6 – Diseases and Nematodes

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Corn diseases are important yield-limiting factors in many production areas of the U.S. In Arkansas, corn has been a minor field crop for many years, and little disease research has been conducted. Corn hybrids grown in Arkansas are developed by private seed companies. Each company collects information on diseases on their lines. Seed company information is sometimes the only source of disease resistance data on hybrids.

Good management practices, as outlined elsewhere in this guide, can reduce the impact of many diseases on corn. For example, many disease organisms survive from crop to crop in infected residue, which means that diseases can be worse in minimum tillage corn than where the residue is thoroughly incorporated into the soil each year. Stressed plants are also often more susceptible to diseases, so drought stress or poor drainage should be avoided. Balanced fertility can also reduce disease problems, so it is especially important to complete a soil test, apply adequate potassium and other elements as recommended, and to avoid excessive nitrogen use.

For specific problems, effective disease management begins with correct identification of the disease and its cause. The Cooperative Extension Service offers two excellent diagnostic services for Arkansas corn producers in this regard. The Plant Disease Clinic at the Lonoke Research and Extension Center can diagnose most corn diseases, and the Nematode Assay Laboratory at the Southwest Research and Extension Center near Hope provides nematode diagnosis. These services can be accessed by submitting diseased plant samples – or soil samples for nematode analysis – to the local county agent. The county agent can advise you on the proper way to sample and what you can expect in the way of results, in addition to sending the sample to the appropriate lab. Currently, plant disease diagnosis is free, while a small fee is charged for nematode assays.

The following information offers brief descriptions of some of the more common diseases of corn in Arkansas and several suggested management options, when they are known. If you need additional information, please contact the loca1 county agent.

Seed Rots and Seedling Blights

Corn seeds and seedlings may be attacked by various seedborne or soilborne fungi (e.g., *Pythium, Diplodia, Fusarium, Pencillium*, etc.) that cause seed rot or seedling blight. These fungi may cause significant stand loss in poorly drained, excessively compacted, cold and/or wet soils. Seed rot and seedling blight severity are also affected by planting depth, soil type, seed age/viability, seed coat injury and genetic resistance.

Symptoms – Aboveground symptoms of seedling blights can be confused with mechanical, insect or chemical injury. A soft rotting of stem tissues near the soil, yellowing, wilting and death of leaves are common symptoms on blighted seedlings.

Control – Plant high quality, injury- and disease-free seed into a warm (soil temperature consistently above 55°F), moist, but firm seedbed. Use the most appropriate equipment to assure proper placement of seed, pesticides and fertilizers in order to promote the establishment of healthy, vigorous seedlings. All commercial hybrid corn seed is also treated with one or more fungicides, which provides additional protection against seed rots.

Crazy Top

This disease is caused by the soilborne fungus *Sclerophthora macrospora*, and it is occasionally seen in Arkansas, usually in corn fields that have been waterlogged early in the growing season.

Symptoms – Infection usually occurs in young plants (before the 5-leaf stage) exposed to flooded soils for at least 24 to 48 hours. After infection, the fungus grows within the plant, causing various symptoms including excessive tillering (up to 10 tillers per plant), stunting, whitish striped leaves or narrow, leathery leaves. The most striking symptom occurs at tasseling, when the tassel develops a twisted, leafy appearance that may resemble tiny ears (Figure 6-1).

Control – Plant in fields with good drainage and not prone to sustained flooding. Flooding early in the season predisposes corn to infection. It is also recommended that grassy weeds be controlled because they may also be hosts of the fungus.

Anthracnose

Anthracnose is a widespread disease of corn, and it is caused by the fungus *Colletotrichum graminicola*. The disease is favored by long periods of warm, wet weather. Although the fungus attacks many grasses, including johnsongrass, it is believed that isolates from corn do not attack grain sorghum, and vice versa.

Symptoms – The first symptoms of the disease are small spots that appear on the leaves of seedling and mature plants. The lesions appear water-soaked at first and enlarge to about 1/2 inch long tan with reddish-brown bordered lesions over time, depending on the variety and environment (Figure 6-2). The lesions may grow together, killing large leaf areas or entire leaves. Fruiting bodies of the fungus may be observed in the dead tissue with a hand lens as clusters of dark, hairlike structures (called setae) sticking out of the leaf.

Control – Use resistant varieties if available. Practice crop rotation with soybean or rice and plow under old crop residue. Maintain a balanced soil fertility program and control weedy grasses. Minimum tillage favors this disease.

Gray Leaf Spot

A fungus, *Cercospora zeae-maydis*, causes this disease, which appears to have increased in many corn production areas of the U.S. since the adoption of minimum tillage. Heavy yield losses have been reported in no-till corn fields of the eastern U.S. under favorable weather conditions.

Symptoms – Leaf lesions develop on the older, bottom leaves first, and the disease moves up the leaves as the plant matures. The disease is favored by long periods of warm, humid weather. The tan to gray lesions are narrow and rectangular and occur typically between the leaf veins (Figure 6-3). Under favorable conditions, the lesions may join, killing the whole leaf.

Control – Practice crop rotation with a non-grass crop. Destroy infected corn residue with good tillage practices. Use resistant varieties, if available. Practice good weed control as johnsongrass and barnyard grass are hosts of the fungus.

Southern Corn Leaf Blight

Several "*Helminthosporium*" leaf blights attack corn in the U.S. but the most common one in Arkansas is probably Southern Corn Leaf Blight. This disease is caused by the fungus *Bipolaris* (*Helminthosporium*) *maydis*, and it attacks many other grasses besides corn. In 1970, an epidemic of this disease destroyed about 15 percent of the U.S. corn crop, costing an estimated one billion dollars. Resistant corn hybrids have kept it under control since then.

Symptoms – Leaf lesions vary in shape, color and size but are generally oval to elongated, tan in color, with yellow green halos to reddish brown borders (Figure 6-4). Lesions may occur on leaf blades, sheaths, stalks, husks and shanks. The fungus may also attack ears causing a black, felty mold on the kernels.

The fungus overwinters in soil and infected crop debris as well as on infected kernels. The disease may be favored by minimum tillage. Spores produced by the fungus are windborne over long distances or splashed by rain to other plants. The disease is favored by long periods of cloudy, warm and wet weather.

Control – Plant resistant varieties and plow under crop debris. Rotation with non-host crops can be effective. Fungicides are available but rarely economical except in seed corn production (Table 6-1).

Table 6-1. Fungicides Available for Foliar Diseases of Corn in Arkansas *				
Diseases	**Fungicide**	**Active Ingredient**	**Rate/Acre**	**Comments**
Rusts Leaf Blights Gray Leaf Spot	Tilt 3.6E	propiconazole	4 fl oz	Do not apply after silking. See label for other restrictions.
	Propimax EC	propiconazole	4 fl oz	See label for restrictions.
	Stratego	propiconazole + trifloxystrobin	7-12 fl oz	See label for restrictions.
	Quadris 2.08 SC	azoxystrobin	6.2-15.4 fl oz	Not labeled for Southern Rust. Use higher rates for gray leaf spot and leaf blights. See label for warnings and restrictions.
*Notes: Table information was current as of October 21, 2002, and applies only to Arkansas and may not be appropriate for other states. The listing of any product does not imply endorsement of or discrimination against any product by the University of Arkansas Division of Agriculture. Every effort was made to ensure accuracy but the user and/or applicator of any crop protection product must read and follow the most current label of the product – THE LABEL IS THE LAW.				

Rusts

Two similar rust diseases, common rust and southern rust, occur on corn in Arkansas. Common rust is caused by the fungus *Puccinia sorghi*, and the disease often develops when susceptible varieties are grown under cool, wet weather conditions. Southern rust is caused by the fungus *Puccinia polysora*, and it may develop on susceptible varieties when hot, moist weather persists. Although rusts have not been of major concern in Arkansas corn for several years, they remain a potential problem.

Symptoms – Lesions or pustules that contain the rust spores appear on all above-ground parts but are most abundant on the leaf. Pustules are circular to elongated, golden-brown to cinnamon-brown early in the season (Figure 6-5). Pustules become brownish-black as the plant matures. Southern rust pustules are more common on the upper leaf surface and less so on the lower surface than pustules of common rust. Southern rust pustules also remain covered by the epidermis longer than common rust pustules. When the infections are severe, leaves and leaf sheaths may turn yellow and die (Figure 6-6).

Control – Plant resistant varieties if available (check seed company data). Avoid late planting and excessive nitrogen fertilization. Fungicides are available but can rarely be justified economically (Table 6-1).

Charcoal Rot

The soilborne fungus *Macrophomina phaseolina* causes disease on more than 400 different plants including corn. Severe yield losses may result if hot, dry weather persists during and after tasseling.

Symptoms – Infection can occur at any stage from seedlings to plants approaching maturity. Early symptoms include brown, water-soaked lesions on the roots that later turn black. The fungus spreads up into the lower stalk causing premature ripening and lodging. Inside the stalk, symptoms include a dry, stringy appearance rather than a solid pith.

Numerous black sclerotia inside the stalk give the appearance of powdered charcoal, thus the name. The rotting of the stem leads to lodging, with plants bending over a few inches above the soil line where it has become stringy inside.

Control – Charcoal rot losses can be minimized by proper irrigation during the growing season. Excessive nitrogen rates and low potassium dramatically increase charcoal rot damage. Thus, timely irrigation, combined with a well-balanced fertility program based on soil tests, can effectively reduce charcoal rot. Resistant varieties are not available. The planting of high stalk strength varieties is encouraged to reduce lodging.

Other Stalk Rots

Various soil and seedborne fungi, including species of *Diplodia, Gibberella, Fusarium, Macrophomina* and *Pythium*, can cause stalk rot of corn. The exact causal organism can be difficult to identify. Stalk rots cause yield losses by increasing lodging of the crop or by cutting off the supply of water and nutrients from the roots. Stalk rots are usually increased by drought stress, hail damage, leaf diseases, high stand density, excessive nitrogen fertilization, low soil potassium levels, lack of rotation, possibly minimum tillage and stalk feeding insects.

Symptoms – Stalk rots normally begin soon after pollination, and become more severe as the plant matures. Rotting affects the roots, crown and lower internodes. Various discolorations of the pith, including whitish-pink to salmon, are common as is stalk breakage and premature ripening.

Control – Plant strong-stalked varieties to reduce lodging. Practice balanced fertilization based on recent soil tests and avoid excessive nitrogen. Avoid narrow rows and excessive seeding rates if possible. Control stalk insects and harvest as early as possible.

Smut

Three types of smut generally occur on corn – common, head and false smut. While these diseases occur worldwide, only common smut is regularly observed in Arkansas. Losses of 10 percent from smut have been reported, but recently have tended to be negligible as a result of the use of resistant varieties.

Symptoms – All aboveground parts of the plant are susceptible to common smut, but the tender ears and tassels are more commonly attacked. Symptoms are easily recognized on the corn ear as 1/4- to 1/2-inch diameter galls covered with glistening, greenish to silvery-white skin (Figure 6-7). The interior of the galls darken over time and turn into masses of powdery, dark brown to black spores (teliospores). Some galls at maturity may be 5 to 6 inches in diameter. Older affected plants may appear reddish, similar to those heavily infested with aphids.

Soilborne teliospores overwinter and produce spores in the spring that are carried onto young plants by wind or by splashed water.

Control – Plant resistant varieties and avoid mechanical injury to plants during spraying or cultivation. Avoid excessive nitrogen fertilization.

Ear and Kernel Rot

Several widely distributed fungi are responsible for ear and kernel rot. Economic losses are common, especially in rainy years and on insect or bird-damaged ears.

Symptoms – Early infections may be noticed as bleached or straw-colored husks on the ear with heavily infected ears remaining upright due to poor grain fill and light weight. Late infections may show no external symptoms, but when husks are removed, mold growth is commonly found between the kernels on ears with discolored tips (Figure 6-8). Mold colors may range from white to black, with pinkish color quite common.

Control – Plant only adapted corn varieties known to have few ear rot problems. Fertilize properly and control ear feeding insects as needed. Harvest early to avoid increased ear rot on corn standing too long in adverse weather. Store harvested ears and grain at the proper moisture to avoid increased rot in storage.

Storage Rots and Mycotoxins

Storage diseases of harvested corn grain in on-farm bins are potentially serious problems in Arkansas as they are throughout the southeastern U.S. Not only can storage rots lower the quality of grain through discoloration, mustiness, heating and caking, but some of the causal fungi can produce chemicals, known as mycotoxins, that are poisonous to animals and humans. The most important fungi involved include *Aspergillus flavus* and *Aspergillus parasiticus*, which produce aflatoxin, and *Fusarium* species that produce zearalenone, vomitoxin and other toxins. Not all moldy corn grain in storage necessarily has mycotoxins, but if suspected, laboratory testing must be conducted to confirm their presence or absence. Various lab tests are used including UV light to detect “glowers” (Figure 6-9) but this method is no longer considered as accurate as new “Elisa” test kits.

Symptoms and Control – See the section on aflatoxin and proper grain storage for detailed information.

Nematode Damage

More than 40 species of nematodes have been reported to feed on corn. There is little information, however, on the level of damage nematodes cause on corn grown in Arkansas.

Symptoms – Evidence of injury may vary with species of nematode, its population level, soil type and soil moisture. The major symptoms are stunting, restricted root growth, lesions or galls on roots, stubby roots, chlorosis and wilting (Figure 6-10).

Control – Cultural practices, including crop rotation with non-host or less susceptible plants, and prevention of soil compaction, which restricts downward root growth, are often good nematode management practices. Many corn varieties are excellent hosts for root knot nematode (RKN) and should not be used as a non-host rotation crop when attempting to manage RKN in other crops such as cotton or soybean. The reniform nematode and the soybean cyst nematode, on the other hand, do not appear to attack corn; and corn in rotation with either soybean or cotton where these nematodes are present will lower nematode populations. Resistant corn hybrids may be available for some nematodes.

However, if nematodes are suspected, a soil sample should be sent through the local county agent to the Cooperative Extension Service Nematode Assay Laboratory for assessment. There is a small fee for this service but the correct diagnosis can greatly help plan future rotations and variety selection.

Virus Diseases

Several virus diseases attack corn. Maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV) are the most common in Arkansas. Symptoms caused by double infections of these two diseases are more severe than either alone.

Symptoms – MDMV symptoms are highly variable, but usually first appear at the base of the youngest leaves as an irregular, light and dark green mottle or mosaic which may develop into narrow streaks along veins. These can appear as dark green "islands" on a yellowish background. Leaves may become entirely yellowish-green as infected plants mature. Plants with these symptoms are sometimes stunted with excessive tillering, multiple ear shoots and poor seed set. Early infection, which is vectored by several species of aphids, may predispose maize to root and stalk rots and premature death. Aphids usually acquire the virus from johnsongrass in early spring and infect corn plants later. The symptoms of MCDV include yellow to white narrow stripes on young, infected corn leaves. Infected plants are stunted to various degrees and leaves may turn partially or completely yellow and/or red, depending on the severity of the disease (Figure 6-11). Unlike MDMV, MCDV is transmitted by leafhoppers which acquire the virus from infected johnsongrass.

Control – Plant only resistant varieties (seed company information). Use good weed management that especially reduces infestations of johnsongrass, as well as other grassy weeds. It is critical to plant as early as possible to avoid later buildup of insects and increased disease. Rotate with cotton, soybean or other non-grass crops.

Photographs reference Section 6 – Diseases and Nematodes

Figure 6-1 Crazy Top
by Jeremy Ross

Figure 6-2 Anthracnose
by Dave TeBeest

Figure 6-3 Gray Leaf Spot
by Jeremy Ross

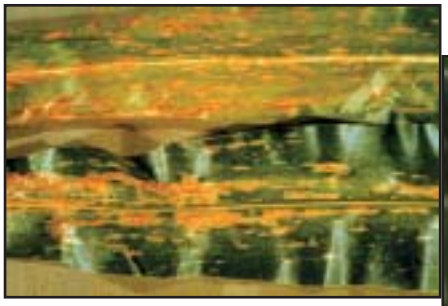

Figure 6-4. Southern Leaf Blight
by S. M. Lim

Figure 6-5 Common Rust
by Jeremy Ross

Figure 6-6 Southern Rust
by Dave TeBeest

Figure 6-7. Corn Smut
by Jeremy Ross

Figure 6-8. *Aspergillus flavus* ear rot
by Steve Vann

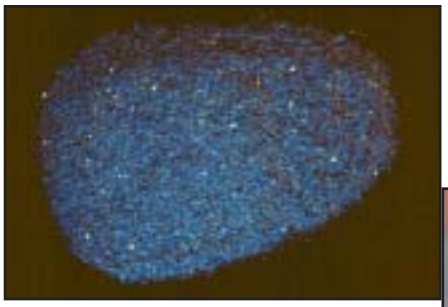

Figure 6-9. "Glowers" of corn particles contaminated by aflatoxin under UV light
by Steve Vann

Figure 6-10. Nematode Damage to Corn Roots
by Rick Cartwright

Figure 6-11. Southern Corn Virus Complex
by Rick Cartwright