Bedding Plant Diseases

Bedding plant production has become a specialized, energy-efficient, and highly-profitable business. The short period of time between seeding and selling the crop leaves no room for mistakes. Plant diseases cannot be allowed to reduce the quantity of plants for sale or to reduce plant quality by stunting plants or spotting the flowers and foliage.

Prevention of diseases of young plants ensures the high quality of the salable item, but also makes it likely that the plant will perform well in the customer's garden. Bedding plant damage is often due to one or more of four major causes: damping-off, gray mold (*Botrytis*), phytotoxicity from pesticides used on seedlings, and over-fertilization. This fact sheet presents methods for avoiding plant losses due to each of these factors.

Damping-Off

The most important disease of bedding plants is called damping-off. Damping-off is caused by fungi that rot the seeds during germination or kill the seedlings after emergence. The three fungi involved (*Pythium, Rhizoctonia*, and *Fusarium*) live in the soil. They are common throughout the world and cannot be eliminated from the greenhouse environment. For that reason, the flats or pots, potting mix, the tools used to move the mix, and the surfaces where the mix is handled must be clean and free of soil harboring *Pythium, Rhizoctonia*, and *Fusarium*. Damping-off is favored by excessive soil moisture, dense seeding, cool soil temperatures (cooler than 68°F) before seed germination, and warm soil temperatures (warmer than 77°F) after seedling emergence. Moderate soil temperatures and moderate soil moisture levels stimulate rapid seed germination and seedling development, thereby reducing susceptibility to damping-off.

Damping-off rarely destroys all plants in a flat. Usually round patches of plants are affected in flats broadcast seeded; in flats seeded in rows, parts of the row are destroyed. When damping-off occurs, growers may be tempted to drench the flat with fungicide. Fungicides are not totally effective in eliminating fungi from the soil and will not cure a root rot once it has begun. Live fungus remains in the flat and may cause root rot in the remaining plants once the concentration of fungicide declines. Infected plants never fully recover or perform well in the garden. In certain potting mixes, some fungicides will stunt seedling development. When damping-off develops, it is best to discard all the plants and soil in the flat, sterilize the flat, refill it with pest-free soil (using disinfested tools), and reseed the plants.

If damping-off is a recurrent problem, seeds treated with a fungicide such as captan or thiram should be purchased. These protect seeds during germination and early growth. Established plants are less susceptible to damping-off.

Treatment of planting mixes

The objective of treating a potting mix is to reduce the numbers of disease-causing organisms, insects and weed seeds therein. Commercially available "soilless mixes" generally do not harbor such pests and require no special treatment before use. However, if field soil or sand is used in preparing potting mixes, pasteurization is required because these mixes usually harbor pests.

Timing

Autumn is an excellent time to treat soil. Treatment of soil is most effective when the soil is warm (55°F or warmer) and evenly moist (50 to 85% of field capacity). Disease-causing organisms and other pests are most active under these conditions. Many pests in cold, dry soils are dormant and thus very resistant to heat.

Selecting the method

Dry heat, steam, and aerated steam may be used to pasteurize soil for any crop. Usually most, but not all, organisms are killed. Soil thus treated is said to be pasteurized. The greatest danger with heat treatment is that if extreme heat (hotter than 200°F) or treatment times in excess of one hour are used, organic matter is broken down and salts are released in amounts toxic to seedlings. Effective pasteurization occurs when steam or dry heat is used to raise and maintain the temperature of the entire soil mass to between 180° and 200°F for 30 minutes. Almost all living organisms in the soil are killed by this treatment. If aerated steam is used, the temperature of the entire soil mass is kept between 145° and 160°F for 30 minutes. Aerated steam kills most disease-causing organisms while many beneficial fungi and bacteria survive to work as competitors in case a disease-causing organism is reintroduced.

Prevent recontamination

Tools and equipment used to handle the potting mix and all surfaces that the mix will touch, including potting benches and dibble boards, must be clean so that the soil is not contaminated with disease-causing organisms. Cleaning is the first step, followed by disinfestation by heat or by chemicals.

Steam or Dry Heat

Disinfects non-plastic items. Heat the materials to 180°F and hold for 30 minutes.

Ammonia Disinfestant (Green Shield* or Triathlon*):

Disinfests clean soil-free tools and benches if they are kept wet for 10 minutes.

Alcohol: (70 percent wood, grain, or rubbing)

Swab on tools or use as a dip. Alcohol will not corrode metallic objects, but is highly flammable and should not be used near electric equipment, gas-fired equipment, or in any place where a spark may ignite the fumes. Alcohol burns without visible flame.

Hydrogen Dioxide (ZeroTol*)

Use a 1:50 dilution (2.5 oz. in 1 gal. of water) to dip, spray, or swab objects. Thorougly wet the surface.

Sodium Hypochlorite (Clorox*):

Disinfests clean soil-free tools and benches if they are kept wet for 10 minutes. Metal tools should then be rinsed with clean water to prevent corrosion.

Gray Mold (Botrytis)

The fungus *Botrytis* is found virtually everywhere plants are grown. Dormant *Botrytis* spores can be found on the surface of seeds or on the surface of established plants. *Botrytis* persists in crop debris, fading flower parts, and damaged tissues. Seedlings growing under cool humid conditions are particularly susceptible to gray mold.

Sanitation is important for the control of *Botrytis* in bedding plants. Remove and destroy all crop debris and dying tissue. Do not throw plant residues outside the greenhouse; to do so permits *Botrytis* to continue to develop and produce spores.

Ventilating and heating the greenhouse to reduce the humidity, particularly early in the day, is the most important step in *Botrytis* control.

Fungicides are available for *Botrytis* control on many bedding plants in the greenhouse. Labels of some products list a wide range of bedding plants; frequently not all bedding plants are listed. It is illegal to apply a chemical to a plant if the name of the plant is not on the chemical label. **Always read the instructions on the label.**

Phytotoxicity

Phytotoxicity is the term that denotes damage on plants sprayed with a pesticide. Damage is usually avoided by using the concentration recommended on the product label. If a range of concentrations is suggested, use the lower rate when treating seedlings. Evidence of phytotoxicity appears as death of young succulent tissues, stunting, death of margins of the leaves, dead spots on leaves or cotyledons, delayed plant development, or death of the seedlings. Injury symptoms appear within a few days. Damage may appear only on plants in flats at the end of benches or at locations along the bench where excessive overlapping of the spray pattern occurred or where a pesticide dripped from the sprayer nozzle.

Phytotoxicity is influenced by many factors. Dusts and wettable powders are generally less phytotoxic than emulsifiable concentrates. Spray additives, including spreaders, stickers, and wetting agents, can cause toxicity. High-pressure spraying can cause physical damage and increase phytotoxicity. High temperatures during and following application favor chlorinated hydrocarbon and sulfur toxicity. Low temperatures during and following application favor oil, carbamate, and organophosphate toxicity. Certain chemicals become phytotoxic when applied to wet foliage. A prolonged period of wet foliage after application can result in damage. The application of a mixture of two incompatible chemicals or separate applications of two such chemicals within too short a period can result in damage.

Over-Fertilization

Over-fertilization of bedding plants can cause as much damage to crop quality as damping-off or gray mold. Yellowing, wilting, death of leaf tips and margins, slowing of growth and death of the seedlings can occur if soluble salt levels are excessive.

Harmful Concentrations Of Fertilizers Can Develop In Several Ways

- Too much fertilizer added at one time.
- Application of soluble fertilizer several times with little or no leaching during application.
- Improper combination of slow-release and soluble fertilizers.
- Improper steaming of the potting mix.
- Insufficient water for the amount of fertilizer present.

A conductivity meter can be used to measure the total soluble salt level in a water extract of the potting mix. The water extract can be prepared in one of two ways, the 1:5 dilution or the saturated paste. To prepare the 1:5 dilution, air-dry the potting mix and then weigh a small sample. To the sample, add 5 times its weight of water. Stir the mixture intermittently for 30 minutes. Decant the water into a clean container and measure its conductivity.

A saturated paste is prepared by adding just enough water to the soil that the soil glistens, but not so wet it puddles. Stir the sample intermittently for 30 minutes. Extraction can be accomplished by dumping the saturated soil into two layers of paper towels, wrapping the soil and towels with cheesecloth, and then squeezing gently while catching the liquid in a clean container. Measure the conductivity of this liquid. One part of dry soilless mix wetted with 5 parts water is very close to being a saturated paste.

Seedling damage may be expected if conductivity readings exceed those listed below.

Extraction Method	Conductivity Soil Mix	Conductivity Soilless Mix
1 part air-dry mix: 5 parts water (by weight)	0.75 mS	1.0 mS
Saturated paste	4.0 mS	1.0 mS
100 mhos/cm x 10 -5 = 1.0 mhos/cm x 10 -3 = 1.0 mS		

When salts become excessive because of soluble fertilization or excessive steaming, flats can be leached. Applying 6 inches of water with a hose will reduce salts by 50 percent. Twelve inches of water will reduce salts by 80 percent. Measure the conductivity following leaching. If salts are excessive because excess amounts of slow-release fertilizer were used, little can be done. Leaching only releases more salts.

*Trade name

Phytotoxicity on geranium seedling. Damping-off.

Gray mold (Botrytis) on geranium

extension.psu.edu

Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.