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Soil Sterilization Methods For the Home Gardener

Disease-free soil is particularly desirable for house plants and for starting transplants. Sterilized potting mixes can be purchased at garden supply centers, but 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. Disease-causing organisms such as fungi, bacteria and nematodes, as well as insects, may build up in garden soil and prevent satisfactory growth of many different kinds of plants. When plant growth becomes severely affected and soil organisms are responsible, then sterilization of flower beds or garden areas may be necessary.

Soil Preparation

Soil to be treated must be easily crumbled and without clods or large pieces of plant debris. Any amendments such as manure, compost, peat moss, etc. should be added to the soil before treatment. Packaged vermiculite and sand are usually free of disease-causing organisms.

The soil should be moist, but not too wet — about what is required for good seed germination. Test for proper soil moisture by gently squeezing a handful of soil. When you open your hand, the soil should break apart somewhat. If it doesn't, and if you can't break it apart by gently pushing down on the ball with your forefinger, then the soil is too wet. If the ball readily falls apart when you open your hand, the soil is too dry.

If the soil to be treated is outdoors and if formaldehyde treatment is to be used, the soil temperature at the 4-inch depth should be 60 to 65° F. In many areas in Idaho, these soil temperatures are not reached until after normal spring planting time. Since all formaldehyde odor must be gone from the treated soil before seeding or transplanting in it, fall treatment usually is best.

Soil Treatments

Heat Treatment

Oven Sterilization - Place soil not more than 4 inches deep in nonplastic containers such as seed flats, clay pots and glass or metal baking pans. Level the soil but do not pack it. Tightly cover each container with aluminum foil. Insert a meat or candy thermometer through the foil into the center of the soil. Set the oven between 180 and 200° F, and heat for 30 minutes after the soil temperature reaches 180°. Do not allow the temperature to go above 200° since this may cause products toxic to plants to develop in the soil. After the treatment, allow the soil to cool, remove the containers and leave the aluminum foil in place until ready for use.

Pressure Cooker Sterilization - Pour several cups of water into the cooker. Place the soil in shallow containers to a depth of no more than 4 inches. Level the soil, but do not compact it. Cover each container with aluminum foil. Stack the containers on the rack in the cooker. Separate the containers to allow steam circulation. Close the lid, but leave the steam valve open somewhat until all the air is forced out and steam begins to escape. Then close the steam valve and heat at 10 pounds pressure for 15 minutes. Turn off heat, allow the containers to cool and remove them. Again leave the aluminum foil in place until you are ready to use the soil.

Steam Sterilization Without Pressure - Pour about an inch of water into the sterilizing container. Follow the soil preparation procedures as above. Place filled soil containers on a rack which will hold them out of the water. Close the lid and bring the water to a boil. Open the lid just enough to prevent the pressure from building up. When the steam begins to escape, continue boiling for 30 minutes. Then turn off the heat, replace the lid and remove the soil containers when cool.

Avoid Toxicity from Heated Soil

With heavier soils, and soils containing lots of organic matter such as manure, compost, leafmold or peat moss, a toxic effect from heat sanitation may occur which can cause poor seed germination, plant growth abnormalities or plant death. The toxicity is caused by an accumulation of ammonium, soluble organic compounds, minerals or salts. Soil toxicity is most likely to occur when the soil is heated for too long a period, at too high a temperature or both.

A heavy irrigation of the soil will leach out many of the toxic substances. Storing the soil 2 to 3 weeks without the aluminum cover will also reduce soil toxicity.

Formaldehyde Treatment

Formaldehyde (formalin) soil drenches commonly are used when small areas of ground such as garden or flower beds need to be treated because of disease-causing organisms. Treatments may also be used on a bench or floor or in a seed flat or similar container. The material can be obtained from most drug stores as a 37 to 40 percent solution.

To treat a bushel of soil (32 quarts or 8 gallons or 1.25 cu. ft.), add 3 tablespoons of formaldehyde to 1 cup of water. Sprinkle evenly on the soil and mix thoroughly. Wear rubber gloves to protect your hands. After mixing, you may place the treated soil in flats, pots or other containers or leave it in a pile. Cover it tightly for at least 48 hours with a plastic tarp, canvas or wet burlap to prevent the formaldehyde fumes from escaping. After 48 hours, remove the cover and allow all the fumes to escape before seeding or transplanting. Fuming action and subsequent aeration will proceed faster under warm conditions. Working the soil daily will speed dissipation of the fumes, but it usually takes 2 to 3 weeks before you can plant or transplant.

To treat soil in place, such as an unplanted garden area or flower bed, mix 1 cup of formaldehyde in 3 gallons of water. With a sprinkling can, apply 1 gallon of the mixture to each square foot of spaded or rototilled, moist, clod-free soil. Cover the soil with a plastic tarp, canvas or wet burlap. Bury the edges of the covering to prevent the fumes from escaping. Remove the cover after 48 hours.

Allow all the fumes to escape before seeding or transplanting. Working the soil with a shovel or rototilling will assist in dissipation of the fumes. Aeration will take 2 to 3 weeks if the soil is 60 to 65° F and perhaps up to a month if the soil is cooler.

If treatment has been made in the spring, you can determine when it is safe to seed or transplant by planting a few pea seeds about 1½ to 2 inches deep in the treated soil. Pea seeds germinate readily at 60 to 65° F. After about a week, dig up the seeds to see if the germinated plants show any signs of toxicity. If so, repeat the process.

Prevent Recontamination of Treated Soil

Be careful to prevent recontamination of the treated soil by plant disease-causing organisms. During the soil treating process (heat or chemical) not only are the harmful pests destroyed or reduced in numbers, but also those organisms that are natural enemies or predators of the undesired organisms. Thus, recontamination of soil with plant disease-causing organisms enables them to reproduce rapidly and reach exceedingly high populations because of the lack of natural enemies.

For this reason, you should also sanitize all cultivating tools, pots, flats and any other items which will come in contact with the treated soil. Place them under the cover in the formaldehyde fumes, or soak them for 30 minutes in 180° water (depending on the item) or dip them in a 1:20 formaldehyde solution.

Caution - Formaldehyde fumes are toxic. Follow all labels and instructions. Do not treat soil in which plants are growing, or use in enclosed areas which contain plants or animals. Wash off with soap and water if you splash any on your skin. If you spill on your clothes, remove the clothing and bathe immediately.

Plants from contaminated soil, or contaminated soil itself, should not be placed in treated soil. Only disease-free plant material should be used in the treated soil.

Many plant disease-causing fungi can be carried on the seeds of planting material. Planting only treated seed will help prevent recontamination of the treated soil. Much seed on the market is already chemically treated and is stamped "treated." If untreated seed is purchased, the home gardener can treat his own seed with such chemicals as Thiram (Arasan, Tersan), Chloronil (Spergon) or Captan, according to the manufacturer's recommendations.

Large seeds such as peas, beans, corn, etc., can be treated by placing the seed in a jar, spreading the required amount of chemical over the seed, and shaking or rotating the jar until each seed has been thoroughly coated with the chemical. Screen off the excess chemical.

To treat small paper packets of seed, tear off one corner of the packet. Put about twice as much chemical material in the packet as can be picked up on the first half inch of the flat end of a toothpick. Shake the packet until the seed is thinly coated with the chemical.

PESTICIDE RESIDUES: These recommendations are based on the best information currently available for each chemical listed. If followed carefully, residues should not exceed the tolerance established for any particular chemical. To avoid excessive residues, follow recommendations carefully with respect to dosage levels, number of applications and minimum interval between application and harvest.

Remember: Read the label directions thoroughly before preparing and applying pesticides. Many of the commercially prepared mixtures contain insecticides as well as fungicides.

THE GROWER IS RESPONSIBLE FOR RESIDUES ON HIS CROPS AS WELL AS FOR PROBLEMS CAUSED BY DRIFT FROM HIS PROPERTY TO OTHER PROPERTIES OR CROPS.

The toxicity of pesticides listed here is relatively low. Trade names are used only to identify the chemicals as they are known in the marketplace. No endorsement by the University is intended, nor is discrimination implied against products not listed.

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