



Common Bacterial Blight and Halo Blight

Two Bacterial Diseases of Phytosanitary Significance for Bean Crops in Washington State

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS038E

This fact sheet has been prepared to increase awareness of seed-borne bacterial diseases that afflict bean plants—both edible bean crops and bean seed crops. Five seed-borne bacterial diseases are regulated in 20 counties of Washington under a bean seed quarantine:

- Common bacterial blight, caused by *Xanthomonas axonopodis* pv. *phaseoli*
- Halo blight, caused by *Pseudomonas syringae* pv. *phaseolicola*
- Fuscous blight, caused by *Xanthomonas phaseoli* var. *fuscans*
- Brown spot, caused by *Pseudomonas syringae* pv. *syringae*
- Bean bacterial wilt, caused by *Curtobacterium flaccumfaciens* pv. *flaccumfaciens*

In 2009, the common bacterial blight pathogen was detected on three seed lots and the halo blight pathogen on two seed lots harvested from bean seed crops grown in Washington. These were the first reports of these pathogens in bean seed crops in this state since the quarantine was implemented in 1968.

Introduction

In the state of Washington, beans (including snap beans, lima beans, and dry beans) are produced on more than 65,000 acres annually, at an estimated value of \$35 million (National Agricultural Statistics Service 2007). The economic well-being of the Washington bean industry could be threatened by the introduction of bean seed contaminated with certain bacterial, fungal, or viral pathogens. Consequently, both a bean seed quarantine and a phytosanitary inspection program were established in the state in 1968. The quarantine reduces the risk of introducing seed-borne pathogens into the major bean production areas of the state. The phytosanitary inspection program provides bean growers in Washington with seed lots that have been tested for seed-borne pathogens prior to planting. The bean seed quarantine and the phytosanitary inspection program are administrated by the Washington State Department of Agriculture (WSDA). Under the provisions of the quarantine, bean seeds known

to be contaminated with regulated pathogens may not be planted in protected areas of the state, which include 20 counties: Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima. Bean seed crops produced in these protected areas must be in compliance with quarantine requirements and must be entered into the Washington bean phytosanitary inspection program or the Washington seed certification program.

In 2009, five bean seed lots harvested from seed crops produced in Washington tested positive for regulated bacterial pathogens: three seed lots tested positive for the common bacterial blight pathogen, *Xanthomonas axonopodis* pv. *phaseoli*, and two tested positive for the halo blight pathogen, *Pseudomonas syringae* pv. *phaseolicola*. These were the first known reports of these pathogens in bean seed lots grown in the regulated areas of Washington since the quarantine and the phytosanitary inspection program were established in 1968. Each of the five bean seed lots in which the common bacterial blight or halo blight pathogen was detected had been harvested from a different bean seed crop, and each crop had been planted with a different stock seed lot. Each of the stock seed lots had been certified as “pathogen-free,” based on seed health assays completed by certified labs, before they were planted. Each of the five infected seed lots was produced in fields that had been rotated out of beans for more than three years. All five affected crops were grown using overhead irrigation. Symptoms of common bacterial blight and halo blight were not observed during WSDA field and windrow inspections of each of the five bean seed crops, but harvested seeds from these crops later tested positive for bacterial pathogens. Consequently, these five seed lots were not certified by the WSDA and had to be destroyed. It has not been possible to pinpoint the sources of inoculum that led to infection of these bean seed lots, in part, because symptoms were not observed in any of the fields.

Spread of the Pathogens

The pathogens that cause common bacterial blight and halo blight are usually introduced into new regions on contaminated seeds but may also be introduced on infested

plant residues. Once introduced, the bacteria can spread from plant to plant and to nearby fields in windblown water (rain and irrigation), soil, and plant debris. Spread also occurs by contact between wet leaves, or via irrigation water, contaminated equipment, and people or animals moving through infested fields. The bacteria gain entry into plants through wounds and natural openings during periods of high humidity or when the foliage is wet. The pathogens can overwinter in or on contaminated seeds, infested plant debris, volunteer beans, or weed hosts.

Disease Development

The incidence and severity of these bacterial diseases is greatly affected by environmental conditions. Common bacterial blight is more severe when conditions are *humid and warm* (daily highs >80°F). The disease is most often detected in July and August. Halo blight is also encouraged by humid conditions but is usually more severe when temperatures are *cool to moderate* (daily highs <80°F). Halo blight is usually detected shortly after seedling emergence in the spring, when weather conditions are cool and moist.

Symptoms

Below is a description of symptoms typically associated with common bacterial blight and halo blight. However, these pathogens can be present in bean crops and on bean seed without any visible symptoms of infection. Consequently, harvested seed lots may test positive for these pathogens despite the absence of symptoms in the crops from which bean seed lots were harvested.

Common Bacterial Blight Symptoms

Common bacterial blight affects the foliage and pods of the common bean and soybean. Symptoms initially appear as small, water-soaked spots (lesions) on the leaves (Figure 1). The lesions gradually enlarge and coalesce into irregular shapes, frequently one inch or more in diameter, and they exhibit a scalded appearance. The lesions may become dry and brown and surrounded by a narrow, lemon-yellow-



Figure 1. Water-soaked lesions of common bacterial blight. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)

colored margin (Figure 2). The lesions frequently occur along leaf margins. Infected pods may exhibit circular, slightly sunken, water-soaked areas (Figure 3). In humid conditions, infected areas on the pods may produce yellow masses of bacterial ooze. The infected areas on the pods usually dry to become reddish-brown lesions, and pod infections frequently result in discolored and shriveled seeds.



Figure 2. Mature common bacterial blight lesions. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)



Figure 3. Common bacterial blight on pods. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)

Halo Blight Symptoms

Halo blight affects the foliage and pods of the common bean, lima bean, and soybean. The first symptoms are small, water-soaked lesions resembling pinpricks on the underside of leaves. The small lesions rapidly turn dry

and reddish-brown, and are visible on both sides of the leaf. These lesions usually remain small. A greenish-yellow zone of irregular shape and size, resembling a halo, often develops around the reddish-brown lesions (Figure 4). At high temperatures, the halo may be small or absent. Infections can become systemic, that is, spread throughout the plant, leading to yellowing and death of new foliage (Figure 5). Pod symptoms begin as tiny, water-soaked spots on the pod surface that gradually enlarge to form dark, sunken lesions (Figure 6). A cream-colored to silver bacterial ooze is often associated with pod lesions, and seeds in infected pods can be discolored, shriveled, and small.



Figure 4. Halo blight on leaves. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)



Figure 5. Foliar halo blight symptoms. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)

Pod symptoms of common bacterial blight and halo blight are very similar but may be distinguished by examining leaf symptoms and by identifying the causal agent using isolations from symptomatic leaves. It is important to consult a qualified diagnostic lab to verify the source of suspect symptoms. For a list of commercial and state diagnostic labs in the Pacific Northwest, refer to the Pacific Northwest Vegetable Extension Group (PNW VEG) website under the section, Diagnostic Labs: http://mtvernon.wsu.edu/path_team/vegCropResources.htm.



Figure 6. Halo blight on bean pods and seed. (Courtesy of Howard F. Schwartz, Colorado State University, Bugwood.org)

Disease Management

Several disease management strategies can be used to control common bacterial blight and halo blight.

- Reduce overwintering of pathogen populations that cause common bacterial blight and halo blight by using at least a three-year bean crop rotation.
- Use effective sanitation practices with bean residues to reduce the amount of inoculum that can affect nearby bean crops in the following season and future bean crops in the same field. Bacterial pathogens survive longer on crop residues left on the soil surface than on residues incorporated into the soil. Bean residues should be incorporated into the soil shortly after harvest to promote decomposition. It is also important to remove and destroy volunteer bean plants.
- Use resistant or tolerant cultivars, since bean cultivars differ widely in susceptibility to the bacterial pathogens that cause common bacterial blight and halo blight. Most of the older bean cultivars, especially pintos and light red kidneys, are susceptible to both of these pathogens. Many navy and small white cultivars and some red kidney cultivars are only resistant to the halo blight pathogen, while some great northern cultivars are resistant to both pathogens. Consult regional bean seed personnel for help in selecting resistant cultivars.
- Plant only bean seed that is certified as pathogen-free.
- Plant seeds produced in arid regions of the western US, since dry conditions discourage bacterial diseases.
- Treat seed with the antibiotic streptomycin to reduce bacterial contamination on the surface of the seed coat. However, streptomycin will not control systemic infections in the seed. Always follow federal and state pesticide application laws when applying any pesticide.

- Clean tractors and other equipment before moving them from one bean field into another to prevent unintended spread of bacterial pathogens.
- Avoid cultivation or any traffic through fields, including foot traffic for manual field inspections, when the foliage is wet. Spread of bacterial pathogens is more likely to occur when plants are wet.
- Avoid wounding bean plants. Bean fields should not be cultivated when stands are tall enough that equipment passing through the fields will damage plants.
- Avoid using overhead irrigation systems, if possible. Overhead irrigation increases secondary spread of bacterial pathogens compared to furrow (rill) or drip irrigation. If overhead irrigation is used, allow plant surfaces to dry completely between irrigations. If possible, irrigate in the morning so the canopy dries out in the afternoon instead of remaining wet all night. The longer leaves remain wet, the higher the risk of bacterial disease.
- Avoid re-using irrigation water because bacterial pathogens can be transmitted in water.
- Use copper-based bactericides (for example, copper hydroxide) to reduce growth of bacteria on foliage and to reduce spread of bacteria to healthy foliage and pods. Copper-based bactericide applications are most effective as a preventive measure to protect plants when conditions are conducive to disease development. The first application should be made before symptoms appear, with repeat applications at 7- to 14-day intervals, because these bactericides will not eradicate the bacterial pathogens once plants are infected. Always read the product label carefully, follow state and federal laws, and consult your local WSU Extension office and bean industry representatives for recommendations.

Disease Prevention

The bacteria that cause halo blight and common bacterial blight are regulated pathogens of phytosanitary significance for bean seed crops because seed-borne inoculum can readily lead to outbreaks of these diseases in production crops. The potential for close proximity of bean seed crops and bean production crops in Washington means that effective, long-term management of these bacterial diseases is dependent on cooperation among all producers of bean crops.

For seed crops, stock-seed sources must be certified as pathogen-free before planting. In addition, the seed crops must be inspected by the WSDA prior to harvest. However, even these measures do not completely eliminate the risk of infection because significant populations of the common bacterial blight or halo blight pathogens can build up on the foliage or pods before symptoms are noticeable. Consequently, harvested bean seed lots may test positive for a pathogen even when symptoms have not been observed in the field.

If halo blight or common bacterial blight is observed in a production crop, the crop does not have to be destroyed. Observing the presence of disease can result in implementation of timely and appropriate management practices—before the disease becomes widespread. In addition, seed companies should be notified of affected crops, so they can avoid planting bean seed crops near a field in which a bean production crop has been identified as having halo blight or common bacterial blight.

If you observe bean seed or bean production crops with suspected symptoms of halo blight or common bacterial blight, the WSDA Seed Program should be notified by calling 509-249-6950. Bean seed crops found to be infected with regulated pathogens must be reported to the WSDA within 72 hours of discovery. For more information, contact your local WSU Extension office.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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