

2000 FSP - 26 (REV. 1981)

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FSP-26, revised 1981



AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA

PLANT PATHOLOGY
FACT SHEET No. 26—Revised 1981
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Damping-Off of Seedlings

Damping-off generally refers to sudden plant death in the seedling stage due to the attack of fungi (see figure 1). These fungi are soil-borne and are stimulated to grow and infect the seed or seedling by nutrients released from a germinating seed. However, seedlings may be injured or killed by something other than fungi, for example: toxic materials in the soil, excess or deficient soil moisture, seed defects, temperature extremes, toxic gases in the air, etc. A correct diagnosis is the key to effective control measures.

Occurrence and Importance

Damping-off disease of seedlings is widely distributed and is a problem on a worldwide basis. It occurs in most soils, temperate and tropical climates, and in greenhouses. The disease affects seeds and seedlings of various crops. The amount of damage the disease causes to seedlings depends on the fungus, soil moisture, and temperature. Normally, however, cool wet soils favor development of the disease. Seedlings in seedbeds often are completely destroyed by damping-off, or they die after transplanting. Frequently, germinating seeds are killed by damping-off fungi before they emerge from the ground, which accounts for poor stands in many crops. Older plants are seldom killed by damping-off fungi mainly because the development of secondary stem tissue forms a protective barrier and limits fungal penetration. However, portions of the roots and stems still can be attacked, resulting in poor growth and reduced yields.

Symptoms

When seeds are planted in infested soils, damping-off fungi may attack them at any stage. The damping-off fungi may attack the seed prior to germination, or they may attack after the seed has germinated but before the seedling has emerged above the soil line. Infected seed becomes soft and mushy turning a brown to black color, and it eventually disintegrates. Seeds that have germinated and become infected develop water-soaked spots that enlarge and turn brown. The infected tissue collapses, resulting in death of the seedling. Penetration and death of seeds before they emerge is termed preemergence damping-off.

Seedlings that have emerged are usually attacked at or below the soil line. The organism can easily penetrate the young soft stem tissue. The infected stem portion becomes discolored and begins to shrink. As this occurs, the supportive strength of the stem's invaded portion is lost, and the seedling topples over (see figures 1 and 2). The fungi continue to invade the remaining portion of the seedling, resulting in death. This phase of the disease is termed postemergence damping-off.

Older established plants also can be attacked by damping-off fungi. Usually the new developing rootlets are infected, resulting in root rot. Infected plants show symptoms of wilting and poor growth.



Figure 1. A seedling infected with damping-off fungi: Note the stem constriction near the soil line, a symptom characteristically associated with damping-off. This phase of the disease is called postemergence damping-off.



Figure 2. Seedlings grown in a container of soil infected with damping-off fungi.

Control

Proper conditions for seed germination and seedling emergence also favor vigorous growth of fungi that cause damping-off. Seed and roots must be kept moist and warm until the roots have penetrated the soil and the seedlings have emerged. As the seedlings continue to grow, moisture at the soil surface can be decreased, and the damping-off fungi then will have less of an advantage. When watering, thoroughly saturate the soil and then apply no more water until soil approaches the point at which plants wilt. This procedure will keep surface soil dry for a maximum time. Avoid frequent sprinkling because this generally keeps surface soil too moist and promotes fungal growth.

Damping-off may not occur at a location for many years and then be devastating in one season. Such situations sometimes can be traced to a change in crops or plant varieties, a change of source of soil, or some change in cultural practice. Prior to initiating any changes, it would be wise to test the intended changes on a small scale before the main planting is done.

Control measures for damping-off fall into several categories depending upon the facilities available and whether preventive measures are to be used after the trouble has begun. Preventive measures are much preferred, but make preparations for emergencies. Preventive measures are based on eliminating fungi that cause damping-off or providing chemical barriers to prevent the fungi from growing.

Sterilization of Soils

Soil for growing transplants in flats can be sterilized by steam or chemicals. If steam is used, the entire soil mass should be maintained at a temperature of 160°F for 30 minutes. If chemicals are used for soil sterilization, use a plastic seal and make sure soil temperature is 55°F or above. The following chemicals may be used for soil sterilization:

- Formaldehyde
- Chloropicrin
- Vapam

Plant beds or seedbeds can be fumigated by using one of the following chemicals:

- Methyl bromide (MC₂)
- Vapam
- Chloropicrin
- Vorlex

Before using any soil fumigant, it's important to read and follow label instructions for timing, crop safety, and method of application.

The home gardener obviously does not have facilities such as steam to sterilize soil, and the use of soil fumigants may not be feasible. However, sterilized, packaged soil mix is available from many garden centers. To prevent soil recontamination, all items such as tools, pots, flats, etc., must be clean. These items can be cleaned in hot water (160°F for 30 minutes) or in a chlorine bleach solution (1 part bleach to 9 parts water; soak for 30 minutes). It is important to use fresh chlorine bleach: water solutions.

Seed Treatment

Since the possibility exists for recontamination of pasteurized soil and thus for damping-off losses to occur, a fungicide seed treatment should be considered to minimize losses. Examples of fungicides used as seed treatments include thiram and Captan.

Permissible chemicals for seedling drenches or preplant soil incorporates on various vegetable crops include Captan and PCNB. PCNB can be used only as a preplant material. Carefully read and follow label instructions for specific crop use, safety, etc., prior to use of these fungicides.

Captan and PCNB can be used on various ornamentals but only as preplant materials. Before using Captan or PCNB on any ornamentals, read the label to determine specific crop uses.

Some trade names for Captan are: Orthocide 50 Wettable, Orthocide Garden Fungicides, Stauffer Captan 50-W, and Stauffer Captan Garden Fungicide. The trade name for PCNB is Terraclor.

Various cultural practices may be helpful in reducing the amount of infection. Fungicide treated seed that is sown directly, or seedlings that are planted in garden plots or larger fields, should be planted only on well drained soils. Avoid crowding the plants, and plant when temperatures are favorable for rapid plant growth. Avoid heavy applications of nitrogen fertilizers, and do not plant the same crop in the same field for more than 2 consecutive years.

The information given in this publication is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Minnesota Agricultural Extension Service is implied.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Norman A. Brown, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap. 5 cents

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