STRIPE RUST: SO I CAN SEE IT, SHOULD I SPRAY IT?

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Key words

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GRDC codes

NGA00001: Validation and integration of new technology through grower groups in north-west NSW and south-west Queensland grain growing zones
NGA00002: Validation and integration of new technology through grower groups in north-east NSW grain growing zones
DAQ00096: Emerging foliar wheat disease issues in the northern region

Take home messages

- Not all varieties need spraying
- Economics more marginal on crop yields below 2 t/ha
- Most consistent benefits from application during stem elongation (GS32-33) at earliest signs of disease
- Consider application when stripe rust in local area but not yet in crop or in tank mixture with a late herbicide, near GS32, to eliminate extra application cost
- If you are going to spray, don't delay
- Average 'cost' of **not** spraying susceptible varieties is ~ 200-250 kg/ha

Background

Stripe rust has emerged as an important regional disease in northern NSW and southern Qld in the last 5 years primarily due to more virulent pathotypes and consequently an increase in the number of susceptible wheat varieties grown. Although plant breeding will catch up in time, we are currently at a stage where we must decide how or whether to manage stripe rust in commercial varieties.

Fungicide recommendations in the period from the 1980's to the early 2000's were based on targeting a threshold level of disease on a specific leaf eg 1% of leaf area infected on the flag leaf. Northern commercial experience from application after flag leaf emergence often showed some visual improvement but rarely consistent or useful yield benefits.

Trial work was commenced in 2005 to determine realistic regional levels of benefits and to investigate alternative timings for disease control and most importantly net returns.

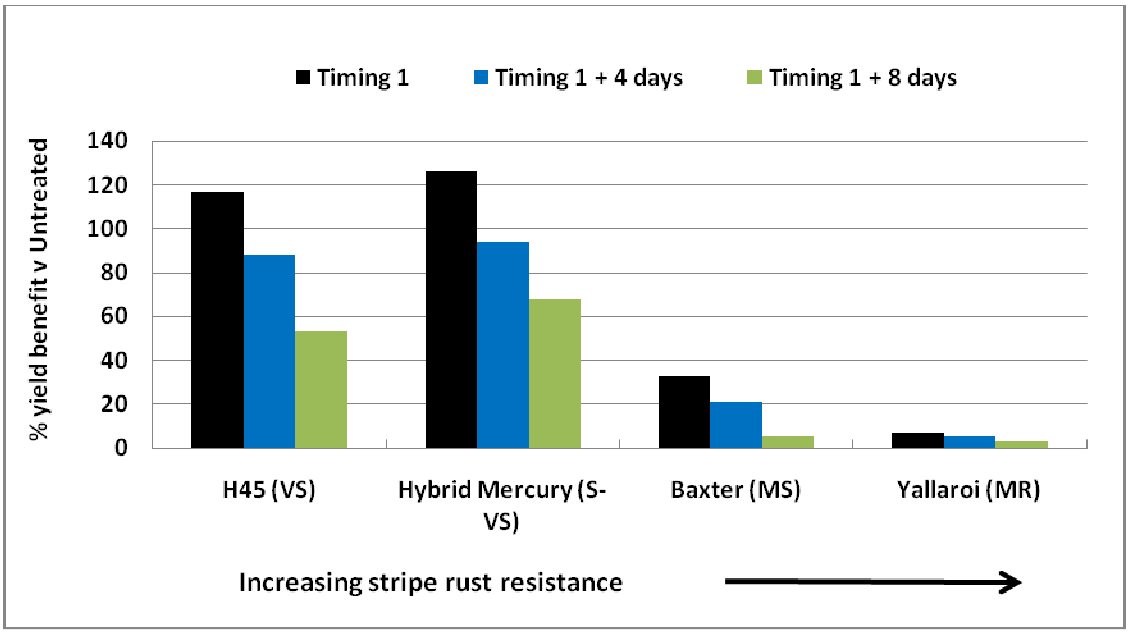
The importance of application timing

The figure below shows data generated by I&I NSW at Tamworth in 2005. Stripe rust first appeared in the very susceptible variety H45 at awn peep at which time all varieties were sprayed. Application timings were also conducted where spraying was delayed by either 4 or 8

days. This data, generated under high disease pressure, shows the two most important considerations for stripe rust management:

1. **Susceptibility of the variety**
   Yield benefit was more than doubled in the two very susceptible varieties but with much reduced but still useful benefits in Baxter. Much smaller benefits in a moderately resistant variety (Yallaroi) even under high disease pressure.

2. **Application timing is critical**
   In all varieties there was a clear drop in yield benefit even from a short delay in spraying



Included in the trial were 6 different fungicides with nearly all at the low and high label rates. Although differences were apparent, application timing was far more important than fungicide choice or even rate. These results have been confirmed with numerous field trials

The tip of the iceberg

Stripe rust has a long latent period of infection. The latent period is the time between the actual infection and when disease symptoms are first visible. In stripe rust this period is generally ~14 days ie the pustules we can see on the leaf reflect an infection that started at least 14 days earlier. Under conducive conditions (generally mild evening temperatures with 4 hours or more of leaf wetness), there may also be a series of infections developing within the leaf but not yet visible.

Do we need to spray all varieties?

NO. Fortunately in the north there is no significant production of very susceptible wheat varieties such as H45 or Hybrid Mercury. The varieties most at risk in northern NSW/ southern Qld are those rated as MR-MS (moderately resistant to moderately susceptible) to MS eg Baxter, Cunningham, Lang, EGA Wylie, Hartog, Kennedy and Petrie. Varieties that are rated as MR or better may show signs of infection but generally will not benefit from fungicide management.

What are we trying to protect?

The flag leaf and the two leaves below it (flag-1 and flag-2) are the key contributors to grain yield. **These are the most important leaves to protect**. Generally flag-2 emerges when the plant is at growth stage GS32 (2 nodes present on stem) and flag-1 emerges at GS33 when there are 3 nodes on the stem.

Available strategies

1. **The "Rolls Royce"**

The most effective stripe rust management is generally achieved by a stripe rust active seed treatment followed by a fungicide application at ~GS32 (protects flag-1 and leaves lower in canopy) and then an application at GS39 (flag leaf emergence). Although this will give the best control, it is a high expense and high management approach that would only be considered in very susceptible varieties in areas of high risk.

2. **Application at flag leaf emergence (GS39) alone**

This is the historic approach. It would be useful when stripe rust only becomes present after flag leaf emergence but in most years in the north the disease comes in much earlier and this timing is too late with low net benefits.

3. **Application at ~2nd node (GS32)**

Much of the trial work in recent years has focused on this growth stage **combined with early detection of the disease**. Trial and commercial experience has shown this to be more consistent in yield benefit than an application at GS39. Although it doesn't physically protect the flag leaf and flag-1, it reduces the level of disease pressure on these leaves by managing the disease pressure lower in the canopy. Generally provides 80-90% of benefit of 'Rolls Royce" treatment but with much lower input cost and lower risk.

4. **Application earlier than GS32 eg with late herbicide**

Jury is still out on benefits. Does give good stripe rust control in crop for ~3-4 weeks but may 'run out' too early and require a second spray particularly in a bad disease year. Biggest benefit is ease of management and reduced cost for the grower.

Be realistic about yield benefits

The majority of varieties that will require stripe rust management in the north have similar or slightly lower susceptibility than Baxter. Trial work on varieties with this level of susceptibility have shown an **average yield benefit of ~7%** over ~30 comparisons during the last 4 years. In real terms this has represented ~200-250 kg/ha extra grain. The highest yield benefits were seen in 2008 (mild spring conditions that favoured disease) and were up to 20% benefit (500 kg/ha or more) from a single spray timed at early disease onset. In 2009 with a dry, hot spring yield benefits were closer to 3-4 %.

Economics of spraying

Table 1 below shows the extra grain production needed to breakeven with the cost of spraying under two scenarios. Firstly where a standalone fungicide spray is made and secondly where fungicide can be sensibly applied with another spray operation.

Table 1: 'Breakeven' grain production needed (kg/ha)

Grain price $/t	Fungicide cost + application cost	Fungicide cost only
100	140	60
150	93	40
200	70	30

Assumptions: fungicide cost $6/ha, ground-rig application cost $8/ha

This table shows that at a grain price of $200/t, you need to generate an extra 70 kg/ha of grain to cover the cost of a separate fungicide application. If the fungicide can be included with another planned spray operation the extra grain required drops to ~ 30 kg/ha.

However there is little point however simply spending $1 to get $1 back in two months time. Tables 2 and 3 show the % yield benefit needed at various yields and grain prices to achieve 100% return on investment (ROI) ie $2 return for every $1 invested under the two scenarios.

Table 2: % yield benefit needed - total application cost $14/ha

Grain price $/t	Crop yield kg/ha 1000	1500	2000	2500	3000
100	28	19	14	11	9
150	19	12	9	7	6
200	14	9	7	6	5

Shaded cells are where a % yield benefit less than 7% is required to achieve 100% ROI
Assumptions: fungicide cost $6/ha, ground-rig application cost $8/ha

Eg Table 2 highlights that for crop yields of 2000 kg/ha or less you need yield benefits of 7% or greater to generate a 100% ROI, unless grain prices were much higher than $200/t. Given the average yield benefit seen from managing stripe rust in commercial varieties in the north has been ~7%, spraying crops with yield potentials less than 2 t/ha looks to be a poor economic decision.

Table 3: % yield benefit needed - total application cost $6/ha

Grain price $/t	Crop yield kg/ha 1000	1500	2000	2500	3000
100	12	8	6	5	4
150	8	5	4	3	3
200	6	4	3	2	2

Shaded cells are where a % yield benefit less than 7% is required to achieve 100% ROI
Assumptions: fungicide cost $6/ha, ground-rig application cost $0/ha

Table 3 highlights the improvement in economics when the fungicide can be applied with another planned operation. NB although it indicates that economic returns can still be obtained from 1 t/ha crops, these crops are less likely to develop significant disease due to their sparse canopy.

Summary

Some of the key factors to consider when making stripe rust management decisions

1. Crop yield potential – economic benefits are most likely where >2 t/ha potential
2. Resistance rating of your variety – economic benefits are most likely for MR-MS or MS rated varieties
3. Stripe rust presence in your local area or already detected in your crop
4. Crop growth stage – economic benefits most likely if crop is from stem elongation to head emergence

If your tick all these factors then the key thing is to move quickly. If disease is present don't delay.

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