

## **Diseases in Alfalfa Seed Production**

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### **Introduction**

Alfalfa seed production is a well-established industry in Western Canada, however, acreages have declined recently due to high grain and oilseed prices, and reduced alfalfa usage in livestock production systems in North America. For the remaining acres, good agronomic practices, along with an understanding of the biology and control of diseases in alfalfa seed production are required to maximize productivity.

Alfalfa is susceptible to a number of plant diseases that can impact yield potential and seed quality. Plant disease risk is determined by components of the disease triangle: host, pathogen, and environment. Environmental stresses (eg. extreme temperatures, moisture, destructive weather) can predispose crops to infection by pathogens. Conversely, disease damage may increase susceptibility to environmental stresses such as winter injury. Fields that had alfalfa diseases in the previous year may have inoculum over wintering in soil, crop residue, seed, and/or on plants themselves. Practice crop rotations to break disease cycles and start with disease-free seed exhibiting good germination. Consider seed treatments when seeding new fields. Most importantly, crops should be scouted for disease regularly to identify issues early and consider appropriate action.

**Figure 1: Scouting Spring Black Stem (Saskatchewan Ministry of Agriculture, 2007)**



**Table 1: Conditions that Favour Diseases of Alfalfa**

Conditions	Disease
Cool, wet or dry soil conditions during seedling establishment; infected or poor quality seed; deep seeding	<ul style="list-style-type: none"> <li>✓ Seed rot</li> <li>✓ Damping-off / Seedling Blight</li> <li><i>Pythium, Phytophthora</i> (wet)</li> <li><i>Rhizoctonia, Fusarium</i> (dry)</li> </ul>
Heavily cut, grazed or burned, frost, poor drainage, low fertility, poor snow cover	<ul style="list-style-type: none"> <li>✓ Crown rot</li> <li>✓ Winter kill</li> </ul>
Early abundant snow fall, or late irrigation delaying dormancy	<ul style="list-style-type: none"> <li>✓ Snow moulds</li> </ul>
High humidity	<ul style="list-style-type: none"> <li>✓ Blossom blight</li> </ul>
Moist and cool conditions, rain-splash	<ul style="list-style-type: none"> <li>✓ Black Stem and Leaf spots</li> <li>✓ Anthracnose</li> <li>✓ Downy mildew</li> </ul>
Irrigation	<ul style="list-style-type: none"> <li>✓ Verticillium wilt</li> <li>✓ Bacterial wilt</li> <li>✓ Nematodes</li> </ul>

**Blossom Blight**

Two fungal pathogens are capable of causing blossom blight disease in alfalfa. The first, *Sclerotinia sclerotiorum*, is common in the black soil zone and causes white mould or sclerotinia stem rot on a variety of broad-leaf crops including pulses, canola, borage and sunflower. Small, black fungal bodies called sclerotia overwinter in soil or seed. Under prolonged wet soil conditions, sclerotia produce small mushroom-like structures that release spores into the crop canopy.

The second fungus that can cause blossom blight is *Botrytis cinerea*. This pathogen commonly causes seed rots or seedling blights of various crops and is common in agricultural soils. Spores are produced on infected residue and are blown with the wind onto their host crop. Spores of either or both of these pathogens infect alfalfa blossoms, causing abortion of florets and reduced seed development. Early symptoms are difficult to detect and often losses are not detected until it is too late to apply fungicides for control. Symptoms will be first observed in areas where a dense, moist crop canopy is favoured, such as low-lying or sheltered areas.

Yield losses due to blossom blight can be as high as 50 to 100 per cent under extended cool, wet conditions. Blossom blight will not be a problem in all years, which is why disease forecasting is critical. Risk is higher when using rotations with canola and borage, but risk decreases when conditions become hot and dry. In Saskatchewan, blossom blight was first identified in 1993 when severe losses occurred due to cool, wet weather during the bloom stage. From 1994 to 1999, blossom blight was found in localized areas only and did not result in significant yield loss. In 2000, early infections were prevalent but dry conditions followed and reduced the impact of the disease. From 2001 to 2003, risk of blossom blight was low due to dry conditions in most alfalfa production regions. Blossom blight risk increased in 2004 and in 2005, blight developed late in the season after rain was received in late-August and September. A dry season in 2006 and variable conditions in 2007 to 2009 limited the reports and impact of blossom blight. Wet conditions in 2010 were conducive for development of *Sclerotinia* and *Botrytis* in alfalfa as well as other crops such as lentil.

## **Leaf Spot Diseases**

There are a number of leaf spot diseases affecting alfalfa, but the most common one in seed production is spring black stem, caused by *Phoma medicaginis*. Spring black stem was observed in every field surveyed in 2005 and 2006 for foliar alfalfa diseases. Most leaf spotting pathogens have a similar disease cycle and are controlled in the same way.

Spring black stem symptoms can occur on leaves, crowns and seed pods as well as on the stem. Early symptoms appear as small black spots, often referred to as “tar spots”, on the lower leaves and stems. These spots expand rapidly and coalesce into larger lesions during moist periods, which leads to reduced photosynthetic area of the leaf and can cause stem girdling, limiting flow of nutrients and water. Reduced plant productivity leads to leaf drop and reduced seed yield. In addition, this disease can attack the developing seed pod, which may lead to pod splitting and seed infection. Spores are produced on infected residue in the fall and spring during periods of cool, wet weather and are spread by rain-splash and wind on the plant.

Some of the other common leaf diseases observed in alfalfa include: yellow leaf blotch (*Leptotrochila medicaginis*), lepto leaf spot (*Leptosphaerulina trifolii*), common leaf spot (*Pseudopeziza medicaginis*), anthracnose (*Collectotrichum trifolii*) and downy mildew (*Peronospora trifoliorum*). Environmental conditions such as drought, frost damage or nutrient deficiencies can manifest themselves as symptoms similar to leaf diseases. If diagnosis is uncertain, contact a local agronomist or the Crop Protection Laboratory.

## **Root and Crown Rots**

There are a number of pathogens present in agricultural soils that cause seed rot, seedling blights and root/crown rots of many crops. Some of the common pathogens on alfalfa are *Fusarium*, *Rhizoctonia*, *Sclerotinia*, *Pythium*, *Phytophthora*, *Phoma* and *Aphanomyces*. Diseases gain entry through stems or crown buds, and then spread to the crown. Root and crown rots are associated with inadequate drainage, poor fertility, frost, and crown injury due to insect feeding, harvesting or grazing. Plants can tolerate some crown damage, but good stand establishment and healthy root systems are critical for a high-yielding, weed-free seed crop. Infected stands with diseased crowns become more susceptible to adverse conditions and often decline within three years. Many of the crown-rotting pathogens are favoured by cool, wet soils: these conditions also delay plant metabolism. However, warm dry soils favour rhizoctonia root rot, which is characterized by reddish-brown lesions or cankers on crowns. Severe infections lead to stunting, leaf drop and plant death. Infected plants often occur in patches in the field, following a pattern of dry soil conditions.

Control of root and crown rots is difficult because fungicides are ineffective on below ground plant parts once the crop is established. Seed treatments help prevent loss only during seed germination and emergence. Crop rotation, limiting stress to the crop and maintaining soil fertility will also provide protection.

## Verticillium Wilt

Verticillium wilt is caused by the fungus *Verticillium albo-atrum*. It is a vascular wilt disease, meaning that the pathogen invades the water-conducting vessels of the plant resulting in reduced water and nutrient uptake. This leads to drooping of the plant under warm conditions, and wilting and yellowing of lower leaves and shoots. The pathogen over-winters in crop residue, crowns and seed. Verticillium wilt is favoured by high moisture levels and is typically only found in fields that are under irrigation. The pathogen can be spread between fields by harvest equipment or other mechanical contact, alfalfa hay and residue, seed, wind, irrigation and insects. Limiting disease spread via these mechanisms is fundamental for disease control.

## Integrated Pest Management (IPM) of Alfalfa Diseases for Seed Production

To maximize stand longevity and economics, it is necessary to delay disease entry into the alfalfa crop. Once disease symptoms are detected, losses have likely already occurred and there will be additional cost to control the disease. Integrated Pest Management (IPM) is an important tool for successful alfalfa seed production. See Table 2 for a list of IPM approaches for alfalfa seed production.

**Table 2: IPM Approaches for Alfalfa Seed Production**

IPM Approach	Description
<b>Cultivar Selection and Seed Quality</b>	<p>Refer to Saskatchewan Ministry of Agriculture factsheet <i>Forages-Relative Cultivar Yields for perennial Species</i> for current variety information. Remember that “resistance” does not imply immunity to disease. If environmental conditions are favourable and the pathogen is abundant, disease can develop even on cultivars that are rated as resistant.</p> <p>Most disease pathogens can also be spread in or with the seed. Do not assume that pedigreed seed is disease free. <i>The Seeds Act</i> includes standards for genetic purity, freedom from weed seeds and germination, but does not have standards for seed-borne diseases of alfalfa. Before buying seed, ask the origin of the seed, if any disease problems were observed in the field, and if any disease tests have been conducted in an accredited laboratory.</p>
<b>Seed Treatments</b>	<p>Seed treatments are considered cost effective and often necessary insurance for valuable crops. If using inoculants (nitrogen-fixing rhizobia), refer to the label for proper mixing instructions. Seed treatments will not protect against soil-borne pathogens that attack plants beyond the establishment stage.</p>
<b>Crop Rotation</b>	<p>Maintain at least four years between alfalfa crops, and control volunteer alfalfa during interim seasons. This is effective for leaf spot pathogens, since they are specific to alfalfa only. To help manage blossom blight, do not plant alfalfa into a field that had broadleaf crops (i.e. pulses, canola, mustard, borage) in the previous two years.</p>

<p><b>Agronomics</b></p>	<p><i>Stand establishment</i></p> <ul style="list-style-type: none"> <li>• Plant winter-hardy varieties</li> <li>• Maintain well-drained soils</li> <li>• Do not damage crowns when cutting, grazing or burning</li> </ul> <p><i>Sanitation</i></p> <ul style="list-style-type: none"> <li>• Remove debris from seed (ergot, sclerotia, leaf and stem pieces)</li> <li>• Burn in spring to remove residue</li> <li>• Control volunteers and weeds</li> <li>• Do not move from older stands to younger stands when cutting</li> <li>• Removing foliage by haying reduces dense leaf growth, and consequently snow moulds and leaf spot diseases</li> </ul> <p><i>Fertility</i></p> <ul style="list-style-type: none"> <li>• A healthy crop is better able to withstand disease and winterkill</li> <li>• Avoid excessive fall fertilizer</li> </ul> <p><i>Insect control</i></p> <ul style="list-style-type: none"> <li>• Reduce injury to plants and spread of disease</li> </ul>
<p><b>Foliar Fungicides</b></p>	<p>Disease development and spread are highly weather dependent, therefore applying foliar fungicides in dry years and/or when early symptoms are not evident is unnecessary and uneconomical. There are no well-developed thresholds for leaf spotting diseases in alfalfa. Scout early for symptoms (vegetative stage) and base decisions on disease risk and weather forecast.</p>