



SPOT BLOTCH, NET BLOTCH, AND STRIPE DISEASE OF BARLEY

Spot blotch, net blotch, and stripe are common diseases of barley, sometimes serious ones. In Illinois, they collectively reduce potential yields an average of 3 to 5 percent. The 3 diseases are caused by similar fungi, their disease cycles are much the same, and all 3 are controlled by use of disease-free seed, seed treatment, resistant barley varieties, and sanitary practices.

SPOT BLOTCH

Spot blotch is caused by *Helminthosporium sativum* or *H. sorokinianum* = *Drechslera sorokiniana* (*Bipolaris sorokiniana*). The disease is widespread in Illinois and is believed to lower potential barley yields by 1 to 3 percent; also, the bushel weight. The causal fungus affects all parts of the plant and produces a variety of symptoms, from a seedling blight and root rot to "Black point" of the kernels.

Spots (lesions) that are chocolate brown-to-black appear near the soil line or at the base of the sheaths that cover the seedling leaves. Infections may progress until the seedlings turn yellow and die, either before or after emergence, thus reducing the stand. The latter case is more frequent. Affected seedlings may be dwarfed, tiller excessively, and have dark-green leaves. Diseased barley seedlings commonly have weakened, dark-brown, rotted crowns and roots. Tillers may be killed. When seedling infections are severe, plants may be dwarfed, the heads may not emerge completely, and the kernels are poorly filled.



Figure 1. Spot blotch of barley: barley leaves showing infected areas, some of which have fused.



Figure 2. Black point of barley; kernels discolored by the spot blotch fungus (courtesy Dept. of Plant Pathology, Univ. of Wisconsin).

Barley plants that escape serious seedling infection usually appear normal until about heading time, when the characteristic leaf lesions, of various sizes and shapes, appear on the lower leaves after warm, moist weather (Figure 1). The center of each lesion is dark brown, the color gradually fading at the edge into the normal green of the leaf. Many spots are oblong or lens-shaped, with the centers a lighter brown than the margins. Where numerous, the lesions may merge—producing large irregular blotches. Heavily infected leaves dry out and die prematurely. The centers of older lesions on both living and dead

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leaves have an olive-green cast caused by fungus growth and an abundant production of summer spores (conidia). Spot blotch starts on the older leaves and sheaths, spreading upward to the younger leaves. The lesions never have the netted appearance characteristic of net blotch (Figure 3).

Dark brown-to-black spots may appear on the glumes and kernels. The black point at the germ (embryo) end of a kernel is a common symptom (Figure 2). Kernels infected early are shriveled and are light weight. The market price is reduced on grain containing 5 percent or more of black-point kernels.

The fungus overwinters in diseased crop refuse of wild and cultivated grasses or cereals grains, on or within the seed, and on the seedling leaves of winter barley. Seedling blight, crown rot, and root rot result directly from seedborne infection. Injury to the crown tissues by insects frequently is followed by an invasion of the spot blotch fungus. In the spring, the fungus produces immense numbers of conidia on the leaves, straw, and stubble of barley, wheat, and wild grasses. These wind-borne spores infect barley and wheat, starting the disease cycle again.

The spot blotch fungus has a wide range of hosts and is extremely variable in pathogenicity. The fungus is known to attack at least 28 species of cultivated and wild grasses, including most of those present in Illinois fields. The spot blotch fungus includes many physiologic races that differ greatly in virulence and ability to attack specific cereals and grasses. New races may arise by hybridization between existing races or by mutation. The wide range in pathogenicity of the fungus and its ability to change its pathogenicity greatly complicate efforts to select and maintain resistant varieties of barley.

NET BLOTCH

Net blotch is caused by the fungus *Helminthosporium teres* (*Pyrenophora teres*). The blotch is principally a leaf disease. The net blotch fungus is restricted to the *Hordeum* species of cultivated and wild barley. Net blotch is most abundant in Illinois during cool, damp periods. Fall-sown and volunteer barley are commonly infected late in the fall. The estimated annual losses caused by net blotch range from a trace to 0.5 percent of the potential yield. G.H. Boewe, plant pathologist with the Illinois Natural History Survey, reported that one year 75 percent of the barley plants of the state were affected.

The disease appears first on the seedling leaves of both fall- and spring-sown barley as oblong brown spots or blotches, often confined by the veins and marked internally with a characteristic netting (Figure 3). The netted blotches, made up of narrow lines that are a darker brown and cross-hatched, are best seen by holding the leaves up to a light. Infections occur on leaves from the seedling stage until near maturity. When abundant, the lesions enlarge and fuse, forming long brown streaks with irregular margins that may cover much of the leaf and destroy its usefulness. The stripes do not extend into the leaf sheath, and the leaf tissue does not split as in the stripe disease (Figure 4).

Small brown streaks, without the netted appearance, develop on the chaff (glumes), causing reduced yields and shriveled seed. At the base, infected kernels have indistinct brown lesions. At harvest, the stems may be a dull brown and may lack strength.

The net blotch fungus lives over between barley crops within the hulls of infected seed and in infected straw and stubble. Seedling leaves become



Figure 3. Barley net blotch.

infected from the sowing of infected seed or the spreading of wind-blown “winter” spores (ascospores) to barley plants from unburied crop residues. Successive crops of “summer” spores (conidia) develop on the dead leaf lesions. These spores are scattered by the wind and by splashing rains.

New infections continue to occur on both fall- and spring-sown barley as long as the weather remains cool and moist. Conidia that lodge on the chaff may germinate and grow into the hulls. There the fungus remains dormant until the seed is sown and starts to germinate.

When a barley plant matures, the net blotch fungus grows into the sheath and culm tissues. These tissues produce the fruiting bodies (perithecia) in which the ascospores develop. The net blotch fungus includes a number of physiologic races that react differently on the general groups of barley.

STRIPE DISEASE

Stripe disease is caused by the fungus *Helminthosporium gramineum*. The disease occurs only on barley. Stripe is more prevalent on winter barley than on spring barley. Unlike spot blotch and net blotch, the stripe disease produces a systemic infection that affects the entire plant. G.H. Boewe’s data, taken over a 15-year period, indicate that in Illinois stripe disease causes an average annual loss of 2 percent of the potential barley yield.



Figure 4. Barley stripe disease.

The first symptom of stripe is the appearance of small, pale, easily overlooked lesions on seedling leaves—usually at the early-to-late tillering stage. If severely infected seed of a susceptible barley variety is sown, some of the seedlings may be killed by the stripe fungus. The characteristic streaks or stripes—long, narrow, and yellowish-to-straw colored—appear in the leaves as they unfold. Parallel stripes, 1 to 7, may extend the entire length of the blade. The light-yellow streaks soon turn brown. The browning is usually followed by a drying-out and lengthwise splitting of the leaf blade (Figure 4). The streaks spread to the leaf sheath when the leaves are mature.

Stripe-affected plants are severely stunted, produce few tillers, and usually do not head or produce seed (Figure 5). The heads that do emerge are grayish-brown, withered, twisted, often barren, and erect.

Generally, all the leaves and culms of a diseased plant are affected. Infected plants, shrivel and die prematurely and are easily overlooked at harvest.

Large numbers of summer spores (conidia) of the stripe fungus are produced in the dark gray-to-olive gray stripes on dead barley leaves. These spores, like those of the spot blotch and net blotch fungi, are carried by air currents or splashing rain to the heads of healthy barley plants at or soon after flowering. During moist weather, the spores lodging near the tips of the glumes germinate and produce mycelial growth. The mycelium grows between the hulls and the kernels and may even penetrate the embryo.



Figure 5. Barley stripe; left, diseased plant; right, healthy plant.

Infection can occur anytime from before the heads emerge through the soft dough stage, and over a wide range of temperature and moisture conditions. The fungus remains dormant as mycelium on or within the dry barley kernel (up to 5 years) until the seed germinates. The stripe fungus then resumes active growth, progressing into the sheath surrounding the first seedling leaf, from that into the next leaf, and continuing until all of the leaves are infected. If the growing point of the barley plant is invaded, the culm dies. The spores of the stripe fungus can remain alive for as long as 34 months.

Seed transmission is high at soil temperatures below 52°F (12°C). The transmission is reduced or prevented when the temperature is above 59°F (15°C).

Control

1. Sow only thoroughly cleaned, certified barley seed from disease-free fields. The seed should be treated with a suggested fungicide. Where practical, sow winter barleys early. Little or no seedling leaf infection by net blotch and stripe occurs when the seed is sown in a seedbed that is warm (68°F or above), moist, well-drained, fertile, and well-prepared. Plant no deeper than is necessary to provide enough moisture for good germination.
2. Sow adapted resistant varieties, which is the most practical way to control spot blotch, net blotch, and stripe. However, no high-yielding, adapted varieties commonly grown in Illinois presently are resistant to all 3 diseases. Some barleys are moderately resistant to stripe (e.g., Paoli and Pike); but since this disease can be easily controlled by seed treatment, little effort has been spent in developing resistant varieties. Changes in pathogenicity and in the ability of the causal fungus to live over in plant refuse have slowed the development of barleys that are resistant to net blotch. Although no currently recommended varieties for Illinois are highly resistant to net blotch, Paoli and Pike winter barleys and Manker spring barley are considered to be moderately resistant; Larker and Barsoy, moderately susceptible. Resistance to spot blotch is by far the most difficult to achieve because of the wide range of hosts for the causal fungus, its variability in pathogenicity, and the lack of sources of resistance to all phases of the disease. Barley lines that are resistant to the root-rotting phase may lack resistance to leaf spot or kernel blight, and so on. Manker is the only barley recommended for planting in Illinois that is considered as even moderately resistant. Progress is being made in increasing resistance, but it is very slow.
3. Plow under crop residues—deep and clean—as soon as possible after harvest.
4. Where practical, keep down susceptible grasses and volunteer small grains by cultural or chemical means.
5. Rotate small grains and grasses with nongrass crops, preferably legumes—soybeans and forage legumes.