



Extension FactSheet

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Take-All Disease of Wheat

Patrick E. Lipps
Department of Plant Pathology
The Ohio State University

The term “take-all” was first used in Australia more than 100 years ago to describe a severe seedling blight which destroyed entire stands of wheat. In Ohio, the take-all disease is best known as a root and crown rot. It generally occurs sporadically in wheat fields planted continuously to wheat or in fields infested with perennial grass weeds. The damage to wheat is related to the extent of root and basal stem colonization by a soil-borne fungus. Wheat plants can withstand mild infections with only minimal yield loss. Mild infections do not result in obvious symptoms of the disease. However, when symptoms become obvious, yield losses can be as high as 80 percent in Ohio.

Symptoms

The most conspicuous field symptom of take-all is the occurrence of stunted, yellow plants in circular patches during early stages of growth (Figure 1). Occasionally, dead plants can be found scattered throughout the stand. The roots of diseased plants are rotted and break when plants are pulled from the soil. Yield loss is attributed to the premature death of plants soon after heading and before grain filling. Prematurely killed plants produce bleached or whitened, empty heads known as ‘white heads.’ These white heads stand out in contrast to the normal green color of the crop. White heads are usually empty of grain, but may contain only a few shriveled kernels. During wet weather, the dead plants become covered with saprophytic fungi which mask the bleached white heads by turning them blackish in color. Since several other soil-borne fungi and stem feeding insects can cause the white head symptom, positive diagnosis is made by examining the roots and lower stems of affected plants. When plants with white heads are pulled from the soil and the lower leaf sheaths are peeled off to expose the stem base, the stem base and roots near the crown are usually blackened due to the growth of the take-all fungus (Figure 2). In seasons of abnormally wet weather, the black fungus growth can extend up the stems 1 to 2 inches. Less severe infections can be diagnosed by microscopic examination for characteristic dark “runner hyphae” of the fungus on the roots

of affected plants. The “runner hyphae” can be detected on plants by early spring if the upper leaves of the plants appear yellow.

The Disease Cycle

Gaeumannomyces graminis var. *tritici* is the fungus causing take-all of wheat. Two other varieties of the take-all fungus are known and they are distinguished by their virulence on various crop and grass species. *G. graminis* var. *avenae* is pathogenic on oats and also causes Ophiobolus patch of turfgrasses. *G. graminis* var. *graminis* is the least pathogenic of the three varieties and is pathogenic on common weed grasses. This fungus persists from year to year in infested wheat residues, and in infected volunteer wheat and weed grasses. Wheat plants become infected when their roots contact infested residues or living plants harboring the fungus. The fungus spreads from residues to the root surface and from one root to the next by growth of “runner hyphae” through the soil. Although the fungus can produce spores, they are unimportant in the spread of the disease.



Figure 1. Circular patch of stunted wheat with “white heads,” typical of the take-all disease.



Figure 2. Plants infected by the take-all fungus. Note the blackened roots and stem bases of these plants.

Take-all is usually more severe in lighter soils, with higher pH, and low fertility. Generally, the earlier infection takes place, the more disease and the greater the yield loss at harvest. Thus, infections of young plants soon after planting result in the most severe yield losses. Moisture retaining, poorly drained soils or abnormally wet weather, especially in the second half of the growing season, favors the development of the disease. Take-all is reduced by maintaining adequate levels of N, P and K for crop growth. Nutritional stress imposed by overwintering loss of nitrogen (N) is a serious predisposing factor for this disease. Spring applications of N normally suppress this disease. Recent research has shown that ammonium (anhydrous ammonia and urea) and the use of denitrification inhibitors (N-serve, nitropyrin, etc.) will suppress take-all. Slow release forms prevent N loss by leaching and denitrification. Nitrate forms of nitrogen tend to increase the severity of the disease.

Control

1. There are no varieties of wheat available with a high degree of resistance. Varieties claimed to be tolerant tend to show fewer white heads, but yield losses can still be great.
2. Crop rotation is the most practical, economical and successful means of control of take-all. Rotations with soybeans, other legumes, or corn is most satisfactory. A rotation with two years between wheat crops is highly recommended.
3. Control grassy weeds, especially quackgrass. Since the take-all fungus survives from year to year on grassy weeds, elimination of these weeds and volunteer wheat will reduce inoculum levels in the field.
4. **Lime:** Applications of lime immediately prior to planting wheat generally increases take-all. A pH of 7.0 or above is most favorable for disease development. Lime should not be applied before planting except when aluminum toxicity has been a problem.
5. **Fertilizer:** Adequate amounts of N, P and K should be applied at planting to ensure good root growth. If nitrogen is divided between fall and spring applications, 15 to 20 lb of N should be applied in the fall prior to planting. Nitrate fertilizer generally increase the severity of take-all compared to ammonium and slow release forms. Do not over fertilize with nitrogen. High rates of N may increase the susceptibility of wheat to other diseases.
6. **Planting date:** Take-all is favored by very early plantings, as are several other wheat diseases. Plant after the Hessian fly-safe date recommended for your area.
7. If there is no legume underseeding, plow down wheat residues as soon as possible after combining to enhance residue decomposition and to control volunteer wheat.

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