Leaf Rust in Barley 2011

Background, Aims and Method

Background

Leaf rust in barley (*Puccinia hordei*) occurred at epidemic levels in 2010 across many areas of northern NSW and southern Qld. This epidemic was driven by a combination of:

1. **Widespread susceptible host** – Grout was a dominant variety rated as very susceptible (VS) to leaf rust
2. **Large amounts of disease inoculum** – leaf rust was widespread in barley in the region the previous season
3. **Favourable conditions for disease development** – 2010 was a season with above average to record levels of rainfall during August and September combined with record high minimum temperatures during September

Commercial experience from 2010 indicated that fungicides such as Tilt® or Folicur® (both registered in barley but without claims for leaf rust control) provided very poor efficacy against this disease.

Aims

1. To screen the range of currently available fungicides for efficacy against leaf rust in barley
2. To compare leaf rust control between single and multiple applications
3. To quantify the overall level of yield, grain quality and economic cost
4. To improve our understanding of leaf rust management in barley

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Method

A program of six trials was planned in commercial barley crops from Gunnedah in the south to the Darling Downs. Five sites were selected in paddocks of Grout®, the most susceptible variety with a rating of VS (very susceptible) with the sixth site in a paddock of Commander®, rated S (susceptible).

Leaf rust did not develop, even in the variety Grout®, at either of the Gunnedah sites. Consequently these trials were not sprayed. The sites at Macalister and Allora, Qld and North Star and Yallaroi, NSW were sprayed when leaf rust was first detected in either the surrounding commercial crop or the pegged out trial area.

Treatments

Treatment Number	Product	Rate (mL/ha)	Adjuvant	Application Timing	Approximate product cost $/ha
1	Untreated	-	-	-	-
2	Triazole Pro	High label rate	-	1	$6.50
3	Tilt® Xtra	250	-	1	$9.00
4	Tilt Xtra	250	Bonza 0.5%	1	$9.00
5	Tilt Xtra	500	-	1	$18.00
6	Tilt Xtra x 2	250	-	1 & 2	$18.00
7	Triazole Teb	High label rate	-	1	$4.50
8	Opus®	500	-	1	$16.00
9	Amistar® Xtra	200	Adigor 2%	1	$10.50
10	Amistar Xtra	400	Adigor 2%	1	$21.00
11	Opera®	500	-	1	$19.00
12	Prosaro®	300	-	1	$18.00

Treatments 2 and 7 are common fungicides, registered for use in barley but without a leaf rust control claim. These were included for benchmarking purposes.

Application Timings

Timing 1 = first sign of leaf rust
Timing 2 = ~21 days after timing 1 (two applications of Tilt Xtra 250 mL were applied in Trt 6)

Assessments

The four sprayed trials were assessed for % leaf area diseased due to either leaf rust, or spot form net blotch (SFNB), on the top 2 -3 leaves. The trials at Macalister and Allora on the Darling Downs both developed moderate levels of leaf rust with no SFNB present. The trial near Yallaroi developed low levels of both leaf rust and SFNB. The trial near North Star developed only low levels of SFNB, despite leaf rust presence in the surrounding commercial crop. All sites were harvested using small plot headers with grain quality also assessed.

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Results in a Nutshell

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Results in a Nutshell

Disease level comments

- Despite the majority of sites being in paddocks of Grout (rated VS for leaf rust), only moderate levels of leaf rust developed in the two Qld trials and very low levels at Yallaroi
- Leaf rust appeared to develop much more slowly than in 2010 and did not increase rapidly until late September/early October

Leaf rust control

- It appeared that the Timing 1 applications, made on the first sign of leaf rust, were up to a month earlier than when leaf rust became most active
- The most effective control was obtained from two applications of fungicide (Tilt Xtra 250 mL) with the second timing much closer to the start of more active disease development
- Amistar Xtra 400 mL provided the best efficacy from a single application
- At the highest disease pressure site, all fungicides reduced leaf rust levels by ~45-65% even when applied at least 4 weeks prior to rapid disease development
- Fungicides with leaf rust claims provided more consistent leaf rust suppression than Triazole Teb and Triazole Pro, both registered for use in barley, but without a leaf rust label claim

Yield

- There was no significant difference in yield in any of the trials
- At the highest disease pressure site (Macalister) there was a trend to a yield benefit from all fungicide treatments (mean 9%, range 6-17%)

Grain quality

- Grain size was significantly reduced at the highest disease site. Grain from the Untreated plots was significantly lower in % retention and higher in % screenings than 8 of the 11 fungicide treatments.

The major question - why was leaf rust a much bigger issue in 2010?

The concern after 2010 was that once leaf rust became well established it was nearly impossible to manage. As a result, the approach taken in 2011 was to spray at first sign of leaf rust presence in a very susceptible or susceptible variety.

However despite having a very susceptible host and the presence of inoculum in the crop, leaf rust was only a minor disease issue in 2011.

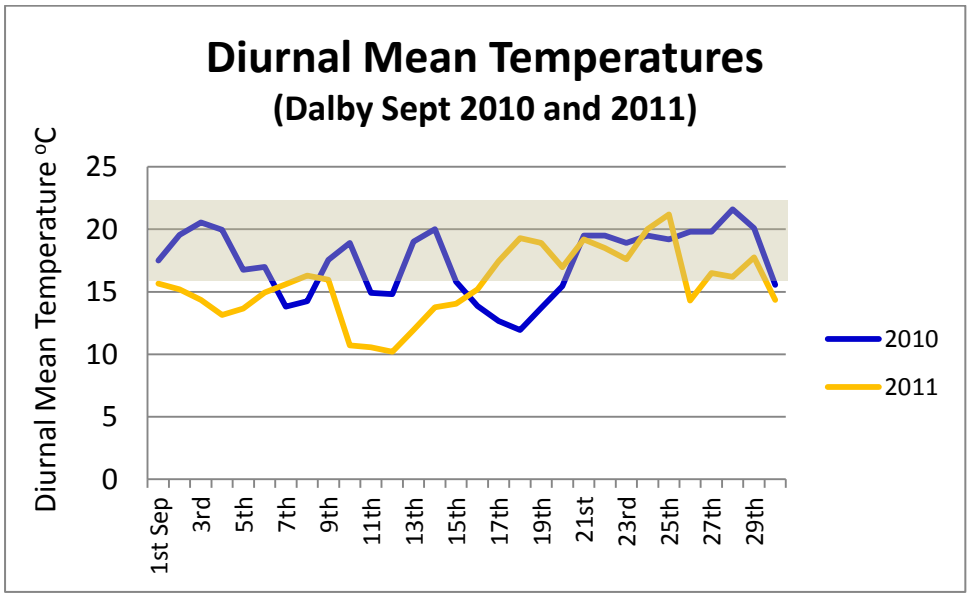
Disease epidemics rely on having a susceptible host, plentiful inoculum and conducive conditions for disease development.

Susceptible host: the majority of trials in 2011 were in paddocks of Grout(b) with the disease actually present in the surrounding crop.

Plentiful inoculum: very hard to quantify but above average rainfall was recorded in summer 2010/11. This should have provided ample opportunity for volunteer barley plants and the over-summering of leaf rust inoculum. In addition leaf rust inoculum was present at most sites.

Conducive conditions: appears that the conditions in September 2010 were much more suitable for leaf rust development than in 2011 with the two most likely factors being rainfall and temperature. Rainfall in many areas of southern Qld was at record highs in 2010 and certainly much closer to average in 2011. However in northern NSW rainfall was well above average during both years.

International literature indicates that for rapid disease development, leaf rust requires temperatures ~6 °C warmer than for stripe rust in wheat. Diurnal means (daily average of maximum and minimum) of ~16-22 °C are often cited as ideal for leaf rust development with stripe rust preferring ~10-16 °C. Mean minimum monthly temperatures were at record highs in many parts of northern NSW and southern Qld in September 2010. At Dalby in September 2010, the mean minimum temperature was 12.0 °C compared to 6.9°C in 2011 and a long term mean of 8.8 °C. In the first half of September 2010 the mean minimum was 11.4°C compared to only 5.6°C in 2011. The graph below shows the diurnal mean temperatures at Dalby in September 2010 and 2011. The shaded rectangle indicates the ideal temperature conditions for leaf rust development.



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Results in a Nutshell

Low minimum temperatures may explain why leaf rust has only infrequently been a major issue of barley in the north. In 'average' seasons, barley is already starting to mature or even senesce just as temperatures become more favourable for rapid disease development. In contrast, in 2010 leaf rust started to develop rapidly from early September combined with later maturing and high yielding crops driven by the record spring rainfall.

Overall:

1. **All fungicides provided useful levels of leaf rust suppression, even when rapid disease development did not occur until ~3-5 weeks after application**
2. **Crops should be monitored for the presence of leaf rust and fungicides applied in the early stages of epidemic development**
3. **Leaf rust management strategies should focus on; selecting barley varieties with increased resistance, reducing the green-bridge (rusts need live plants to over-summer) and the use of fungicides as early as possible during active disease development**
4. **Leaf rust in barley is likely to be a bigger threat in years with above average diurnal mean temperatures in spring, particularly when combined with late maturing crops and good moisture availability**

Acknowledgment: Thanks to Greg Platz (Principal Pathologist, DAFF Qld) for report review and suggestions

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Individual Trial Results

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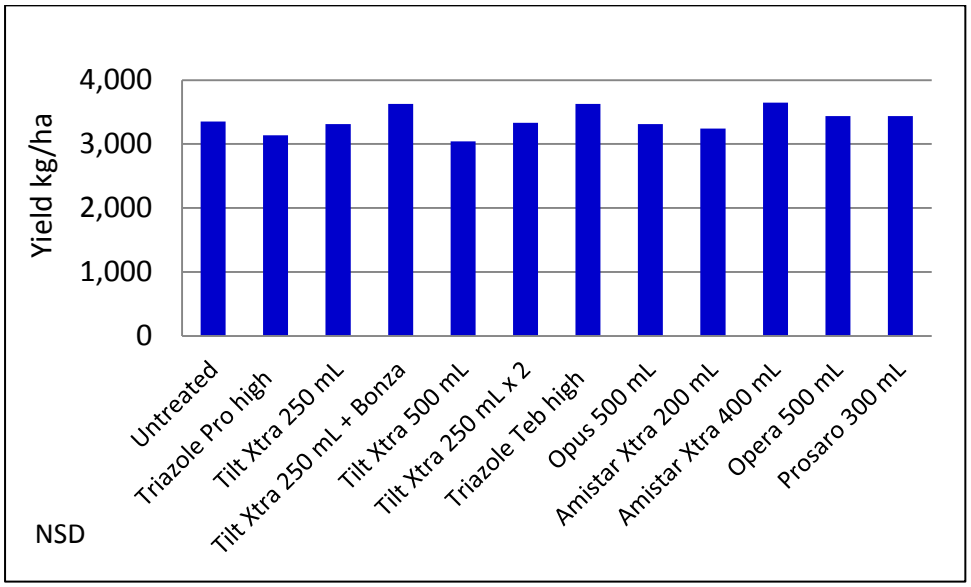
Yield:



Harvested 10th November, cv 12%

Grain quality:

Grain analysis showed no significant differences in test weight, protein, retention or screenings. Mean test weight 60 kg/hL, mean protein 10%, mean retention 98%, screenings <2%

Key messages – yield and grain quality:

- There was no significant impact from any fungicide treatment on yield
- There was no significant impact from any fungicide treatment on grain quality

Conclusion:

Clear differences were apparent between fungicides in efficacy on leaf rust. The most effective control was achieved by two applications of Tilt Xtra 250 mL, 11 days apart with the most effective single application Amistar Xtra 400 mL. Leaf rust at this site developed slowly during late August and early September but was widespread by early October. The absence of significant yield benefit was disappointing, however this site was poorly managed for wild oats. It is expected that wild oats had more impact on yield in this trial than leaf rust.

Acknowledgments: Thanks to Shane Peters (trial co-operator) and Rob Duncan (NGA) for field activity

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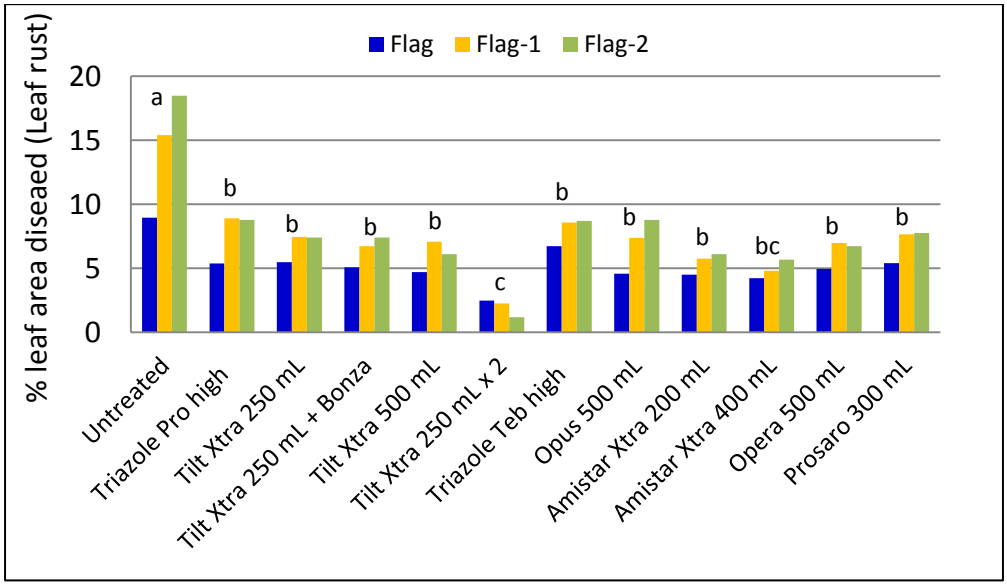
Individual Trial Results

Trial:	**RD1117**
Location:	**"Waronga", ~3 km north east of Macalister, Qld**
Planting date:	9/6/2011
Plot size:	12 x 4m on 25cm row spacings
Trial design:	Randomised complete block with four replicates
Spray parameters:	AIXR110015 at 70 L/ha (300 kPa and 10.1 km/hr)
Variety:	Grout

		Crop stage	**Leaf rust level**
Spray timing 1:	6/8/2011	~GS31 (first node)	Trace
Spray timing 2:	24/8/2011	~GS44-49 (mid boot to awn peep)	Nil

Leaf rust comments:

At Timing 1, leaf rust was found at trace levels only with no leaf rust apparent at timing 2. Leaf rust levels increased most rapidly in the Untreated at the end of September with levels on Flag-2 increasing from ~5% on the 23rd of September to ~18% on the 4th of October. The graph below shows the level of leaf rust diseased leaf area on the 4th of October (59DAT1, 41DAT2).



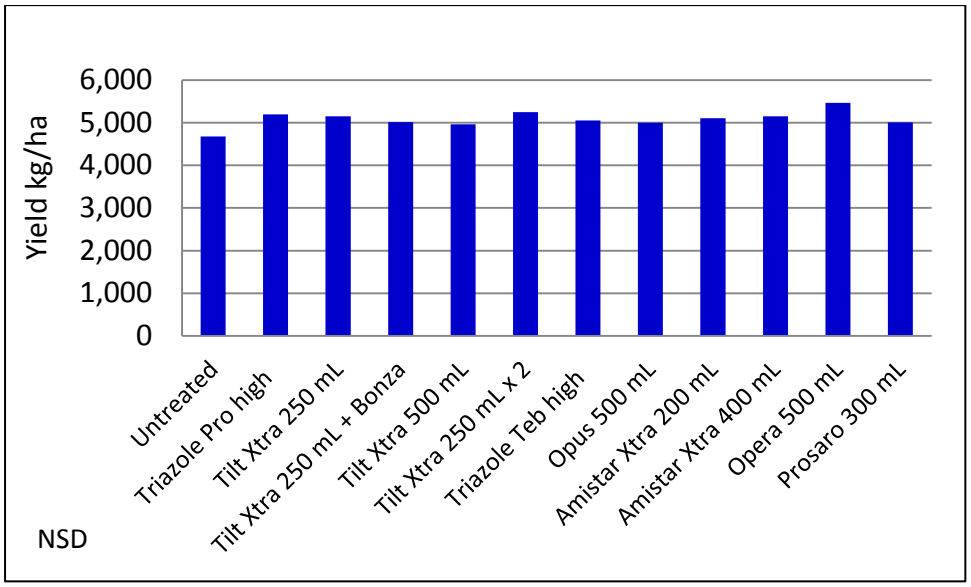
Letters of comparison are for the mean of the top 3 leaves, p=0.05. Treatments sharing the same letter are not significantly different

Key messages – leaf rust disease severity:

- Disease levels were moderate with significant levels of suppression from all fungicides
- It would appear that timing 1 applications were made at least 4 weeks prior to active disease development with most rapid leaf rust build-up from ~mid-September onwards
- Two fungicide applications of Tilt Xtra 250 mL provided the highest level of control with the second application still ~1-2 weeks prior to active disease development

- Amistar Xtra trended to provide the best control from a single application at timing 1 and resulted in ~65% suppression on the top 3 leaves

Yield:

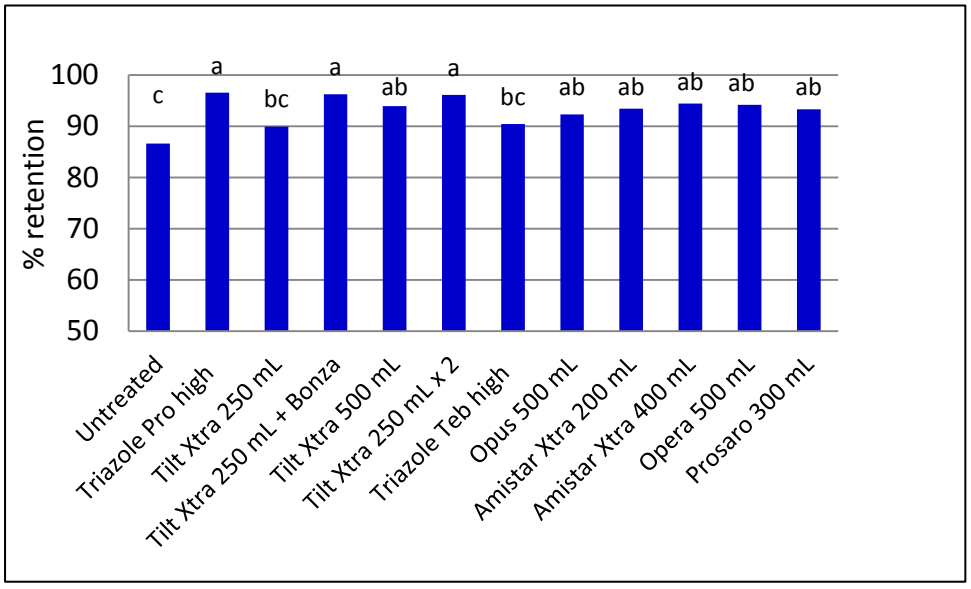


Harvested 4th November, cv 6%

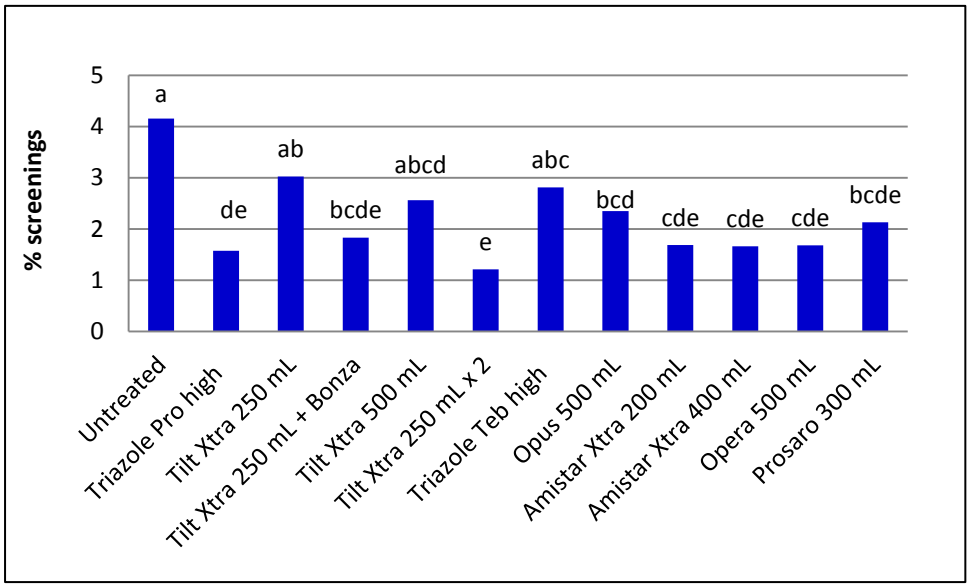
Grain quality:

Grain analysis showed no significant difference in test weight (mean 61 kg/hL) or protein (mean 11%). However there were significant differences in retention and screening. Untreated retention was ~87% and significantly lower than 9 of the 11 fungicide treatments. Untreated screenings were ~4% and significantly higher than 8 of the 11 fungicide treatments.

The graph below shows the treatment impact on % retention.



The graph below shows the treatment impact on % screenings.



Key messages – yield and grain quality:

- There was no significant impact from any fungicide treatment on yield. However the mean yield of all fungicide treatments was 9% higher than the Untreated with a range from 6-17% higher.
- There were significant differences in both retention and screenings. Tilt Xtra 250 mL (timing 1 only) and Triazole Teb provided the least benefit and were not significantly different from the Untreated for either assessment.

Conclusion:

This trial was sprayed on first sign of leaf rust but under conditions where the disease did not develop rapidly until at least 4 weeks later. Under that situation, the performance from all single application fungicide treatments in providing ~45-65% leaf rust suppression was encouraging. The standout disease control was achieved from two applications of Tilt Xtra 250 mL with the second application still applied ~1-2 weeks before active disease development. Of the single application treatments, Amistar Xtra 400 mL provided the highest level of leaf rust suppression (~65%) on the top 3 leaves, more than 8 weeks after application. This trial design unfortunately did not include a timing 2 application alone. It is expected that a single fungicide application at this timing alone would have provided a high level of control.

Acknowledgments: Thanks to Jason Schelberg (trial co-operator) and Rob Duncan (NGA) for field activity