

Identifying Rust Diseases *of Wheat and Barley*

Rust diseases are among the most widespread and economically important diseases of cereal crops worldwide. Three distinct diseases, leaf rust, stripe rust and stem rust, occur on wheat and barley in North America. The fungi that cause these diseases are notorious for their ability to increase rapidly and overcome the resistance of wheat or barley varieties. The potential yield loss caused by these diseases

depends on host susceptibility and weather conditions, but the loss also is influenced by the timing and severity of disease outbreaks relative to crop growth stage. The greatest yield losses occur when one or more of these diseases occur before the heading stage of development. Early detection and proper identification are critical to in-season disease management and future variety selection.



Figure 1. *The diagnosis of rust diseases requires some basic understanding of plant anatomy and a quick review of this information may improve the accuracy of the identification process.*

Emerging Races of Stem Rust

Historically, stem rust has been an extremely important disease of wheat and barley. A series of severe outbreaks occurred in North America between 1900 and the 1950s, affecting grain production in the Great Plains, many Midwestern states, and Canada. More localized outbreaks of the disease occurred in the southern Great Plains as recently as 1985-1986. In all of these cases, the increased frequency and intensity of the stem rust epidemics was associated with the emergence of new races of the fungus that were able to overcome the genetic resistance of many popular varieties.

Once again, after several decades of control with disease-resistant varieties, new races of the stem rust fungus are threatening grain production in some parts of the world. The first of these variants, known as "Ug99," was initially reported in the East African countries of Uganda, Kenya, and Ethiopia. Additional variants also have emerged, further complicating efforts to contain the problem. The disease continues to spread and may soon threaten wheat and barley production in North America. The rapid detection of the new races is an important component of the international response to these emerging disease threats.

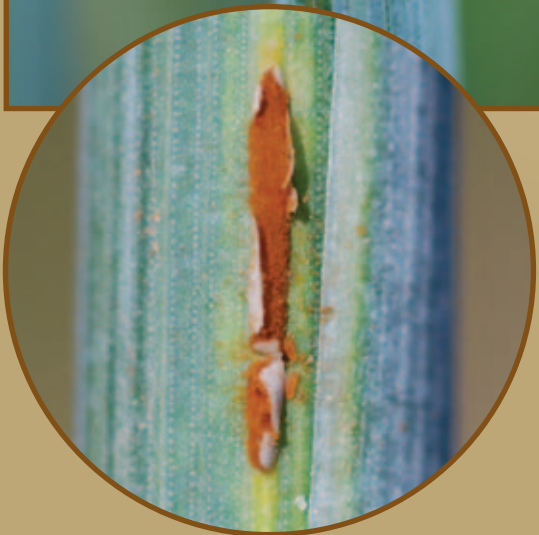
Stem rust

Parts of plant infected: Commonly affects stems, leaf sheaths, and leaf blades; occasionally will affect parts of the head

Shape and distribution of lesions: Oval-shaped or elongated blister-like lesions scattered on affected tissues, lesions visible on both sides of leaf

Lesion color: Orange-red

Degree of damage: Tearing of outer layers of plant tissue that is visible without magnification



Leaf rust

Parts of plant infected: Commonly occurs on leaf blades, but may also affect leaf sheaths; infections of stems and heads are rare

Shape and distribution of lesions: Round or slightly elongated blister-like lesions scattered on affected tissues

Lesion color: Brown

Degree of damage: Tearing of outer layers of plant tissue rare, visible with magnification



Stripe rust

Parts of plant infected: Commonly affects leaf blades, occasionally observed on heads when disease is very severe; infection of leaf sheaths or stems is rare

Shape and distribution of lesions: Small, round, blister-like lesions that merge to form stripes

Lesion color: Yellow-orange

Degree of damage: No tearing of outer layers of plant tissue



Identification of Rust Diseases

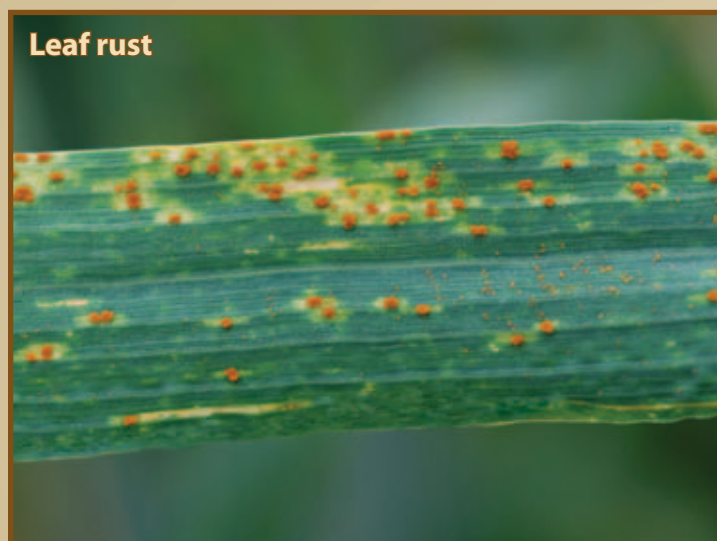
Differentiating the rust diseases can be difficult, but with practice they can be reliably identified. Begin by considering broad characteristics such as which plant parts are affected (Figure 1) or arrangement of the blister-like lesions on plants. These characteristics will often separate one or more of these diseases quickly. Continue by examining less obvious characteristics including lesion size, shape, and color to either confirm the diagnosis or separate the more similar diseases. For example, stripe rust is the only one of these diseases to have the blister-like lesions organized into stripes on the leaves (left). If the lesions are scattered on the affected plant parts, both stem rust and leaf rust are a possibility and additional characteristics must be considered. Leaf rust typically causes small, round lesions on the leaf blades and leaf sheaths. In comparison, stem rust causes oval or elongated lesions and is capable of infecting nearly all aboveground parts of the plant, most notably the true stems (Figure 2).



Figure 2. Comparison of the stem rust and leaf rust lesions on leaf tissue. Note the larger diamond shape of the stem rust relative to leaf rust.

All three diseases have unique interactions with common varieties of wheat and barley. These interactions can modify the disease symptoms resulting in reduced lesion size and varying amounts of yellow or tan tissue surrounding the lesions (Figure 3). Becoming familiar with the range of possible symptoms for these diseases will improve the accuracy of the diagnosis and the management of these economically important diseases.

Figure 3. Examples of the variability in symptoms caused by stem rust (below), leaf rust (upper right) and stripe rust (lower right) as a result of unique interactions with wheat or barley varieties.



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