Wheat foliar disease results 2007 and looking ahead to 2008

By Peter Wilkinson QDPI&F

The Emerging Wheat Foliar Disease program, based at DPI&F's Leslie Research Centre, Toowoomba, monitors foliar diseases of winter cereals in northern New South Wales and Queensland and conducts trials looking to improve cultural, chemical and varietal management options for stripe rust on wheat.

Probes, comprising a series of wheat and barley varieties, are planted at about two dozen sites each year. These are placed at geographically strategic locations across the wheat growing northern regions of eastern Australia. They are monitored regularly and any foliar diseases found are identified. Stripe, stem and leaf rusts are sent to the Australian Cereal Rust Survey in New South Wales, where the identification is confirmed and the strain or pathotype of the particular rust is determined. Growers and other stake holders are then alerted to any foliar diseases allowing them to take timely action and to plan which wheat varieties to use for the next season.

From the 2007 probes, stripe rust was found throughout northern New South Wales, southern and central Queensland. Mostly this was shown to be the established Western Australian pathotype known as WA 134 E16 A +. However at a number of sites in northern New South Wales, the new pathotype, WA 134 E16 A + YR17 was found. It is anticipated that this will move into Queensland in the 2008 winter season.

This new pathotype has overcome genetic resistance in a number of wheat varieties and growers should consult the DPI&F publication "Wheat Varieties for Queensland 2008" http://www.dpi.qld.gov.au/cps/rde/xbcr/dpi/Wheat-variety-guide-2008.pdf for information on varietal response to the YR 17 pathotype.

Stripe rust has already been found in northern New South Wales and southern Queensland in 2008. Finding it this early in the season does not bode well for the wheat industry.

Yellow spot was seen towards the end of the 2007 season. Although there were no reports of economic damage in 2007, there has been a wet summer, facilitating a build up of this disease. Growers should be on the look out for it in the 2008 season. It has been found on a number of properties already in 2008.

In 2007, trials were conducted looking at management options for stripe rust. These compared varieties with different stripe rust reactions. The varieties comprised EGA Gregory (R resistant "7"), Lang (MR-MS, moderately resistant to moderately susceptible "5"), EGA Wylie (MR-MS, moderately resistant to moderately susceptible "4"), Petrie (MR-S, moderately susceptible- susceptible "3") and H45 (VS, very susceptible "1"). Categories are based on the ratings of the University of Sydney, Plant Breeding Institute, Cobbitty New South Wales who manage the above mentioned Australian Cereal Rust Survey.

Given the spread of stripe rust throughout the region, the timing and dosage of fungicide intervention was investigated. Two trials were done, one at Gatton Research Station and the other at Hermitage Research Station near Warwick.

The fungicide applied was propiconazole (Tilt® 250 ec). The low registered dose, 250 mls product per ha and the high registered dose 500 mls product per ha were compared. Each dose was applied pre flag leaf (~2nd-3rd node) and after flag leaf emergence (~ 3 weeks later) to each of the above wheat varieties. There was an untreated control.

The results from these trials showed that avoiding the disease is the best form of control. This can be achieved by using a resistant variety of wheat, that is a variety designated MR (Moderately Resistant, or 6 in the old numerical notation), and higher.

Practising crop hygiene is another method of limiting stripe rust. The fungus causing the disease, can only survive the summer on a limited number of host species. It furthermore, can only survive for any length of time on living plants. These are called the green bridge. In the main, the green bridge comprises volunteer wheat plants. Removing these plants avoids or delays the onset of the disease.

The fungicide trials showed that, on susceptible varieties of wheat, the early application of the fungicide gave better results then the late application. This is because the flag leaf and the two leaves below are the main factories for wheat yield and quality. Protecting these leaves preserves the yield potential of the crop.

The timing of application was more important then the dosage, as the registered high and low dosages gave similar levels of control. It must be noted that ground application equipment was used for these trials and the situation could be different if using aircraft.

The message going out to wheat growers is to be alert for yellow spot and for stripe rust. Even if you have used a resistant variety of wheat, it is important to inspect it in case a new strain or pathotype of a disease is present.

Unless the fungicide label states otherwise, apply the fungicide at first sign of stripe rust. Adhere to pesticide label recommendations, especially pre-harvest intervals and re-entry periods. Ensure spraying equipment is in good working order and calibrated. Check that the fungicide has not exceeded the shelf life.

Looking ahead to the 2009 season, sources of seed of desirable varieties should be identified to plant next year. Make an entry in diaries well prior to planting to eradicate the green bridge.

Stripe rust in the north – The Consultant's View

By Drew Penberthy, Penagcon

In the past stripe rust was a disease that was poorly understood in terms of the damage it was doing to our yields and what economic impact it was having on our profitability. Previously we would usually wait for outbreaks to establish and start to spread before we would discuss and try to justify control measures with our clients. We would then watch the horizon for rain events before we would start spraying for the disease. This previous standard management process would sometimes result in clients not spraying until the disease was rampant throughout the crop, especially if the infection had started well prior to flag leaf. We believed that these delayed decisions may have been putting a "cap" on any higher yields from our crops, but it was difficult to put a figure on how much it was costing us. What we needed was information on management and impact under northern conditions which we all believed would be different from that experienced in the soft growing conditions of the south.

Penagcon has been involved with NGA's stripe rust trials over the past few seasons and continued to work closely with Steven Simpfendorfer at the DPI in Tamworth. Although the last few years have been far from productive for us due to very dry seasons, outbreaks of stripe rust have continued to occur and the trials were thankfully conducted. We would not have normally sprayed these crops in the past but the trial work showed that even under these conditions it was still a very viable and profitable option.

The trial work undertaken by NGA and DPI has comprehensively changed our stripe rust management practices. The process of managing the disease has now started prior to planting with variety selection and seed treatment options discussed before a seed is put into the ground. The crops are monitored very closely, well and truly prior to flag leaf, and though a network of consultants (NGA, DPI and other industry leaders) outbreaks of the disease are closely monitored district and state wide. We now have the reassurance to spray crops that are at high risk even before the disease establishes itself in the canopy. This is because we have peace of mind that our yields will no longer be compromised from this disease and profitability will be protected if controlled.

Of course there are still questions to be answered such as in what situations is a two spray approach beneficial. However with more science and economics now behind our decision, we are much more comfortable with making our management calls. If we do get a reasonable season with a high disease outbreak in the future, I'd love to see the economic benefits from these trials and what the impact it is on our profitability.

STRIPE RUST MANAGEMENT – THE NGA VIEW

BY RICHARD DANIEL NGA

Background

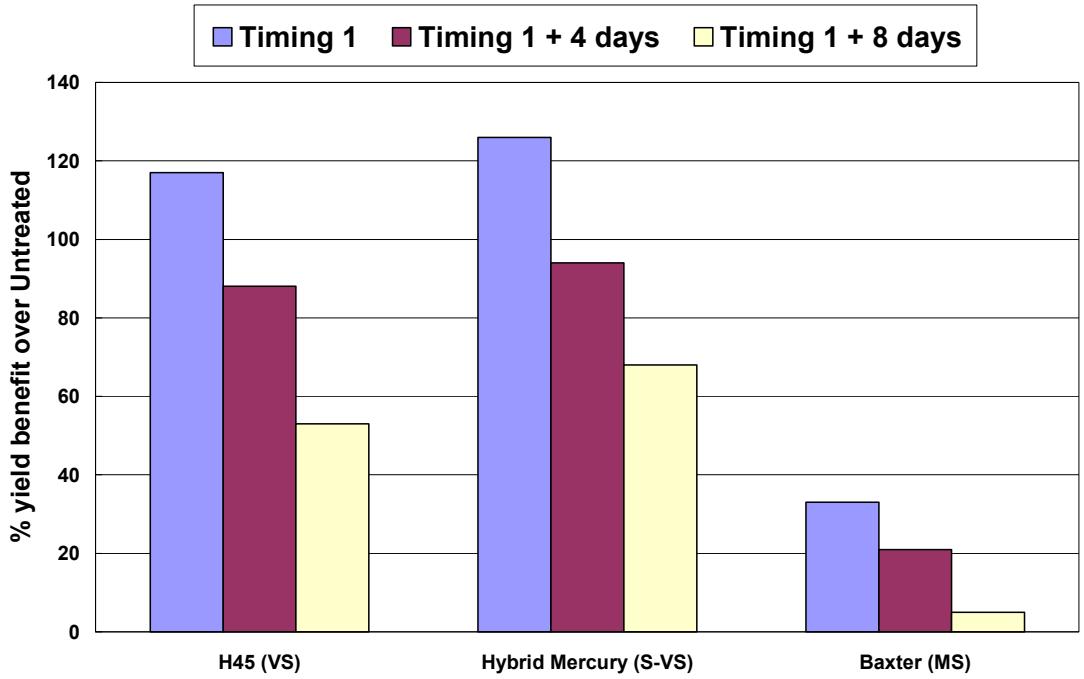
In the early 2000's, commercial stripe rust management in the north generally involved dealing with a crop during head emergence to flowering (or later) with heavy levels of infection of the upper leaves and environmental conditions of rapidly increasing heat and moisture stress. Although the fungicides applied generally provided good 'eradicant' activity (they dried out established stripe rust pustules) and provided 'protectant' activity against further infection, the overwhelming view was that little or no yield/economic benefit was generated. The damage had already been done.

The lack of regional data on the actual cost of stripe rust and the benefits of different management approaches was seen as a key limitation by growers and advisers across the northern grains region. Since 2005 a significant amount of co-ordinated activity has been conducted by NGA, NSW DPI and QDPI&F to help generate the information to allow the most agronomically and economically sound practices to be compared and adopted as suits individual situations.

The first indications

Steven Simpfendorfer from NSW DPI performed a series of screenhouse evaluations in 2005 with four wheat varieties, six different fungicides and three application timings. Although there were some small differences in yield benefit between products, the biggest impact was from varying the application timing of a single spray, as shown in Figure 1.

Figure 1 Impact of application timing, NSW DPI 2005



NB Timing 1 was applied the day the first rust pustules were detected in the variety H45
Stripe rust resistance ratings: VS = very susceptible, S = susceptible, MS = moderately susceptible

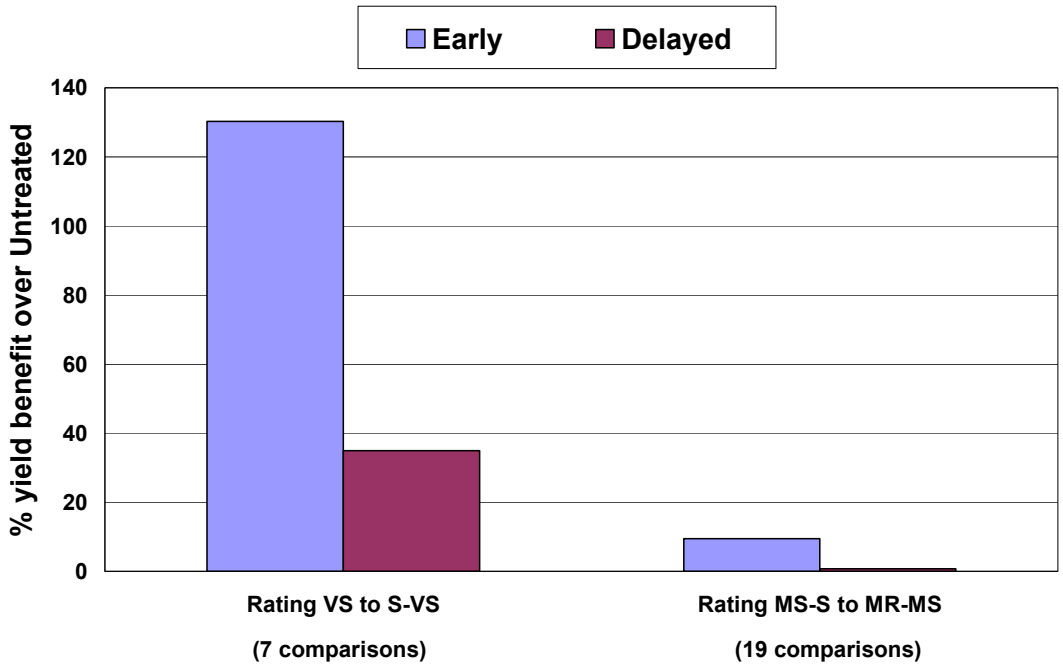
Key points from Figure 1:

- Much higher level of 'benefit' from stripe rust management in very susceptible varieties such as H45 and Hybrid Mercury
- Dramatic reduction in benefit from either a 4 or 8 day delay in application across all three susceptible varieties
- Even with an 8 day delay, good benefits from application for very susceptible varieties although becoming marginal in a moderately susceptible variety

Field validation

Field trials conducted by NGA and QDPI&F during 2006 and 2007 have continued to evaluate the impact of timing on the level of disease control and yield/economic benefits obtained. Figure 2 shows the average yield benefits over all 26 comparisons conducted from 2005-2007.

Figure 2 Overall impact of application timing 2005-2007



NB 'Early' application timings from GS32 onwards, at or just prior to first evidence of stripe rust
Delayed application ~10-20 days after early application timing
Stripe rust resistance ratings: VS = very susceptible, S = susceptible, MS = moderately susceptible, MR = moderately resistant

Key points from Figure 2:

- Overall trends very similar to 2005 results
- Much higher level of 'benefit' from stripe rust management in very susceptible varieties
- Dramatic reduction in benefit from 'delayed' application
- Even with delayed application, still good benefits in very susceptible varieties
- **However on average no economic benefit from delayed application on moderately susceptible varieties eg Baxter, Lang, EGA Wylie, Clearfield JNZ and Petrie**

These results also support recent southern NSW management strategies that promote the use of **an early or preventative strategy** in varieties with stripe rust resistance ratings of VS to MR-MS.

To spray or not to spray ?

The final decision on management approach always rests with the grower and will vary by their attitude to risk. However the work conducted by NGA, NSW DPI and QDPI&F has clearly highlighted that if a foliar application is to be undertaken it is critical to ensure it is applied early in the disease cycle rather than once rust is well established and leaf tissue damage is irreparable. The other consideration of course is the level of realistic yield benefit and as a result the direct economic basis for spraying.

1. Very susceptible varieties (resistance ratings VS to S-VS)

The cost of **NOT** managing stripe rust in these varieties is immense and lack of management will frequently result in more than a 50% reduction in yield. Even delayed applications should be considered in these varieties. However the area sown to these varieties in the north is very small.

2. Moderately susceptible varieties (resistance ratings MS-S to MR-MS)

This group includes the majority of 'at risk' varieties in the north. Table 1 shows a summary of the most recent independent northern regional data. Although it does not claim to cover all scenarios, it can help provide some framework for spray decisions.

Table 1: Yield benefits obtained from a SINGLE early foliar application

Year	Organisation	Location	Variety (resistance rating)	% yield benefit	Actual benefit kg/ha
2005	NSW DPI	Tamworth	Baxter (MS)	29*	-
2006	QDPI&F	Gatton	Baxter (MS)	7	219
		Warwick	Petrie (MS-S)	6	182
		Warwick	Baxter (MS)	4	139
		Warwick	Baxter (MS)	-1	-19
	NGA	Bellata	Clearfield JNZ (MS)	5	118
		Bellata	Baxter (MS)	11	223
2007	QDPI&F	Warwick	Lang (MR-MS)	5	185
		Warwick	EGA Wylie (MR-MS)	13	490
		Warwick	Petrie (MS-S)	12	365
		Gatton	Lang (MR-MS)	4	190
		Gatton	EGA Wylie (MR-MS)	13	585
		Gatton	Petrie (MS-S)	11	415
			Average	**7**	**258**

* Trial in a screenhouse with high disease pressure and extended grain fill period (not included in average)
NB QDPI&F results in 2007 are an average of both low and high fungicide dose rates. There was no rate response in any of these comparisons.

Key points

- Under field conditions, yield benefits averaging 7% (~260 kg/ha) have been achieved managing stripe rust in commercially important varieties
- Realistic yield benefits generally in range of 5-15%
- Losses may be as high as 30% under sustained disease pressure and favourable conditions (as seen in 2005 screenhouse evaluation)

Economics of management 2008

Of course the goal of most management activities is to create extra value. The full cost of a fungicide application is made up of both product cost plus any application cost. In recent years the fungicide cost has reduced dramatically with low fungicide rates now often only ~$5-6/ha. The two tables below show the % yield benefit required to generate a 100% return on investment (ie $2 return for every $1 invested) under two different scenarios. NB Both the product and application costs indicated are conservative.

Table 2: % yield benefit required (current fungicide costs, separate application)

Grain price $/t	Crop yield kg/ha 1000	2000	3000	4000	5000
100	46	23	15	12	9
200	23	12	8	6	5
350	13	7	4	3	3

Shaded cells are where a % yield benefit less than 7% is required.
Assumptions: fungicide cost $8/ha, application cost $15/ha

Table 3: % yield benefit required (current fungicide costs but no extra application cost)

Grain price $/t	Crop yield kg/ha 1000	2000	3000	4000	5000
100	16	8	5	4	3
200	8	4	3	2	2
350	5	2	2	1	1

Shaded cells are where a % yield benefit less than 7% is required.
Assumptions: fungicide cost $8/ha, application cost $0/ha

The shaded cells in both tables indicate where a 7% yield benefit (as averaged in northern trials on moderately susceptible varieties) would give at least a 100% return on investment. With current high grain prices, it appears sensible to consider stripe rust management in susceptible varieties with yield potential of 2000 kg/ha or more even when separate application costs are incurred. NB Although in Table 3 it appears that management in crops as low as 1000 kg/ha would be warranted, these crops would be less conducive to rust development due to open and sparse canopies and still not considered candidates for fungicide management.

For those more interested in the '**breakeven'** yields, with current grain prices and product costs, we need to harvest **an extra 40-70 kg/ha of grain** to cover the total product and application costs.

Conclusions

As more research has been completed on stripe rust management, the economic advantages of early or preventative strategies have become clearer. Prior to planting a grower has a number of strategies available:

1. Ensure wheat volunteers (green bridge) are controlled well before planting to help reduce early inoculum pressure
2. Select and grow a stripe rust resistant variety with other suitable agronomic traits
3. Consider an 'at planting' seed or fertilizer treatment on susceptible varieties to suppress rust development

However once stripe rust starts to threaten susceptible varieties during stem elongation onwards it appears the critical factor to generate useful returns is ensuring any action is done promptly. If you are going to spray, don't delay.

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