

# Stripe Rust of Wheat

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Given favourable conditions stripe rust can cause large losses in susceptible wheat varieties. However, farmers have shown that by planning to manage this disease they can effectively minimise its effects.

## Stripe rust in Victoria

There have been two introductions of wheat stripe rust into Australia. These introductions may have entered Australia on clothing. The first introduction occurred in Victoria in 1979, and stripe rust rapidly spread across eastern Australia. This original rust mutated, and a number of pathotypes (also known as races or strains) developed enabling the rust to attack more wheat varieties over time. This first introduction, even though wide spread in the east, did not move to Western Australia.

The second introduction of stripe rust into Australia occurred in Western Australia in 2002. In 2003, this pathotype was detected in eastern Australia. This second introduction, now known as the “WA” pathotypes, quickly became dominant in eastern Australia. Since 2003 the “WA” pathotype has undergone several mutations. There are now many pathotypes of wheat stripe rust that are common in Victoria. The resistance ratings provided in disease guides often represent the worse of the pathotypes.

## What to look for

Stripe rust is easiest to identify in the morning. Examine the leaves, especially the older leaves low in the canopy, and look for yellow stripes of pustules. These pustules are raised above the leaf surface and can be easily wiped off onto a white cloth or tissue leaving a yellow stain (see Figure 1). Also, watch for hot spots in the crop. Hot spots are 1-10 meters in diameter, and are generally well developed just before the disease becomes widespread in the crop.

## Disease cycle

Stripe rust is caused by *Puccinia striiformis* f.sp. *tritici*. The fungus is dispersed as wind-blown spores which produce new infections. This cycle is repeated many times during the cropping season causing epidemics to develop. Conditions suitable for epidemic development occur from April to December in Victoria, and stripe rust can be expected in crops by September in most years.

The fungus requires temperatures of less than 18°C (optimum 6-12°C) with a minimum of three hours of leaf-wetness (for example, dew) for new infections to occur. Once an infection is established the fungus can survive short periods of temperatures as high as 40°C.

Sufficient rust survives the summer on volunteer or self-sown wheat plants to allow a new epidemic to develop in the following season. Only one infected leaf per 30 ha of regrowth needs to survive the summer to produce severe epidemics. Stripe rust can also infect the developing head reducing grain number and size.



Figure 1. Stripe rust on a MSS variety.

## Stripe rust management

Stripe rust can cause significant loss to wheat yield and grain quality, given appropriate environmental conditions and susceptible varieties. However, farmers have shown that by planning to manage this disease they can effectively minimise its effects.

The most appropriate stripe rust management strategy for a given farm will vary from one farm to another, from region to region, and from season to season.

While there has been much discussion regarding the merits of various approaches to stripe rust management, such as choice of seed or fertiliser fungicide treatment, versus reliance on fungicide sprays alone. Whichever strategy is used, provided it is implemented in a timely fashion, it will be effective. Therefore, it is important that growers choose a strategy that is appropriate for their situation, and follow it during the growing season. The following management strategies are recommended to minimise the impact of stripe rust:

## Management strategies to minimise the impact of stripe rust

- Remove volunteer wheat plants (the “Green Bridge”) that will support stripe rust inoculum in the 6 weeks prior to sowing.
- Avoid Very Susceptible (VS) and Susceptible (S) varieties by selecting more resistant varieties.
- Use a seed or fertiliser treatment to suppress early infection.
- Monitor crops during the growing season and apply a foliar fungicide early in the epidemic, if required.

Each of these approaches is discussed below:

## The green bridge

Stripe rust can only survive from one season to the next on living plants (mostly wheat, and to a lesser extent barley, triticale, barley grass, brome grass and phalaris). This is called the “green bridge”.

Stripe rust does not survive on seed, stubble or soil. Therefore, the more susceptible volunteer wheat plants growing during summer/autumn the greater the risk of a stripe rust epidemic.

The susceptibility of the volunteer wheat plants over summer influences the quantity of inoculum generated by the green bridge. If most varieties in a district are resistant there will be considerably less inoculum than if the majority of plants are susceptible or very susceptible.

It is critical that all volunteer wheat plants are removed either by spraying, cultivation or heavy grazing by the end of March. Particular care should be taken to destroy plants around sheds and silos, as stripe rust often survives on these plants.

## Variety selection

Selecting wheat varieties for rust resistance is an extremely important part of rust management. Select varieties with the highest levels of rust resistance possible, keeping in mind other agronomic and disease traits of the variety. The actual disease response that occurs in the field will depend on many factors including the amount of inoculum carry over, the timing of the rust outbreak in the crop, and the pathotypes (races/strains) of stripe rust occurring in a region.

The resistance ratings to stripe rust presented in Table 1 are based on data collected from around Australia. For additional varieties, refer to the current Information Note “[Cereal Disease Guide \(AG 1160\)](#)”. Since stripe rust pathotypes are known to change over time, it is critical that a current disease guide is used.

Varieties rated as Very Susceptible (VS) or Susceptible (S) to stripe rust should be avoided. In such varieties stripe rust is more difficult to manage, especially if the season is favourable for stripe rust. VS and S varieties have the potential to rapidly lose all leaf area to stripe rust.

The build up of rust on these varieties can lead to infection of other crops in the district and increase the chance of resistance break down occurring due to the large amount of spores they produce.

If VS or S varieties are grown it is critical that seed or fertiliser is treated with a fungicide before sowing. Crops of VS and S varieties should be monitored regularly for the first sign of rust, and a fungicide applied when necessary.

Varieties rated as Moderately Resistant to Moderately Susceptible (MRMS) or Moderately Susceptible (MS) generally have adult plant resistance ([APR - see below](#)). These varieties are unlikely to lose all their flag leaf to disease, but may need a fungicide spray if rust is detected early (before flag emergence).

Varieties rated Moderately Resistant (MR) show only limited rust symptoms on their flag leaves under ideal rust conditions. Varieties rated as R are those with resistance

which persists for the duration of the plant’s life. Even varieties rated as MR and Resistant (R) should be monitored with a view to fungicide application as mutations in the rust can occur.

**Table 1. Variety rating to stripe rust, leaf rust and stem rust (current February 2014)**

Variety	Stem	Stripe	Leaf
Axe	MS	RMR	MR
Barham	MR	MSS	MRMS
Beaufort	SVS	RMR	R
Bolac	MRMS	RMR	MS
Chara	MRMS	MSS	MS
Cobra	RMR	MSS	MR
Corack	MR	MS	MS
Correll	MRMS	MRMS	MSS
Derrimut	MR	MSS	R
EGA Gregory	MR	MR	MR
Elmore CL Plus	MR	MRMS	RMR
Emu Rock	MRMS	MRMS	MSS
Estoc	MR	MRMS	MRMS
Forrest	R	RMR	MR
Frelon	S	R	MR
Gauntlet	RMR	MRMS	MRMS
Gazelle	MR	MR	MR
Gladius	MR	MRMS	MS
Grenade CL Plus	MR	MRMS	MS
Impala	RMR	MR	S
Justica CL Plus	MR	MRMS	MSS
Kellalac	MSS	MRMS	S
Kord CL Plus	MR	MRMS	MS
Lincoln	MR	RMR	MR
Livingston	MRMS	MRMS	R
Mace	MR	SVS	MR
Mackellar	MR	RMR	S
Magenta	RMR	MS	MS
Manning	MRMS	RMR	R
Merlin	RMR	MR	MS
Phantom	MS	MR	MS
Preston	SVS	RMR	MRMS
Scout	MR	MS	R
Sentinel	RMR	RMR	R
Shield	RMR	MR	R
Spitfire	MR	MR	MS
SQP Revenue	RMR	R	R
Suntop	MR	MR	R
Trojan	MRMS	MR	MR
Waagan	MS	S	MS
Wallup	RMR	MRMS	MS
Yenda	R	S	R
Yitpi	S	MRMS	MSS
Young	RMR	MS	MRMS

# These varieties may be more susceptible if alternative strains of are present. <sup>P</sup> These ratings are provisional - treat with caution.

R = Resistant RMR = Resistant to moderately resistant  
 MR = Moderately resistant MRMS = Moderately resistant to moderately susceptible MS = Moderately susceptible  
 MSS = Moderately susceptible to susceptible S = Susceptible SVS = Susceptible to very susceptible VS = Very susceptible

## Seed / fertiliser fungicide treatments

Seed and fertiliser fungicide treatments play an important role in stripe rust management. In the Wimmera, Western, Central and North East districts all varieties with a stripe rust rating of MRMS or lower should be treated with either a seed or fertiliser treatment to suppress early stripe rust. In the Mallee, growers should use a seed or fertiliser treatment that suppresses early infection in crops when there is a high carry over of inoculum on the green bridge and susceptible varieties are grown.

These treatments will be most effective when adopted across a region as they will greatly reduce the inoculum levels in a district. The length of protection varies depending on the product selected. For a comprehensive list of products, see "[Cereal Seed Treatments](#)".

Be aware that some seed treatments effective against stripe rust (e.g. products containing triadimenol and flutriafol) may reduce coleoptile length, and this should be considered at sowing time. Also note that fertiliser treatments do not control bunts and smuts, so a seed treatment still needs to be applied to the seed. Where crops are sown early for anticipated grazing benefits, issues such as withholding period will need to be considered.

Products containing triadimenol or triticonazole give suppression of stripe rust for about 4 weeks after sowing, and can help reduce early development of the disease in the crop. However, crops must continue to be monitored during the growing season with a view to fungicide application.

Longer season protection can be provided by applying fluquinconazole to seed, or flutriafol or triadimefon to fertiliser. These products can give protection up to flag leaf emergence or later in some cases. Often these products will reduce the need for follow up foliar sprays, however, crops should still be monitored with a view to foliar sprays if necessary.

## Fungicide sprays

Effective fungicides for controlling stripe rust are available; but should be regarded as a support, and not a substitute, for growing resistant varieties.

The requirement for fungicide sprays will depend on the carry over of rust inoculum on the "green bridge", the timing of the epidemic (in relation to crop growth stage) and the level of resistance in the variety. For example, in 2011 where stripe rust was detected early (i.e. tillering to flag), a fungicide spray was required in many varieties to protect green leaf area until the onset of adult plant resistance, which starts around ear emergence. Varieties without effective APR may have required sprays beyond ear emergence. Sprays are generally more effective when applied early in an epidemic.

It is likely that the onset of a rust epidemic will be different in different years. The timing of the first occurrence in the crop may be different, and the area where it first occurs may also be different. It is, therefore, important that the decision to apply fungicides is made during the season, using available information, and is not based on previous experiences alone.

During the season crops should be monitored regularly (at least every 2 weeks) for the presence of stripe rust. The earlier that rust occurs within a crop the greater the potential loss, but the easier it is to control.

If stripe rust is present before ear emergence, then crops must be sprayed before the level of infection reaches 1 per cent leaf area affected (this is when approximately 35 leaves per 100 have stripe rust). It is better to spray sooner than later.

When stripe rust is first detected at ear emergence, only the most susceptible (S and VS) crops or longer season crops may need spraying. After a fungicide application crops should continue to be monitored as fungicides only provide between 2 to 4 weeks protection.

There is often an apparent increase in stripe rust for a few days after spraying. This is caused by the development of symptoms of infections that occurred just before spraying. Control becomes apparent within a week of spraying, and the period of protection is normally about four weeks.

## Early season protection vs. foliar sprays

There has been much discussion as to the relative merits of either applying or not applying early season seed or fertiliser treatments (with follow up fungicide spray if required) versus just relying on applications of foliar fungicides. Both approaches can effectively manage stripe rust, with similar costs to the grower, if used appropriately.

The disadvantage of early season protection is that expense is incurred before knowing if rust will be an issue, or the yield potential of the crop. The advantage of the early applied long season protection is that in the presence of rust, the likelihood that a fungicide will be required before flag leaf emergence is reduced. This minimises the need for timely fungicide applications during the season.

The disadvantage of the foliar spray option alone is that crops must be sprayed early in the rust epidemic, in a timely fashion, keeping in mind the difficulty of spraying during a period of continuous wet weather. The advantage of this approach is that expense is only incurred when, and if, stripe rust is an issue within the crop.

Both methods are effective if used appropriately. To determine which approach is the most suitable, growers need to consider rust carry over on the green bridge, variety selection, local conditions, and the ability to spray for stripe rust in a timely fashion.

## Resistance to stripe rust in wheat

In general, there are two types of resistance to stripe rust deployed in Australian wheats. They are, major gene resistance and adult plant resistance. These resistance sources may be used either alone or in combination.

**Major gene resistance** is a race specific resistance that is very effective against some strains of rust, but ineffective against others. Typically when these major genes are first deployed they are completely effective, but through mutation of the rust these resistances are often short lived in wheat as they are overcome or "broken down" by the pathogen. An example of this is the acquisition of virulence toward the Yr17 gene deployed in many varieties.

When a major resistance gene is “broken down” the level of resistance, in a variety, will depend on the other genes present in that variety.

**Adult plant resistance (APR)** is a resistance that is widely used in Australian wheats. APR genes are often partial resistance genes that work by slowing down the rate of epidemic development. They do not stop the disease progress completely.

There are a number of APR genes used in commercial wheats. The relative effectiveness of APR genes can be influenced by factors such as:

- Temperature (they often working better at higher temperatures).
- Crop nitrogen status (there may be a delayed onset in high nitrogen status crops).
- The wheat variety that they are deployed in.
- The number of APR genes present (their effects are often additive).
- Sometimes the pathotypes of stripe rust present.

Even though APR genes are widely used in Australian wheat varieties they are often not well understood. Some APR genes may also be pathotype specific, and therefore prone to being overcome by new pathotypes of stripe rust, while other APR genes are regarded as “durable” and, therefore, less likely to be overcome.

In general, APR becomes effective at around ear emergence and works best if rust levels are not excessive in the crop at this time. In varieties that have APR as their only source of resistance it may be important to protect the earlier growth stages of the crop with seed or fertiliser treatments and/or fungicide sprays. In general, varieties rated as MS with effective APR will rarely lose all their flag leaf to disease, whereas varieties rated as S and VS are at risk of losing 100 per cent of their leaf area to disease.

Many cultivars with APR can be very susceptible as young plants. Growers using such varieties must plan to protect their crops from stripe rust before the onset of effective APR to minimise rust build up. The level of susceptibility of young crops will vary from one variety to another. This early susceptibility of young crops can result in build up of rust in some years.

## Further Information

Detailed information on each of the cereal diseases can be obtained from [DEPI Information Notes](#)  
[www.depi.vic.gov.au](http://www.depi.vic.gov.au)  
[Cereal Root Diseases – \(AG 0562\)](#)  
[Wallwork, H \(2000\) Cereal Leaf and Stem Diseases](#)  
[Wallwork, H \(2000\) Cereal Root and Crown Diseases](#)  
[Wallwork, H \(2011\) Cereal Seed Treatments 2014](#)  
[Rust Bust](#) [www.rustbust.com.au/](http://www.rustbust.com.au/)

## Contact/Services available from DPI

DEPI Field Crop Pathology, Grains Innovation Park, 110 Natimuk Rd, Horsham 3400. Tel (03) 5362 2111, or the DEPI Customer Service Centre 136 186.

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