

clear polyethylene curtains can reduce heat loss by approximately 50%.

A review of fuel saving techniques being used by greenhouse operators in both the USA and Europe is in the October, 1976, issue of *Growers Talks* (1).

#### LITERATURE CITED

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2. Benham, D.S., Jr. and Frank Wiersma, 1974. Design Criteria of Evaporative Cooling. *Am. Soc. Ag. Engr. Paper 74-4527*.
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### SANITATION IN PLANT PROPAGATION

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In 1957, the *U.C. Manual 23, U.C. System for Producing Healthy Container-Grown Plants* (1) was published. It cost one dollar and was reprinted at least once. It is now out of print and in need of revision because of changes in pesticide registrations and other changes. But the information about plant diseases has not changed significantly. One section, "A Nursery Sanitation Code" by Kenneth Baker, is as good a guide now as it was 20 years ago. I would like to discuss this section explaining and commenting on the code which appears on pages 22 and 23.

There are two main sources of plant-disease causal organisms: infected plant parts, and infested soil. Reproductive or survival units (spores, sclerotia, etc.), referred to as inoculum, may be present in soil or produced on diseased plants. The inoculum can spread or be disseminated (transported) in various ways. A knowledge of the various dissemination methods will help the propagator understand the need for sanitation practices.

<b>Methods of Dissemination</b>	<b>Sanitation Procedures</b>
Equipment: Shovels, hoes, tractors, hoses, etc. Structures: Stakes, wires	Remove soil; running water is effective. Disinfect with formalin 37%, diluted 1:18.
Hands	Wash with soap and water.
Clothing, shoes	Brush clean or wash. Keep shoes off plant beds, etc. Rubber boots can be treated with formalin.
Water: irrigation	Well and municipal water are not contamination sources. Filtration and chlorination of ditch water may be necessary in some cases.
Water: rain and moisture from the atmosphere; drainage water	Bacteria and fungus spores are spread in splashing water from infected tissue. Drainage water can transport soil and microbes.
Wind	Many types of spores, particularly rusts, mildews, and some leaf-spotting fungi, are airborne. It is possible to filter greenhouse air, but it is not often practiced.
Plant containers	Remove clinging soil, and steam or chemically treat. Formalin can be used for plastic.
Animals: Dogs, cats, birds, mice	Exclude them from propagation areas.
Insects and mites	Besides transmitting viruses, some insects spread bacteria and fungus spores. Fungus gnats can carry <i>Rhizoctonia solani</i> and <i>Pythium</i> species. Flies spread bacteria.
Nematodes	Plant-parasitic nematodes cause disease and some transmit plant viruses.
Fungi	Some root-infecting fungi ( <i>Olpidium</i> species) can spread certain viruses.
Plants: vegetative reproduction (cuttings, bulbs, corms); seeds; pollen (a few viruses are transmitted by pollen)	Infected plant parts are a common means of introducing or perpetuating many kinds of diseases. Pathogen-free material can be developed in most cases. Bulbs and seeds can be treated with fungicides and by heat treatment in some cases.

## DISINFECTANTS

There are several different types of disinfectants used to control plant diseases. Most are used in sanitation to prevent diseases of man. The choice of disinfectant depends on the disease and plant.

Disinfectant	Use	Disadvantages
Bleach (sodium hypochlorite, calcium hypochlorite) (5.25%, diluted 1:9)	Surface disinfectant. Effective against small microbes such as viruses, bacteria, and fungus spores. Surfaces should be visibly clean before they are wiped or dipped in solutions.	Poor penetration; no residual action; corrosive to iron. Solutions rapidly lose activity, especially in light or in presence of organic matter. Not effective in killing fungus sclerotia or other resting structures ( <i>Verticillium</i> , <i>Sclerotinia</i> , <i>Macrophomina</i> , <i>Fusarium</i> , <i>Pythium</i> ).
Formalin (37%, diluted 1:18)	General disinfectant for tools, flats, and soil. Good keeping quantities.	Fumes are irritating to people and plants. Porous materials like wood and soil must be kept damp until all fumes have dissipated, or plant damage may result. Not effective against viruses.
Phenols (Amphyl®, Lysol®, LF-10®, CM-19®) Usually contain surfactants and alcohol.	Effective against bacteria and fungus spores. Residual action. Solutions retain activity for some time.	Not effective against fungus sclerotia or viruses.
Alcohol (ethyl or methyl alcohol and others)	Disinfectant of tools and tree wounds. Not generally recommended for use in plant disease control.	Not effective against sclerotia, viruses, and some bacteria. No residual action.
Quaternary ammonium compounds (example: alkyl dimethylbenzyl ammonium chloride)	May be useful in controlling bacterial contamination. Good algicide.	Not effective against fungus sclerotia.
Copper naphthenate	Used on wooden surfaces to provide a self-disinfecting surface. Helps control algae, fungi, and bacteria.	Not useful for tools. Toxic to plant roots that contact treated surfaces.

### LITERATURE CITED

1. Baker, K.F., ed. 1957. The U.C. System for Producing Healthy Container-Grown Plants. Calif. Agr. Exp. Sta. Man. 23.