Bacterial Diseases of Beans

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Bacterial Diseases of Beans

Several bacterial diseases affect the dry bean crop in Wyoming and the Central High Plains production areas. These diseases are **halo blight** (*Pseudomonas syringae* pv. *phaseolicola*), **bacterial brown spot** (*Pseudomonas syringae* pv. *syringae*), **common bacterial blight** (*Xanthomonas campestris* pv. *phaseoli*), and **bacterial wilt** *(Curtobacterium flaccumfaciens* subsp. *flaccumfaciens*). Bacterial diseases cause losses to bean growers in several different ways. Because these bacteria are seed-borne, the presence of diseased plants in seed fields will affect the certification eligibility of the crop, as defined by certification rules and regulations. Outbreaks of bacterial disease reduce yield and quality of the crop. Losses range from a trace to complete crop failure.

Disease Detection

Bacterial diseases of beans are usually detected when foliar, stem, or pod symptoms are present. However, disease diagnosis is often complicated by plant injury from wind or other factors, as well as the presence of other diseases and pests. A laboratory test to recover and identify the particular bacterial pathogen involved is often required for a definitive diagnosis.

Figure 1. Foliar symptoms of halo blight with characteristic broad yellow halo (Source: H.F. Schwartz)

Figure 2. Water-soaked halo blight lesions on a recently infected pod and seed. A silvery bacterial exudate is visible on several pod lesions.

Diagnostic records for the University of Wyoming Extension Plant Pathology Laboratory reveal that 188 bean samples were positive for bacterial bean diseases from 1991 to 1995. Of these, 96 percent of the samples were halo blight and 4 percent were common bacterial blight. Although not detected in Wyoming during the survey period, bacterial brown spot is common in the Central High Plains production region while bacterial wilt is occasionally detected.

Halo blight foliar symptoms begin as small water-soaked lesions on leaflets. Lesions remain small, become brown with age, and are often surrounded by a broad greenish-yellow halo (Fig. 1). The appearance of the halo varies and may be absent under high temperatures. The disease may become systemic under conditions of severe infection, which can cause general yellowing and curving of younger leaflets. Lesions on stems, pods, and seeds

Figure 3. Foliar symptoms of bacterial brown spot.

Figure 4. Mature bacterial brown spot pod lesions (Source: H.F. Schwartz)

Figure 5. Common bacterial blight lesions with yellow margins.

begin as water-soaked spots (Fig. 2). Stem and pod lesions become brown or reddish-brown with age. Cream or silver-colored bacterial exudate may be found on stem and pod lesions during moist conditions. Severely affected seeds become brown and shriveled. Stem girdling and joint rot may occur above the cotyledonary node of plants grown from infected seed.

Bacterial brown spot leaflet lesions are usually small and become dark brown (Fig. 3). A narrow yellowish-green halo may surround lesions. Dead tissue in the center of old lesions often falls out, resulting in "shot-holes" or tattered leaves. Numerous lesions eventually kill leaflets. Stem and pod lesions start as water-soaked spots and become brown or reddish-brown with age (Fig. 4). Cream or silver-colored bacterial exudate may be found on stem and pod lesions during moist weather. Infected seeds initially have water-soaked spots and become brown and shriveled when severely affected. Older plants are usually more resistant to infection.

Common bacterial blight foliar symptoms begin as small water-soaked spots on the undersides of leaves. Lesions enlarge, turn brown and coalesce to form large dead areas on affected leaves. A narrow, lemon-yellow margin often surrounds larger lesions (Fig. 5). If disease is severe, leaflets are killed, and premature defoliation will result. Stem lesions are elongated, brown, and often split at the surface (Fig. 6). Pod lesions begin as water-soaked spots that may produce a yellow bacterial exudate during moist weather. Pod lesions can enlarge and become sunken brown spots that are circular to irregular in shape (Fig. 7). Pod lesions sometimes are surrounded by a reddish margin. A water-soaked lesion is usually the first visible evidence of seed infection, and severely affected seeds become shriveled and brown. Stem girdling and joint rot may occur above the cotyledonary node of plants grown from infected seed.

Bacterial wilt kills young seedlings by plugging the water conducting (vascular) tissue in stems. Larger plants that become infected may survive the entire season and produce seed. However, leaves will wilt during periods of moisture stress and during warmer parts of the day (Fig. 8). Golden brown, irregularly shaped leaf lesions occur, and affected leaves may drop off. Infection can occur on pod sutures similar to those caused by halo and common bacterial blights. However, bacterial wilt seldom causes circular water-soaked spots on pods. Infected seed may be bright yellow, orange, or purple, depending on the strain of the infecting bacterium. The wilt bacteria are not spread as easily by rain or contact with wet foliage as compared with other bean disease bacteria. However, wilt bacteria spread rapidly during hailstorms because of the extensive wounding that occurs.

Figure 6. Symptoms of common bacterial blight symptoms on stems.

Disease Cycle

The bacteria that cause halo blight, bacterial brown spot, common bacterial blight, and bacterial wilt survive from season to season in infected seed and infested bean residue. Bean plants grown from infected seed often serve as the initial source of bacteria. Infected plants may be volunteers from the previous bean crop or plants grown from infected seeds used to plant the current crop. The brown spot bacteria can also spread from some weed species (hairy vetch). Bacterial cells are spread from infected plants and residue to healthy plants by splashing rain, hail, aerosols, irrigation water, windblown residue, contaminated equipment, and other methods. The bacteria are able to multiply on plant surfaces before infecting plants through wounds and natural openings. Bacteria that penetrate the plant multiply and spread through the tissue, causing symptoms within several days to approximately two weeks after infection. Under favorable environmental conditions, bacteria continue to spread, and the disease cycle repeats. During moist weather, bacteria may be

Figure 7. Common bacterial blight symptoms on pods (Source: G.D. Franc).

Figure 8. Symptoms of bacterial wilt (Source: H.F. Schwartz).

present in sufficient numbers to be visible as a bacterial exudate on the surface of lesions.

Disease development is more likely to be severe following rainy, humid weather. Wounds caused by hail, wind, machinery, and other factors favor disease development by providing infection sites for bacteria. Temperature greatly influences disease development. Halo blight is favored by temperatures less than 80 degrees Fahrenheit, bacterial brown spot by temperatures less than 85 degrees Fahrenheit, and common bacterial blight and bacterial wilt by temperatures greater than 80 degrees Fahrenheit.

Management

Bacterial bean diseases are managed most effectively by integrating several control practices.

1. **Crop rotation.** Bacteria that cause halo blight, bacterial brown spot, common bacterial blight, and bacterial wilt do not survive well in the absence of bean plants. As infested bean residue decomposes, bacteria are exposed to the soil environment and quickly die. Crop rotation to a nonhost crop for two years or longer will provide sufficient time for residue decomposition and also will reduce the number of volunteer beans present during each succeeding season.
2. **Resistant varieties.** Most resistant varieties become diseased to various degrees, but they usually sustain less loss than susceptible varieties. However, the performance and disease resistance of each variety often varies from region to region. Therefore, consult your seed supplier to determine if a particular variety is suitable for your production practices.
3. **Certified seed**. Certified seed should always be planted to minimize the risk of introducing bacterial pathogens with the seed. The use of certified seed does not guarantee freedom from disease. However, the certification tag does provide the assurance that the seed was produced following certification guidelines and that bacterial diseases were not detected.
4. **Seed treatment**. Seed treatment with streptomycin will help eliminate bacteria present on the surface of the seed. Thus, seed treatment helps to reduce contamination that may be present in a seedlot.
5. **Destroy volunteer beans**. Because volunteer plants are important sources of bacteria for initiating disease outbreaks, volunteer bean plants within or near bean fields should be destroyed as soon as they are discovered.
6. **Residue management.** Bacterial pathogens of beans may survive in infested bean residue. Fall or early spring incorporation of bean residue into the soil will reduce the amount of inoculum available to initiate disease development.

7. **Irrigation practices.** Overhead irrigation increases the risk of disease by providing the moisture and splashing water necessary for bacterial spread and disease development. Overhead irrigation should be avoided when growing beans for seed certification. Because some bacteria are spread in irrigation water, avoid reusing irrigation runoff from bean fields or fields planted to beans the previous year.

8. **Movement through the field**. Bacterial cells are easily spread between plants and between fields by machinery, people, and animals. Spread is more likely to occur when plants are wet. Consequently, it is important to minimize movement through bean fields when plants are wet.

9. **Copper-based bactericides**. Halo blight, bacterial brown spot, and common bacterial blight disease severity can be reduced by timely applications of copper-based bactericides. The greatest benefit occurs when copper is applied to foliar surfaces of susceptible varieties, prior to symptom appearance, during periods of weather favorable for disease development. A sufficient spray volume and pressure must be used to cover all surfaces of the plant. Several commercial copper-based bactericides are available. Always read the product label carefully and consult local extension representatives for updated recommendations.