

Damping-Off in Vegetables

- » Damping-off can result in substantial stand reductions in vegetable crops.
- » Damping-off is often favored by cool, wet conditions that slow germination and seedling growth.
- » Damping-off may be managed through proper sanitation and the use of pathogen-free seed and potting mix.

Damping-off is an early-season disease affecting many vegetable crops. Damping-off is defined as “the death of a seedling before or shortly after emergence due to decomposition of the root and/or lower stem; it is common to distinguish between preemergence damping-off and postemergence damping-off.”¹ With pre-emergence damping-off, seeds and seedlings are affected during or after germination but before emergence resulting in poor stands. If seedlings emerge and then wilt and collapse, that is called post-emergence damping-off.^{2,3} There is a window of susceptibility to damping-off from pre-germination to the time when the first few true leaves are produced, with seedlings becoming less susceptible as they develop.^{2,4}

PATHOGENS

Damping-off is caused mostly by fungal and water mold (oomycete) pathogens. Common fungal pathogens include species of *Botrytis*, *Fusarium*, *Rhizoctonia*, *Sclerotinia*, and *Thielaviopsis*. The oomycete pathogens include species of *Pythium* and *Phytophthora*.^{2,3,5} Species of *Fusarium* and *Rhizoctonia* often attack seedlings at the soil line and cause post-emergence damping-off. *Pythium* and *Phytophthora* species often attack plant parts below the soil surface.^{4,6} Some of these pathogens, such as *Phytophthora*, also cause roots and crown and fruit rot diseases on older plants.

SYMPTOMS

Symptoms of pre-emergence damping-off include decay of seeds (Figure 1) and rotting of radicles and hypocotyls. Failure of seedlings to emerge is often the first indication of a damping-off problem. When dug up the seed or seedlings can be rotted (soft and mushy) with gray-brown discoloration of the radicle, hypocotyl, and cotyledons. Thread-like, fungal growth (hyphae) may be seen on and around the affected tissue.^{2,4,5,6}

Common symptoms of post-emergence damping-off include root decay and rotting of the lower stem, usually at or below the soil line. Affected tissues can be

water-soaked, mushy, and show a brown-gray or green-gray discoloration (Figure 2A). In some cases, lesions on the roots and lower stems can be dark brown, reddish-brown, or black discrete, dry, and sunken. When severe, lesions can girdle the stems of young seedlings resulting in wilt followed by collapse and death of the seedling (Figure 2B).^{4,5,6}

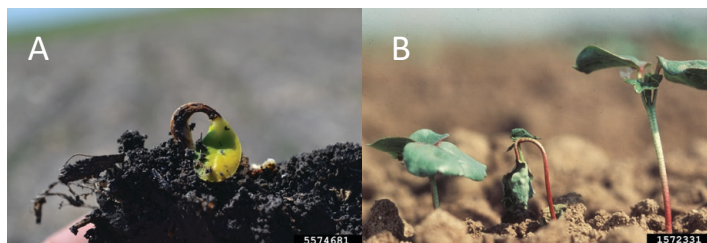


Figure 2. [A] A seedling with a rotted hypocotyl. [B] Belowground damage can result in seedling wilt. Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.

Both pre- and post-emergence damping-off can be limited to just a few plants, or the problem can be extensive, requiring replanting of transplant trays.⁶ Some abiotic factors can result in symptoms similar to those of damping-off, including excessive fertilization, drowning, drought/desiccation, excessive heat or cold, and chemical injury. The patterns of occurrence can help distinguish damping-off from abiotic disorders. Damping-off tends to occur on a random scattering of plants or in patches, while abiotic disorders tend to appear more uniformly or in some regular pattern associated with growing conditions (lighting, bench placement) or cultural practices (water application, worker handling).⁵

CONDITIONS

In transplant production systems, inoculum of damping-off pathogens can be present on infested pots, tools, and greenhouse surfaces. Pathogens can also be introduced in infested potting mixes. Some damping-off pathogens, such as *Fusarium* spp., can be airborne, but this may not be a primary source of inoculum in most operations. Pathogens can also be spread by insects, splashing or flowing water, and on tools and workers' hands and clothing.² Lower temperatures can slow seedling growth and extend the window of susceptibility of seedlings. Overly wet conditions favor the germination and growth of many fungal pathogens. Other conditions that slow seedling growth, such as low light levels and high salt concentrations, can also increase problems with damping-off.²



Figure 1. Seed rot causes pre-emergence damping off. Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org.



MANAGEMENT

One strategy for managing damping-off focuses on lowering pathogen inoculum levels. Damping-off pathogens can survive on used pots, flats, trays, tools, and greenhouse surfaces. Therefore, sanitizing tools, pots, and surfaces before use will help manage damping-off.^{2,4,5} Several types of sanitizing agents are available (Table 1). Products vary in how corrosive they are, the length of residual activity, and the range of pathogens they are effective against.^{6,7} Many growers choose to avoid some of these problems by using only new pots, flats, and trays. Sanitation of tools and greenhouse surfaces will still be important for these growers. Please refer to the product label for use restrictions and instructions.

Table 1. Sanitizing agents that can be used on tools and surfaces. ^{6,7}		
Active Ingredient	Example Product	Comment
benzalkonium chloride	Lysol®	not corrosive, uncertain effectiveness
sodium hypochlorite	chlorine bleach	corrosive, inexpensive
ethanol or isopropyl alcohol		no soak or rinse needed, highly flammable
trisodium phosphate	TSP	very corrosive, avoid skin contact
hydrogen peroxide	OxiDate® Broad Spectrum Bactericide/Fungicide	corrosive, limited effectiveness
quaternary ammonium salts	Green-Shield® II Disinfectant	not corrosive, very effective

Contaminated planting mixes can also be a source of inoculum. Therefore, only newly opened bags of sterilized soilless mixes should be used. Bags that have been open for a long time can become contaminated. Bags should be opened and used on a clean, sanitized surface. Potting media should not be reused.

Hoses and watering heads used for irrigation should be kept off the greenhouse floor to help avoid contamination.² Certified, disease-free seeds should be used, as some damping-off pathogens can be seed-borne.⁴ Seeds should be planted at the depth recommended for the crop.^{3,5,6}

Managing growing conditions can also help prevent damping-off. Ensuring good drainage of potting mixes and avoiding over-watering will help make conditions less favorable for damping-off.^{2,5,6} Using warming pads under pots and flats to keep temperatures in the optimal range for the crop and watering with warm water will help seedlings germinate and grow faster. Apply dilute (quarter strength) fertilizers to seedlings after they have produced several true leaves. Do not apply additional fertilizers if the potting mix contains a slow-release fertilizer.²

Provide supplemental lighting if ambient light levels are insufficient to sustain adequate growth and development.⁶ If symptoms of damping-off start to appear, stop watering plants to let them dry out somewhat and increase the air circulation around the plants.⁸

Fungicide applications to the seed can help protect seeds and seedlings from infection by damping-off pathogens. However, certified disease-free seeds planted into sterilized soilless mixes usually do not benefit from seed-treatment fungicides.³ Seeds pre-treated with fungicides can be purchased, or seeds can be treated after purchase. If growers are treating seeds themselves, they should select products that are labeled for that use on the crop to be treated and known to be effective against the target pathogens.⁵

Some seed-treatment fungicides, such as Captan Fungicide and Thiram® Seed Treatment, are effective against a fairly-broad spectrum of fungal pathogens. Other fungicides, such as metalaxyl, have a narrower spectrum of activity.^{3,4} Fungicides are usually not used to treat sanitized soilless mixes. If fungicides are to be used as drenches or for foliar applications in the greenhouse, they must be labeled for that purpose. Consult current local production and pest management guides for registrations, rates, and restrictions, as labeled uses can change.⁴

Sources:

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- ² Grabowski, M. 2018. How to prevent seedling damping off. University of Minnesota Extension. <https://extension.umn.edu/solve-problem/how-prevent-seedling-damping#:~:text=Damping%20off%20affects%20many%20vegetables, trays%20of%20seedlings%20are%20killed>.
- ³ Egel, D. 2020. Damping-off of vegetables. Purdue Vegetable Crops Hotline. Issue 671.
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Websites verified 12/9/2022

For additional agronomic information, please contact your local seed representative.

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about greenhouse cucumber production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop.

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