



## DOWNY MILDEW OF SMALL GRAINS

Downy mildew or crazy top of wheat, oats, barley, and rye (also of corn, sorghum, rice, and a large number [about 140] of annual and perennial cultivated and wild grasses) is caused by the fungus *Sclerophthora macrospora*. Among perennial grasses, species of bentgrasses (*Agrostis* spp), bluegrasses (*Poa* spp), bromegrasses (*Bromus* spp), canarygrasses (*Pharus* spp), St. Augustinegrasses (*Stenotaphrum* spp), and wheatgrasses (*Agropyron* spp) are likely reservoirs for the downy mildew fungus. The disease occurs all over the world. It is widespread but sporadic in Illinois.

Downy mildew occurs **only** in localized areas of fields where seedlings have been growing in waterlogged soil. Infected plants are most common in flooded areas near ditches and lowlands where the *Sclerophthora* fungus commonly occurs on other host plants.

Downy mildew is not a major disease of cereal plants in Illinois. However, it may become destructive in individual fields when the soil is saturated for 24 hours or longer within several weeks after planting. Spots within a field may have dead plants in the center, surrounded by plants with a variety of symptoms.

### SYMPTOMS

Downy mildew produces various symptoms, depending on the severity of the disease. The symptoms may closely resemble those produced by an excessive concentration of 2,4-D or other phenoxy herbicide.

Affected small-grain or grass plants often tiller excessively. Many of the tillers grow only a few inches before they wither, turn brown, and die. Such plants appear as dense, dead clumps. Diseased plants may appear somewhat stunted to severely dwarfed and deformed with short, thickened or warty leaves that need to be stiff and upright. The upper leaves also may be twisted and curled. Some leaves will have yellow stripes, or will turn almost completely yellow and fleshy. Such affected plants rarely head-out. Some may die prematurely; others may remain green a few days longer than healthy plants.



Figure 1. Oat panicle deformed by downy mildew (T.H. Bowyer photo).



Figure 2. Oat plants variously distorted by downy mildew.

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Figure 3. Wheat heads abnormally enlarged and deformed by downy mildew (University of Wisconsin photo).

The most characteristic symptoms are the proliferation of florets and the development of distorted, twisted, and abnormally large panicles (Figures 1 and 2) or heads (Figure 3). When downy mildew infects wheat, the heads have a more open appearance than healthy heads, and the chaff may be fleshy and green. The beards of bearded wheats are distorted and abnormally long (Figure 3, left). Diseased heads yield no viable grain. The stems (culms) below the affected heads are often thick and deformed. A virus carried by the fungus may influence the expression of symptoms in host plants.

## DISEASE CYCLE

The downy mildew fungus produces a large number of round, pale yellow, smooth-walled resting spores (oospores) within infected, senescing leaf, glume, and culm tissue (Figure 4). The fungal structures are best seen with a light microscope in decolorized leaf tissues stained with acid fuchsin. The thick-walled oospores may persist in dead host tissue for several years and are released into the soil when diseased tissues decay. Oospores are carried from one field to another in diseased plant residues and soil, in seed grain, and

by the wind, surface runoff water, and tillage equipment.

The oospores germinate in water or saturated soil to produce lemon-shaped sporangia (conidia). Within an hour or two of formation the sporangia usually liberate 30 to 90 motile zoospores.

The zoospores are capable of swimming short distances in water before settling down and forming slender germ tubes that penetrate the host tissues of mostly seedling plants.

Following infection, the downy mildew fungus develops systemically within the plant, becoming most abundant in actively growing tissue. Sporangia are formed and infection occurs over a wide range of soil temperatures (44° to 88°F or 6° to 31°C; optimum 50° to 77°F or 10° to 25°C).

The causal fungus is incapable of reproducing in the absence of a host plant. The fungus must infect **living** plants each season—small grains, grasses, corn, sorghums, or rice; however, oospores persist and remain viable for several years.

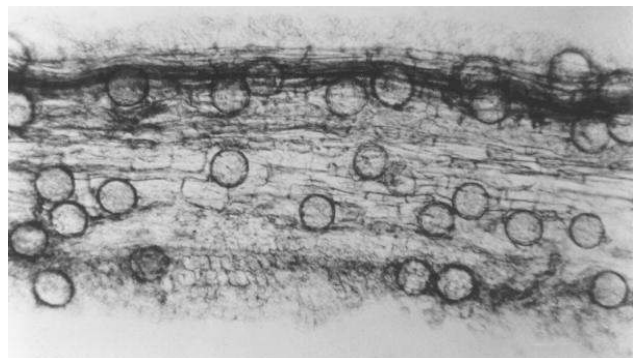


Figure 4. Oospores of the downy mildew fungus, *Sclerophthora macrospora*, embedded in oat leaf tissue.

## CONTROL

Downy mildew is seldom severe enough in Illinois to warrant special control measures. However, the following steps may be taken.

1. Where possible, provide for proper surface and subsurface soil drainage. Plant in well-prepared soil. Rotation with noncereal crops is beneficial.

2. Control all grassy weeds since they may serve as host plants.
3. Avoid low areas of fields that are likely to be flooded.
4. Grain to be used for seed should be thoroughly cleaned by fanning to remove all fragments of diseased tissue and lightweight kernels.
5. Whenever possible, select seed from fields known to be disease-free.

Very little is known about the relative resistance of small-grain varieties to downy mildew. Seed treatment has **no** effect.