Occasionally the home gardener may wish to sanitize small quantities of soil or small areas of ground in order to kill or reduce amounts of plant disease organisms in the soil. It is particularly desirable to have disease-free soil for house plants and for starting transplants. Sterilized potting mixes can be purchased at garden supply centers, but home gardeners may wish to sanitize their own. Outdoors especially, some disease microorganisms (bacteria and fungi) as well as nematodes, insects, and other pests, may build up in the soil and prevent satisfactory growth of many different kinds of plants. When plant growth becomes severely affected and soil organisms are responsible, then sanitation of flower bed or garden areas may be necessary.

**Important Preliminary Information**

1. Soil to be treated must be easily crumbled and without clods or large pieces of plant debris. Any amendments (manure, compost, peat moss, etc.) to be added to the soil must be added before treatment. However, packaged vermiculite, sand, and similar materials are normally sterile.

2. Soil moisture must be that required for good seed germination, but not too wet. The soil can be tested for proper soil moisture by gently squeezing a handful of soil. When the hand is opened, the soil ball should break apart somewhat. If it doesn’t, and if gently pushing down on the top of the ball with the forefinger doesn’t break it apart, then the soil is too wet.

3. Soil temperature at the four-inch depth should be at least 60-65 degrees F. if formaldehyde treatment is to be used. In Washington, these soil temperatures (in flower beds, garden areas, etc.) will probably not be reached until late summer or early fall. In addition, all formaldehyde odor must be gone from treated soil before seeding or planting in it, since the fumes are toxic.

4. Any disease organisms which become reestablished in the soil shortly after sanitizing may cause worse problems than if the soil had not been treated. For this reason, all cultivating tools, pots, flats, and similar items which will come in contact with the treated soil must also be sanitized. This can be done by placing them under the cover in the formaldehyde fumes, dipping them in a 1:20 formaldehyde solution, washing thoroughly with soap and water, or soaking them for 30 minutes in 180 degree water, depending on the item. In addition, plants from contaminated soil, or contaminated soil itself, must not be placed in sanitized soil. Disease-free plant material should
be used in the treated soil. Be consistent and thorough in eliminating all possible sources of contamination when handling treated soil.

5. With heavier soils, especially those containing manure, compost, or leaf mold, a toxic effect from heat sanitation may occur which can cause stunting and other plant abnormalities, poor seed germination, or plant death. Such toxicity is due to accumulation of ammonium, soluble organic components, minerals, salts, and other factors. If such toxicity is a problem, heavy irrigation of the treated soil is helpful. Storing the soil after heat treatment for several weeks before using may also reduce the toxicity. Both of these methods of reducing toxicity of heat-treated soil greatly increases chances of recontamination of the treated soil.

Heat Treatment

Oven Sanitation. Place the soil in containers so that the soil is level, and the depth does not exceed four inches. Suitable containers would be seed flats, clay pots, and glass or metal baking pans. Cover each container tightly with aluminum foil. Place a meat or candy thermometer through the foil and into the center of the soil. Set the oven to 180-200 degrees F., and heat for 30 minutes after the soil temperature reaches 180 degrees. Burying a small potato about 1 1/2 inches in diameter in the center of the soil before placing in the oven also provides a good way to judge when the soil has been heated sufficiently. The soil may be removed from the oven when the potato is thoroughly cooked. Do not allow the temperature to go above 200 degrees since this may damage the soil. After the treatment, allow the soil to cool.

Pressure Cooker Sanitation. Pour several cups of water into the cooker. Place the soil in shallow containers to a depth of no more than four inches. Level the soil, but don't compact it. Stack the containers on the rack in the cooker, being sure to allow enough separation between containers for proper steam circulation. Close the lid, but leave the steam valve open somewhat until all the air is forced out and steam begins to escape. Cook at 10 pounds pressure for 15 minutes. Turn the heat off, and remove the containers when cool.

Steam Sanitation Without Pressure. A pressure cooker, large kettle, or similar container may be used. Pour about an inch of water into the kettle, and place the soil containers (filled as above) on a rack which will hold them out of the water. Close the lid and bring the water to a boil. Leave the valve or lid open just enough to keep the pressure from building up. When steam begins to escape, continue boiling for 30 minutes. Keep the lid on and remove the soil containers when cool.

Formaldehyde Treatment

Formaldehyde soil drenches are most commonly used when small areas of ground, such as a garden or flower bed, need to be sanitized because of plant problems due to soil-inhabiting organisms. Treatments may also be used on small amounts of soil on a bench or floor or on soil in a seed flat or similar container. Formaldehyde (sometimes called formalin) can be obtained from most drugstores as a 37 to 40 percent solution. CAUTION: Do not treat soil in which plants are growing, or use in
enclosed areas which contain plants or animals. The fumes are toxic! Wash off if splashed on the skin. Follow all label directions and precautions. There are some indications that the seed of stock or other cabbage family seeds may be injured if planted in treated soil. Formaldehyde is ineffective against nematodes.

To treat a bushel of soil (32 quarts or 8 gallons or 1.25 cu. ft.), place three tablespoonfuls of formaldehyde in one cup of water, sprinkle evenly on the soil, and mix thoroughly. The treated soil may then be placed in flats, pots, or other containers, or left in a pile. Cover tightly for at least 48 hours with plastic, canvas, wet burlap, or similar material to hold in the formaldehyde fumes. Then remove the cover and allow all the fumes to escape before planting or seeding. Fuming action and subsequent aeration will proceed faster under warm conditions and slower under cool conditions. Working the soil occasionally will help it air out. It may take two weeks or more for proper aeration.

To treat soil in place, such as in a seed flat, cold frame, unplanted flower bed, or garden area, mix one cup of formaldehyde in three gallons of water. Apply one gallon of this mixture in a sprinkling can to each square foot of spaded, clod-free soil. Cover the soil with plastic, canvas, etc., for 48 hours, then remove the cover and allow the fumes to escape. Bury the edges of the covering to prevent escape of the fumes. Allow all the fumes to escape before planting or seeding. This will take a week or two or more, depending on soil and air temperatures, soil moisture, and other factors. Cold, wet soils will take longer to air out, perhaps a month or more. If the soil is very cold, few if any fumes will be released, and danger to seedlings will be high and prolonged. Cultivating the soil will help air it out, unless temperatures are too low.


Prepared by Roy M. Davidson, Jr., research technologist, and Arlen D. Davison, former Extension plant pathologist, Western Washington Research and Extension Center, Puyallup; Washington State University, Pullman.

To simplify the presentation of information, it is sometimes necessary to use trade names. No endorsement of products is intended nor is criticism of unnamed products implied.