



## Wheat Leaf Rust

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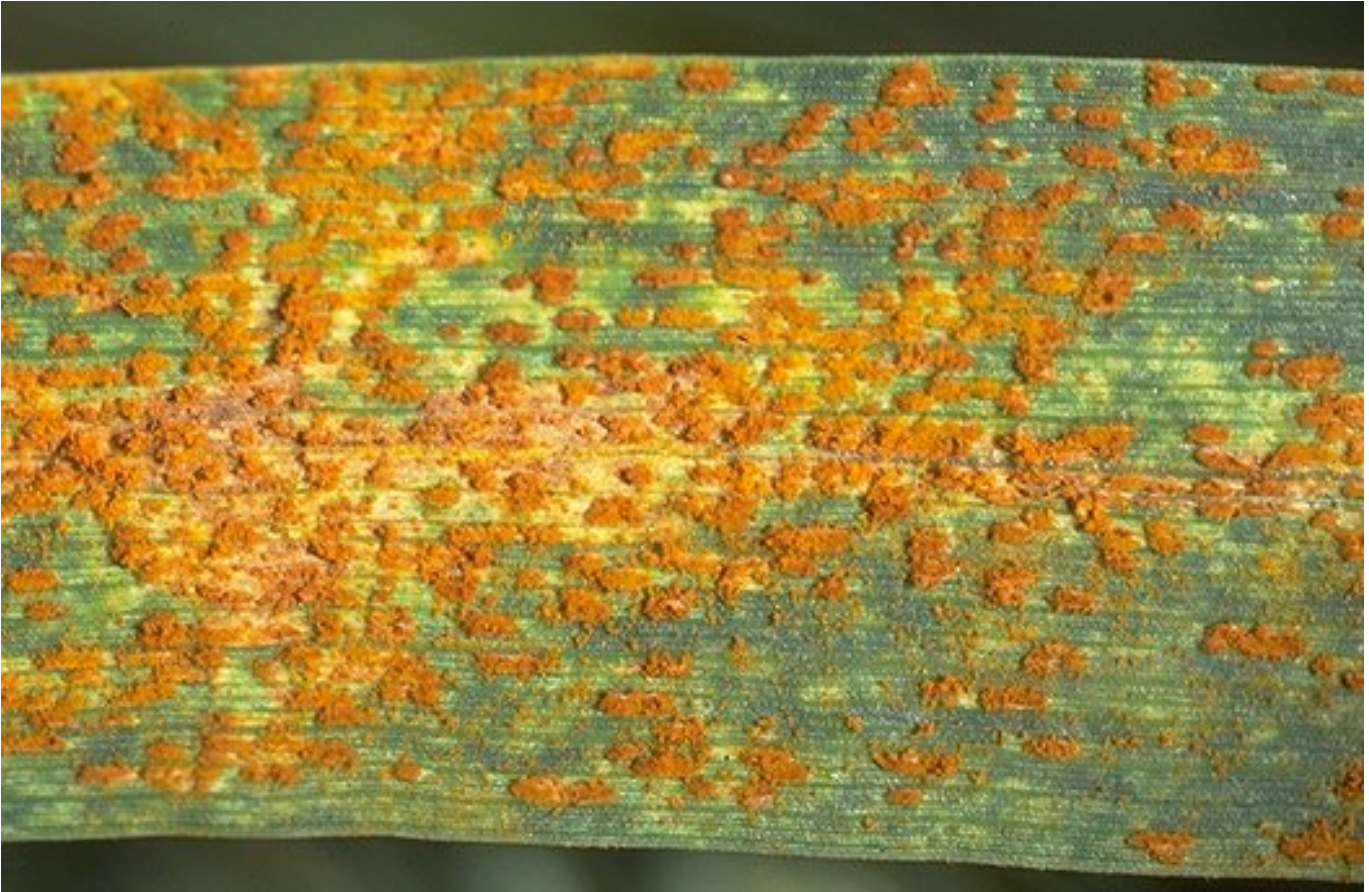


Fig. 1. Orange pustules of leaf rust. (photo by Bill Willis)

Leaf rust is one of the most common and most important wheat diseases in Kansas. It is also very important in other wheat growing areas of the world. Leaf rust is caused by a parasitic fungus called *Puccinia recondita* f. sp. *tritici*. Kansas annual wheat yield losses due to leaf rust have ranged from trace to 11%, averaging about 4% over the last two decades. Losses due to leaf rust in individual fields can range from trace to over 40%. Conditions are most favorable for leaf rust in the eastern two thirds of Kansas, but significant losses can also occur in western Kansas under irrigation or during years with high precipitation.

### SYMPTOMS

Leaf rust causes very small (about 1/32 inch long by 1/64 inch wide), orange pustules that

erupt through the leaf surface (Fig. 1). In some cases, pustules are surrounded by a narrow yellow or white halo. The pustules contain masses of powdery orange spores of the rust fungus. Spores may spill out of pustules and form a grainy orange dust on the leaf surface around the pustule. When rust severity is high, field scouts may notice the orange dust on hands and clothing. As leaves age, pustules begin to produce dark black spores instead of orange spores. These black pustules look like tar spots and are most easily seen on the lower leaf surface and leaf sheaths. Although leaf rust may initiate tiny orange spots on culms and heads, it does not form large, open pustules on these organs. This helps distinguish leaf rust from stem rust. Stem rust is uncommon and usually only occurs late in the season because it requires warm temperatures. Leaf rust pustules occur randomly across the leaf; this distinguishes leaf rust from stripe rust, which has narrow yellow stripes of pustules. Stripe rust is rare in Kansas because it requires very cool weather.

Leaf rust typically occurs uniformly across a field. In overwintering locations, it is most severe on the bottom leaves. When it blows in from distant fields, it will be most severe on upper leaves.

## **DISEASE CYCLE**

Alternative hosts are not important in the leaf rust life cycle. Although some strains of the leaf rust fungus can survive on jointed goatgrass or wheatgrass, they appear to be different from the strains that attack cultivated

wheat. Many rusts have special alternate hosts for completion of the sexual cycle. Meadow rue (*Thalictrum* spp.) is the alternate host for wheat leaf rust in Eurasia. However, the sexual cycle on meadow rue apparently does not occur in North America. Therefore, the leaf rust population in the U.S. is composed of distinct races that do not cross with each other. This slows the development of new races because mutation is the only means of genetic change.

The leaf rust fungus can only survive in living leaf tissue. It is not soilborne or borne in crop residue. In the summer, it survives on volunteer wheat. In the fall, spores blow to newly planted wheat. Early planted wheat sometimes sustains heavy rust infection and may turn yellow in the fall. This does not seem to cause winterkill of the wheat. Leaf rust can survive the winter as latent infections if green leaves survive the winter. In the early spring, pustules erupt and fresh spores blow to new leaves. If rust does not survive through the winter in Kansas, spores eventually blow up from Oklahoma or Texas. However, the delay often reduces the final severity of the disease. The rust fungus moves back to volunteer wheat around harvest time.

Leaf rust epidemic severity increases exponentially over time. That's why rust epidemics appear to suddenly "explode" during favorable weather. Rust development in the spring is favored by daytime temperatures between 60 and 75F. The infection process requires moisture, which can be provided by rain or dew. Heavy rain is unfavorable for rust because it tends to wash the spores off the leaves. Infection can occur in as little as four hours during favorable weather. Dispersal of spores to upper leaves and between fields is favored by dry, windy conditions.

## LOSSES

Leaf rust reduces yields and test weights because infected leaves die prematurely. The earlier leaves are lost, the more severe the yield loss. Losses may vary depending on the variety's ability to fill from the stem, glumes, and awns. The following table provides a rough estimate of percent yield loss due to leaf rust at various flag leaf severities and different growth stages.

## CONTROL

Resistant varieties are the best control for leaf rust. See "Wheat Variety Disease and Insect Ratings" (KSU Cooperative Extension fact sheet MF-991) for details. Resistant varieties possess one or more special leaf rust resistance genes called Lr genes. Currently there are more than thirty different Lr genes available, but most varieties have only a few Lr genes. In order to be virulent on a given variety, the leaf rust fungus must be able to defeat all the Lr genes in the variety. Different races of leaf rust can defeat different combinations of Lr genes in the wheat. The prevalence of different rust races is always changing in response to the popularity of different wheat varieties with different Lr genes.

Some varieties like Triumph 64, Chisholm, Karl 92 and AGSECO 7853 are susceptible to rust but appear to tolerate infection better than other varieties because they fill from the stem or awns. Very early varieties may escape severe losses by maturing before rust can build up to high levels.

Susceptible varieties can be protected from rust with foliar fungicides. See "Wheat Foliar Fungicides" (MF-1026) for details. Tilt, Quadris, and mancozeb are the major fungicides available for leaf rust control. Although systemic fungicides can give very good control of leaf rust, they are relatively expensive. Therefore, fungicide use in Kansas is limited to fields with high yield potential (at least 45 bu/A) and high disease potential. Fungicides usually increase seed size and decrease seed clean out, so fungicides are often profitable when used on seed production fields.

Several seed treatment fungicides such as Baytan and Dividend control fall infection with leaf rust. This may or may not carry through to spring.

Controlling volunteer wheat in the summer reduces leaf rust inoculum, but it does not guarantee freedom from rust blowing in from distant sources. Delayed planting reduces fall rust infections, but delayed maturity in the spring may lead to higher final rust levels. Fall grazing may reduce overwintering inoculum, but this has not been scientifically documented.

## Rough Estimate of Percent Yield Loss For Different Leaf Rust Severities

Growth Stage	Rust Severity on Flag Leaf				
	10%	25%	40%	65%	100%
Flowering	10	15	20	30	35
Milk	2	5	8	14	20
Soft Dough	1	3	4	7	10
Hard Dough	1	1	2	3	5

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