be overstated, particularly in post methyl bromide production systems. In this study, we used disease free strawberry plants that were commercially produced in sterile potting media (strawberry transplants, or "plug plants"), and planted them into non fumigated soil for comparison with conventionally produced bare root plants in non fumigated and conventionally fumigated soil. Compared to bare root plants, plug plants were more vigorous and yielded 38.5% higher fruit yield in non fumigated soil. Further, fruit production from these plants was statistically the same and numerically higher (4.8%), than conventionally produced bare root plants planted into methyl bromide fumigated field soil.

3. Alternative strawberry production system, 1997. Our current experiments include chemical alternative field plots with Telone/chloropicrin, basamid, metham sodium and clove oil concentrate, in addition to soil amendments incorporated into preconditioned soil that has been continuously cover cropped and composted for one year prior to initiation of the study. This soil is more biologically complex with higher organic matter than the 1996 site, and thus, may have a greater potential for establishment of disease suppressive organisms. This site is not unlike soil used in organic production systems nationwide. We are using the information developed in our first and second years studies above, to develop a commercially sound alternative strawberry production system for the California central coast.

4. Public outreach. Pacific Ag Research recently held a day long symposium on methyl bromide on the California central coast where over 100 farmers and pest control professionals attended. Speaker topics included the following: the uses and characteristics of methyl bromide based fumigants; the atmospheric chemistry of methyl bromide and ozone depletion; the toxicology of methyl bromide and risk assessment; economics of methyl bromide and the impact to California and national agribusiness; biological control of soil diseases and the concept of disease suppressive soils; the soil ecology of methyl bromide use; and the importance of crop rotation in management of soilborne plant diseases. We are now in post production of an educational video from this event, which will be available to interested persons who contact our office.

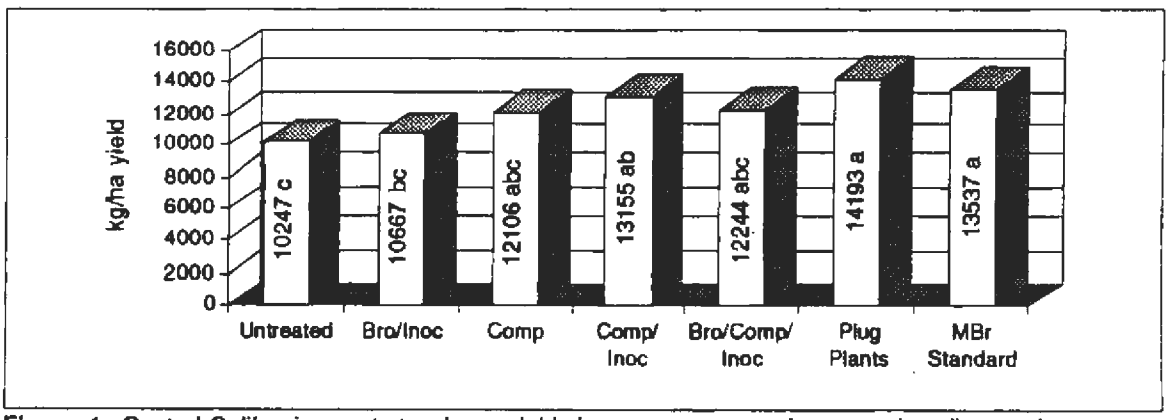

Figure 1. Central California coast strawberry yields in response to preplant organic soil amendments using conventionally produced bare root plants, compared with alternative transplant plugs in non fumigated artificial potting soil, with the standard commercial practice of methyl bromide/chloropicrin fumigation in the fruiting field with conventionally produced bare root plants. Data are average total yields from a three month harvest period of No.1 quality fruit from 4 replicated plots per experimental treatment. Chandler cultivar, 1996 season. *Pacific Ag Research station, Arroyo Grande, CA.*