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G95-1250 Rust of Dry Bean

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Rust of Dry Bean

The symptoms, sources, spread and management of rust in dry edible beans is discussed in this NebGuide.

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Rust is an important disease that affects dry beans in eastern Colorado, western Nebraska and adjacent regions. The disease is caused by the fungus *Uromyces appendiculatus* which has caused periodic epidemics in this region since the 1950s. Recent yield losses from the disease have exceeded 50 percent in some areas.

Disease Symptoms

Rust symptoms initially appear as small yellow or white slightly raised spots on upper and/or lower leaf surfaces *(Figure 1)*. These spots enlarge and form reddish-brown or rust-colored pustules called uredinia, which are about 1/8 inch or smaller and contain thousands of microscopic summer spores called urediniospores *(Figure 2)*. Pustules may be surrounded by a yellow border. Spores (fungus seeds) are readily released from the pustule to give a rusty appearance to anything they contact. Rust can be distinguished from other leaf spots because the rust-colored spores will rub off, while with blights and bronzing, nothing rubs off.

Figure 1. Severely infected bean plants (24K JPG).

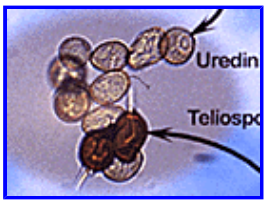
Severe infection causes leaves to curl upward, dry up, turn brown and drop prematurely. A severely damaged bean field often appears scorched *(Figure 3)*. Pod set, pod fill and seed size can be reduced if infection is severe. Green pods, and occasionally stems and branches, also may become infected and develop typical rust pustules. However, bean rust is not seedborne.

Near the end of the season, pustules undergo a subtle change and form telia containing brownish-black winter spores (teliospores) signaling the end of the current infection cycle. Bean debris containing this overwintering phase provides for early season infection the following year. This has contributed to rust epidemics in eastern Colorado and western Nebraska and is a factor in northern states such as North Dakota and Minnesota.

Source and Spread

Two potential sources of rust inoculum (spores) that initiate an epidemic are locally overwintered teliospores and airborne urediniospores blown in from distant bean fields *(Figure 2)*.

Figure 2. Life cycle of rust disease in dry beans (48K JPG). (Graphics based on research by N. S. McMillan, Colorado State University.)



Rust spores, especially teliospores, overwinter in bean straw in some regions of the United States such as the High Plains. Teliospores germinate in the spring and produce basidiospores that are blown onto volunteer or new bean plants in late May or June. Volunteer beans within fields of irrigated winter wheat are often unnoticed sources of hidden spores. Bean plants become infected by basidiospores, which initiate specialized types of white pustules called pycnia and aecia *(Figure 2)*. These pustules are visible for only a few days and are difficult to detect. Spores (aeciospores) from these pustules eventually infect other bean plants and the characteristic reddish-brown repeating spore-stage develops, usually on the leaves.

Rust usually appears in the High Plains in mid-summer, apparently after urediniospores from distant bean production regions to the south and/or urediniospores and aeciospores from infected local volunteer beans are transported by wind and deposited on leaves. These spores germinate to produce structures that enter a leaf through the plant stomates (breathing pores) and develop within the host tissue to form a small white uridinial spot or blister in 5-7 days and mature reddish-brown pustules in 10 to 14 days.

Factors Favoring Epidemics

Rust development is favored by cool to moderate temperatures (70-85°F) with moist conditions that result in prolonged periods of water (more than 10 hours) on the leaf surface. Rain, dew and sprinkler irrigation are common sources of moisture. Cool, wet conditions during May and June favor early season infection of volunteer beans by the overwintering stages. The same conditions during July and August will affect the rate of disease development and spread on new beans. Repeating disease cycles may occur at 10- to 14-day intervals under favorable conditions.

The earlier the plant becomes infected during its development, the greater the chance for yield loss. Anything delaying plant maturity, such as late planting, herbicide damage, excess nitrogen or hail damage, increases the potential for significant yield loss in the event that a rust epidemic occurs. This potential also is increased by planting on or adjacent to old bean ground where the rust pathogen survives through the winter. Infection that occurs within 21 days of knifing will not significantly affect yield although the symptoms may be quite noticeable.

Rust Management

No single control or disease management measure prevents rust fungus infection. Several management practices should be integrated to provide long-term and reliable crop protection. Cultural practices such as crop rotation (two to three years) and soil incorporation of bean debris remove potential sources of rust spores, as well as bacterial blights. It also is important to plant during recommended periods (May 15 to June 15 in eastern Colorado and western Nebraska) to reduce late-season exposure to high levels of the pathogen. If possible, sprinkler irrigation should be timed so that foliage can dry before darkness to avoid long moist periods (more than 10 hours a day). However, severely rusted bean plants may require twice as much water to complete pod fill and maintain acceptable seed weight.

Many older bean varieties are susceptible to rust. Under severe rust pressure, their productivity will depend on the timely use of fungicides. Rust-resistant varieties are being developed by public and private varietal improvement programs and are available for many market classes including pinto, great northern, small

white, red kidney and black beans. However, seed availability of rust-resistant pinto and great northern varieties may be limited. Also some rust-resistant varieties may be susceptible to other disease and insect pests.

Figure 3. Severely infected bean plants (56K JPG).

Rust-resistant pinto varieties may yield nearly 200 percent more than susceptible varieties when exposed to severe rust epidemics. However, the value and stability of this resistance can be affected by the variability in virulence of the pathogen. The effectiveness of current resistant varieties, however, can be extended by integrating the cultural measures described previously and limited use of protectant and possibly systemic fungicides.

Some fungicides can prevent or reduce rust infection if applied early during the season at first signs/symptoms of infection before the epidemic becomes severe. Fungicides should be applied in at least 5 gallons of water per acre to thoroughly cover plant foliage. Apply a spreader sticker with the fungicide. However, sprinkler system irrigation and frequent rains favor rust development and may wash protectant fungicides off leaves, reducing protection.

To evaluate whether a fungicide treatment is needed, scout bean fields frequently during blossom and early pod development, especially during the first set, for initial rust pustules. Use the worksheet below to help determine the need for implementing fungicide sprays. The worksheet is based on Colorado data on varietal susceptibility, rust severity the previous season, weather data and date of first signs/symptoms. Infections that occur at or after pod bump and stripe seldom cause economic loss. Effectiveness and economic benefit of fungicides depend on application before the epidemic becomes established.

WORKSHEET TO ESTIMATE BEAN RUST POTENTIAL

I. Disease Reaction of the Variety:			**Disease Alert Status***
1=Resistant			
2=Intermediate			
3=Susceptible (or unknown)			
[If rating is 1, no further action is required except periodic scouting for evidence of new races.]			_____
II. Disease Incidence/Severity During Previous Season:			
1= Absent-Light			
2= Light-Moderate			
3= Moderate-Severe			_____
III. Weekly Weather Patterns During May-June			
Ave. High Temp	Rainfall	Ave. high Humidity	
1= > 86 F and	< 0.25"	< 90%	
2= < 86 F or	> 0.25"	> 90%	
3= < 86 F and	> 0.25"	> 90%	_____
IV. Weekly Weather Patterns During July-August:			
Ave. High Temp	Rainfall	Ave. High Humidity	
1= > 86 F and	< 0.25"	< 90%	
2= < 86 F or	> 0.25"	> 90%	
3= < 86 F and	> 0.25"	> 90%	_____

V. First Signs/Symptoms of New Crop Infection:

1= Late Pod to Pod Fill Stages

2= Late Flowering to Mid-Pod Stages

3= Late Vegetative to Mid-Flowering States _____

***Disease Alert Status:** Add the values for disease alerts throughout the season, and follow these guidelines when implementing disease and crop management strategies.

TOTAL: _____

Total	**Alert**	**Management Guidelines**
1 - 5 =	Low	Low potential for yield loss
5 - 9 =	Moderate	Scout fields 1-2 times a week, monitor weather, spray if concerned.
> 9 =	High	Scout fields 2 times a week, monitor weather, spray on a 7-10 day schedule.

Protectant fungicides include chlorothalonil (Bravo 720) and maneb formulations. Use all products according to label directions. Colorado State University and the University of Nebraska are continually evaluating the potential effectiveness of new chemicals for rust control. These include protectants and systemically active fungicides that work at low rates. Consult your Cooperative Extension, Experiment Station and bean industry personnel for updated fungicide and rust management recommendations.

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