Gunning Gap & Wirrinya CWFS Sites - Wheat Stripe Rust and Fungicide Control

Ken Motley, NSW Agriculture Forbes

Andrew Rice, CWFS Parkes

Key Points

- H45 had a significantly higher level of rust infection than Bowerbird at the Wirrinya trial site.
- The very dry season at Gunning Gap meant little strip rust developed.
- The fungicide treatments had no significant effect on grain yield, protein, screenings or test weight at Wirrinya and Gunning Gap. However the triazole foliar fungicides were very effective at reducing the level of rust in the trial.
- Late infections and dry finishes can result in a nil response to fungicides.

Background

Stripe Rust *(Puccmia striiformis f.sp. tritici)* has emerged as a serious foliar disease of wheat. Varietal resistance to stripe rust has in the past generally provided adequate protection without the need for fungicides. However, the popular variety H45 has low resistance to stripe rust. In the autumn of 2003 H45 had a stripe rust resistance rating of 4 out of 10 (McRae *et al.,* 2003), being the lowest rated variety available. The emergence of a new virulent Western Australian (WA) strain (134 E16 A+) in 2002 cast further doubt over the resistance status of H45 and authorities were warning of the dangers of a potential stripe rust epidemic.

Trials were conducted at the Gunning Gap and Wirrinya CWFS Regional Sites to compare the response of H45 and Bowerbird when treated with a range of fungicide treatments. Bowerbird was release in 2001, being a similar wheat to Diamondbird, but with better black point resistance. It had a stripe rust resistance rating of 6 at the beginning of 2003 (McRae *et al.,* 2003).

Stripe rust proved to be a problem throughout Australia in 2003, as the authorities had predicted. The WA strain was found to be present in NSW, further reducing the resistance rating of H45 from 4 to 1. Bowerbird's resistance rating to the WA strain was also reduced from 6 to 3 (McRae *et al,* 2004). Dry conditions in the Forbes District prevented stripe rust from causing damage to most commercial crops. The exceptions were those in the far south of the Forbes District around Lake Cowal and Wirrinya, where the levels were high enough to warrant spraying of commercial crops. The trial site at Wirrinya experienced stripe rust at levels high enough to observe the effect of the different fungicide treatments.

Methods

Trial design: Randomised block design with three replicates

Plot size: 1.7m × 15m

Sowing rate: 60 kg/ha

Fertiliser: 130 kg /ha of Granulock 15 (supplying 18.5N:15.6P: 13S kg/ha).

Foliar fungicide application: Hand held boom at a water rate of 250 L/ha

Rust Assessments: 50 leaves from each plot were randomly picked from top of the canopy of each plot on the 27th October (milk stage - DC75). The number of leaves with visible yellow leaf spot infections were counted and expressed as the % of infected leafs. Leaves were taken at this time and sent away to Australia Cereal Rust Survey, Camden, for rust strain identification.

Table 1. Rainfall at Wirrinya and Gunning Gap 2003

Location	Monthly Rainfall (mm)												TOTAL	Fallow	Growing season
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	*Dec*		(Jan - Mar)	(Apr - Oct)
Wirrinya	**26**	**90**	**14**	**2**	**8**	**33**	**33**	**64**	**15**	**23**	**0**	**14**	**322**	130	178
Gunning Gap	**17**	**38**	**11**	**14**	**3**	**18**	**51**	**58**	**9**	**30**	**29**	**32**	**310**	**66**	183

Table 2. Fungicide rates and costs

Chemical Name (active)	Type	Application Rate	Cost $/L	Cost $/ha
Control	**n/a**	**n/a**	**$0**	**$0**
Vincit C (flutriafol/cypermetherin)	**seed dressing**	**100 mL/100 kg seed**	**$19**	**$1**
Jockey (fluquinconazole)	**seed dressing**	**450 mL/100 kg seed**	**$74**	**$20**
Folicur 430SC (tebuconazole)	**foliar fungicide**	**290 mL /ha**	**$97**	**$17**
Tilt 250EC (propiconazole)	**foliar fungicide**	**500 mL /ha**	**$62**	**$19**

1% Oil with Folicur
No ajuvants with Bumper
Seed dressing costs assume a sowing rate of 60 kg/ha

Table 3. Foliar Fungicide application dates

Location	Previous crop	Sowing date	Foliar Fungicide 1st application Date	Growth stage	2nd application Date	Growth stage	Harvest date
Wirrinya	**Wheat**	8-Jul	23-Sep	DC43 (booting)	14-Oct	DC63 (flowering)	2-Dec
Gunning Gap	**Wheat**	4-Jul	23-Sep	DC43 (booting)	Not done		25-Nov

Results & Discussion

Stripe rust development

The very dry season at Gunning Gap meant little strip rust developed within the Gunning Gap trial. As such rust infection levels were not measured in the Gunning Gap trial (Table 5).

Season conditions at Wirrinya were much more conducive for rust development. However the rust developed very late at Wirrinya. Little rust was present at the first foliar application (23rd September, Z45). However, by the time of 2nd application 3 weeks later (14th October, DC65) stripe rust levels within the trial were very high as indicated in Table 4 below.

Assessment of leaf rust samples from H45 were completed at the Plant Breeding Institute Cobbitty. The results indicated that the WA strain 134 E16 A+ was present (Wellings, *personal communication.).* This pathogenic type is known to be very virulent on H45 and Bowerbird (Wellings *et al,* 2003).

Variety effect

The performance of H45 and Bowerbird in the absence of any seed or foliar fungicide treatments is presented in Tables 4 and 5. No significant difference between H45 and Bowerbird in grain yield or test weight was recorded at either Wirrinya or Gunning gap for the nil fungicide treatment. The yield at the Gunning Gap site was very low being approximately 0.6 t/ha (ie. 3 bags/ac). Bowerbird had significantly higher protein than H45 at Wirrinya. H45 had significantly higher screening than Bowerbird at Wirrinya Gunning Gap.

H45 had a significantly higher level of rust infection than Bowerbird at the Wirrinya trial site. The results in Table 4 indicate that the level of stripe rust in H45 was more than double that of Bowerbird. This is due to the lower level of stripe rust resistance in H45. The level of rust infection in both H45 and Bowerbird was surprisingly low given that the WA strain (134 E16 A+) was found to be present in this trial (Wellings, *personal communication).*

Table 4. Comparative yield of Bowerbird and H45 at Wirrinya for the Nil fungicide treatment (i.e. no seed or foliar fungicide)

Variety	Yield	Protein		Screenings	Test weight	Infected leaves
Bowerbird	2.68	14.5	a	4.8	73.8	30% b
H45	2.51	13.6	b	5.5	72.7	69% a
lsd	0.40	0.6		1.5	3.1	28%
CV%	9%	2%		18%	2%	42%
Significant	No	Yes		No	No	Yes

Results with different letters beside them are significantly different

Table 5. Comparative yield of Bowerbird and H45 at Gunning Gap For the Nil fungicide treatment (i.e. no seed or foliar fungicide)

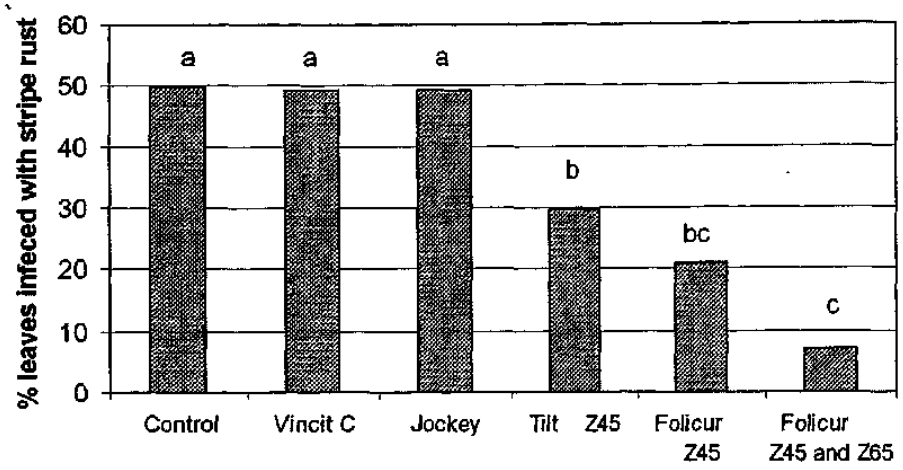
Variety	Yield	Protein	Screenings	Test weight	Infected leaves
Bowerbird	0.63	16.2	2.1 b	77.5	Not measured
H45	0.64	15.5	2.7 a	76.2	Not measured
lsd	0.15	0.6	0.4	1.5	
CV%	13%	2%	10%	1%	
Significant	No	No	Yes	No	

Results with different letters beside them are significantly different

Fungicide effect

The fungicide treatments had no significant effect on grain yield, protein, screenings or test weight at Wirrinya and Gunning Gap.

However, there were significant differences between the treatments with regard to the level of rust infestation at Wirrinya. Graph 1 represents the pooled percentage of leaves infected with stripe rust for H45 and bowerbird at Wirrinya. Since no significant variety by treatment interaction was recorded, this allowed results of the leaf infection counts for the 2 varieties to be pooled.



Graph 1. The % leaves infected with stripe rust at Wirrinya. Pooled data for Bowerbird and H45. (Letters above columns indicate significant differences - results with different letters are significantly different).

These results show that the seed dressings (Vincit C and Jockey) had no effect on the level of stripe rust. Vincit C is not registered to control stripe rust (McRae *et al*, 2004), and so no effect on stripe rust is to be expected. Product information for Jockey states that it may provide protection for up to 6 weeks and good suppression thereafter (Bayer, 2004a). Given that the stripe rust occurred very late in the Wirrinya trial it is understandable that Jockey had had little effect on stripe rust. So these results are expected. The main benefit of a broad spectrum seed fungicide, such as Jockey, is that early protection may help to delay the infection until post DC39 (flag emergence). Resistance to stripe rust increases in these later stages in varieties with at least medium resistance (Wellings *et al*, 2004)

In comparison the use of the triazole foliar fungicides was very effective at reducing the level of stripe rust in the Wirrinya trial. No significant difference was measured between the single applications of Tilt and Folicur at DC45. The timing of foliar fungicides has been described as being more critical than the product used (Poole and Pyke, 2004). However, new foliar fungicides such as the strobilurin fungicides (eg Amistar Extra) do appear to have the potential to provide superior long protection than the triazole fungicides such as Tilt and Folicur (Poole and Pyke, 2004). Monitoring of the trial indicated that the most of the stripe rust infection occurred during flowering (DC60 - DC69). Cool

conditions in early October provided an ideal climate for the disease to develop and spread during this time.

There was no significant difference in the percentage of leaves infected using either of the triazole foliar fungicides, Tilt or Folicur, in September at DC45 (Graph 1; both have the letter b). There was no significant difference between applying Folicur once in September and applying Folicur twice, in September and October (Graph 1; both have the letter c). However there was a significant difference between using Folicur twice and using Tilt in September (Graph 1; Tilt with letter b and Folicur twice with a letter c). It appears that using Folicur twice resulted in significant lower levels of stripe rust infection sites, than using Tilt in September

Product information and label recommendations for Tilt and Folicur state that a 2nd applications of these products maybe required 3-4 weeks after the initial application to ensure control of late infections (Syngenta, 2003; Bayer, 2004b). It is very likely that the residual effect from the Tilt and Folicur application at early booting (DC43) would have been reduced by the time the infection level had rapidly increased at mid flowering (DC65) in mid October.

The economic threshold for stripe rust is generally suggested to be 10-30% of leaves infected (Murray, 2003; Bayer, 2004b). Fungicide treatments in both H45. and Bowerbird reduced the rust infection to below these suggested threshold levels but this did not have any impact on yield or quality in this trial

The lack of grain yield or grain quality response when there was such an obvious infection response is likely to be due to the fact that the infection occurred very late. The Rustman2b model has been developed to help predict Stripe rust development and its effect on yield potential (Murray, 2003). This model predicted that in this trial a small response to the fungicide applications should have occurred. However, the Rustman2b model also clearly shows that the chance of getting a response to foliar fungicides decreases the later the date of infection. The very dry spring conditions are also likely to have a levelling effect on any treatments expressing a yield advantage.

Trials in southern NSW, where seasonal conditions where better, indicated clear yield responses in H45 when treated with fungicides (Poole and Pyke, 2004)

Conclusion

The WA stripe rust strain l34 E16 A+ was present in the Wirrinya trial. Severe drought conditions at Gunning Gap prevented Stripe rust from being a problem there.

At Wirrinya H45 was badly infected with stripe rust, although seasonal conditions resulted in the infection occurring very late (during flowering, DC60-69). Bowerbird suffered a significantly lower level of stripe rust than H45, even though it is rated to be susceptible to the WA strain. Earlier infections (ie flag emergence, DC45) with the WA strain on both varieties may have increased the level of strip rust infection.

Despite high levels of stripe rust in the trial, no fungicides treatments improved yield or grain quality. However, the triazole foliar fungicides were very effective at reducing the level of rust in the trial.

The seed treatment Jockey had no effect on stripe rust in this trial due to the late outbreak of the disease. Jockey is known to give early protection against stripe rust, but this protection gradually becomes diluted as the plant grows and Jockey will not protect against late infections.

The combination of a broad spectrum seed fungicide for early protection (up to DC45) and the use of a foliar fungicide thereafter is seen as the most practical way of managing stripe rust in susceptible varieties. The timing of foliar fungicides just prior to infection appears very important.

This trial demonstrates that stripe rust infestations do not always reduce grain yield and quality. Late infections and dry finishes can result in a nil response to fungicides.

These trials will be conducted again in 2004.

Acknowledgments

Kim & Wendy Muffet, Clem, Gary & Steven Hodges (trial co-operators); Greg Gibson and Tim McNee (technical assistance); Sharon Taylor and Helen Nicol (statistical analysis); Catherine Evans (Editing); Central West Farming Systems, Grain Growers Association and GRDC (funding).

References

Bayer, 2004a. Jockey Technical Manual 2004. Bayer Crop Science.

Bayer, 2004b. Product Label. Folicur430SC Fungicide. Bayer Crop Science

McRae, F.J., McCaffery, D.W. and Carpenter, D.J. (2003). Winter Crop Variety Sowing Guide 2003. NSW Agriculture.

McRae, F.J., McCaffery, D.W. and Carpenter, D.J. (2004). Winter Crop Variety Sowing Guide 2004. NSW Agriculture.

Murray, G. (2003). Rustman2b. Computer Simulation model. NSW Agriculture.

Poole, N. and Pyke, N. (2004). Fungicide strategies for wheat and barley - What can we learn from the 2003 season. *In* "GRDC Southern NSW Grains Research Update". Wagga Wagga. pp. 105-109.

Syngeta 2004. Product Label. Tilt 250EC Systemic Fungicide.

Wellings, C. Murray, G., and McRae, F. (2004). Stripe Rust Epidemic in 2003. Post Mortem and Options for 2004. *In* "GRDC Southern NSW Grains Research Update". Wagga Wagga. pp. 97-103.