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Seedborne Diseases of Cereals

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Idaho wheats and barleys are subject to a number of serious disease problems, several of which are seedborne. This publication summarizes information on selected seedborne diseases of wheat and barley that are important to Idaho growers.

Bacterial Diseases

Black Chaff

Black chaff is a seedborne disease caused by the bacterium *Xanthomonas translucens.* It has recently become a serious problem of sprinkler-irrigated wheat and barley in parts of the Magic Valley and eastern Idaho. In addition, it is a major cereal disease in the southeastern U.S. and in other parts of the world. The disease may cause losses as high as 40 percent in severe cases.

Symptoms on the head may appear either as dark interveinal streaks and blotches on the glumes or, in severe cases, as a general chlorosis of the head accompanied by failure of kernel development. Leaf symptoms include streaking and spotting (see Fig. 1, next page). Lesions begin as translucent, water-soaked streaks and spots that turn brown after a few days. Under moist conditions, viscous, light yellow droplets or slime layers composed of millions of bacterial cells may be seen on the infected tissue. As weather conditions turn dry, those droplets appear as tiny yellow sugar crystals or as layers of dried cells called "shellac."

Infected seedlings grow from contaminated seed and serve as point sources (disease foci) for spread of the pathogen in the field. The pathogen is spread over short distances by splashing water, plant contact and spike-visiting insects. Hence, sprinkler irrigation and rain showers facilitate rapid spread of the disease in the field. Further information may be found in CIS 784, *Black Chaff of Wheat and Barley.*

Once black chaff has started to develop in a field, disease control is extremely difficult. The best means of control is to use seed that is free of the black chaff pathogen, i.e. "clean seed." The University of Idaho is currently attempting to produce clean seed in its foundation seed program. This seed would then be increased at the registered and certified levels and tagged with a special black chaff phytosanitary certificate.

Bacterial Leaf Blight

Bacterial leaf blight is caused by the bacterium *Pseudomonas syringae*, an organism that attacks a wide range of crop plants, including cereals, broad-leafed crops and trees. Symptoms of this disease have been observed in irrigated wheat fields in Idaho, but little is known about the disease in the state.

Blight develops on uppermost leaves after plants reach the boot stage. Initial water-soaked spots expand, become necrotic and progress from gray-green to tan-white. The spots may coalesce into irregular streaks or blotches within 2 to 3 days, and entire leaves may die prematurely. Adequate control measures have not been developed.

Basal Glume Rot

Basal glume rot, caused by the bacterium *Pseudomonas atroseptica*, is believed to be present in Idaho. However, more work is needed to confirm the presence and severity of the disease. Symptoms tend to be inconspicuous, but close examination of the heads will reveal darkened or streaked glumes, the initial symptom of the disease. As is the case with both black chaff and bacterial leaf blight, moisture is extremely important in disease development. Clean seed is apparently the best means of control.

Fig. 1. Chlorotic, necrotic and water-soaked spots and streaks on leaves are the predominant symptoms of black chaff in Idaho.

Fig. 2. Heads of plants with loose smut emerge and shed black spores, leaving a bare rachis (stalk).

Fig. 3. Lesions of barley stripe extend the length of the leaf and run down the sheath.

Fig. 4. Scab infections cause one to several spikelets to turn prematurely brown.

Viral Disease

Barley Stripe Mosaic

Barley stripe mosaic occurs principally in barley and only rarely in wheat. It is caused by the Barley Stripe Mosaic Virus (BSMV), which is the only virus affecting the grass family that is efficiently transmitted through seed. The principal symptoms are chlorotic stripes that develop on leaf blades and become increasingly yellow or brown. Yield losses are caused primarily by decreased photosynthesis and BSMV-induced sterility of ovules and pollen. Yield losses as high as 35 percent have been reported, but losses in Idaho are believed to be slight. Because BSMV survives only in seed, planting virus-free seed ensures a crop free of barley stripe mosaic. Seed assays are available to test for this disease.

Fungi Diseases

Common Bunt or Stinking Smut

Common bunt (stinking smut) is caused by two species of the fungus *Tilletia.* It occurs worldwide, reducing wheat yields and grain quality. Seed contaminated with bunt spores has a pungent odor and darkened appearance and is discounted in value. Bunt spores released during threshing were responsible for the dark clouds that were a common sight behind the combines several decades ago. Diseased plants are moderately stunted but not readily distinguished until heads emerge. Bunted heads are slender and maintain their green color longer. The glumes of some or all spikelets may be conspicuously spread apart because they surround bunt balls rather than normal seed.

Bunt fungi persist as resting spores on seed and in soil. Spores germinate in response to moisture, and infection of the young shoot occurs before seedlings emerge. Bunt is controlled by the use of resistant varieties and seed treatments.

Loose Smut

Loose smut is caused by the fungus *Ustilago nuda* and is primarily a disease of barley, although wheat can also be infected. It is found wherever barley is grown but is more common in areas of high humidity and rainfall. Losses from loose smut are usually minor but have occasionally reached 15 percent or more in individual fields in Idaho. Infected seeds are fully germinable and not visibly altered. The pathogen infects the embryo. When the infected seed germinates, the pathogen is activated and progresses toward the shoot apex. The head is converted into a mass of fungus spores that are dispersed by the wind when the infected heads emerge (Fig. 2). Open flowers on neighboring plants become infected at that time.

Unlike other seedborne fungi, the loose smut fungus is not controlled by surface-active protectant fungicides used as seed treatments. Carboxin, a systemic seed-treatment fungicide, is the only effective registered seed treatment for control of loose smut of wheat and barley.

Barley Stripe

Barley stripe is caused by the fungus *Pyrenophora graminea* and is not to be confused with the virus disease described earlier. This disease once caused a great deal of damage in many areas of the world but has not been a problem for several decades. It was recently reintroduced into the Pacific Northwest in a barley variety of European origin. In 1985, it caused losses estimated as high as 60 percent in individual fields in Idaho. As with loose smut, losses are directly proportional to the percentage of infected plants in the field.

The principal symptom is a beige-to-yellow leaf stripe that initially develops on the leaf sheath and the basal portion of the leaf blade (Fig. 3). These stripes gradually extend the full length of the leaf and soon become necrotic. As the tissue dies, the leaves begin to split and fray at the ends so that they appear shredded. In many infected plants, spikes fail to emerge. In others, they emerge distorted, resulting in underdeveloped or very shriveled grain.

At the time of heading, spores are produced on infected leaves under conditions of high moisture and are dispersed by wind to nearby heads. Seed can become infected at all stages of development, but the most severe infection occurs during the early stages of kernel development.

Infection of developing seedlings from seedborne inoculum is greatly affected by soil temperature and moisture. Little or no seedling infection occurs at temperatures above 60°F.

Barley stripe is controlled by use of clean seed and by a seed-treatment fungicide. Seed treatments containing imazalil are highly effective in eradicating the pathogen from seed. Producing seed in semi-arid areas without irrigation is also an effective means of control.

Scab or Head Blight

Scab (head blight) is an important disease of wheat, barley, oats and other small grains. It has been a serious problem in parts of Canada and the United States for more than 50 years but has only recently been found in southern Idaho. In 1982 and 1984, scab epidemics occurred in sprinkler-irrigated wheat and barley fields in south-central and eastern Idaho, causing yield losses estimated at 50 percent in individual fields. The disease is caused by several species of *Fusarium* fungus. It can also cause seedling blight and root rot. In addition to the potential for a yield reduction, scabby grain may contain a toxin that causes hogs to refuse feed.

The disease is characterized by the appearance of beige-to-tan or brown spikelets occurring before normal maturation (Fig. 4). Part or all of the head may be affected. If grain is produced, it is typically small and shriveled.

The causal agent overwinters in infested small grain cereal and corn residues as mycelium and spores. Spores

Table 1. Summary of selected seedborne diseases of wheat and barley.

Disease	Pathogen	Severity in Idaho	Symptoms	Control
Bacteria				
Black chaff	*Xanthomonas translucens*	slight to severe	brown-black streaked glumes and brown leaf spots	clean seed
Bacterial leaf blight	*Pseudomonas syringae*	unknown	white-gray leaf streaks and tips	unknown
Basal glume rot	*Pseudomonas atroseptica*	slight	darkened or streaked glumes	clean seed
Virus				
Barley stripe mosaic	barley stripe mosaic virus	slight	chlorotic-yellow leaf stripes	clean seed
Fungi				
Common bunt	*Tilletia* spp.	slight	slightly stunted plants; glumes are spread widely	seed treatment
Loose smut	*Ustilago nuda*	slight to moderate	bare blackened rachis	seed treatment
Barley stripe	*Pyrenophora graminea*	slight to severe	beige-to-yellow leaf stripes	seed treatment and clean seed
Scab	*Fusarium* spp.	slight to severe	bleached heads	seed treatment

are the primary inoculum. In the presence of moisture, they germinate and invade the flower parts and the rachis. Infection occurs most frequently and is most serious at flowering and is greatly favored by wet, humid conditions.

Only one disease cycle occurs annually. Spores produced on infected heads of the current crop are of little importance with respect to the head blight phase of the disease. However, they serve as an important inoculum source for seed decay and seedling blight when the seed is replanted. Reports from Washington and elsewhere indicate that germination and vigor of contaminated seed may be substantially reduced.

No economically effective control measures are available to control head blight. However, seed treatments containing thiram or TCMTB may help prevent seedling blight and root rot caused by infection by the *Fusarium* species.

Other Seedborne Cereal Diseases

We have not discussed several other seedborne diseases of cereals that occur infrequently or have limited economic importance. In addition, some other cereal diseases are also technically seedborne, but other inoculum sources such as soil or infected debris are generally considered more important in their development. Hence, they have not been included here.

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Trade Names

To simplify information, trade names have been used. No endorsement of named products is intended nor is critism implied of similar products not mentioned.

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