WHEAT DISEASES

Stripe rust

CAUSAL ORGANISM
Fungus: *Puccinia striiformis*

HOST RANGE


Different forms of the stripe rust fungus infect different hosts, e.g. *P. striiformis* f. sp. *tritici* infects wheat, *P. striiformis* f. sp. *hordei* infects barley, and *P. striiformis* f. sp. *dactylidis* infects orchardgrass.

IMPORTANCE
Stripe rust was first reported in South Africa in 1996 and established itself in most of the wheat growing areas. The disease is capable of causing yield losses varying between 10-70%, depending on inoculum pressure and environmental conditions favouring disease during the growing season. Yield loss is dependent on: susceptibility of the cultivar; earliness of the initial infection; rate of disease development and duration of disease, with early and prolonged infection causing more yield reduction than later infection. The major grain-producing parts of the wheat plant are the flag leaf and the ear and severe infection of these parts may result in maximum yield reductions. The main causes of yield reduction are reduced grain number per ear arising from induced sterility and lower kernel weight caused by the presence of shrivelled grain.

Like other cereal rusts, *P. striiformis* is one of the most variable pathogens, able to form new physiologic races in a very short time to overcome resistance in existing wheat cultivars. This is referred to as the "boom-and-bust cycle". Surveys are now performed annually in many countries to identify different and/or new races using a differential set of wheat cultivars.

SYMPTOMS
Symptoms of stripe rust usually occur earlier in spring than symptoms of leaf or stem rust. Stripe rust can occur on all aerial parts of the plant, but is most frequently seen on the leaves. It appears as yellow to orange-yellow powdery pustules on the leaf surface. *P. striiformis* typically forms stripes, longitudinally between the veins of the leaf. Pustules (uredinia) are closely packed producing parallel lines of bright yellow new urediniospores giving leaves the typical striped appearance (Fig. 1) which can progress the length of the leaf blade. Individual pustules are roughly circular and about 0.5-1 mm in diameter. On seedlings, pustules appear scattered across the leaves rather than in lines. Spores can be found on both the upper leaf surface and the heads (Fig. 2) of wheat plants. At the end of the season, pustules turn black in colour as a result of telia production.

![Figure 1. Typical "stripe" symptoms on leaves.](image1)

![Figure 2. Pustules on upper leaf surface and heads.](image2)

![Figure 3. Abundant spore production.](image3)
**WHEAT DISEASES**

**Stripe rust**

**SIMILARITY TO OTHER DISEASES**

If a plant is simultaneously infected by stem rust (*P. graminis* f.sp. *tritici*), leaf rust (*P. triticina*) and stripe rust (*P. striiformis*), stripe rust can be distinguished from the other two rusts on the basis of the difference in colour and arrangement of the uredia. Uredia of stripe rust are yellow to orange in colour and arranged in stripes whereas dark brown stem rust pustules are randomly scattered on the stems and also on leaves and leaf rust produce similar random rust pustules but are orange-brown in colour (Fig. 4).

![Figure 4. (a) Stripe rust, (b) stem rust and (c) leaf rust.](image)

**DISEASE INFORMATION**

Stripe rust is a more common and damaging disease in late maturing crops, but is also found as a seedling disease in areas where green host plants allow for the rust to survive and initiate early infections. Infections on tillering plants are often seen on winter wheat in the summer rainfall regions of South Africa. Stripe rust “oversummers” on wild grasses, volunteer wheat seedlings and/or late-maturing spring wheat. It is blown onto growing wheat crops, thereby infecting young seedlings. Spores are dispersed very long distances by the wind and through physical contact (Fig. 3) throughout the season.

*P. striiformis* occurs on wheat crops in the cooler areas in which wheat is cultivated. When spores land on wheat plants they germinate in high humidity, usually at temperatures of less than 15°C, and the germ tubes enter the leaves or other parts of the plant via the stomata. Optimum temperatures are 10-15°C for 4 hours and free moisture (dew/rain) on the leaves (Fig. 5). First pustules normally appear 7-14 days after infection. Hot dry weather and temperatures over 25°C will limit disease development. Stripe rust epidemics tend to start from disease hot spots in the field and, at least initially, the pattern of spread may be related to wind direction.

Stripe rust is not seedborne and cannot survive on wheat debris.

![Figure 5. Rain/dew conditions conducive to disease development.](image)

![Figure 6. Resistant variety (right) vs. Susceptible variety (left).](image)

![Figure 7. Severely infected flag leaf.](image)

**CONTROL**

**Cultural control:**
- Resistant varieties offer the most effective, economical and practical means of control. All PANNAR wheat varieties are annually screened for resistance against the prevalent races and the information on PANNAR varieties is available on request (Fig. 6).
- Destroying the green bridge (volunteer wheat, triticale).

**Chemical control:**
- Fungicides approved for use against *P. striiformis* include bromuconazole, carbendazim/cyproconazole, carbendazim/epoxiconazole, carbendazim/flusilazole, carbendazim/tebuconazole, cyproconazole, flusilazole, cyproconazole/propiconazole, propiconazole, tebuconazole and triticonazole. On very susceptible varieties, fungicides should be applied as soon as the disease appears. On less susceptible varieties, fungicides should be applied if weather conditions are favourable for disease development and there is evidence of the disease spreading in the crop. It is necessary to keep the flag leaf healthy as it contributes significantly towards grain filling. It is also important that fungicides used for control do not leave residues in the grain.
- Disease at the seedling stage can be delayed by treating seed with certain fungicides.