SOIL STERILIZATION

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Florists, nurserymen, home gardeners and others who try to grow plants sooner or later encounter one or more soil-borne organisms which cause "damping-off" of seedlings and cuttings, reduces vigor, or causes death of the plants by destroying the roots. Some of this trouble can be avoided by changing soil or moving to a new location. However, this is not always feasible or satisfactory.

The steaming of soil has been practiced in greenhouses for many years and has been used more than any other method for soil sterilization. However, this method is expensive and not always practical unless facilities for steaming are available.

Many chemicals have been and are being tested for soil sterilization with varying degrees of success. Regardless of the method or material used certain precautions must be taken if the desired effect is to be obtained. The operation must be done thoroughly. If heat or steam is employed it is essential that all parts of the soil reach a temperature of at least 140° F. This temperature should be maintained for a period of two hours to assure killing of all soil-borne disease-producing organisms. If chemicals are used they must be applied in such a way that all parts of the soil are reached by the chemicals. In any case, after the treatment has been done caution must be taken to prevent recontamination. Beds, flats and propagating benches must be cleaned and disinfected before they are filled with fumigated soil. This can be accomplished by scrubbing the benches with a solution of formaldehyde or other good fungicide. Tools should be disinfected by dipping them in a solution such as formaldehyde. Pots and plant containers can be disinfected by dipping in formaldehyde. This solution is made up at the rate of 1 part commercial formalin to 49 parts water.

There are several materials which can be used as soil drenches to sterilize soil before planting or to minimize the incidence of damping-off of seedlings or cuttings.

Formaldehyde has been used for some time as an effective soil drench. A solution of 1 gallon of formalin diluted in 50 gallons of water and applied at the rate of 1 gallon per square foot of soil is effective in destroying many soil-borne disease-producing fungi. The soil should be loosened before application of the material. After treatment the soil should be covered with canvas, boards or paper and left for 24 hours, then allowed to dry until all odor of formaldehyde has disappeared from the soil.

Some of the commercial fungicides can be used as soil drenches to lessen the effects of damping-off in seed beds, flats, and cutting benches. These materials are made up in solution and poured on the soil around the plants. Spergon or Ferbam used at the rate of 2 ounces in 3 gallons of water has been effective in reducing "damp-off." The Coppers and Mercury compounds can be used, however, they may be injurious to some plants and should be used with caution.

Soil drenches are usually only partially effective and should not be relied upon where complete control is desired or where severe disease problems are expected.

A number of volatile chemicals have been introduced within the last few years which have shown varying degrees of success as soil fumigants. The materials kill by means of volatile gases or water solutions which penetrate several

inches from the point of injection or place of application. Since most of these materials contain substances which are toxic to plants they have to be used from one to several days before planting or setting of plants can safely be done.

Most of the volatile materials are only effective against nematodes and to a lesser extent against the fungi which cause damping-off and root rots. The principal fungants which are available at the present time are Chloropicrin, DD (mixtures of dichloropropane and dichloropropene), ethylene dibromide and methyl bromide.

The fungicidal and nematicidal properties of Chloropicrin are well known. When injected into the soil it will kill fungi, nematodes, insects and weed seed. At present probably no other fumigant surpasses it in fungicidal properties. However, Chloropicrin has several drawbacks which limit its use. It is expensive. It is highly phytotoxic and cannot be used near growing plants. The vapor kills foliage as well as plant roots. If Chloropicrin is used in a greenhouse or enclosed space all growing plants must be removed from the area.

To insure kill, after chloropicrin is injected into the soil, a seal is necessary. Usually this consists of sprinkling the soil surface with water. The gas is insoluble in water and a water seal will keep the gas from escaping. In fumigating potting soil, a gas tight bin or gas proofed canvas or paper cover can be used.

"DD mixture" has been shown to be just as effective against nematodes as Chloropicrin, and is a great deal less expensive. However, it has little effect on fungus diseases. DD has several advantages as a nematicide. It is less objectionable to use than Chloropicrin. The material remains in the soil for some time and a water seal is not necessary. While the material cannot be used around living plants the escaping fumes are not particularly toxic to the foliage of plants growing nearby. It can be used in greenhouses without injury to plants in the house provided there is adequate ventilation. Since DD remains in the soil for some time two to three weeks may need to elapse before the treated soil can safely be used. This depends a great deal on the temperature and moisture content of the soil.

There are several commercial soil fumigants on the market which contain various amounts of ethylene dibromide. Although these materials are not effective fungicides they are among the cheapest soil nematocides and insecticides now available. Ethylene dibromide persists in the soil for some time and a seal is not necessary. The commercial mixtures are not objectionable to handle. However, ventilation should be provided and the fumes should not be breathed.

In this group of materials there is one form which should be of especial interest to the home gardener and the small grower. It is a capsulated form of ethylene dibromide and is sold under the trade name of "Soilfume-Caps." The fumigant is embedded in gelatin pellets. This material would probably be expensive to use on a large scale, but where small areas are to be treated the convenience in handling the material offsets the added expense.

For flower beds, small plots and areas where shrubs and other plants susceptible to root knot are to be planted, the soil can be easily treated with "Soilfume-Caps" for the control of nematodes and wireworms. It is recommended that the soil be treated once a year prior to planting. Holes are made in the soil four to five inches deep and spaced twelve inches apart. One capsule is placed in each hole, the hole filled and the surface packed firmly. Under ideal conditions, a minimum of two weeks should elapse

between treatment and planting. The material should not be used near growing plants, particularly if the roots of nearby plants are growing into the area to be treated. This material is effective for treating an area where a root-knot infested shrub has been removed and a replacement is desired.

Dowfume MC-2, a mixture of Methyl bromide and two percent Chloropicrin, is one of the most effective soil fumigants available and is particularly adapted to use of the nurserymen and the home gardener. It finds its greatest usefulness in the treatment of seed beds, potting soil, benches, and ground beds of greenhouses. MC-2 has been used for sometime as a space fumigant to eliminate insect pests from nursery stock. As a soil fumigant it controls nematodes, certain soil fungi, weed seeds, and insects. It can be used within a foot of many growing plants without injury to their roots.

MC-2 is marketed in sealed cans and must be applied by means of a "jiffy" applicator and injected under a gas tight cover or into a sealed chamber.

Soil to be treated should be worked in a fine, loose condition and should be neither too wet or too dry. It is covered with a gas-proof canvas or paper. The central area of the cover is supported 12 to 18 inches above the soil. The edges of the paper are then pulled down to the ground or floor and covered with soil. The volatile liquid is released through a special tube into a trough or shallow pan placed on top of the soil under the cover.

There are some disadvantages to MC-2. While no complicated or expensive equipment is needed, a special applicator with sufficient tubing and a suitable gas-proof cover are needed. The material is very toxic to man, and extreme care must be taken in its use.

Complete directions for the use of MC-2 together with the necessary material for application can be obtained through the MC-2 dealer.

GREENHOUSE FOLIAGE PLANTS IN FLORIDA

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For introduction to this article, I should say I was first introduced to the State of Florida at the Pageant of Progress in Chicago in 1933-1934. I had been buying some Sansevieria from one of the growers in Apopka. That was about the only plant I could get with the exception of Boston Ferns.

In December of 1934 I decided to make a trip to Florida for the purpose of investigating possible sources of other plant material. I arrived in Apopka in December 1934, then known as the Fern City. (I think now it should have a more appropriate name to embrace a larger field of horticultural products.) On my trip around the nurseries, I did not find much of a selection in plants, but I did find a delightful climate, remarkably suited to growing most of the decorative green plants that are used in the Northern part of the United States for indoor decoration and sold by the Northern retail florists. I was surprised that so few had discovered these advantages offered in Florida; but since the Florida growers have become acquainted with the possibilities in the Northern markets, rapid strides have been made in this branch of horticulture. As late as 1937, there was but one small greenhouse in the Apopka section. Today there are 200,000 feet of glass houses, around Apopka and Plymouth, devoted to production of this class of plants in