EFFECTS OF EARLY PLANTING ON POTENTIAL FOR CORN DISEASES

- Seed and seedling diseases can reduce viable plant populations.
- Early season disease potential increases when soils are cold and wet.
- Insect feeding damage can mimic seedling disease symptoms.

The potential for corn seeds and seedling plants to become infected with a disease is greatly determined by environmental conditions, use of fungicidal seed treatments, time of planting, residue from a previous crop, and the presence of causal agents (fungal or bacterial pathogens, viral vectors, and nematodes). Genetic improvements in germination and seedling growth characteristics under cool conditions has allowed for earlier and earlier corn planting. However, early planting increases the opportunity for seeds to be affected by unfavorable environmental and agronomic conditions.

Newly planted seeds are immediately subjected to pathogenic fungi, bacteria, and soil-inhabiting insects that can infect or feed on seeds, seedling tissue, or both. In general, disease pathogens have a greater potential for causing damage when soils are wet and cold; however, some pathogens prefer warm conditions. Infected seedlings may show signs of damping-off or rotting, stunting, leaf discoloration, and deformities. If the causal pathogen is a fungus, fungicidal seed treatments can help protect the seeds from infection. If a systemic fungicide is used, the treatment can help protect the seedlings as well. Fungicidal seed treatments generally do not protect against bacterial diseases.

Soil insect injury can mimic disease symptoms because injured plants can be stunted, wilted, or discolored (Figure 1). Therefore, it is important to dig up seedling plants to closely examine the roots and other below ground seedling tissue for evidence of insect feeding. Insects that may be a threat to seeds and/or seedlings include seed corn maggot, seed corn beetle, garden symphylan, wireworm, billbug, true white grub, stink bugs, cutworm, grape colaspis grub, and corn flea beetle. While feeding, corn flea beetles can transmit the bacterium that causes Stewart's bacterial wilt, which has a seedling phase and a later-season phase. Should insects be the cause for seedling death, insect activity, depending on life cycle and threshold, may need to be addressed if the field requires replanting.

Figure 1. Wireworm "deadheart" is caused by wireworms boring into the stem below ground. Without digging around the seedling, the insect damage could be mistaken for seedling disease.

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Depending on environmental conditions and crop residue, infection by some foliar diseases may occur during the seedling stage; however, symptoms may not appear until later in the growing season. Foliar diseases that may infect seedling corn include anthracnose, holcus spot, and Goss's bacterial wilt.

Early season scouting is important to identify emergence issues and determine a course of action. Randomized population counts across the field should be made to determine the population levels of healthy plants. These counts, compared to projected potential yield based on planting date, can help a grower determine if replanting corn is necessary and profitable.

Considerations to help reduce the potential for seedling disease development include:

- Rotate crops to reduce crop specific disease pathogens living on crop residue.
- Improve soil drainage through compaction alleviation, subsurface drainage, and where practical, conservation minded surface drainage.
- Select seed products with high scores for emergence and rapid seed growth.
- Invest in fungicidal and insecticidal seed treatments.
- Plant when the forecast calls for a period of warm weather without cold rain.

Seed and Seedling Diseases

Fusarium

Identification, Characteristics, and Diagnosis:

- Caused by at least six *Fusarium* species.
- Initially, infected seedling roots and the mesocotyl may be shriveled and have tan to reddish-brown lesions, which later become brownish to dark black and rotted (Figure 2).
- Favored by wet and cool (55°F or lower) soils.
- Most notable in early planted and reduced tillage fields.

Management:

- Use fungicide-protected seed.
- Plant into warm soils that are favorably dry.
- Plant at the recommended seeding depth.

Figure 2. Fusarium-infected corn roots. Note discoloration of the mesocotyl.

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Penicillium

Identification, Characteristics, and Diagnosis:

- Caused by the fungus *Penicillium oxalicum*.
- A bluish-green mold develops on seed causing roots to deteriorate (Figure 3).
- Seedling leaves turn yellow and may die (Figure 4).
- Favored by wet and cool (55°F or lower) soils.
- Most notable in early planted and reduced tillage fields.

Figure 3. Corn seedling roots infected with Penicillium fungi. Picture courtesy of William M. Brown, Jr., Bugwood.org.

Management:

- Use fungicide-protected seed.
- Plant into warm soils that are favorably dry.
- Plant at the recommended seeding depth.

Figure 4. Corn seedling with symptoms of Penicillium seedling blight. Picture courtesy of William M. Brown Jr., Bugwood.org.

Pythium

Identification, Characteristics, and Diagnosis:

- Caused by several *Pythium* species.
- Favored by wet and cool (55°F or lower) soils, depending on the *Pythium* species present.
- Symptoms include dark, slimy lesions that cause roots or the mesocotyl to shrivel. The outer layer of roots may be rotted while inner tissues remain white and intact (Figure 5).
- Most notable in early planted and reduced tillage fields.
- Can infect anytime from planting to mid-season.

Management:

- Use fungicide-protected seed.
- Plant into warm soils that are favorably dry.
- Plant at the recommended seeding depth.

Figure 5. Darkened mesocotyl near the soil surface caused by Pythium. Picture courtesy of Don White, University of Illinois.

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Rhizoctonia

Identification, Characteristics, and Diagnosis:

- Caused by the fungus *Rhizoctonia solani*.
- Initial symptoms include brown lesions on the mesocotyl and roots of seedlings and young plants (Figure 6).
- Later symptoms on older plants include dry, reddish-brown, sunken cankers on crown and brace roots.
- Plants may be stunted, chlorotic, or have no above ground symptoms.
- Occurs more often in irrigated fields.
- Favored by temperatures between 46 and 82°F.

Management:

- Use fungicide-protected seed.
- Plant into warm soils that are favorably dry.
- Plant at the recommended seeding depth.

Figure 6. Corn seedlings inoculated with Rhizoctonia solani AG-4 HG-II. Picture courtesy of Srikanth Kodati, University of Nebraska.

Other Diseases that May Frequent Seedling Corn

Anthracnose Leaf Blight

Identification, Characteristics, and Diagnosis:

- Caused by the fungus *Colletotrichum graminicola*.
- The disease has three phases – leaf blight, top dieback, and stalk rot.
- Under severe levels of infection, yield losses can approach 40%.
- Roots and foliage of seedlings can become infected from residue when warm, rainy conditions exist during the spring. If young roots are infected, the disease may not be observed until later in the season.
- Favored by warm, rainy, and overcast conditions.
- Splashing rain can move spores from residue to plants.
- Leaf lesions are small, oval to irregular, brown to red-brown, often have a yellow margin, can have a “target-like” appearance, and microscopic black hair-like structures may appear within the lesion (Figure 7).

Management:

- Plant seed products that demonstrate resistance.
- Manage residue through tillage, chopping, shredding, and/or disking.
- Avoid back-to-back corn in no-till fields with a history of infection.

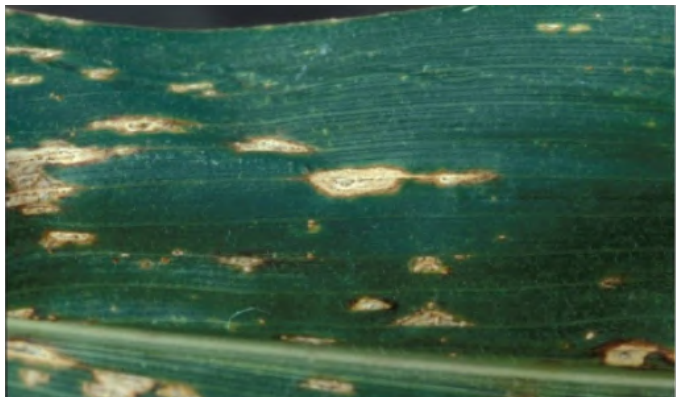

Figure 7. Anthracnose leaf blight on a late-season plant.

- Rotate crops.
- Manage stress factors.

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Goss's Wilt

Identification, Characteristics, and Diagnosis:

- Caused by the bacterium *Clavibacter michiganensis* subsp. *nebraskensis*.
- Symptoms include wavy-edged leaf lesions, dark-green to black water-soaked spots (freckles) near the edge of the lesions, and an ooze or exudate within the lesion that appears shiny when dry (Figure 8).
- The disease has a stalk rot phase.
- The pathogen can survive from season to season in crop residue on the soil surface and be transported to plants by irrigation, splashing rain, or in windblown infested particles.
- The bacterium enters plants through wounds caused by hail, wind, sand blasting, and other injurious causes.
- The pathogen can (rarely) be transmitted within seed.

Management:

- Plant seed products that demonstrate resistance.
- Foliar fungicides DO NOT provide protection for bacterial diseases.
- Prior to leaving an infested field, residue should be removed from equipment.
- Crop rotation and tillage may help degrade infested residue.
- Control alternative hosts that include green foxtail (*Setaria viridis*), shattercane (*Sorghum bicolor*), and barnyard grass (*Echinochloa crus-galli*).

Figure 8. Goss's wilt lesions on a late-season leaf.

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Holcus Spot

Identification, Characteristics, and Diagnosis:

- Caused by the bacterium *Pseudomonas syringae* pv. *syringae* van Hall.
- Symptoms initially appear as water-soaked, dark-green lesions on the tips of lower leaves. More mature lesions are round to elliptical, tan to white spots with red to brown margins, and 1/8 to 1/4 inch in diameter. Yellow halos may surround the spots (Figure 9).
- Spots can be confused with injury resulting from paraquat herbicide drift.
- The bacterium enters plants through wounds caused by hail, wind, sand blasting, and other injurious causes.
- Favored by wet weather and warm temperatures (76 to 86°F).
- The bacterium overwinters in infested crop residue.
- The bacteria may have ice nucleating capabilities that can enhance frost injury.

Management:

- Rotate crops to help reduce residue.
- Tillage can help promote residue decomposition.
- Foliar fungicides DO NOT provide protection for bacterial diseases.
- Prior to leaving an infested field, residue should be removed from equipment.

Figure 9. Holcus spot. Picture courtesy of Kiersten Wise, University of Kentucky.

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Stewart's Wilt

Identification, Characteristics, and Diagnosis:

- Caused by the bacterium *Pantoea stewartii*.
- The bacterium is transmitted to plants by corn flea beetle (*Chaetocnema hortensis*) feeding.
- Most commercial corn products have very good tolerance to Stewart's bacterial wilt; however, symptoms may occur if corn flea beetles are present. Sweet corn tends to be more susceptible.
- Symptoms of early-season infection may include pale green to yellow foliar streaks, wilting, cavities within the stem (Figure 10), and death.
- The leaf blight phase generally occurs after tasseling.
- More likely to occur after a warm winter that promotes corn flea beetle survival.
- Damage is less likely if the mean temperature in the preceding December, January, and February is below 27°F. Potential damage exists in susceptible seed products if the mean temperature for these months is above 33°F.
- The bacterium can survive in seeds and residue; however, infection from these sources is rare.

Management:

- Plant seed products that demonstrate resistance.
- Maintain a good fertility program.
- If the seed product is susceptible and flea beetle populations are excessive, a foliar insecticide may be warranted.

Figure 10. Cavity in lower stalk resulting from Stewart's bacterial wilt. Picture courtesy of and used with the permission of Larry Weller.

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