Management of vegetable diseases in home gardens

W. M. Colt, S. K. Mohan, and S. L. Hafez

Plant disease management starts long before you plant vegetable seeds or seedlings. It requires an understanding of the nature of the disease and implementation of a prevention and control program.

To reduce losses from plant diseases in your garden, take the following precautions and steps.

1 Dispose of plant residue at the end of each season.

You may incorporate plant residue into the soil early in the fall so it decomposes, remove it from the garden and put it in a compost pile, or destroy it.

Before returning plant residue to your garden, be sure it has decomposed completely. Many plant disease-causing organisms survive in dead, nondecomposed plant material, and some can survive even if the plant material has decomposed completely. Therefore, do not include diseased plant material in the compost pile.

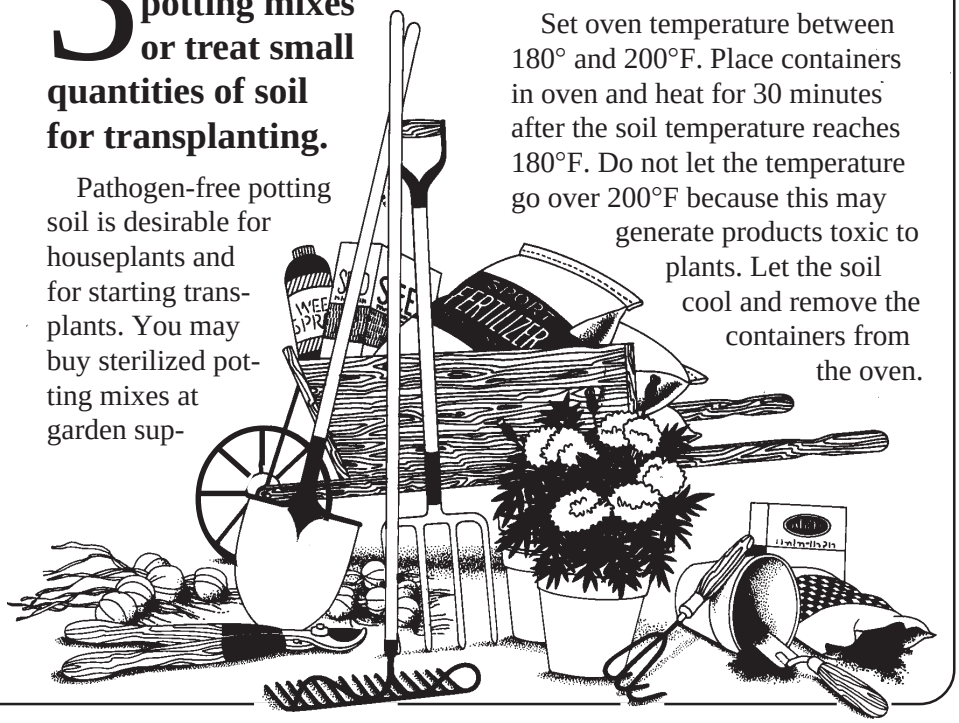
2 Adopt a long-range crop rotation program.

Growing the same or closely related plants in the same area of the garden each year will increase populations of disease-causing organisms specific to those plants.

For example, do not follow beans with peas or potatoes with eggplant because the fungi in the soil that causes damping-off, root rot, or wilt will increase in population and may severely damage the following crop. Generally, disease-causing organisms that attack monocot plants such as sweet corn do not attack broad-leaved plants such as tomato and vice versa.

3 Use sterilized potting mixes or treat small quantities of soil for transplanting.

Pathogen-free potting soil is desirable for houseplants and for starting transplants. You may buy sterilized potting mixes at garden supply centers. Occasionally, the home gardener may want to sanitize small quantities of soil. If you do, then use one of the following methods.



Dry heat

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 oven temperature between 180° and 200°F. Place containers in oven and heat for 30 minutes after the soil temperature reaches 180°F. Do not let the temperature go over 200°F because this may generate products toxic to plants. Let the soil cool and remove the containers from the oven.

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Leave the aluminum foil in place until ready for use.

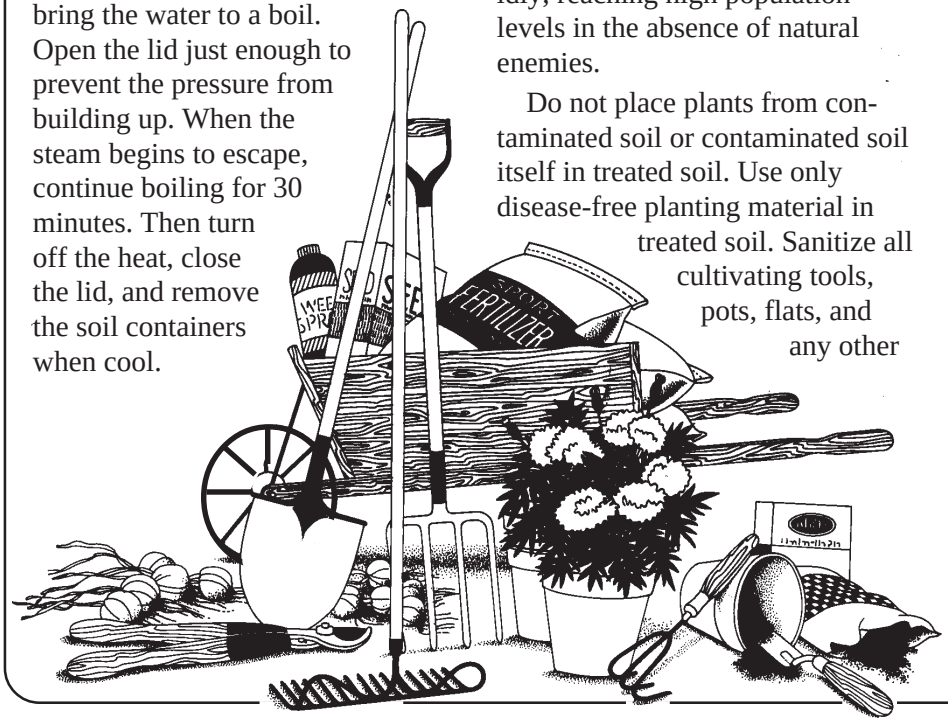
Moist heat

Pressure cooker sterilization — Pour several cups of water into a pressure cooker. In shallow containers, place soil no more than 4 inches deep. 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. Leave the aluminum foil on 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 above.

Place filled soil containers on a rack that will keep 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, close the lid, and remove the soil containers when cool.



Precautions

Avoid toxicity from heated soil — In heavier soils and soils containing high levels of organic matter such as manure, compost, leafmold, or peat moss, heat sanitation may produce a toxic effect that may cause poor seed germination, plant growth abnormalities, or plant death.

An accumulation of ammonium, soluble organic compounds, minerals, or salts causes the toxicity. Soil toxicity is most likely to occur if you heat the soil too long or at too high a temperature.

A heavy irrigation will leach out many of the toxic substances from such soil. Also, storing the soil 2 to 3 weeks without the aluminum cover will reduce the toxicity.

Prevent recontamination of treated soil — Heat treatment of soil reduces or destroys not only the harmful pests, but also the beneficial organisms that are natural enemies or predators of the disease-causing organisms. If heat-treated soil is recontaminated with plant disease-causing organisms, they will grow and reproduce rapidly, reaching high population levels in the absence of natural enemies.

Do not place plants from contaminated soil or contaminated soil itself in treated soil. Use only disease-free planting material in treated soil. Sanitize all cultivating tools, pots, flats, and any other items that will come in contact with the treated soil with a 1:10 dilution of household bleach.

4 Treat garden site soil if necessary before planting.

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 plants. In this case, some form of physical or chemical soil treatment may be necessary before planting.

Soil solarization

Solar heating the soil is one way to control soilborne pathogens, insects, nematodes, and weeds. Just mulch thoroughly cultivated and moistened soil with a transparent polyethylene sheet during the hot season. The soil temperature increases primarily because of the elimination of evaporation and partially because the polyethylene film creates a greenhouse effect.

The soil solarization process generates moist heat causing complex changes in soil that are effective in controlling many plant pathogens and pests while stimulating activity of soil microorganisms beneficial to plant growth. Soil solarization, however, is not effective against all disease-causing organisms and is practicable only in warmer climates.

Soil fumigation

When certain chemicals are introduced into the soil, they are converted into toxic gases killing weeds, insects, and disease-causing organisms. Currently, there are no products available for use by the home gardener. Only someone with a commercial pesticide applicator's license may apply registered fumigants.

5 Prepare seedbed and select disease-resistant varieties.

Prepare the soil

Good seedbed preparation is important and cannot be over emphasized. Seeds placed in moist, finely granulated, firm soil germinate readily. Small seeds placed in cloddy soil often germinate poorly or die soon after germination because the soil dries before the roots become established.

Plant resistant varieties

Obtain seed or seedlings of disease-resistant varieties. Many vegetable and flower varieties are resistant to one or more specific diseases such as wilts, rusts, mildews, leaf spots, viruses, or nematodes. Check the seed packet or with the nursery for the variety's disease reaction.

Plant disease-free seed or transplants

Obtain disease-free seed or transplants from nurseries or seedsmen with a reputation for producing high quality transplants or seeds. Many plant disease-causing organisms are capable of living on or in the seed.

Unless the seed is disease-free, it is not wise to save seed from your own garden. Also, do not save seed from F1 hybrids such as tomatoes. If you save and plant seed from F1 hybrids, the resulting plants will be "interesting" to observe and may look a little odd, but they will not yield vegetables of the same quality as the parent plants.

Also, be sure to plant only certified potato seed tubers. Potatoes from the grocery store are edible, but they often are infected with disease-causing organisms that substantially reduce the yield and quality of tubers produced from such planting stock.

To be labeled "certified," potato seed tubers must meet strict standards of freedom from these pathogens. Also, "noncertified" potato seed may introduce plant disease-causing fungi, bacteria, viruses, or nematodes into your garden site.

Treat the seed

Most soils and some seeds contain plant disease-causing organisms capable of causing seeds to decay (seed rot) or young seedlings to die (damping off). These diseases are more severe if garden crops are planted early in the season when the soil is cold and wet. Planting treated seed often will ensure good stands and avoid the time and expense of replanting.

Most of the seed on the market is treated and stamped "treated." If you buy untreated seed, you may treat it with recommended seed treatment chemicals. Place the seed in a jar, spread the required amount of chemical over the seed, and shake or rotate the jar to coat each seed with the chemical. When using any seed treatment chemical, read and follow the label directions carefully.

6 Follow good cultural practices.

Cultural practices influence the incidence and severity of plant diseases. Any practice that causes stress to plants predisposes those plants to diseases. The higher the number and frequency of stress factors, the more severe the diseases.

In the home garden the most common stress factors are irrigation, fertilization, and cultivation.

Irrigation

Vegetables usually are shallow-rooted plants. Soil that is too dry may limit plant growth seriously.

Any irrigation method is satisfactory if you apply water properly. Avoid rapid application rates that may cause water run-off. Light and frequent water applications are best when starting seedlings. As the plants grow, apply just enough moisture at each irrigation to wet the root zone of the plant.

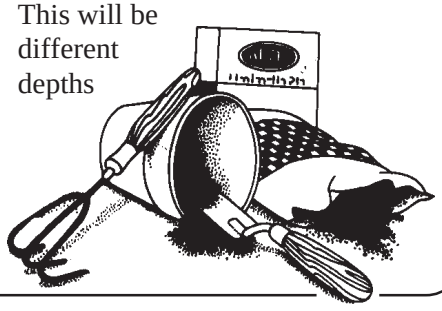
Plants with shallow root systems become stressed easily during hot weather. Shallow roots develop from excessively wet conditions and from frequent light irrigations that do not completely wet the entire rooting depth.

Generally, irrigate light sandy soils one or more times per week and heavy soils every 10 days to 2 weeks depending upon the weather. Plants will transpire two to three times more moisture on hot, windy days than on cool, cloudy, windless days.

Keep the soil moisture supply as constant as possible throughout the growing season. Roots do not seek out water. Instead, roots will grow only when water is readily available. Plants wilting from lack of water already have been under water stress for 2 or more days.

One way to tell if it is time to irrigate is to dig into the root zone. If the soil holds firmly together when gently pressed in your hand, it is moist enough. If the soil crumbles easily, it is too dry.

Remember, dig to the root zone. This will be different depths



for different plants. This is why it is wise to grow all shallow-rooted plants in one part of the garden and those that develop deep root systems in another part. A mulch of compost or grass clippings helps retain moisture and hold down soil temperature. A black plastic mulch also will help retain moisture, but will increase the soil temperature.

Fertilization

Different plants require varying amounts of nutrition for maximum production and quality. Nutrient excess as well as deficiency will put plants in stress. To determine the type and amount of fertilizer needed, send a soil sample to any soil testing laboratory.

Cultivation

Cultivation should be shallow and frequent. Keep the soil from becoming packed and soggy. Cultivation after rains or sprinkling controls weeds and keeps the soil surface from crusting.

Your goal should be a weedless garden. Weeds take away valuable plant nutrients, reduce the moisture supply, are unsightly, and may harbor many plant disease-causing organisms and insect pests. Also, weed control is important because weeds slow air movement around the desirable plants and favor disease development.

Other cultural techniques

Keep plant foliage as dry as possible for as long as possible. Bacteria and fungi (except for powdery mildews) require free moisture on the foliage for 3 to 12 hours for infection to occur.

Increase row spacing, orient the rows parallel to prevailing winds, and irrigate or sprinkle only when temperatures are rising (usually in the morning) to minimize the time foliage remains wet. Avoid working among the plants when the leaves are wet because this facilitates disease spread from plant to plant. Also, wider spacing of plants in the rows may help reduce or prevent disease spread.

Support plants to prevent fruits from coming in contact with the soil. Wire cages, plastic, or organic mulches will reduce many fruit rots. Avoid injury to fruits. Cuts, bruises, cracks, and insect damage are often sites for invasion by disease-causing organisms.

Store only those vegetables that are free from injury or disease. Place them in a dry area or under refrigeration to prevent the development of rots or molds caused by fungi or bacteria.

7 Use pesticides to control some diseases.

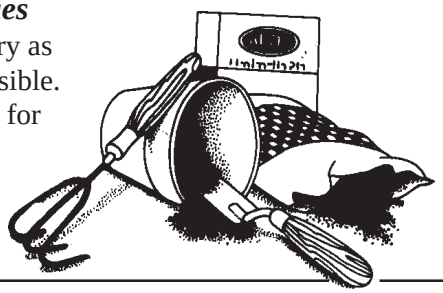
You can manage many plant diseases with appropriate cultural practices and without pesticides. Under some conditions, however, you may need to apply pesticides to control certain diseases.

Pesticides are naturally occurring or synthetic products used to control such pests as weeds, insects, nematodes, and disease-causing organisms. Most pesticides for home garden use are called protectants and prevent infection of the plant. Apply them promptly and before disease buildup. For good control, you should reapply pesticides every 7 to 14 days.

Dusts, liquids, or wettable powders are available, but be careful in selecting the proper formulation. When you apply chemicals, be sure to adequately cover all plant parts.

Use only pesticides registered for the crop and the disease that they are intended to be used. Recommendations for control of diseases in the home vegetable garden are in the publication, *Pacific Northwest Plant Disease Control Handbook*. Revised annually, the handbook contains available labelled products, proper rates and intervals between applications, and the necessary waiting period after application and before harvest can begin. To buy a copy, contact the Ag Communications Center at Oregon State University by calling (503) 737-2573.

Always read the pesticide label and follow the directions. Handle pesticides safely, and store and dispose of containers properly.



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