Stem rust control in wheat – 2010 trials review

Nick Poole & Tracey Wylie
Foundation for Arable Research (FAR), New Zealand

Key findings

- Fungicides can be employed successfully to control stem rust in wheat (Puccinia graminis f.sp. tritici) but timing in relation to disease development is crucial.
- In susceptible cultivars fungicide application must be made at a very early stage of disease development, preferably before it can be seen.
- Fungicide activity is limited in scenarios where disease is already established in the stem at application, in these cases cultivar resistance was far more effective in defence against this disease than fungicides.
- Propiconazole (Tilt) gave significantly poorer stem rust control than the other fungicides tested at full label rates.
- Prothioconazole the partner azole to tebuconazole in Prosaro was particularly strong on stem rust, making Prosaro one of the most cost effective fungicides for control of this disease.

Following favourable conditions for stem rust development, six trials were set up at short notice to gather fungicide efficacy data on control of this disease. In order to take account of any possible product shortages in an epidemic year, fungicide products were evaluated across a range of rates (N.B. the use of fungicide or use at rates lower than the label does not constitute a recommendation in this report). Since the disease developed late in the season, there has been less opportunity to test the influence of fungicide timing, however some data has been collected. This project is a variation on GRDC project SFS 00017.

How did fungicide product and rate influence stem rust control?
Seven fungicides were evaluated at four trial sites: 1. Booleroo, SA, 2. Jamestown, SA, 3. Quambatook, VIC (Mallee) and 4. Inverleigh, VIC (high rainfall zone - HRZ). At three of these sites fungicides were applied (Table 1) before stem rust infection was visible in the crop, however at the Booleroo site products were sprayed at very low levels of infection (less than 10% less sheathes infected). Fungicide products were applied at three rates (low, intermediate and high). In many cases the high rate was the label rate for stem rust control if registered (Table 2). The infection came in late in crop developmentat all of these trial sites, first infection being evident from early grain fill (GS71). In the three shorter season environments, Booleroo, Jamestown and Quambatook physiological maturity arrested the disease, which had steadily increased until that stage (Table 3). Yipti (S - susceptible stem rust rating) was the cultivar used in all the trials, except in the HRZ where Beaufort feed wheat was used (S - susceptible stem rust rating).

Table 1. Application details (date, growth stage, water rate and nozzle settings)

Trial Site	Application Date	Growth Stage	Water rate l/ha	Nozzles & Pressure
Trial 1 Booleroo SA	Oct 19th	GS72 (early milky ripe)	107 l/ha	015 flat fan nozzles, 1.5 bar
Trial 2 Jamestown SA	Oct 26th	GS71 (watery ripe)	107 l/ha	015 flat fan nozzles, 1.5 bar
Trial 3 Quambatook VIC	Oct 27th	GS69 (end of flowering)	160 l/ha	DG 110-02, 2.0 bar
Trial 4 Inverleigh VIC (HRZ)	Nov 10th	GS55 (50% ear emergence)	100l/ha	110-02 flat fan, 3.0 bar

Influence of fungicide rate (mean of fungicide products - 4 site mean)

Stem rust control assessed over the 4 trial sites (Figure 1) revealed that using a high rate was essential for the control of the disease, even if the fungicide had been applied before infection was visible in the crop. There was a significant advantage to the high rate of fungicide (87% control) over the intermediate rate (76% control), which in turn was superior to the low rate (61% control).

Influence of fungicide product & rate on stem rust control - 4 site mean

At the high rate of fungicide, the formulated mixtures azoxystrobin/cyproconazole (Amistar Xtra), propiconazole/cyproconazole (Tilt Xtra) and prothioconazole /tebuconazole (Prosaro) gave significantly better disease control (92 - 93% control) than propiconazole (e.g. Tilt) at 500ml/ha (75% control). At the intermediate rate, a rate which it must be stressed is below the label rate for most of the products, the spread of performance was greater with Prosaro performing significantly better than single active ingredients epoxiconazole (Opus), tebuconazole (Folicur) and propiconazole (Tilt). At the lowest rate of active ingredient disease control ranged from 46 – 71% control, tebuconazole (Folicur) and propiconazole (Tilt) being inferior to all other fungicides except propiconazole/cyproconazole (Tilt Xtra) .

Was it economic to spray for stem rust in these trials?

At Booleroo in SA there was no significant difference in yield between the treatments (yields ranging from 4.0t/ha - 4.29t/ha) with an untreated yield of 4.14 t/ha. At Quambatook in Victoria (harvested December 31st) all fungicides applied at the high rate gave significantly higher yields than the untreated, except propiconazole (Tilt) and propiconazole/cyproconazole (Tilt Xtra). The significant yield increases ranged from 0.29-0.45 t/ha and all gave rise to economic yield increases, however it was lower cost fungicide products such as Folicur, Prosaro and Opus that gave the greater margins in this trial (Figure 2).

Table 2. Fungicide treatment and application rate. Label rates for stem rust control are highlighted (note Amistar Xtra is not registered for stem rust control in Australia).

Trt	Fungicide treatment and rate	Rate description	Active ingredient
1.	Prosaro® 420SC 75 ml/ha + A	Low	Prothioconazole + Tebuconazole
2.	Prosaro 420SC 150ml/ha + A	Mid	
3.	Prosaro 420SC 300ml/ha + A	High	
4.	Opus® 125SC 125 ml/ha	Low	Epoxiconazole
5.	Opus 125SC 250 ml/ha	Mid	
6.	Opus 125SC 500ml/ha	High	
7.	Amistar Xtra® 280SC 200 ml/ha	Low	Azoxystrobin + Cyproconazole
8.	Amistar Xtra 280SC 400 ml/ha	Mid	
9.	Amistar Xtra 280SC 800 ml/ha	High	
10.	Tilt® 250EC 125 ml/ha	Low	Propiconazole
11.	Tilt 250EC 250 ml/ha	Mid	
12.	Tilt 250EC 500 ml/ha	High	
13.	Tilt Xtra® 330EC 125 ml/ha	Low	Cyproconazole + Propiconazole
14.	Tilt Xtra 330EC 250 ml/ha	Mid	
15.	Tilt Xtra 330EC 500 ml/ha	High	
16.	Folicur® 430SC 72.5 ml/ha	Low	Tebuconazole
17.	Folicur 430SC 145 ml/ha	Mid	
18.	Folicur 430SC 290 ml/ha	High	
19.	Opera® 147SC 250 ml/ha	Low	Pyraclostrobin + Epoxiconazole
20.	Opera 147SC 500 ml/ha	Mid	
21.	Opera 147SC 1000 ml/ha	High	
22 to 24	Untreated		

A – Adjuvant applied was Hasten at 1%.

Table 3. Stem rust development in the untreated plots at 4 trial sites relative to the date of fungicide application in the trial – assessed on the flag leaf sheath.

Trial Site	Assessment method	% Stem rust in untreated (relative to days following fungicide application)			
		0	7	14	22-34
Booleroo	% incidence	6	14	94	99
	% Severity	0	0.2	2.2	6.5
Jamestown	% incidence	0	2	28	95
	% Severity	0	0.01	0.3	1.9
Quambatook	% incidence	0	0	7	83
	% Severity	0	0	0.07	3.2
Inverleigh	% incidence	0	0	16	93
	% Severity	0	0	0.11	2.9

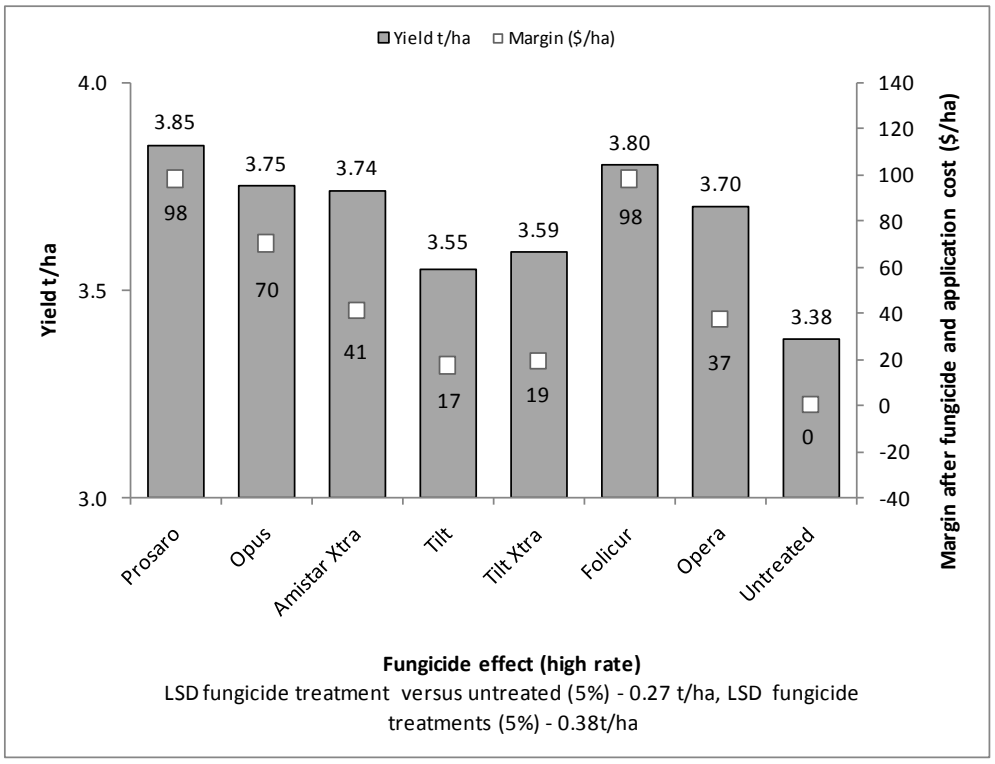

Figure 2. Influence of fungicide application for the control of stem rust on the yield (t/ha) and margin after fungicide and application cost ($/ha) – cv Yipti, Quambatook, VIC
Note: grain price $317/t; 2.5% wheel damage was subtracted from the treated yield;

How important is fungicide timing for stem rust control?

Though there were few opportunities to explore fungicide timing due to the late nature of infection this season, work in the longer season environment in southern Victoria, on the feed cultivar Beaufort, compared fungicide application pre and post infection. Application of the same seven fungicides (as outlined in Table 1) was made at the high rate at 50% ear emergence (GS55) pre visible infection, and then again 16 days later at early grain fill-watery ripe stage (GS71).

Comparisons of stem rust control between the two timings illustrated that when the plant structure to be protected is already infected with stem rust the ability of the fungicide to control the disease is reduced (Figure 3). At GS71, when the second fungicide timing was applied, the flag leaf sheath was already infected (16% flag sheathes infected), in comparison to the earlier application at ear emergence when no infection was noted. As a consequence the stem rust control achieved with high rates applied late (GS71) was significantly inferior to the same rates used earlier (GS55) and was no better for stem rust control than the low and mid rate fungicide applications (Figure 3).

In contrast, the peduncle (the true stem beneath the ear) was not fully exposed to the fungicide at the ear emergence timing (since it was still inside the sheath) and the later application timing, at grain fill (GS71), was applied with no visible infection in the peduncle. In this case there was no significant difference in stem rust control between the two timings for the protection of this part of the plant, though the trend was for the earlier spray to be superior (Figure 4).

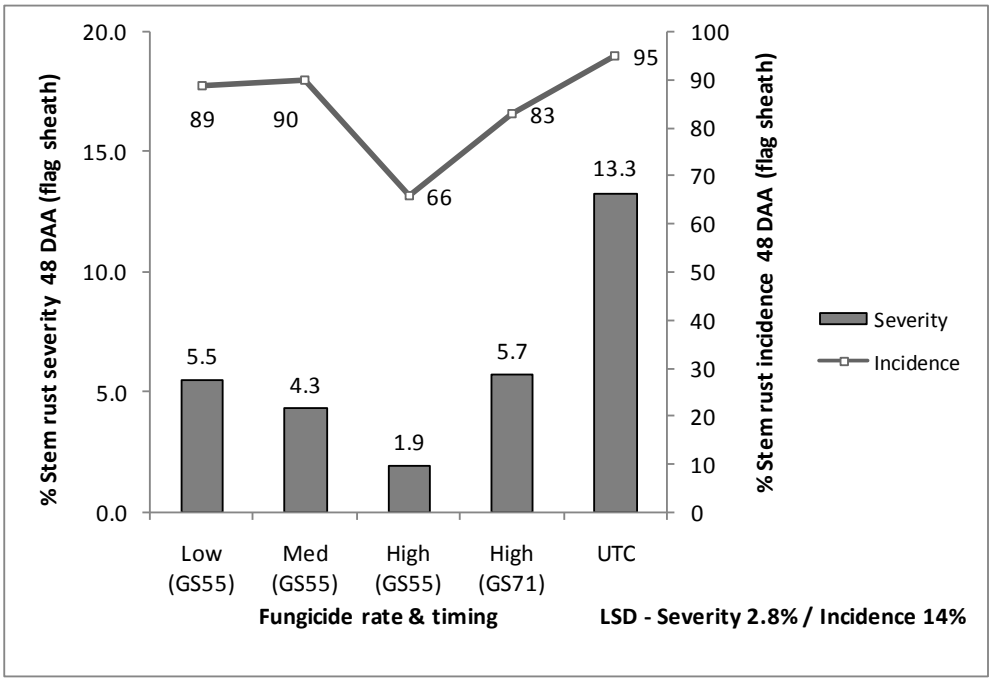

Figure 3. Influence of fungicide timing at 50% ear emergence (GS55) v watery ripe (GS71) and rate of application on stem rust (% incidence and severity) on the flag sheath 48 days after fungicide application at GS55 and 32 days after fungicide application at GS71 (mean of 7 fungicide products) – Inverleigh (HRZ), VIC

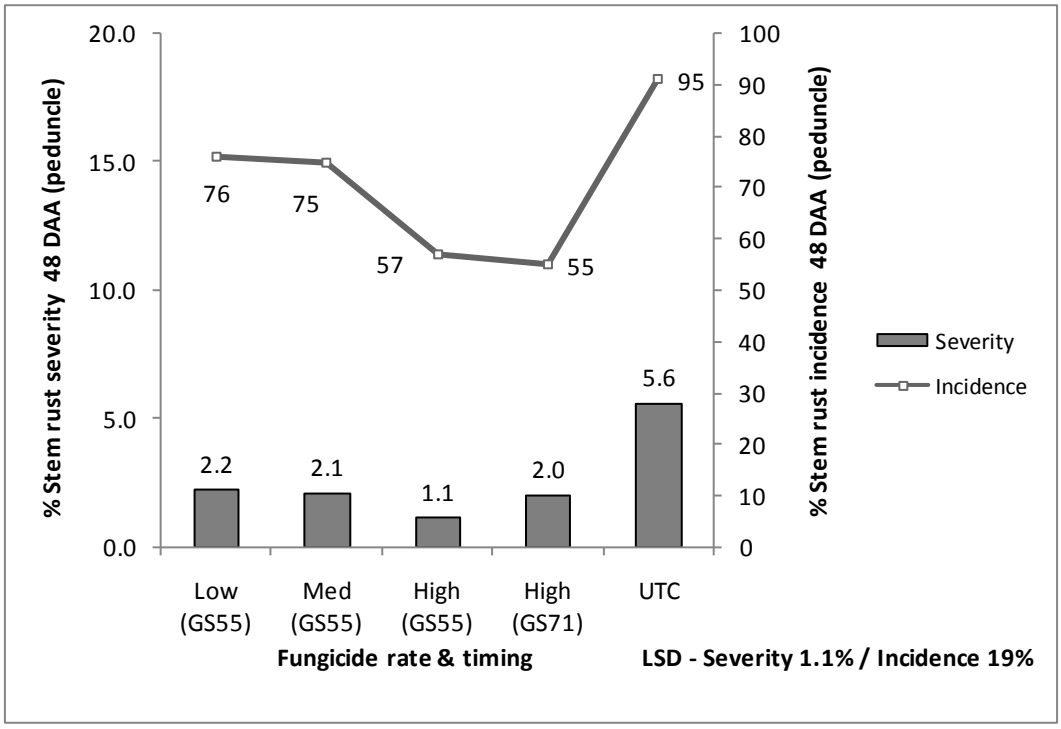

Figure 4. Influence of fungicide timing (50% ear emergence (GS55) v watery ripe (GS71) and rate on stem rust (% incidence and severity) on the peduncle 48 days after fungicide application at GS55 and 32 days after fungicide application at GS71 (mean of 7 fungicide products) – Inverleigh (HRZ), VIC

What is the role of cultivar resistance in the control of stem rust?

Cultivar resistance is crucial for the control of this disease. Whilst information is presented in this paper to show that stem rust can be controlled with foliar fungicides, the activity of these products is limited once infection becomes established. In Gippsland this season, stem rust was first noted in early November by which time the disease was well established on the stem in susceptible cultivars (100% infection incidence). Though yield results are currently being processed, the trial conducted on March and May sown wheat showed little impact from a full rate fungicide (Prosaro 300ml/ha plus Hasten % v/v) in terms of stem rust control where cultivars were badly infected at application (Figure 5). In these trials the impact of Revenue's genetic resistance to stem rust was far superior to the influence of foliar fungicide applied late in the development of the disease.

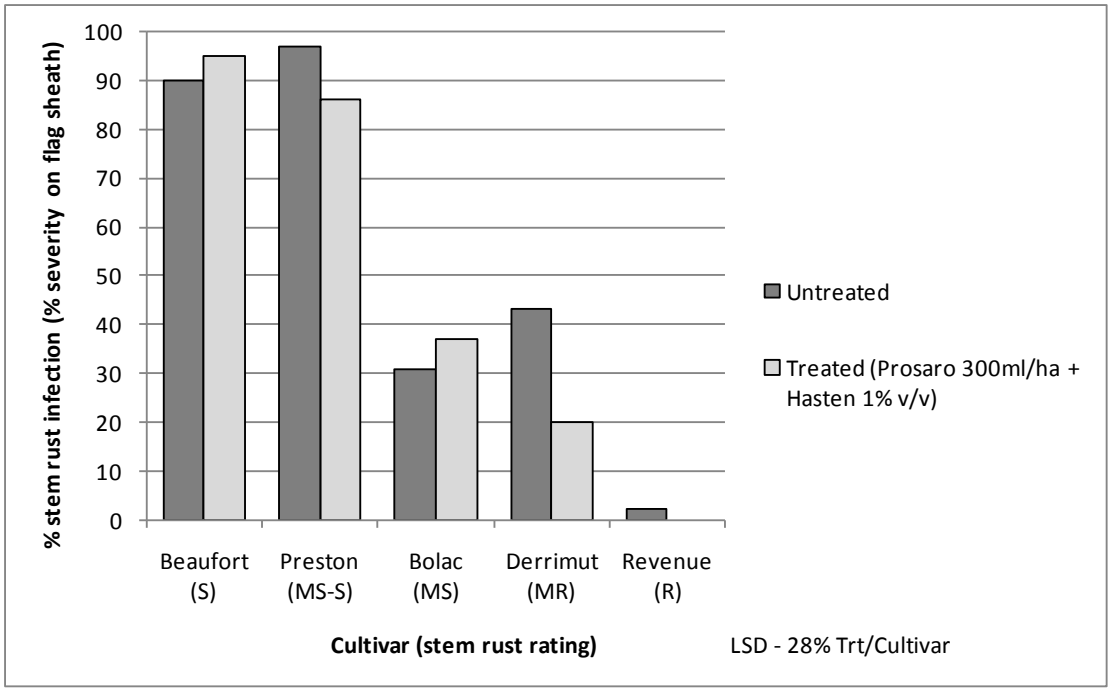

Figure 5. Influence of cultivar resistance and fungicide application on stem rust severity on the flag sheath 18 days after fungicide application assessed at mid dough – physiological maturity (GS85-90) – Bairnsdale, Gippsland, VIC.

Acknowledgements

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