



HAWAII COOPERATIVE EXTENSION SERVICE

College of Tropical Agriculture and Human Resources

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GENERAL HOME GARDEN SERIES No. 28

TREATMENT FOR CONTROL OF SOIL ORGANISMS

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Soil contains many harmful organisms. One of these is weed seeds, which, when germinated, compete with garden plants for space, sunlight, and nutrients. Such competition weakens plants, making them more susceptible to attack by insects and disease-causing organisms such as nematodes, bacteria, and fungi. Weeds cause further damage by providing a home for these insects and pathogens, which in turn cause poor growth, inferior quality, and low yield in garden plants. A severe infection may even kill the plant.

Methods of Controlling Soil Organisms

One of the more effective ways to control these diseases and pests is to treat the soil by either physical or chemical means. In each case, complete or partial treatment may be given.

Physical Means. Heat is the only practical means of treating soil physically. Complete treatment, or sterilization, requires heating soil to 212°F. Partial treatment, or pasteurization, requires heat of 140 to 160°F. In both cases, temperatures should be maintained for at least 30 minutes after the center of the soil mass reaches the desired temperature.

Soil can be heated with steam, hot water, or dry heat in an oven or similar device, or by passing a high-amperage electric current through the soil. Steam or hot water is most effective, as it hydrates the weed seeds, pathogens, and insects, making them more susceptible to the heat. Steam sterilization may be accomplished with an autoclave, large pressure cooker, or steam generator with an injector to inject the steam into the soil.

Dry heat is less effective than steam or hot water because some of the more resistant organisms may survive the heat. Furthermore, there is considerable danger in the use of high-amperage current for soil sterilization; it is not recommended for the home gardener.

Soil temperature should not exceed 212°F, as this often causes toxic substances to develop in the soil. Also, soils containing high amounts of compost or manure may develop toxic substances when treated with heat or steam at temperatures above 212°F. Storing the soil, exposed to the air, for 2 or 3 weeks or longer helps reduce such toxicities. Leaching the soil with heavy applications of water will also reduce this soil toxicity.

Chemical Means. Soil can be treated chemically by contact, fumigation, or a combination of both. Complete treatment results in the death of all weed seeds, insects, and pathogens. Partial treatment is intended to control some of the pathogens or pests and reduce or eliminate their effect upon plants. Selective treatment is meant to control a specific organism or group of organisms, such as nematodes. Although this allows garden plants to develop vigorous growth so they will not be adversely affected by a later infection of these organisms, soil treatment cannot protect the plant from airborne pathogens and insects nor from reinfestation. Partial and selective treatment by chemicals are the most common in agricultural operations, including the home garden.

Chemicals used for weed control are known as herbicides; those for controlling pathogens are bactericides, fungicides, or nematocides, depending on their target. Both organic and inorganic chemicals may be used. There are some chemicals that remain in the soil. This inhibits the growth of plants, while soil-borne pathogens and insects are not affected. Most of the chemicals are poisonous; directions on the label should be followed carefully. For this reason, the Environmental Protection Agency and the Hawaii State Department of Agriculture require a training program and a license for the application of many of these materials. The chemicals available to the home gardener without a permit can be found on the shelves of local garden shops.

Preparing Soil for Treatment

Soil to be treated by either means should be in excellent physical condition—easily crumbled and free of clods and large pieces of debris. If soil is not in good physical condition, spading, rototilling, or plowing may be necessary. Most soil amendments, such as compost and manure, should be added before treatment. If compost or manures are added they should be allowed to decompose in the soil before heat treatment, thus preventing the formation of toxic substances. Fertilizers, lime, or sulfur should not be added before treatment.

The soil should be moist but not too wet. The moisture content should be that required for good seed germination. Wet soil takes much longer to heat and is more likely to develop toxic substances. When wet soil is treated with chemicals, the chemical is diluted or does not make proper contact with the organism to be controlled. If soil is too dry, however, the organisms are not properly hydrated and the more resistant ones will not be controlled.

If chemical treatment is to be used, the soil temperature should be above 60 to 65°F (15.6 to 18.3°C) at a depth of 2 to 4 inches in the field or 4 to 6 inches in containers. In most areas of Hawaii, the soil can be treated at any time of the year, indoors or out.

Preventing Reinfestation of the Soil

Once soils have been treated, they may be reinfected by tools, soil containers, or other items that have come in contact with contaminated soil. These items should be sterilized also. Avoid adding untreated soil, or plants from untreated soil, to the treated soil.

Many pathogens may be carried by seed or planting materials. All seed or planting materials should be treated before placing in treated soil. Some seeds have been treated before purchase. If you obtain untreated seeds, you may treat them yourself by using a suitable fungicide obtainable from your seed supply house or garden shop.

For specific information regarding your soil treatment problems, contact your local county agricultural agent.

NOTE: The use of trade names is for the convenience of readers only and does not constitute an endorsement of these products by the University of Hawaii, the College of Tropical Agriculture and Human Resources, the Hawaii Cooperative Extension Service or any of their employees.

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