Stripe rust: recent lessons learnt in the north

The research view – Steven Simpfendorfer NSW DPI

Stripe rust caused by the fungus *Puccinia striiformis* has re-emerged as a significant limitation to wheat production in eastern Australia in the last two seasons. Stripe rust infection results in small, yellow/orange, circular densely packed pustules on the upper surface of the leaf. In older plants pustules run parallel to the leaf veins giving a 'striping' effect. Production of these pustules effectively reduces the green leaf area (photosynthetic ability) of the plant which can result in yield loss and/or increased screenings.

While resistance is the most effective method of controlling stripe rust there are few varieties currently available with other desirable attributes. For example, in northern NSW there are no varieties with useful resistance to crown rot which also have adequate resistance to stripe rust. Consequently, fungicides as foliar, seed or fertiliser treatments, will play a role in the integrated management of this disease until new varieties with improved resistance become available.

What we did

The aim of these replicated experiments was to assess a range of foliar, seed or fertiliser fungicide treatments (Table 1) against stripe rust in four varieties with different levels of resistance. Plants, growing in screenhouses at Tamworth fitted with overhead mist irrigation, were inoculated with stripe rust spores four times starting at Z34 (4^{th} node detectable) during 2005. Treatments were split for variety with the 1 m plots containing one row each of H45 (stripe rust score=1), Hybrid Mercury (2), Baxter (4) and Yallaroi (6). A separate screenhouse was used to examine seed and foliar fungicide treatments.

Seed and fertiliser treatments were applied at sowing and the foliar treatments were applied just prior to Z49 (awn peep) when disease became evident in the lower canopy. Foliar fungicides were evaluated at full or ½ recommended rates (Figure 2). Delaying the timing of one foliar treatment (290 mL/ha Folicur) by 4 or 8 days was also examined. Disease levels were visually assessed twice during the season and final grain yields determined.

Table 1: Fungicide products, active ingredients and full rates used

Application method	Product used	Active ingredient	Full rate
Seed	Real	triticonazole/cypermethrin	150 mL/100 kg seed
	Baytan T	triadimenol/triflumuron	150 mL/100 kg seed
	Dividend[A]	difenoconazole/metalaxyl-m	260 mL/100 kg seed
	Amistar[A]	Azoxystrobin	100 mL/100 kg seed
	Jockey[B]	Fluquinconazole	450 mL/100 kg seed
Fertiliser	Impact (IF)	Flutriafol	400 mL/ha
	Triad (IF)[C]	Triadimefon	800 mL/ha
Foliar	Folicur	Tebuconazole	290 mL/ha
	Tilt	Propiconazole	500 mL/ha
	Tilt Xtra	propiconazole/cyproconazole	500 mL/ha
	Bayleton	Triadimefon	1 L/ha
	Amistar Xtra	azoxystrobin/ cyproconazole	800 mL/ha

Opus	Epoxiconazole	500 mL/ha

[A]Products are currently not registered seed treatments for the control of stripe rust.

[B]Jockey was also examined at a lower rate of 300 mL/100 kg of seed.

[C]Triad 125 EC is not registered for use as a fertiliser dressing in NSW. Triad 125 EC was used at a rate to provide 100 g ai/ha in line with the registration for triadimefon powder in WA. A powdered product was not used in this experiment due to health risks.

What happened?

In spite of inoculating four times, stripe rust was slow to establish (low spore viability) and did not become evident until just before Z49 (awn peep) which triggered application of the foliar treatments. Twenty four days later, the percentage flag leaf covered with stripe rust pustules in the untreated plots (nil treatment) was 77% in Hybrid Mercury, 76% in H45, 36% in Baxter and 18% in Yallaroi. Disease was assessed 18 days later (42 days after foliar sprays) when the %flag leaf covered in pustules was 100% for H45 and Hybrid Mercury, 80% for Baxter and 27% for Yallaroi in the nil treatment. This highlights how quickly disease can develop in very susceptible (H45 and Hybrid Mercury) and moderately susceptible (Baxter) varieties but is effectively limited in moderately resistant (6+) varieties such as Yallaroi.

The late onset of disease at Z49 influenced the effectiveness of the seed, fertiliser and foliar treatments. The seed treatments Real, Baytan, Amistar and Dividend resulted in no or only slight yield increases which suggest their activity had diminished by Z49 when the stripe rust became more active. Other seed and fertiliser treatments appear to provide longer protection with yield increases of 20% with Triad (IF), 28% Impact (IF), 31% Jockey at 300 mL and 44% Jockey at 450 mL when averaged across the three susceptible varieties (Figure 1). However, in these experiments, stripe rust was most effectively controlled with a foliar application at Z49 (65% yield increase across the three susceptible varieties). This single timely spray provided protection when rust pressure was peaking whereas the activity of the seed/fertiliser treatments was waning.

The combination of Jockey (450mL) seed treatment and Folicur foliar spray at Z49 gave the highest yield with a 72% increase over the untreated control. The early protection from Jockey appears to have only provided an additional 7% yield increase over that achieved with a timely foliar fungicide application in a late disease epidemic. However, the value of seed and fertiliser strategies is likely to be much greater in crops where stripe rust develops earlier than awn peep.

The Commercial View -- Garry Onus, Agronomist Landmark Moree.

The need to monitor wheat for stripe rust has become a reality after some serious outbreaks in the last few years. Work done by NSW DPI over the past couple of seasons and the NGA last season has helped to put the disease into perspective and given farmers and advisers some sound economic guidelines for addressing this potentially yield robbing disease.

In the past there has been very little information on the economics of treating for stripe rust in the northern area of NSW, with most decision support tools and trial results being generated in southern Australia where climatic conditions are generally quite different. When the stripe rust appeared in our crops, if we were lucky we found the “hot spots”, but often weren’t onto the problem before it was quite widespread in the crop. We often waited and watched, hoping that the temperatures rose quickly enough to stop the progress of the disease. When we did decide to treat we often had high inoculant loads in the crop, the temperatures were on a rising phase and we usually struggled to get an economic response. Stripe rust is a bit like a pimple, when you see the first signs of it you know there is a lot more that will still show even if you treat it immediately. We were often unsure of the potential effects of the latent period between infection and expression of rust pustules.

The recent work by NSW DPI and the NGA has shown that early treatment is by far the best and most economical. The results from last season, where economic responses were obtained even in situations were there was negligible stripe rust found, should give farmers and advisers great confidence in managing this disease successfully in the future. Coupled with the significant reduction in the cost of the foliar fungicides, we now find ourselves able to make sound decisions with confidence of an economic outcome.

Where we have had favourable conditions for inoculum survival over the summer following a winter crop where the disease was prevalent (maintained a "green bridge"), the use of seed dressings such as Jockey ® can provide early protection in the seedling phase of the crop. This can help reduce the incidence of "hot spots" developing in the early stages of the crop, which is important to avoid an explosion when seasonal conditions become more favourable for stripe rust as the canopy develops. Use of seed dressings may also be considered where residual herbicides are being applied at planting and there is no plan for post emergent applications.

If we are going into a season where the anticipated inoculum levels are low (such as this year), we will probably get better value out of using foliar fungicides to treat the stripe rust. Given the results of the recent trials and the reduced cost of fungicides, we will probably see fungicides go in with most post emergent herbicide applications as a matter of course. This will certainly be the case if any stripe rust is detected at all in the area and we have a susceptible variety (which now has the potential to extend in to varieties we usually considered to be safe).

Stripe Rust is a manageable disease and sound crop monitoring will be the key to it's successful management in the future. The recent work by NSW DPI and the NGA in the local area gives us confidence to be able to manage the disease economically and will ensure we don't sit back and watch as we have in the past.

Jockey® - Registered seed dressing from Bayer Crop Science

NGA activity - Richard Daniel

Stripe rust management, in the northern grains region, has often previously been seen as of questionable value. Generally it was expected that our rapidly increasing spring temperatures would help limit the spread and damage due to this rust in wheat. When combined with the relatively high cost of foliar fungicides, the common strategy was to wait as long as possible before spraying – if at all.

What has changed ?

Three key changes have occurred in recent years

1. The 'WA strain' of stripe rust became well established from 2003 onwards with higher virulence (more aggressive and damaging) than previous strains and affecting more varieties
2. The cost of foliar fungicides has decreased substantially
3. Registration of new seed or fertiliser options with greatly increased lengths of stripe rust control and suppression

Research done at Tamworth in 2005 by the NSW DPI, under shadehouse conditions, demonstrated a high level of benefit could be obtained by managing this disease appropriately in susceptible varieties. Although economic benefits were obtained with both long active at-planting options as well as foliar sprays, the work highlighted a dramatic drop off in yield benefit when foliar spraying was delayed by as little as 4-8 days. This result supported many commercial experiences where delayed foliar application resulted in a clear visual impact but with little or no yield or economic benefit. Clearly stripe rust management is only sensible if the benefits outweigh the cost, so in 2006 Northern Grower Alliance hoped to validate the benefits seen by the NSW DPI but under regional conditions.

What was done in 2006 ?

Two replicated small plot trials were established in the Bellata district during early September 2006 on the moderately susceptible varieties Baxter and Clearfield JNZ. Plot size was 4m x 10m with four replicates and fine droplet application at 70 L/ha. Two main application timings were conducted:

1. 'Early' prior to any evidence of stripe rust pustules in crop
2. 'Main' timing when pustules were detected on ~20% of random leaves (13-26 days later)

Photo 1 - NGA0618 crop stage at 1st application

The decision for spray timing at the first site (NGA0618) was made on the basis of four simple risk factors:

1. Moderately susceptible variety (Baxter, rating 4)
2. Stripe rust present in local area
3. Good crop potential
4. Conducive conditions for stripe rust development - full canopy closure and reasonable soil moisture at spraying. (see photo 1)

Conditions after spraying

Conditions for the first two weeks after spraying were good at both sites but then severe moisture and heat stress set in. The photograph below shows the NGA0618 crop stage 40 days after the first application.

Photo 2 - NGA0618 crop stage 40 days after 1st application

Results

Timing

Early treatments were applied in NGA0618 just prior to first signs of disease. These treatments provided the best disease management and provided a significant yield and economic benefit. Early treatments in trial NGA0617 were applied ~ 2-4 weeks prior to first signs of disease. Even 'jumping the gun' provided useful levels of disease management. Although yield differences were not significant in NGA0617, the same yield trend was apparent in both trials with the highest yields from the early applications. **Even under very low stripe rust severity, early applications resulted in an average $17/ha net benefit, applications after stripe rust pustules were present on ~20 % of leaves resulted in an average $16/ha net cost.**

Efficacy

All fungicides provided good activity against stripe rust with no significant difference between treatments when applied at the same time.

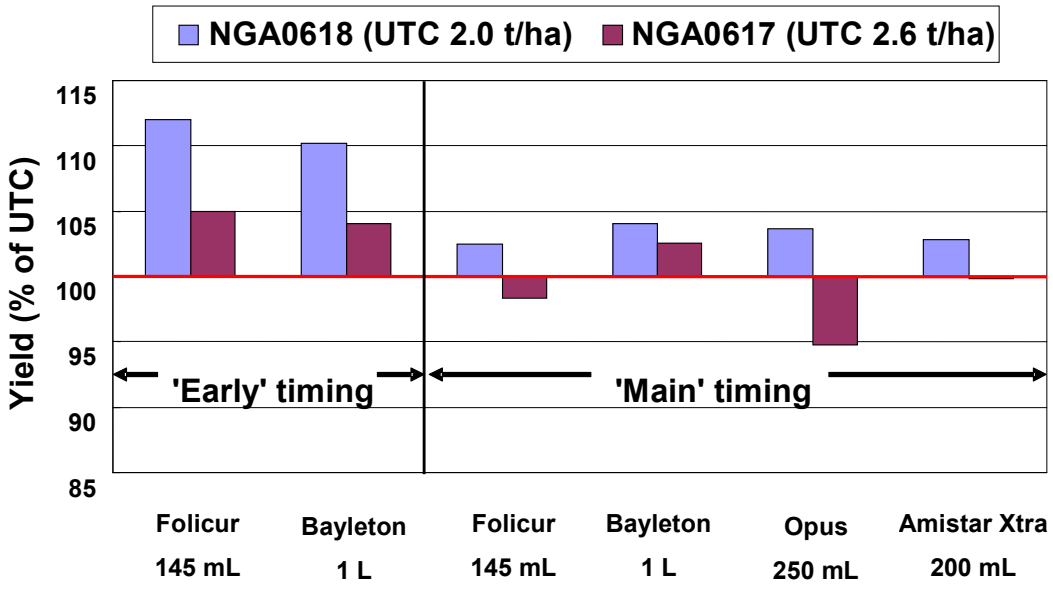

Figure 1 Grain yield compared to Untreated Control (% of UTC)

NB The rates of both Opus and Amistar Xtra are below current label rates. Always read and adhere to the label directions for commercial use

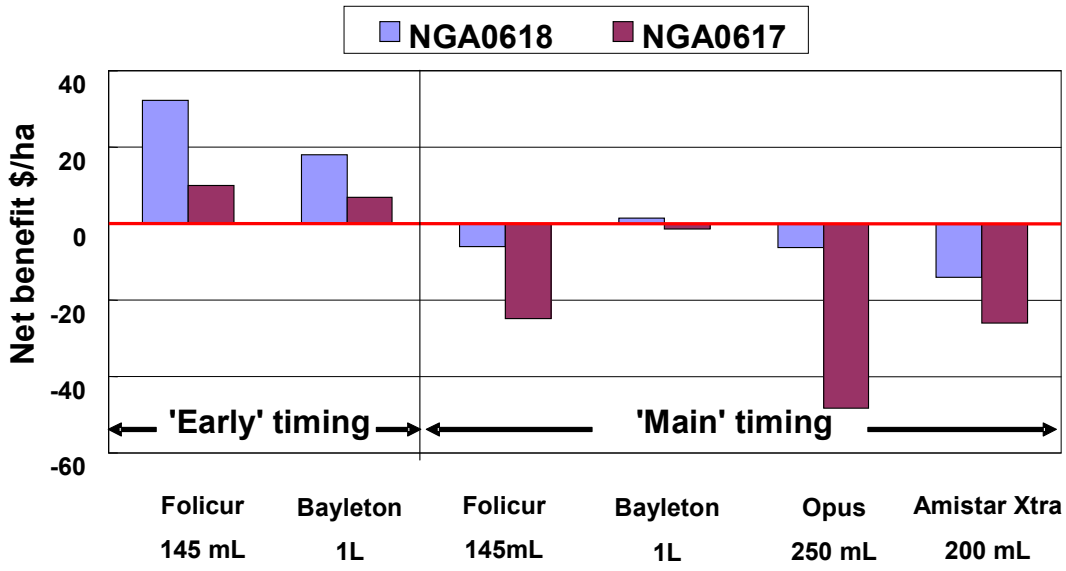

Figure 2 Net benefit compared to Untreated

NB Assumptions: grain price $200/t, application cost $7.50/ha and 2006 fungicide prices

Net benefit of 'early' Bayleton in NGA0618 reduced as treatment also received 'top up' of Folicur 145 mL

Overall

Even though both trials were conducted in a season where moisture stress, rather than stripe rust, was the primary yield limitation, the results were very encouraging and strongly supported the NSW DPI 2005 research.

1. All fungicides provided good activity against stripe rust with no difference evident between products
2. Increased benefit from early timing
3. Even under low disease and low to moderate yield situations, early fungicide applications resulted in useful net benefits

The decision to use foliar sprays for stripe rust management should be based on; susceptibility of variety, crop yield potential, prevailing and expected environmental conditions and presence of disease in the area. Particularly where application cost can be shared with a late herbicide timing, use of foliar fungicides as a preventative strategy may be well warranted.

Where to in 2007 ?

The detection of a new strain of stripe rust in southern NSW and Victoria in late 2006 has increased the potential threat of stripe rust in northern wheat varieties in 2007 and beyond. As a result Northern Grower Alliance will be doing additional regional evaluation in 2007 of a stripe rust management matrix (the most likely combinations of at-planting or foliar management) to further refine the most economic and appropriate management options under a range of conditions. This work will support additional research being conducted by the NSW DPI and QDPI&F.