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Managing stem rust of wheat

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In Western Australia, wheat stem rust (*Puccinia graminis f.sp. tritici*) occurs infrequently, depending on the season, and widespread outbreaks are very damaging but rare. Regional outbreaks are more common, causing losses over limited areas. Regions in Western Australia historically prone to wheat stem rust are the northern wheatbelt region around Geraldton and the south-eastern wheatbelt around Esperance (Figure 1). Stem rust typically causes losses of 10–50 per cent, but this can increase to up to 90 per cent when it occurs in early spring and is not controlled.

Stem rust requires living plants on which to grow and reproduce, so to infect crops during the season it must survive over summer by infecting volunteer cereals or grass hosts, known as the 'green bridge'. Surviving rust builds up in autumn on volunteer cereals. This happens readily after wet summers.

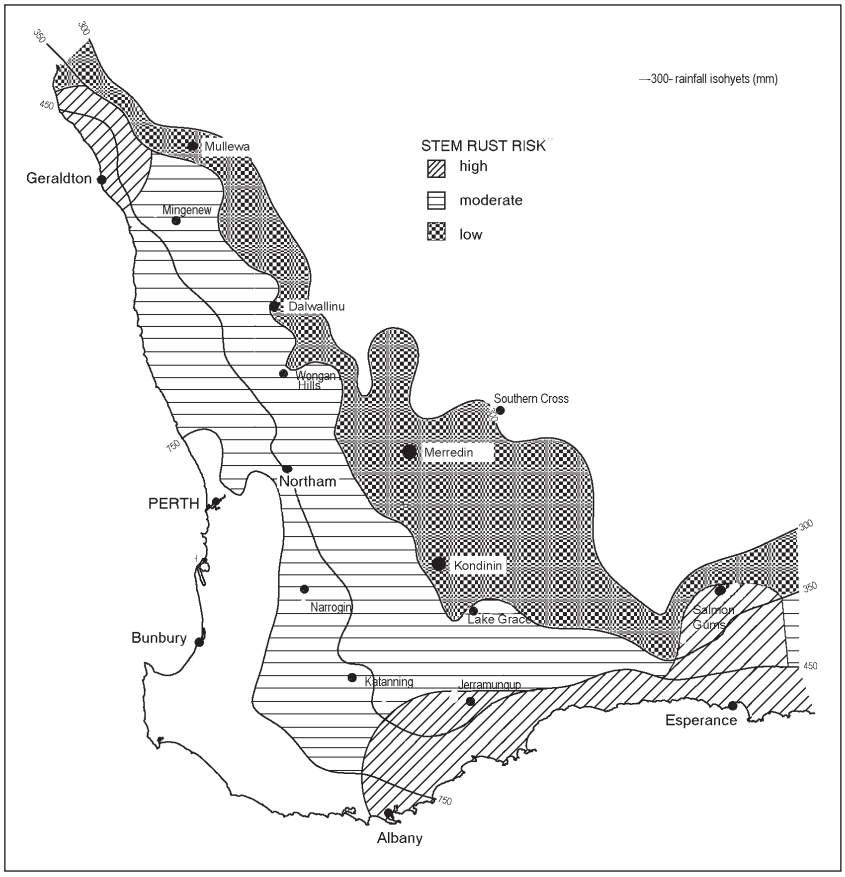

Figure 1. Stem rust risk in Western Australia

Risk factors

While resistance will influence individual crop risk, the overall risk of serious rust outbreaks is influenced by several factors which can be considered each season. The factors are:

- the amount of stem rust present in the previous season – more stem rust in a given year means there is more chance of carryover into the next season
- summer and autumn rains – summer rains permit the development of volunteer hosts, autumn rains permit the early build-up of rust on these volunteers
- spring rains – if all the other factors occur and early rust breaks out in crops, then a stem rust epidemic is more likely if the spring is suitably wet.

Disease development and symptoms

Stem rust attacks wheat and triticale but barley can also be an important host during summer months. Stem rust is adapted to warmer conditions (15–30°C) than leaf or stripe rusts, and is usually detected later in the season (mid-spring) than leaf or stripe rusts. Warm, moist conditions will promote the development of stem rust and disease severity can increase extremely rapidly once a crop is uniformly infected.

Stem rust produces large, reddish–brown oval to elongated spore masses on both sides of the leaf, on leaf sheaths, stems, and outsides of heads. These spore masses rub off onto fingers, as is characteristic of rust diseases. The pustules of stem rust have conspicuously tattered edges. At the end of the season, pustules produce black spores called teliospores.

Yield losses

Yield loss will depend on the disease resistance of the variety and on how early the disease starts in the crop (Table 1). Quality reductions such as increased screenings and lower hectolitre weights can add to high yield loss impacts.

Table 1. Wheat variety resistance ratings and potential maximum yield loss due to stem rust

Resistance rating	Definition	Potential yield loss (%)
2 - very susceptible	Early high disease build-up; can promote epidemic development	50–90
3 - susceptible	High disease build-up	25–50
4 - moderately susceptible	Develops disease less quickly and so reduces loss risk	10–35
5 - intermediate	Some partial resistance; losses depend on disease pressure	5–25
6 - moderately resistant	High partial resistance; generally few losses	5–15
7 - resistant	Highly effective resistance; no or slight losses	0–5
8 - highly resistant	Complete resistance	0

Fungicide control may be required for varieties rating 2–4. Varieties with disease ratings of 5 may benefit from fungicide control if early disease occurs or high spore loads are present (for example, next to another severely rusted paddock). High crop yield potentials also increase the rate of return from fungicides.

Pre-season management

Combining a range of management options is an effective way of reducing risk of stem rust.

Remove summer volunteers that created the green bridge

Self-sown summer and autumn volunteers (predominantly wheat and barley), which help to produce the green bridge, should be killed with herbicides or heavy grazing as soon as they develop and well before crop sowing. This will reduce local carryover of rust spores and reduce the risk of early infection.

Sow resistant varieties

Sowing varieties with resistance to wheat stem rust is encouraged in Western Australia, particularly for rust-prone environments such as the Esperance and Geraldton regions. However, changes in farming practices and varietal availability do not always match the level of threat from stem rust, which can vary seasonally. The recent development of virulence for stem rust resistance in Western Australia has rendered previously resistant varieties Camm and Wyalkatchem susceptible.

Varieties that are partially or fully resistant to rust are effective in reducing disease build-up and preventing losses. The need to sow resistant varieties varies with season and region. Use resistant varieties if rust is likely to occur. Avoiding susceptible and very susceptible varieties is very important in rust-prone environments or high-risk seasons.

Spring management

Paddock monitoring

Warming spring conditions favour stem rust so the disease becomes apparent after flag leaf emergence. When stem rust risk exists (such as in green bridge areas or after reports of stem rust in your region):

- monitor susceptible crops at 7 to 14 day intervals from flag leaf emergence to early dough grain development
- inspect different parts of the crop by carefully examining plants (especially lower stems) for signs of stem rust infection (refer to Bulletin 4539, Identifying wheat leaf diseases, for further information)
- if stem rust is found, walk through the paddock in a 'W' pattern and collect 100 random stems from the crop (that is, 10 stems from 10 locations), and determine the number of stems with any stem rust
- immediately send 6 to 10 infected stems or leaves to AGWEST Plant Laboratories, Department of Agriculture, Bentley Delivery Centre 6983 (ph 9368 3721) for confirmation. Post in a paper envelope (no plastic) with date, location, name, and contact details. Broadacre diagnostic submission forms are available from your local Department of Agriculture or on-line (www.agric.wa.gov.au and search for broadacre form). Once confirmed, these samples are sent on to the Australian Rust Survey at Sydney University to monitor rust strains in Western Australia.

Foliar fungicides

Where wheat stem rust occurs in susceptible varieties, economic control can be achieved with fungicide applied at early disease onset. Economic responses result from improvements in yield and in grain quality (reduced screenings, increased hectolitre weight).

Two fungicide active ingredients are registered in Western Australia for stem rust control: propiconazole (example trade names are Aurora® 250 EC; Bumper® 250 EC; Tilt® 250 EC; and Tyrant® 250 EC) and tebuconazole (example trade names are Folicur® 430 SC; Tebuconazole 430SC; and Quasar® 430 SC). Experimental results with other fungicides have given less consistent results in terms of disease control and yield increases.

Spraying can effectively control stem rust. Early disease detection is important as experiments show that fungicide reduces subsequent rust severity on plant parts that were only slightly infected at the time of fungicide application, but is not effective on plant parts that were more heavily infected when treated. The degree and duration of control depends on the application rate. Control is more effective if the fungicide is applied early in the development of the disease (Table 2). Disease becomes more difficult to control as it progresses. Poor control is likely at rates below those recommended, particularly when disease levels are high. Under high disease levels, high rates should be used.

Table 2. Summary of experimental findings from trials in Esperance, 1997–1999, of natural stem rust infections

Crop stage		Tillers[A] detected with stem rust	Crop yield potential	Yield response t/ha	
Stem rust detected	**Fungicide applied**	**%**	**t/ha**	**1 spray**	**2 spray**
Flag emergence	Booting	Trace (<1)	3.0–3.5	0.9	1.5
Early head emergence	Mid head emergence	5	2.5–3.0	0.2	0.2
Early grain fill	Late milk–early dough	90	1.5–2.0	0.5	n/a

[A] Any stem rust detected on stem or leaves from each of 100 tillers

Strategies for using fungicides to manage rust depend on when the disease starts and the level of risk acceptable to the grower. All strategies assume that rust is detected soon after the start of the epidemic. Monitoring susceptible crops is essential to achieve this.

Foliar spray strategies

Reducing early epidemic development, particularly in VS–MS (ratings 2–4) varieties, is most important. Economic responses have been achieved in susceptible varieties from fungicide sprays from pre-head emergence to grain filling. Responses in less susceptible varieties will be less with later sprays.

Crops infected with stem rust before flowering are considered at high risk as yield losses of 50 per cent or more are possible. If infection starts or re-starts after flowering, losses of around 25 per cent are possible.

When to spray

If any stem rust is detected **before head emergence**, spray S (rating 3) or MS (rating 4) crops as soon as possible with an appropriate fungicide at a high rate. For crops with intermediate resistance (rating 5) continue to monitor and spray if infection exceeds an average of 5 per cent of random stems infected.

If stem rust is detected **after head emergence** but before grains are doughy, apply fungicide if stem rust can be found on more than 5 per cent of random tillers for S or MS crops, or 50 per cent of random tillers on crops with intermediate resistance. Short-term control can be achieved with standard application rates provided infection is not severe. High fungicide rates have been found to be more profitable in experiments.

If stem rust is detected **after grains are at the dough stage**, apply fungicide if stem rust can be found on over 50 per cent of random tillers and if the crop has at least four more weeks of grain filling to go before hard dough stage. It is important to consider withholding periods when choosing an appropriate fungicide.

Note: Mention of trade names does not imply endorsement or preference of any company's product by Department of Agriculture, Western Australia, and any omission of a trade name is unintentional. Recommendations are current at time of printing.

Further reading

Bulletin No. 4539 *Identifying wheat leaf diseases*. Published by Department of Agriculture (2001).

Cereal Leaf and Stem Diseases. Hugh Wallwork, Published by GRDC (2000). Available from the Kondinin Group.

Wheat rust: The back pocket guide. Published by GRDC.

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