

Soybean Damping off

Damping off is a disease that causes stand reduction in Iowa every spring. There are economic costs of stand reduction in extra labor and materials for replanting. Several factors, such as herbicide injury, poor seed quality, and planter skip, can be incorrectly blamed for stand reduction caused by damping off. The best way to avoid future stand reduction problems is to manage the disease by using cultural and chemical controls. Proper identification of the cause also is essential to achieve effective control.

Causal Agents

Damping off is caused by two different fungi, *Pythium* and *Phytophthora*. It is important to determine which fungi cause stand reduction in a field because different chemicals are effective against different fungi. In Iowa, *Pythium* and *Phytophthora* account for 55 to 60 percent of the seedling disease problems each year. Other fungi, mainly *Rhizoctonia* and *Fusarium*, also can cause seedling diseases whose symptoms are different from those caused by *Pythium* and *Phytophthora*. The chemicals used to control *Rhizoctonia* and *Fusarium* are different from those used for *Pythium* and *Phytophthora* (see ISU extension publication Pm-946, *Soybean Fusarium and Rhizoctonia Root Rot*).

Symptoms

There are two types of damping off: preemergence damping off, where the seedlings fail to emerge because of fungal attack (Figures 1 and 2), and postemergence damping off, where seedlings are killed after emergence (Figures 3 and 4).

When damping off occurs before emergence, the fungi attack the seed before or after its germination. Seeds killed before germination are soft and rotted with soil adhering to them. If infection occurs after germination, seedlings fail to emerge and have a short and discolored root. Seedling rot or blight results from infection by these fungi just after the seedling has emerged from the soil. Postemergence damping off is characterized by wilting (Figure 3). Infected plants are easily pulled from the soil. Diseased plants may stand singly



Figure 1. Preemergence damping off caused by *Pythium debaryanum*. Note a seedling (left) which shows one of the typical symptoms, a swollen hypocotyl.



Figure 2. Note rotted appearance of the roots on these seedlings which have failed to emerge.



Figure 3. Seedling damping off under wet conditions. Note the brown lesion at the soil line.

or in small aggregated groups, particularly in low spots in the field, or they may occur scattered (Figure 4) over an entire field if there has been a period of rain.

When postemergence damping off occurs, dead seedlings are visible on the ground. Infected plants killed before the true leaf stage will have a rotted appearance. If leaves are present, they first will have a gray-green color before turning brown (Figure 5). A few days later, the plants die. Damping off by *Phytophthora* can be differentiated from *Pythium* after V2 growth stage because seedlings infected by *Phytophthora* have a brown discoloration extending from the root up the stem (Figure 5). Seedlings older than V2 growth stage normally become resistant to *Pythium*.

Seedling death often is blamed on herbicide injury. If herbicide damage is suspected, examine the root systems as well as the above-ground parts. Injury by some herbicides deforms the root (a malformed root) with a swollen hypocotyl. As the plants grow, the seedlings are stunted and have shortened internodes. In contrast, roots of diseased seedlings are rotted, and the seedlings are easily pulled out. *Pythium debaryanum*, a species occasionally found in Iowa, also can cause hypocotyl swelling (Figure 1). Herbicide injury also can be differentiated from seedling diseases by the damage pattern in the field. While damage by herbicide follows uniform spray patterns, the pattern of damping off is patchy, often occurring in low spots.

Occurrence

Pythium and *Phytophthora* survive in the absence of soybeans by growing on plant residue in the soil. The fungi also can survive in soil or plant residue as numerous microscopic, round, survival structures called oospores. These structures can survive environmental extremes, such as low or alternating temperatures and low soil moisture in the absence of soybean. Oospores will produce and release zoospores at a certain range of temperatures (see below) when the soil is saturated. After zoospores are produced, they need water in order to swim through soil to seed or roots. Therefore, wet soil is necessary for the occurrence of damping off. A heavy rain within one week after planting is favorable for damping off.

Soil temperature also affects the occurrence of damping off. Optimum soil temperatures for *Phytophthora* are between 70 and 77° F, while *Pythium* grows best under cooler conditions (50 to 59° F). Therefore, soybean seed planted in cold, wet soil is most subject to infection by *Pythium*. If damping off happens in warm, wet soils, it is probably caused by *Phytophthora*.

Fields with a history of damping off in the past are considered to be high risk. An increase in damping off has been observed in reduced tillage fields (Figure 6), especially in no-till. Early planting in no-till fields increases disease



Figure 4. Postemergence damping off. Note dead plants are next to healthy ones.



Figure 5. A seedling infected with *Phytophthora*. Note brown discoloration extending up from the root.



Figure 6. Stand reduction in a no-till field.

risk if damping off has occurred in the past. Because *Phytophthora* fungi grow from the root to the above-ground parts of plants, leaving residue untilled increases the amount of *Phytophthora* and/or *Pythium* in fields. Large amounts of residue also reduce soil temperature and increase soil moisture, favoring the development of *Pythium* damping off.

Management

Use of high-quality seed is essential to managing seedling disease. Do not plant seeds with broken seed coats. Do not plant carryover seeds. If seed quality is questionable or disease risk is high, use protectant fungicides. The fungicide metalaxyl is specific for *Pythium* and *Phytophthora* and is available as a seed treatment. Several other fungicides, such as Rival (Gustafson), Captan (ICI), and Maxim (Novartis), also can be used to control *Pythium* although they are not as effective as metalaxyl.

Rotation of soybean with corn is not an effective way to manage damping off because oospores can survive in the soil for many years in the absence of soybeans. Also, some *Pythium* isolates can attack both corn and soybean. If you experience stand reduction in corn, you may use that information to estimate the risk of damping off for the next soybean rotation.

Cultural practices, including proper seed bed preparation, planting depth, and correct application of fertilizers or herbicides, help to reduce the disease risk. Delaying planting until the soil temperature warms up can reduce damage by *Pythium*. Furthermore, use of resistant varieties is effective to manage damping off by *Phytophthora*. However, there is no resistance to *Pythium*.

If stand reduction is significant, replanting may be necessary. This decision should be made according to the severity of damping off. If only a few plants are killed, healthy soybeans may compensate by putting on additional growth, thereby filling in gaps left by the death of adjacent plants and making replanting unnecessary. If replanting is necessary, use of a chemical seed treatment is recommended because the fungi may attack new seeds.

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