



CALIFORNIA STRAWBERRY ADVISORY BOARD

UNDER AUTHORITY OF THE DIRECTOR OF AGRICULTURE, STATE OF CALIFORNIA

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Strawberry Report for 1975

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Report No. 1

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The Department of Plant Pathology, University of California, Berkeley, again acknowledges with appreciation research funds provided by the Strawberry Advisory Board. Reports which follow will bring you up to date on (1) the meristem culture program, on (2) a general view of strawberry virus disease control and (3) a specific treatment on the strawberry mild yellow edge virus disease. Looking at our strawberry industry now, it is a little hard to believe that not too many years ago virus diseases threatened certain major varieties with extinction.

The first report is intended to present some biological principles broadly applicable to soil fumigation for disease control. The principles developed are based on research done in the past, on long experience with soil fumigation and on research being carried on at the present time.

Bringing Our Knowledge Up to Date in Soil Fumigation

Agricultural soils are exceedingly complex biological systems in which many kinds of organisms live together and compete for available foods and space. The organisms are grouped into bacterial, actinomycetes (source of many antibiotics used in medicine), Fungi, protozoa, nematodes, mites and insects. The last four groups are animals. To give an idea of the numbers of organisms in a fertile soil: one gram may contain as many as 1 to 4 billion bacteria, 1 to 20 million actinomycetes and one million fungi. These numbers are estimates based on growth in the laboratory of reproductive propagules of the respective organisms.

For the most part, the organisms live on crop remains which they slowly decompose into humus. During the decomposition, nutrients are released which are usable by a new crop. Thus, these organisms— which we call saprophytes — serve an essential function in the recycling of plant nutrients. Without them, agriculture as practiced today would be impossible. Research being carried on now aims at the identification of the commonest of the saprophytes which survive soil fumigation and of the role of these in recolonizing the fumigated soil.

Another group of organisms present in soils attacks living plant tissues long before the plant has matured. In doing so they cause diseases. These are parasites. Only a small, specialized minority of the soil-borne organisms are in this class. The fungi causing Verticillium wilt, red stele, vascular crown collapse, etc., are examples of parasites. These we combat by soil fumigation, but in doing so admittedly also produce great effects among the saprophytes.

Principle 1. Disease-causing, parasitic soil fungi are killed by lower dosages of fumigant (50% methyl bromide--50% chloropicrin) than many of the beneficial saprophytic organisms.

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Conversely, saprophytic species of bacteria, actinomycetes, and fungi survive dosages of the fumigant which kills *Verticillium*.

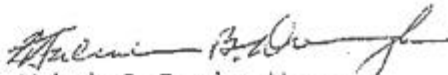
This means that fumigated soil is not sterile, but is recolonized by saprophytic species of fungi, bacteria and actinomycetes. We also have some evidence that the survivors of fumigation are antagonistic to *Verticillium* and act as a buffer against its reintroduction into the fumigated soil.

Principle 2. Nitrifying bacteria--those that convert $\text{NH}_3\text{-N}$ to $\text{NO}_3\text{-N}$ -- are killed by the fumigation. Ultimately these return to the soil, but the elimination of them initially by the fumigant preserves soil nitrogen. After fumigation $\text{NH}_3\text{-N}$ levels increase in the soil. $\text{NH}_3\text{-N}$ is not leached because it is not converted immediately to $\text{NO}_3\text{-N}$. This conservation of the nitrogen released from killed organisms is an extremely valuable bonus to soil fumigation.

Principle 3. The lower the moisture content of the soil, the more rapid the diffusion of the fumigants. The higher the moisture content, the greater the susceptibility of soil organisms to the fumigants.

The practical problem here is to strike a balance between soil dryness, which favors diffusion of the fumigant, and a moisture level which maintains the organism in the most fumigant-susceptible state.

In the final analysis, the soil becomes the reservoir of all plant disease-causing organisms. Soil fumigation offers a means of rapidly reducing the hazard of diseases caused by organisms with minimum disruption of the normal beneficial functions of soil organisms.


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