



# **Soil Treatment Procedures for the Home Gardener**

EB1158

Occasionally the home gardener may wish to treat small quantities of soil or small areas of ground in order to kill or reduce numbers 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 treat their own soil.

Some disease micro-organisms (bacteria and fungi), as well as nematodes, insects, and other pests, may be present in garden soil and increase enough to prevent satisfactory growth of many different kinds of plants. When plant growth becomes severely affected and soil organisms are responsible, then treatment of flower beds or garden areas may be necessary.

In general, soil treatments should be directed toward pasteurization (selective elimination of disease organisms), rather than sterilization (complete elimination). When the soil is sterilized, no organisms remain. This creates what is known as a biological vacuum. If a disease-causing fungus, for example, is accidentally reintroduced into the treated soil, it has no organisms competing with it and can multiply and spread rapidly, causing a severe disease situation. In contrast, treatments can be used that will eliminate the undesirable organisms but leave many of the harmless or beneficial soil organisms. This remaining microbial population will compete with any introduced troublemaker and help prevent it from becoming established and spreading rapidly in the treated soil.

## **Important Preliminary Information**

### **Texture.**

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 the soil must be added before treatment. However, packaged vermiculite, sand, and similar materials are normally pest-free.

### **Moisture.**

Soil must be moist enough for good seed germination but not too wet. The soil can be tested for proper moisture

level 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, then the soil is too wet.

### **Temperature.**

Soil temperature at the 3-inch depth should be at least 60-65°F if fumigants are used. In Washington, these soil temperatures (in flower beds, garden areas, etc.) may not be reached until late spring or early summer. In addition, all fumigants must be gone from treated soil before seeding or planting in it, since the fumes are toxic.

### **Pasteurize.**

Any disease organisms which become re-established in the soil shortly after treatment may cause worse problems than if the soil had not been treated. For this reason, treatments should pasteurize, not sterilize, the soil. Also for this reason, all cultivating tools, pots, flats, and similar items which will come in contact with the treated soil must also be treated. This can be done by washing them thoroughly with soap and water or soaking them for 30 minutes in 180°F water, depending on the item. In addition, plants from contaminated soil, or contaminated soil itself, must not be placed in treated 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.

### **Germinate.**

The soil should be moistened several days before treatment. This allows spores and weed seeds to begin germinating before treatment, thus making them easier to kill.

## **Heat Treatment**

Temperature control is all important when heat treating soils. Overheating or underheating can lead to disappointing results. Most disease-causing fungi are killed by a 30-minute treatment at 140°F. Plant parasitic bacteria, most plant viruses, and soil insects are killed at 160°F for 30 minutes, and most weed seeds between 160° and 180°F for 30 minutes. Remember, however, the higher the treatment temperature, the greater the number of beneficial organisms that will be killed.

In addition, chemicals toxic to plant growth can be produced in soils when temperatures reach around 212°F (boiling point of water and temperature of steam). This more commonly occurs with soils having high organic

matter content. Thus, do not overheat the soil during treatment. A maximum treatment of 160°F for 30 minutes is suggested. Many commercial growers using aerated steam treat their soil at 140°F for 30 minutes.

### **Oven.**

Place the soil in containers so that the soil is level, not more than 4 inches deep. Suitable containers are 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 160-180°F and heat for 30 minutes after the soil temperature reaches 160°F. After the treatment, allow the soil to cool.

### **Steam.**

A pressure cooker, large kettle, or similar container may be used. Place the soil (not more than 4 inches deep) in a shallow container or containers. Level the soil but don't compact it. Pour about an inch of water into the kettle and place the container of soil on a rack which will hold it out of the water. Cover the top of the kettle with aluminum foil. A complete seal is not necessary. Place a meat or candy thermometer through the foil and into the center of the soil. Bring the water to a boil. When the temperature has reached about 155°F, turn off or remove the kettle from the heat source. The temperature will continue to rise. Begin timing when the temperature reaches 160°F. If the temperature falls below 160°F during the 30-minute treatment, again apply heat to the kettle. Allowing steam to escape by partially opening the foil cover will reduce the temperature if it becomes too warm. After treatment, remove the containers and allow them to cool.

## **Fumigation**

Soil fumigation is most commonly used when small areas of ground, such as a garden or flower bed, need to be treated because of plant problems due to soil-inhabiting organisms or weeds. It is unlikely a problem will be totally eradicated by fumigation. However, populations of the target organism should be reduced to a level allowing reasonably good plant growth for several years.

Vapam is a soil fumigant available to home gardeners. When used properly, Vapam will control soil fungi, soil insects, weed seeds, and nematodes. This fumigant is applied into the soil as a liquid solution. It volatilizes to a gas and moves through the pore spaces in the soil. Thus, for good results, it is necessary to have the soil in excellent condition: not too wet, dry, cold, or hot, and no big clods or big pieces of organic matter. The soil

temperature at the 3- inch depth should be at least 60°F and no warmer than 90°F. In Washington, the soils usually do not warm sufficiently in the spring to allow fumigation prior to spring planting time. Thus, fumigation is commonly done in early fall.

It is essential that the fumigant (gas) remain in the soil for a period of time (2-7 days) at a lethal concentration to achieve an adequate kill. Thus, for best results, the treated area should be covered immediately after treatment with a plastic tarp (be sure to seal the edges down with soil). Sealing the soil surface by sprinkling on water is also possible but will, in most cases, be less effective than the plastic tarp.

Be sure to read and follow label directions regarding rates of application, precautions with planting following fumigation, and safe handling precautions. Do not treat soils in which desired plants are growing. Do not use in enclosed areas which contain plants or animals. Refer to EB1062, *Weed Control in Home Gardens*, for further information on Vapam use.



By Ralph Byther, Extension Plant Pathologist, and Roy M. Davidson, Jr., Agricultural Research Technologist, WSU Western Washington Research and Extension Center, Puyallup.

Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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