Identification and Management of New and Emerging Diseases of Corn, Soybean, and Canola

Tar Spot of corn: Tar spot of corn is an emerging leaf disease caused by the fungus *Phyllachora maydis*. It can develop rapidly and cause significant yield loss. Signs of the disease are small (@ 0.1"), raised, irregular-shaped black spots on the leaves. The tar spots are firm, appear mostly smooth, do not rub off, and extend from top to bottom sides of the leaves. Tar spot can also produce fisheye symptoms that appear as tan lesions surrounding the black spots. Tar spot was first detected in the U.S. in 2015 in Illinois and Indiana, and in southeastern Minnesota in fall 2019. Since then, tar spot has spread to multiple states. In Minnesota tar spot has been confirmed in 31 counties as far north and west as central MN but has been severe and caused yield loss only in SE Minnesota. Tar spot has not been detected in North Dakota. The tar spot pathogen can overwinter on infected corn residue and be spread by the wind. All corn hybrids planted in the U.S. appear susceptible to tar spot, although they vary in susceptibility. Fungicides applied at the growth stages VT – R3 can be used to manage this disease.

Brown Stem Rot of soybean: Brown stem rot (BSR) is a fungal disease of soybean that is common across the northern half of the U.S. soybean producing states. Incidence of BSR can increase in relation to the number of years that soybean has been grown in a field. The BSR pathogen (*Cadophora gregata)* appears to survive in infected soybean residue from one year to another. Symptoms of BSR usually don't appear until mid-August or later. BSR causes stem symptoms and often causes leaf symptoms. The pith is typically brown in infected stems that are split, whereas the pith is white in healthy stems. Leaves of infected plants often (not always) also develop brown and yellow discoloration between the veins. The leaf symptoms can be confused with SDS symptoms, but these two diseases can be distinguished by the pith color in the lower stem. Two types of this pathogen (A and B) cause different symptoms. Type A typically causes pith browning and leaf symptoms, but type B usually causes only pith browning. Resistant to BSR in soybean varieties and rotation to non-host crops such as corn or small grains can reduce BSR. Because SCN may interact with BSR, resistance to SCN may also help to reduce BSR.

Sudden Death Syndrome of soybean: Sudden death syndrome (SDS) is an important fungal disease of soybeans throughout much of the U.S. SDS has been spreading north and west in Minnesota and into North Dakota. SDS can result in yield losses greater than 50 percent. Infection of roots by the SDS pathogen (*Fusarium virguliforme*) occurs early in the season, but symptoms usually don't develop until August. Disease development is favored by early planting; wet soil; SCN infection, and susceptible varieties. SDS starts as a root disease and also affects leaves and causes defoliation. Leaf symptoms often begin as yellow spots between veins. The spots then expand to become brown lesions surrounded by chlorotic areas, and the leaves may be cupped or curled. Tan discoloration develops in the vascular tissue of the lower stem and can be seen by removing the epidermis of the stem of fresh plants. The pith remains white, which distinguishes SDS from brown stem rot (BSR). Infected roots sometimes have surface blue fungal growth in moist conditions. SDS appears to primarily infect soybean, although *Phaseolus* bean roots may be infected. This pathogen may survive for long periods of time in soil. SDS can be managed with highly resistant varieties and a few selected seed treatments.

Soybean Cyst Nematode (SCN): SCN are microscopic worms that are present throughout much of the soybean growing regions of the United States. However, SCN is still a developing soybean disease in the northern Midwest region. With heavy infestations commonly identified throughout the Red River Valley, both Northern Minnesota and Western North Dakota are currently witnessing new invasions by this pathogen. Throughout the United States, SCN is considered the most destructive pathogen of soybeans. SCN infections can be difficult to diagnose as there are few to no aboveground symptoms present until after severe infections have occurred. At this point, plants will exhibit stunting and yellowing of leaves. Unfortunately, these symptoms are not exclusive to SCN and can often be misdiagnosed for other conditions such as iron deficiency chlorosis or other root diseases. To manage SCN it is critical to take soil tests to determine if SCN is present and the severity of infestation based on the number of SCN eggs present. Effective management of SCN includes the planting of soybean varieties with SCN resistance (PI88788 or Peking), rotation of the varieties, rotating with non-host crops (corn, sunflowers, wheat), and the use of seed treatments for early season control.

Charcoal Rot: Charcoal rot, caused by the fungal pathogen *Macrophomina phaeseolina*, affects crops like corn, sunflowers, and dry beans in the Northern Midwest, particularly during high heat and drought conditions, as in the 2023 season. Long known to be a severe disease in the Southern United States, charcoal rot has begun appearing more frequently across North Dakota and Minnesota with severe infections occurring in many of the past few growing seasons. Symptoms of charcoal rot typically appear during the end of the growing season during the middle to late reproductive growth stages. However, under conducive environments, symptoms can appear as early as the seedling stage. The onset of symptoms typically will begin with the yellowing of leaf tissue leading to wilting and turning a dark brown. Stem and root tissue have streaking and the development of small black dots, which are the overwintering structures called microsclerotia. To manage charcoal rot, the best strategy is to reduce drought stress if possible. Early-season drought stress may be mediated by using reduced or no tillage to increase water availability. Further, the rotation to non-host crops such as wheat or other small grains may help, but microsclerotia are known to survive for many years. Additionally, there are some options available for planting charcoal rot resistant varieties.

Canola Diseases: One notable emerging disease of canola is Verticillium stripe which is caused by the pathogen *Verticillium longisporum*. Having been present in Europe for over six decades, Verticillium stripe was first identified in North America during the 2015 growing season. The following year, Verticillium stripe was identified in six Canadian provinces. In North Dakota, this disease has been identified at very low incidence in a few fields near the Canadian-United States border. This disease can cause severe yield losses (up to 50%) under ideal environmental conditions. The most prominent symptom of this disease is the presence of a large yellow stripe on only half of the plant stem. Other symptoms can include premature plant death, stunting, shredding of the main stem, and the presence of small microsclerotia on and within the stem tissue. There are no known effective management strategies for Verticillium stripe except for the rotation to non-host crops. Currently, it is believed that this pathogen can only infect other plants within the mustard family such as broccoli, cauliflower, horseradish, and radish.