



Blackleg of Canola

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Blackleg is a common disease in most areas where canola is grown. Blackleg was first reported on cabbage in Oklahoma in 1945. In October 2009, the disease was found on some canola plants in northern Oklahoma fields.

Information contained in this fact sheet deals specifically with the biology and control of blackleg of winter canola in the Southern Great Plains. The response of canola varieties to blackleg and fungicide use recommendations are not included herein because varieties available and fungicide recommendations can change from year to year. This information is available from other sources.

Canola plants collected from infected fields had beige lesions on the leaves and black pepper-like dots were observed within the leaf spots. The observed symptoms were the result of blackleg caused by the fungus *Leptosphaeria maculans*. This disease is also called Phoma blackleg or Phoma stem canker. It is not yet known what effect the disease will have on canola yields in this region.

There are two species of the blackleg fungus, one is weakly aggressive, the other highly aggressive. *Leptosphaeria biglobosa* is the weakly aggressive species and generally affects plants later in the season by causing stem cankers that only minimally impact yield. *L. maculans* is the more aggressive species, which can attack plants at all ages and can significantly affect yield. This more severe form of blackleg caused by *L. maculans* begins as lesions on the leaves that eventually spread to infect stems near the soil line. Stem infections can result in deep cankers, lodging, reduced plant vigor, and in severe cases, kill the plant. The two species of *Leptosphaeria* cannot be distinguished in the field, but laboratory tests have shown that the blackleg fungus recovered in the fall of 2009 to be the more aggressive *L. maculans*. Symptoms can be seen from emergence to harvest. It is likely the blackleg fungus has been present at low levels for several years. The outbreak in the fall of 2009 most likely developed due to the cool, wet weather which was conducive for disease development and spread.

To prevent blackleg from negatively impacting seed yield and quality, it is important to be familiar with blackleg symp-

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toms, the disease cycle, and disease management practices (described below). Growers should begin scouting their fields at the two to four true leaf stage for symptoms of blackleg. Symptoms should not be confused with winter dormancy-related senescence and dieback of leaves in cold weather. Care should be taken to avoid introducing the blackleg fungus to disease-free fields. Disease inoculum (spores, mycelium) can be carried on equipment, shoes, clothing, etc., so these items should be cleaned by thoroughly washing with soap and water when leaving symptomatic fields.

Symptoms of Blackleg

In winter canola, the early symptoms of blackleg may be seen in the fall, but are not obvious because only a few random leaves may be affected (Figure 1).

In some cases, the symptoms are more obvious on leaves within the canopy (Figure 2). Initial lesions are beige colored and are about $\frac{1}{2}$ inch wide. As the disease progresses, additional spots develop on the leaves, and the lesions may coalesce so large portions of a leaf are affected (Figure 3). Lower leaves or severely affected leaves may become chlorotic (yellow) and die. Within the dead tissue, black pepper-like fruiting bodies (pycnidia) develop (Figure 4). In general, the mildly aggressive pathogen species attacks older, senescing leaves, while the highly aggressive species attacks cotyledons (seedling leaves) and young leaves. If the disease appears in the fall, it is more likely that the aggressive species is involved. It is not unusual to observe blackleg symptoms in canola fields, even when resistant varieties are being grown, since cultivar resistance is rarely complete.

As the disease progresses, spores of the aggressive species will spread to attack the stem, causing a lesion or canker near the soil line (Figure 5). These stem lesions are beige to gray and may have a dark border.

Black pepper dots may appear within the lesions. These are the fruiting bodies of the fungus.

Plants with stem cankers are weak and may lodge or snap off in the wind. Often, there is a latent (symptomless) period between the appearance of lesions on the foliage and appearance of lesions on the stems. The weakly aggressive strain may cause lesions on the stem, but they are generally superficial, occur late in the season, and do not impact yield. Lesions also can appear on pods as black pepper-like dots. In such instances, the pods often shatter prior to harvest. If pods are infected, seeds are usually infected with the fungus.



Figure 1. Early symptoms of blackleg disease on canola.



Figure 2. Lower leaves with yellowing and leaf spots caused by the blackleg fungus.

Pods are only affected on canola varieties that are highly susceptible to the disease.

Hosts

The blackleg fungus can affect a variety of *Brassica* crops including canola, rutabaga, turnip and cabbage. It can also attack related cruciferous plants in the mustard family, such as *Sinapis* (white mustard), *Raphanus* (radish), *Descurainia* (tansymustard, flixweed), *Sisymbrium* (rocket), *Thlaspi* (nepicress), and *Capsella* (Shepherd's purse).



Figure 3. Lower and upper leaf surfaces of canola leaves with lesions due to blackleg.



Figure 4. Closeup of blackleg leaf spots with black pepper-like fruiting bodies of the fungus.

Spread and Survival

The life cycle of the blackleg fungus is shown in Figure 6 (page 4). The pathogen has several methods of spread including infected seed. Although seed infection is low (usually less than 1 percent), it can allow disease inoculum to be moved long distances and introduced to new fields. When infected seed is planted, the seedlings may emerge with lesions on the cotyledons (seedling leaves) as shown in Figure 7. These lesions produce numerous spores (pycnidiospores) that can be rain splashed onto healthy seedlings and initiate new infections. Once leaves are infected, the fungus can grow systemically through the plant's vascular tissue into the stem's base.

The pycnidiospores remain viable in plant debris at the end of the season and may continue to be infectious for three to five years, unless stubble thoroughly deteriorates or is tilled into the soil. Large canola roots may take two to five years to breakdown. In the spring, the fungus produces fruiting bodies, called pseudothecia, on infected canola residue. Small microscopic spores, called ascospores, are ejected from the pseudothecia and become airborne, resulting in dispersal to



Figure 5. Top, advanced stem lesion resulting in internal discoloration of the vascular tissue. Middle, canola stem lesion with dark border and numerous black pycnidia, and lower, canola stems girdled and constricted by blackleg. Photos by NDSU Extension Service.

newly planted canola crops. The spores may travel long distances on wind currents, but most land within 1500 feet of the site where the pseudothecia were formed. Ascospores can be released from canola debris for up to five years although most spores are released in the first two years following infection. As with many diseases in other crops, blackleg is generally only an issue every few years, when weather conditions favor the causal fungus' spore production and dispersal.

The earlier initial infections occur in the fall, the greater the likelihood basal stem cankers will develop and result in more severe yield losses. Stem lesions girdle the stem base, preventing the flow of water up the stem and often result in lodging of the crop. The severity of the disease is greatly increased following wounding and insect or herbicide damage. Seedling infection may arise from infected seed or from airborne spores. Plants infected as seedlings may die or become stunted.

Management of Blackleg

Blackleg is best controlled by integrating a variety of methods. The following recommendations should be followed as management practices allow.

1. **RESISTANT VARIETIES:** Growers should plant canola varieties that are less susceptible to blackleg. In locations



Figure 7. Young canola plant with lesions on cotyledons. Photo courtesy Sam Markell, NDSU.

where blackleg is endemic, the use of resistant or tolerant varieties is the main method of controlling blackleg.

2. **FUNGICIDE SEED TREATMENT:** Seed treatment will help prevent the spread of blackleg from infected seed to seedling, but will not protect seedlings from infection by airborne spores. Canola seed should always be treated with a fungicide that is effective for blackleg control. It is important to remember that even if seed tests negative for the presence of the blackleg fungus, a few infected seeds may slip through the testing process. Fungicide seed treatments helps to address the problem of undetected seed infections and reduces the chance of introducing blackleg to a field. Use the recommended rates for seed treatment. Seed treatment against blackleg can sometimes be combined with additional treatments which protect against other diseases and insects. Most of the canola seed sold in Oklahoma and Kansas is treated with fungicides that are effective against the blackleg fungus.
3. **SANITATION:** Clean equipment and machinery before moving from one field to another. This is especially important if canola is being planted in fields or areas not previously planted with canola. Care should also be taken to clean boots, hands, clothing, etc. after visiting an infected field as spores can easily be carried and introduced to disease free fields. Equipment should be thoroughly washed with soap and water.
4. **TILLAGE:** If canola plants are infected with blackleg, the canola stubble should be tilled under the soil surface, or if possible, burn the stubble. Covering canola debris with soil allows for quicker breakdown and prevents fungal fruiting bodies from releasing spores and infecting nearby hosts. Infected canola residue left on the soil surface may release spores for three to five years.
5. **CROP ROTATION:** Rotate out of canola for three to five years in no-till cropping systems, or two to three years with conventional tillage. Longer rotations ensure that infected stubble has sufficiently degraded and spores are no longer viable.

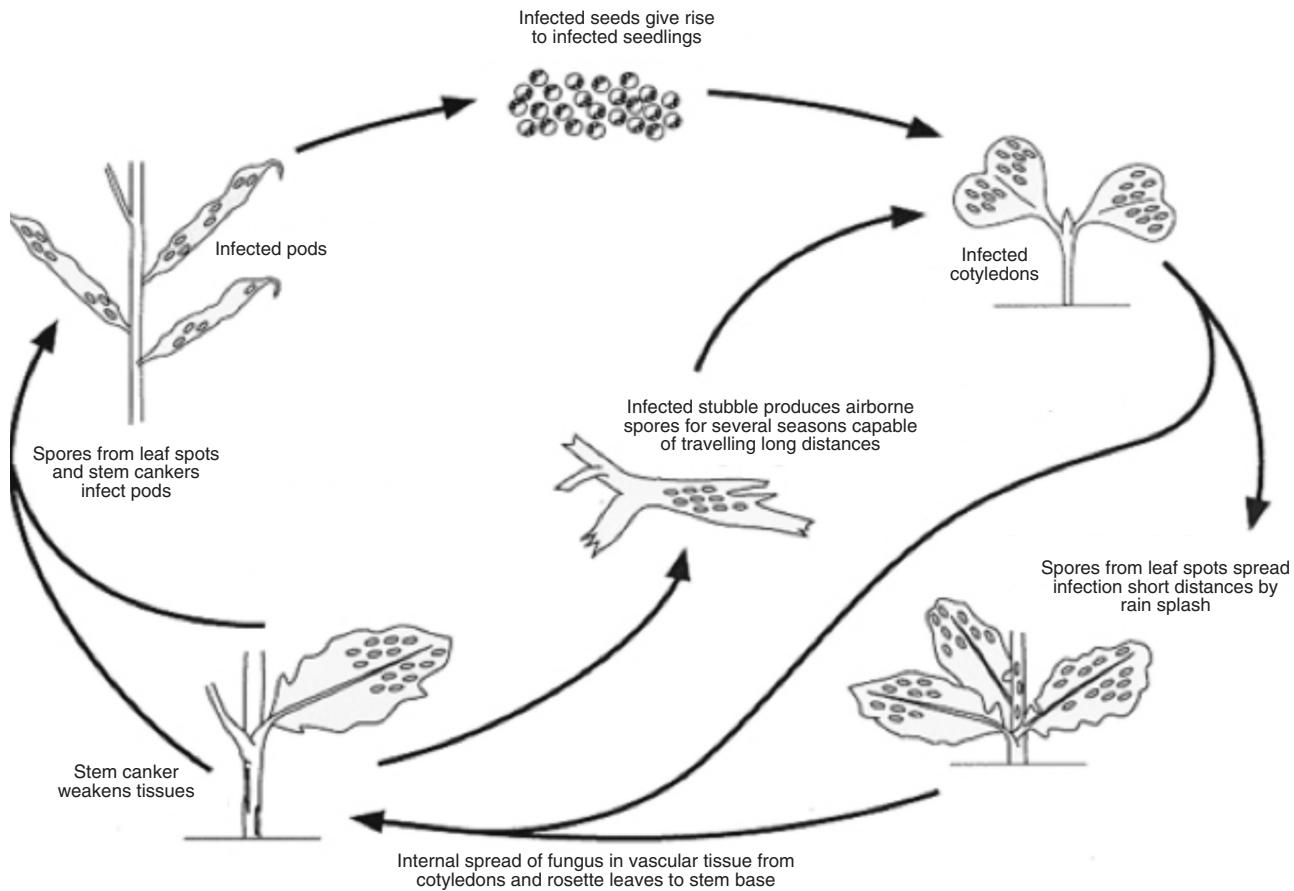


Figure 6. Blackleg Disease Cycle. Diagram courtesy Department of Biology, University of Saskatchewan.

6. **WEED CONTROL:** Volunteer canola and weedy mustards should be eliminated. If these alternative hosts are not removed from the border of infected fields and fields in rotation out of canola, crop rotation will not be as effective. When canola follows wheat, use short residual herbicides for the mustards in the wheat.
7. **SEEDING:** Use shallow tillage or direct seeding to prevent bringing residue back to the soil surface at planting. Non-hosts such as wheat should be planted during crop rotations.
8. **FOLIAR FUNGICIDE:** A foliar fungicide may be warranted if blackleg symptoms are easily observed at the seedling

and rosette stages or if a susceptible variety is being grown. Refer to product labels for information on timing and application of foliar fungicides.

9. **CERTIFIED SEED:** If available, use certified, blackleg-free seed. The seed should include a certificate that indicates the seed lot tested negative for blackleg fungus. This is most important when new fields are being planted in areas not known to have blackleg.

If growers have questions about current varieties, they should contact their local county Extension educator or seed dealer.

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