

Gardennote

Soil-borne Diseases in the Home Garden

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Introduction

Every garden has a range of more or less permanent soil-borne disease organisms. They are usually contained in a balanced environment where different organisms, soil conditions, and hosts interact in a complex system. Garden plants only show aboveground symptoms of disease when this balance is disrupted, and infection by a pathogen organism becomes dominant. Damping-off disease, for example, can occur under moist conditions when plants are overcrowded — the ideal conditions for this disease.

Other diseases, not naturally present, can be very destructive when they are introduced, so take care not to introduce new diseases via planting material, movement, garden tools, or other means.

As radical chemical fumigation of the soil that will destroy disease-causing (as well as useful) organisms is impractical for home gardeners, alternative control measures are needed. These should be aimed at:

- improving conditions for the plant;
- creating a hostile environment for the disease; and
- stimulating the growth of the normal, beneficial soil organisms.

Types of soil-borne diseases

Soil-borne diseases in the garden include pre- and post-emergence damping-off (commonly *Fusarium*, *Pythium* and *Rhizoctonia* species), root rot (for example *Phytophthora*), vascular wilts (for example *Verticillium* and *Fusarium*— all fungi), and nematode diseases.

Pre-emergence damping-off. Young seedlings decay in the soil before they appear above the soil surface. This can happen when conditions for seed germination are poor, for example in cold, hot or very wet soil, poorly-drained soil, compacted soil or in the presence of undecayed organic matter.



Figure 1: *Rhizoctonia* damage on legume seedlings

Post-emergence damping-off. Stems and roots of tender seedlings are attacked at the soil line and the seedlings fall over. High salt concentrations in the soil also cause damping-off.

Root rot. Root rot affects plants beyond the seedling stage, which are debilitated or killed. The fungi invade internal root tissue, interfering with the supply of water and nutrients. Aboveground symptoms include loss of vigour, yellowing of leaves, leaf drop, wilting that starts at the growing tip, twig dieback, and sudden death of the plant when environmental stress is high.

Vascular wilts. Vascular wilts are characterised by wilting of the plant and discolouration of the vascular system at stems or trunks and branches. Vascular wilts are restricted to certain hosts.



Figure 2: *Verticillium* wilt on tomatoes

Important disclaimer

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Nematode diseases. Nematodes are microscopic, unsegmented worms that invade the plants' roots, causing different root disease symptoms. The most common nematodes in the home garden are root knot nematodes. They cause the roots to form gall-like lesions that restrict water and nutrient uptake. Aboveground symptoms are similar to those of root rot.

Practice hygiene

- Plant material (cuttings, transplants, and seeds) should come from a reliable source.
- Second-hand tools or machinery should be sterilised before being used in your garden. This also includes last season's tomato sticks, trellises, and other support material. Potting containers need to be sterilised before plants are seeded.
- Use sodium hypochlorite at 1.2 per cent of available chlorine to disinfect materials.
- Use pasteurised potting mix.
- Learn the disease history of other gardens before transplanting plants from them.
- Dispose of diseased plant material by burning or composting. Do not use the material for mulching until it is well broken down.

Cultural practices for disease prevention

Prevent temperature and moisture stress

High temperatures and low soil moisture predispose many plants to disease. Flooding the plants can also cause moisture stress.

- Transplant during cool, moist weather when mild conditions are forecast for a period of time.
- Shade and mulch soil, using tree bark, sawdust, flat stones, or black plastic sheeting.
- Protect transplants from drying winds.
- Grow transplants in well-drained soil to prevent water pooling.
- Don't damage roots by digging or fertilising in hot, dry weather.

Don't work undecomposed organic matter into the soil immediately before planting

Opportunistic soil pathogens thrive on rotting organic matter, which also depletes soil nitrogen. It is therefore important to only work well-rotted organic matter into the soil near young, growing roots. Give organic matter two to three months to break down before planting a new crop. This is especially important in soil with a history of fungal diseases.

Transplant seedlings when they are young and healthy

Seedlings should be transplanted into their permanent positions when they are sufficiently

hardened but still young. Plants are generally more susceptible to transplanting injury the older they get. Soil organisms will use these injuries to invade the plant.

Avoid saline soils and do not over fertilise

Another cause of plant injury is salty water. This causes general loss of vigour in the plant and associated stunting, yellowing, wilting, leaf-loss and damping-off due to fungal infection.

Over fertilisation can also cause root injury and subsequent fungal infection.

Avoid anaerobic soil conditions (waterlogging)

Seeds and roots decay in anaerobic conditions, which are caused by poorly aerated soils with insufficient drainage. These conditions encourage attacks by fungi such as *Pythium* and *Phytophthora* spp. In those conditions, avoid over watering; in clay soils try to improve drainage with Gypsum (at 1 t/ha) or choose plants that tolerate having wet feet. Use potting mix for seedlings. Potting mix should be aerated with sand, peat, polystyrene beads, and pine bark.

Soil disinfection

If there is a history of fungal diseases in some garden beds, it may be necessary to sterilise them. Consult your local nursery or chemical supplier for suitable, registered chemicals and follow the label instructions. If you do not want to use chemicals, solarisation may be an alternative option. This treatment should be done during the warm season. Moisten the soil and work to a fine tilth to a depth of at least 25 cm. Then cover the soil with a thin, transparent polyethylene sheet, with the edges buried to a depth of 25 cm or more. Leave the sheeting in position for at least four weeks. It is important that the soil is moist and the polyethylene sheet is sealed in place so that no air can blow under it. Solar heating is less effective at the edge of the sheeting, so areas to be treated should not be long and narrow. Under this treatment most pathogens are killed, while normal soil microorganisms survive in sufficient numbers to prevent recolonisation by the disease pathogens. Solarisation also kills weed seeds and insect pests.

Crop rotation

Crop rotation is recommended where annual plants are used. Many soil pathogens are host-specific so planting crops from different plant families can break the disease cycle. If diseases occur, make sure you do not plant the same crop for two to five years in the same position.