

Spot Blotch of Barley

Vernyl D. Pederson, Professor
 Department of Plant Pathology

Marcia P. McMullen
 Extension Plant Pathologist

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Spot blotch is the most important leaf disease of barley in North Dakota. It occurs throughout the state but it is most prevalent and causes most losses in the more humid, warm southeastern sections of the barley producing areas. Frequent rain showers and warm nights are the two most important environmental factors that promote the rapid development of spot blotch. Generally, the environmental conditions that favor the development of spot blotch also favor potentially high barley yields. Therefore, reduction in yield from spot blotch is often masked by favorable conditions for higher than average barley yields.

reduction in kernel plumpness, loss in both quality and yield contribute to losses from the disease.

Symptoms

Spots may develop on leaves and leaf sheaths at all stages of plant development. The spots have uniformly dark brown centers, often with yellow borders. The infected areas, which begin as minute dark brown spots, may continue to

enlarge and join together to form large blotches that cover and kill large portions of the leaf (Figure 1a). Although infections may appear on plants in early stages of development, the disease does not normally become severe until after heading. The disease then progresses rapidly on susceptible varieties under favorable conditions, with lower leaves showing spot symptoms first (Figure 2a) (see back cover). The upper leaves are progressively infected so that by dough stage of kernel development, all leaves, including the flag leaf, show symptoms and may be killed. The

Economic importance

Losses of 10 to 15 percent are common in highly susceptible varieties such as Larker. Losses of up to 40 percent have been observed when the disease occurs on the leaves prior to heading, when most of the upper three leaves are killed by the time of the soft dough stage of kernel development. Yield losses occur primarily from the reduction in seed weight or kernel plumpness. Since the price paid for malting barley is adversely affected by a

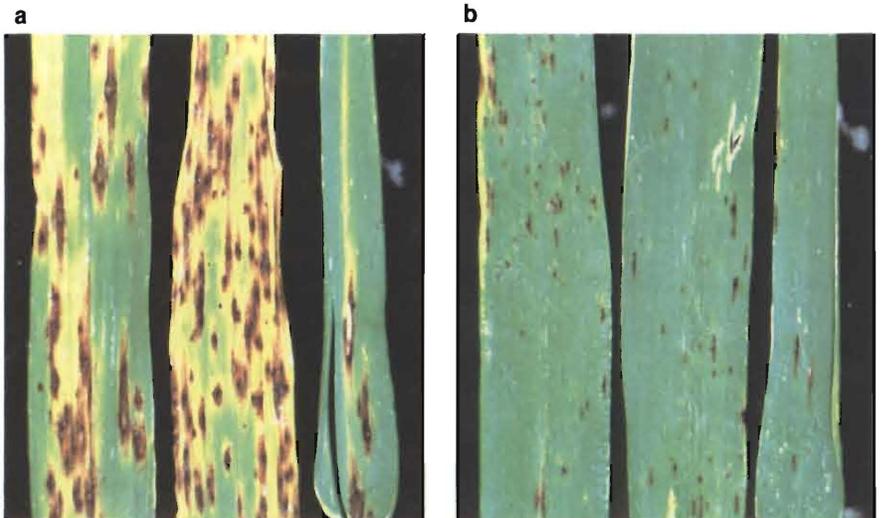


Figure 1. Leaf symptoms of spot blotch on a) the susceptible variety Larker and b) the resistant variety Dickson.

spots are smaller on more resistant varieties, show less of the yellow border, and a smaller percentage of the individual infected leaves are killed (Figures 1b and 2b). (See back page for Fig. 2b).

The Fungus

Spot blotch is caused by the fungus commonly named *Helminthosporium sativum*. The fungus may be seed borne or may arise each year from overwintered spores in the soil, on plant debris, or on other grass hosts. During warm, moist conditions the fungus produces numerous spores (Figure 3). Upon drying, the spores are readily dislodged and dispersed by the wind. Spores germinate and initiate infections within 16-18 hours when leaves are wet from dew or rain. Epidemics occur when temperatures are 68°F or higher during prolonged periods of wet weather.



Figure 3. Sporulation of *Helminthosporium sativum* on barley leaves. (Reprinted, by permission, from I. Stevenson. 1981. *Can. J. Plant Pathol.* 3:76-85.)

Yield loss studies

The relationship between percent disease on the flag leaf and yield of Larker (susceptible) barley was established in experimental field trials at several locations in North Dakota (Figure 4). To determine maximum yield loss under conditions of maximum disease development, one set of plots was inoculated with spores of the fungus at the boot stage of development and was not treated with mancozeb fungicide. To determine attainable yield under natural disease development, another set of plots was left not inoculated and was

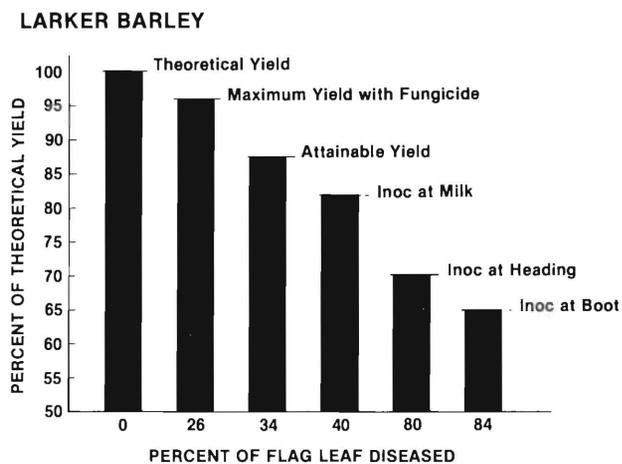


Figure 4. Yields of Larker barley with different levels of spot blotch symptoms on flag leaves at the dough stage of kernel development. Theoretical yield (no disease), maximum yield (natural disease with fungicide applied), attainable yield (natural disease with no fungicide applied), and inoc (inoculated with spores of *H. sativum* at three different stages of plant development).

not sprayed with a fungicide. To determine maximum yield, a third set of plots was sprayed with mancozeb fungicide and not inoculated. Maximum theoretical

yields (without disease) were estimated mathematically. In plots inoculated at the boot stage, where maximum disease developed, 84 percent of the flag

leaves of Larker were diseased. Yield of Larker with maximum disease was only 65 percent of the theoretical yield with no disease. The maximum yield obtained with fungicide was 10 percent greater than the attainable yield (yield with no fungicide protection and no inoculation).

Disease Control

Early seedling infections and seedling blights can arise from seed borne inoculum. Therefore, the use of clean, fungicide-treated seed is recommended. (See Extension Circular PP447, Seed Treatment for Disease Control, for further information.) Foliar applications of fungicides may increase yields and improve kernel plumpness. The economics of foliar applications of fungicides is dependent on the severity of the disease, susceptibility of the variety, the yield potential of the crop, and the occurrence of favorable weather conditions. In most years, increases in yield of 10-12 percent can be expected when fungicides are applied to susceptible varieties such as Larker. (See Extension Circular PP622, Field Crop Fungicide Recommendations, for further information.)

Many of the more recently developed barley varieties have a higher level of resistance to spot blotch than Larker, and use of foliar fungicides is less likely to be profitable on these more resistant varieties. The improvement of spot blotch resistance over the years is demonstrated by comparing the yields from inoculated versus fungicide-treated plots of six

varieties (Figure 5). A gradual improvement in yield potential of these newer varieties has been accompanied by decreased yield loss in spot blotch inoculated plots. The decreased yield loss indicates that the newer varieties have greater spot blotch resistance.

Summary

Spot blotch, an important leaf disease of barley, causes yield losses and reduction in kernel plumpness. Field studies in North Dakota have shown that in a susceptible variety, severe spot blotch infection may cause a yield loss as high as 40 percent, while a 10-15 percent loss commonly occurs at moderate disease levels.

Disease management recommendations include: 1) use foliar fungicides on the more susceptible varieties to protect the flag leaf. Use only if lower leaves are severely infected by the boot stage of plant development, if the yield potential of the crop is 60 bushels or greater, and if favorable weather conditions are present; 2) use the newer, more resistant varieties; 3) use clean, fungicide-treated seed to protect against seedling blights and early seedling infections; 4) rotate with other crops to reduce inoculation from barley residue in the field; and 5) incorporate barley stubble in the spring by plowing or disking prior to seeding. Stubble should be left on the surface through winter months to reduce risk of wind and water erosion, but spring incorporation will reduce chances of movement of spores from surface stubble to leaves.

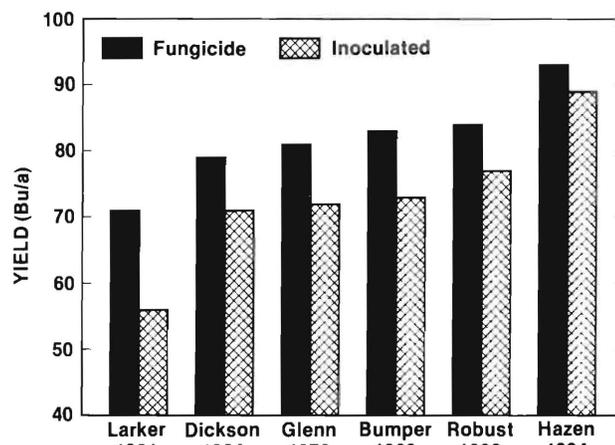


Figure 5. Yields of six varieties of barley from plots sprayed with mancozeb fungicide compared with plots inoculated with *Helminthosporium sativum*. Years indicate when the respective varieties were released.

