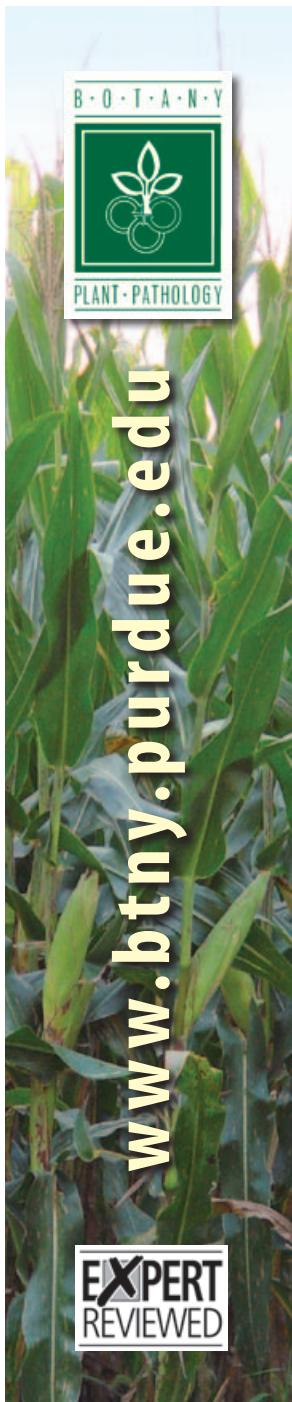


DISEASES OF CORN

Common and Southern Rusts

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Common rust of corn (caused by the fungus *Puccinia sorghi*) is present at low levels in most Indiana cornfields every year. Southern rust (caused by *Puccinia polysora*) is less frequently observed in Indiana.

Rust diseases can cause economic damage in Indiana and are particularly damaging in seed corn, sweet corn, and popcorn production. These diseases may increase in intensity very quickly when weather conditions are favorable, which can result in substantial yield loss if they are not properly controlled.

Common rust was particularly severe in Indiana in 2000, resulting in heavy infections in some hybrid cornfields. Southern rust is less common, but is increasingly damaging in southern states. Although rust diseases rarely cause economic yield loss in Indiana, it is important to accurately diagnose these diseases and be aware of practical management options.

This publication describes:

1. How to distinguish between the two rusts
2. Conditions that favor rust development
3. The impact of rusts in corn
4. How to manage rusts

Photos by Kiersten Wise
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Distinguishing Between Rust Diseases

Common and southern rust fungi produce fungal spores in structures called pustules, which are raised masses of colored spores that rupture epidermal leaf tissue. On infected corn, pustules are located on leaf surfaces or leaf sheaths. Rust spores can be rubbed off of the leaves and leave a brown or orange stain on fingers or clothing.

The location, color, and shape of the pustules are important for identifying the type of rust infection.

Common rust pustules appear on upper and lower leaf surfaces. They are typically brown to brownish red, elongated in shape, and scattered on leaf surfaces (Figure 1).



Figure 1. Common rust pustules are brown to brownish red, elongated, and scattered on the leaf surface.

Southern rust pustules appear primarily on the upper leaf surface, are orange to light brown, round, and densely packed on the leaf surface (Figure 2).

Pustules caused by either disease may first be observed in the upper canopy of the plant, or clustered on leaves from infections that occurred while leaves were in the whorl. Mixed infections of both rust fungi can occur on the same plant, which can confuse diagnosis (Figure 3).

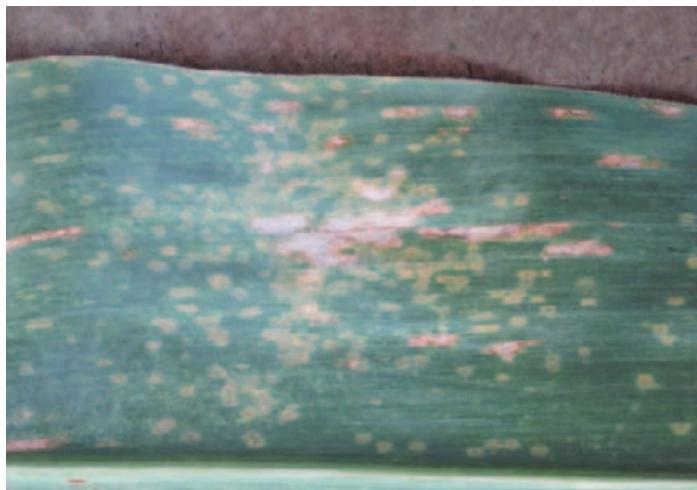
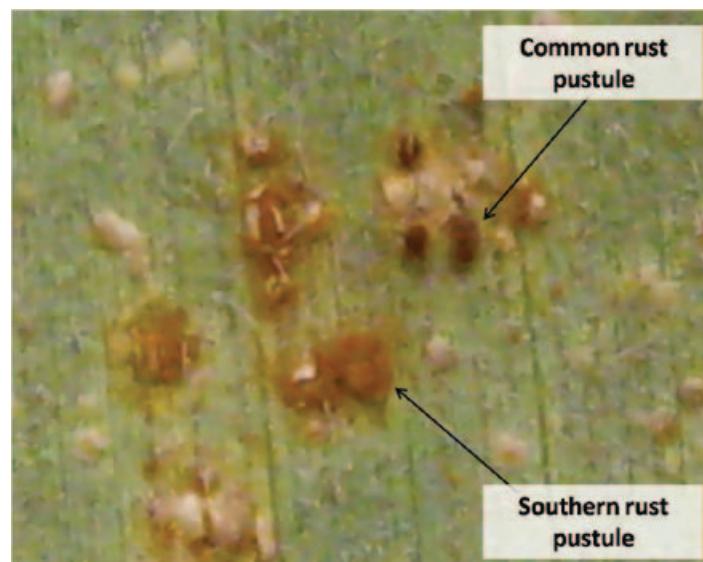


Figure 2. (Top) Southern rust pustules are orange to light brown, small, and densely packed on the upper leaf surface. (Above) The lower leaf surface of this plant has yellow flecks, but very few pustules. This feature distinguishes southern rust from common rust.



Alison Robertson, Iowa State University

Figure 2. This leaf surface shows a mixed infection of common and southern rusts. Note the differences in appearance between common rust pustules and southern rust pustules.

Conditions Favoring Disease Development

Neither rust fungus survives Indiana winters. These fungi require living plant tissue to survive, so once the corn plant dies, the fungus loses its host.

Most rust fungi are biologically complex (with many spore stages) and require more than one host species to complete their life cycles, which includes sexual reproduction. However, the spores produced on corn (called urediniospores) are capable of indefinite asexual reproduction, as long as living corn is available to be infected.

Each year, urediniospores of both rusts are blown north from tropical areas. They are carried on wind currents and deposited into Indiana cornfields.

Both rust fungi require short periods of leaf wetness to cause infection. Approximately six hours of dew is usually enough moisture for infection and disease development.

Temperature plays a critical role in the life cycle of both rusts. The common rust fungus prefers cooler weather (61-77°F) for optimal infection. Common rust symptoms may be observed early in the season, depending on how quickly spores arrive from the South. Cool evenings with dew formation can lead to severe common rust on susceptible hybrids and inbreds.

Hot, dry weather will limit common rust disease development and cause pustules to become inactive, leaving small dead areas of leaf tissue that can be confused with

lesions caused by another fungal disease, gray leaf spot (see *Diseases of Corn: Gray Leaf Spot*, Purdue Extension publication BP-56-W). Careful inspection of the leaf surface with a hand lens should reveal ruptured epidermal leaf tissue surrounding the lesion. This symptom will help to distinguish common rust from other foliar fungal diseases.

Southern rust prefers warmer weather — fungal infection occurs between 77-82°F. This disease usually appears in Indiana in late August or September.

When conditions are favorable for rust development, the infection cycle will continually repeat and result in secondary infections. Each pustule produces thousands of spores that can infect the plant and produce additional pustules in as few as seven days. If these cycles continue, disease intensity can reach epidemic levels very quickly.

The speed at which corn rust can reach damaging levels is why it is necessary to pay careful attention to the level and timing of initial disease infection in susceptible hybrids. Young leaves are more susceptible to rust infection than mature leaves, and late-planted corn may be at greater risk for infection if rust spores reach Indiana and weather conditions favor disease development.

Disease Impact

Rust diseases are parasites and divert nutrients for fungal growth that would normally be used by the plant. This process can lead to yield loss during grain fill when plant resources are needed to contribute to the developing ear.

Rust pustules also rupture leaf epidermal tissue, which can interfere with the regulation of water loss by stomata on the leaf surface. Consequently, severe rust outbreaks may reduce the plant's water use efficiency and infected plants may exhibit symptoms of mild drought stress. These effects can also contribute to the development of stalk rot and lodging.

Rusts have the greatest impact on seed corn, sweet corn, and popcorn because of the inherent susceptibility of inbred and specialty hybrids. Accurate yield loss estimates are not available for most hybrids in Indiana because we do not consistently experience damaging levels of rust diseases.

Estimates from Wisconsin indicate that it takes 162 common rust pustules on a leaf to reach 1 percent

severity. Therefore, a very high level of disease is necessary to reduce leaf tissue enough to have a substantial effect on carrying out photosynthesis. This is not true of all foliar diseases of corn, and this information should be used only to assess common rust severity.

Southern rust has the greatest potential to damage yields if it reaches Indiana at a critical point in the growing season. This disease has increased in importance in southern states, routinely reducing yields as much as 25 bushels per acre on susceptible hybrids that do not receive a fungicide application.

In 2008, a new genetic variant (race) of the southern rust fungus was discovered in Georgia that was able to cause disease on formerly resistant hybrids. This has increased the importance of the disease in southern areas, and scouting programs have been implemented in this region to carefully monitor fields for southern rust.

Managing the Disease

In most years, hybrid field corn in Indiana does not require management for rust diseases. However, rust management may be necessary in specialty corn hybrids or when conditions are especially favorable for disease development.

Resistance ratings may not be available for all hybrids, because the corn rusts are rarely economically damaging in the Midwest. Some ratings for common rust may be available, and if a particular resistance level is desired, producers should consult with their seed dealers to determine the type of hybrid resistance available.

Local ratings for southern rust are scarce. All corn plants have age-related resistance to the rust fungi, and planting corn as early as possible can minimize disease risk later in the season, because leaves will typically be more mature and less susceptible to infection when rust spores arrive from the South.

Fungicides are available for in-season rust management. It is important to remember that fungicide applications are an additional cost to hybrid corn production, so consider economic factors (such as corn market price and fungicide application cost) in addition to disease factors when deciding whether or not to apply fungicides to manage rust in corn for grain production. Fungicides to manage rust in dent corn are rarely needed, but often necessary in seed or sweet corn production.

Research-based fungicide application thresholds are not available for either rust in Indiana. However, in seed corn and sweet corn production, fungicides are typically most effective at preventing yield loss when they are applied at disease onset in susceptible inbreds or hybrids.

In high-value corn production, a few pustules on 50 percent of observed plants could trigger a fungicide application. Fungicides may need to be applied at seven- to 14-day intervals if weather conditions remain favorable for rust development. These thresholds do not apply to fungicide use in field corn.

Fungicides currently available for use on corn can be found in the Purdue Extension *Corn and Soybean Field Guide* (publication ID-179, available from the Purdue Extension Education Store www.the-education-store.com). You may also contact the Purdue Extension field crop disease specialist.

Fungicides vary in their chemical properties, the total amount of fungicide that can be applied to a crop, restricted entry intervals (REI), and pre-harvest intervals (PHI). It is important to understand and follow all label directions and restrictions before fungicide application.

References

For more detailed information on the concepts presented in this publication, please refer to:

Esker, P. 2008. Estimating common rust on corn. *Wisconsin Crop Manager* 15 (23): 1-2.

Dolezal, W., Tiwari, K., Kemerait, R., Kichler, J., Sapp, P., Pataky, J. 2009. An unusual occurrence of southern rust caused by Rpp9-virulent *Puccinia polysora*, on corn in southwestern Georgia. *Plant Disease* 93:676.

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