

4.5 Adult Plant Resistance and Strategic Fungicide Use for Integrated Management of Cereal Rust - Inverleigh, Vic**Location:** SFS Inverleigh Research Site**Funding:**

This is a Sydney University led project funded by GRDC

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Summary of findings:

- Controlling low to moderate levels of stripe rust (15-20% infection severity) on top leaves of crop canopy did not result in a significant increase in yield.
- The best control of stripe rust was given by disease management programmes that included a mid-stem elongation spray applied at GS33 (third node). A spray for stripe rust applied at booting GS45 was too late to give good control.
- Conversely, the booting spray gave significantly better control of stem rust than the third node spray. The two spray approach gave the best control of all three rusts; stripe, leaf and stem.
- There was no evidence that the disease control correlated to yield, since the response to fungicide was no different whether the variety was generally resistant (Bolac) or susceptible (Chara).

Background/Aim:

This nationwide GRDC funded project led by University of Sydney has three overall objectives which are being addressed with controlled environment experiments and field trials. Specifically the project will:

- Define the expression of Adult Plant Resistance (APR) in a range of wheat cultivars in relation to environmental conditions and growth stage.
- Develop improved strategies for intervention with fungicides in the control of stripe rust and yellow leaf spot in susceptible and resistant wheat, and the communication of the strategies to industry stakeholders.
- Develop a model to support growers on the relative merits of applying fungicide for disease control, which takes account of climate, expected yield, economic outlook and genetic inputs including Adult Plant Resistance (APR).

The Inverleigh trial is one of 13 trials across the country and is being run by the Foundation for Arable Research (FAR) and Southern Farming Systems.

Rainfall:

Avg. Annual:	548
Avg. G.S.R:	408
2011 Total:	579
2011 G.S.R:	361

Trials details: FAR Trial Code - FAR W11/12**Rotation position:** 1st cereal after canola

Cultivars: Chara, Yipti and Bolac. Three cultivars of varying resistance to stripe rust (*Puccinia stromiformis*) were established on May 26th and managed with eight different fungicide management strategies

Treatment application:

Fungicides were applied at two different dates an early timing at third node (target of GS32, actual application at GS33) on 5th of September and a later timing (target of GS39, actual application at GS45) on the 26th September.

- Impact in furrow 400ml/ha (full rate)
 - Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha (GS32)
 - Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha (GS39)
 - Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha x 2 (GS32 plus GS39)
 - Untreated seed f.b. Folicur 145ml/ha (GS32)
 - Untreated seed f.b. Folicur 145 ml/ha (GS39)
 - Untreated seed f.b. Folicur 145 ml/ha x 2 (GS32 plus GS39)
 - Untreated seed
- f.b. – followed by*

Cultivar ratings to stripe rust, stem rust and tan spot (yellow leaf spot)

Variety	Stripe Rust	Stem Rust	Tan Spot (Yellow Leaf Spot)
Chara	MS-S	MR-MS	MS-S
Yitpi	MR-MS	S	S
Bolac	R-MR	MR	MS-S

Water rate: 100l/ha Date stripe rust first observed: September 7th 2011
 Date stem rust first observed: November 20th 2011

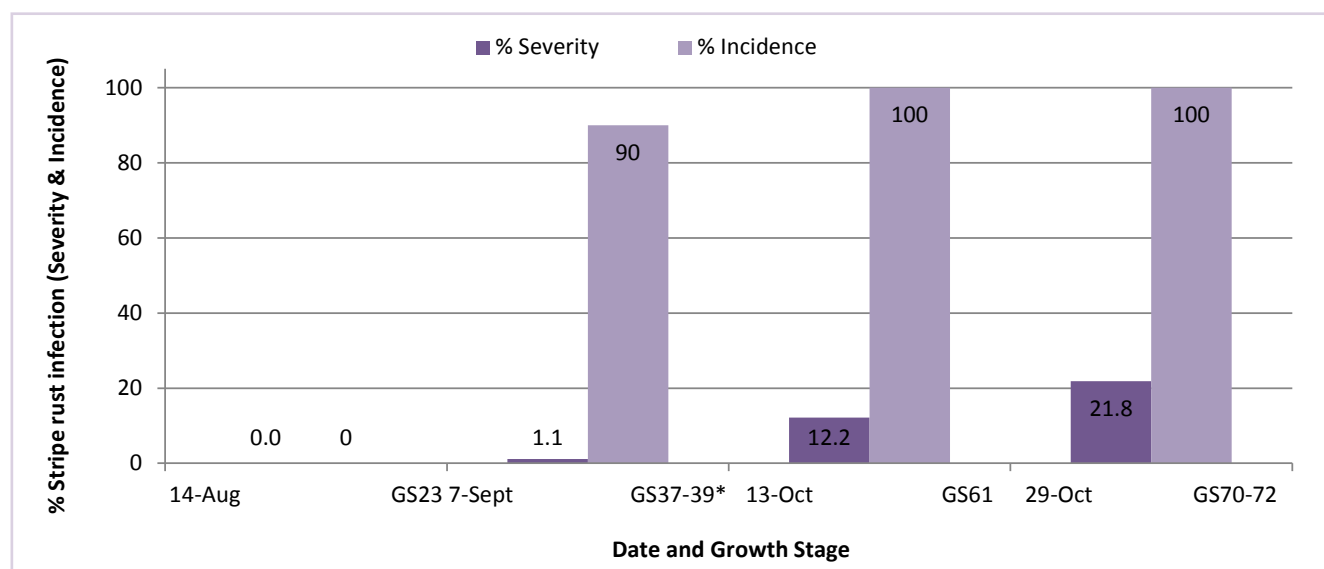
Disease Assessments: Disease was assessed at this trial site on the following dates:
 1. July 16th – GS21
 2. August 14th – GS23
 3. September 7th – GS37-39
 4. October 13th – GS61
 5. October 29th – GS70-72
 6. November 20th – GS90

Results and discussion:

1. Disease control

Stripe rust started to build up in late August on the susceptible cultivar Chara, with 90% of plants showing some infection by flag leaf emergence (GS37-39). Peak stripe rust infection was observed on the two top leaves of the crop canopy in late October during early grain fill (Figure 1). Levels of stripe rust reached approximately 15% on the flag leaf and just over 20% on flag-1 on the most susceptible cultivar, Chara. Leaf rust and stem rust were most prevalent in Yitpi, but severity was never greater than 10% infection.

Figure 1. Stripe rust development (% severity & incidence) on the flag – 1 leaf of the **untreated Chara (MS-S) crop** at GS23, GS37-39*, GS61 and GS70-72 – Inverleigh, VIC.



* Disease assessed on a whole plant basis rather than on the individual leaf flag-1.



Image 1. Stripe Rust on a wheat floret.

Jockey seed treatment gave significant control of stripe rust on the two lower leaves (flag-1 and flag-2) of the crop canopy up to GS61, but gave no significant control of disease on the flag leaf (Table 1). The best level of disease control was given by the single spray applied at third node GS33 and the two spray approach at GS33 and 45 (booting). These approaches were significantly superior to Jockey seed treatment alone and the booting GS45 spray.

Table 1. Influence of fungicide treatment and cultivar on stripe rust infection (% severity) on the flag leaf and flag – 1 leaves assessed at GS70-72, 29th October.

Seed Trt	Fungicide		Flag						Flag-1					
	GS33	GS45	Bolac		Yitpi		Chara		Bolac		Yitpi		Chara	
Jockey	-	-	1.55	f-i	13.18	a-c	14.13	a	0.50	g	5.20	e-g	19.63	ab
	+	-	0.15	hi	6.18	d-f	5.73	d-g	0.10	g	1.95	g	1.93	g
	-	+	0.00	i	9.00	b-d	5.73	d-g	0.45	g	4.73	e-g	15.38	bc
	+	+	0.23	hi	3.10	e-i	1.13	g-i	0.10	g	0.83	g	0.48	g
Untreated	-	-	0.65	hi	13.83	a-c	15.13	a	0.08	g	10.28	c-e	21.83	a
	+	-	0.03	i	4.95	d-h	6.65	de	0.05	g	1.05	g	3.40	fg
	-	+	0.00	i	13.40	a-c	8.60	cd	0.00	g	8.20	d-f	14.08	bd
	+	+	0.00	i	4.28	d-i	2.45	e-i	0.00	g	0.63	g	0.45	g
Mean			0.33	b	8.49	a	7.44	a	0.16	c	4.11	b	9.64	a
LSD (5%)	Cultivars		1.71						2.18					
	Fungicides		2.80						3.57					
	Cult x Fung		4.85						6.18					

The most effective leaf and stem rust control was given by the two spray foliar programme or the single late foliar spray applied at booting (GS45) (Table 2). The disease control was superior to that given by the single third node spray (GS33), however the advantage was only statistically superior with stem rust. Jockey seed treatment did not give significant control of these later establishing rusts.

Table 2. Influence of fungicide treatment and cultivar on the severity of leaf rust infection on flag-1 assessed at GS70-72, 29th October and stem rust severity on the flag sheath assessed at GS91, 23rd November.

Seed Trt	Fungicide		Leaf Rust			Stem Rust		
	GS33	GS45	Bolac	Yitpi	Chara	Bolac	Yitpi	Chara
Jockey	-	-	4.50 b	8.33 a	2.08 cd	---	4.48 a	---
	+	-	0.93 de	1.33 de	1.83 cd	---	5.88 a	---
	-	+	0.00 e	0.03 e	0.00 e	---	0.18 b	---
	+	+	0.00 e	0.00 e	0.00 e	---	0.03 b	---
Untreated	-	-	4.30 b	3.55 bc	1.18 de	---	5.25 a	---
	+	-	0.93 de	1.65 de	1.50 de	---	4.55 a	---
	-	+	0.00 e	0.00 e	0.00 e	---	0.25 b	---
	+	+	0.00 e	0.00 e	0.00 e	---	0.10 b	---
<i>Mean</i>			1.33 <i>ab</i>	1.86 <i>a</i>	0.82 <i>b</i>	---	2.59	---
<i>LSD (5%)</i>	<i>Cultivars</i>		0.62					
	<i>Fungicides</i>		1.01				2.65	
	<i>Cult x Fung</i>		1.76					

2. Yield data (t/ha)

Wheat yields from this trial were generally good, however, as this may have been due to other factors, none of the fungicide treatments significantly improved yield relative to the untreated in any of the three cultivars tested (Table 3). There appeared to be very little correlation between disease control and resultant yield. There was one significant yield interaction between Jockey seed treatment and the need for an early fungicide, which revealed a generally negative effect of a GS33 fungicide when applied following Jockey and a positive effect when the fungicide was applied to untreated seed.

Table 3. Influence of fungicide treatment and cultivar on grain yield (t/ha), harvested 22 December, 2011.

Seed Trt	Fungicide		Bolac			Yitpi			Chara		
	GS33	GS45	Yield		%	Yield		%	Yield		%
Jockey	-	-	7.96	ab	104	7.86	abc	100	7.32	bcd	97
	+	-	7.33	bcd	96	7.35	bcd	94	7.96	ab	106
	-	+	8.19	a	107	7.87	abc	100	7.85	abc	104
	+	+	7.54	bcd	99	7.67	a-d	98	7.34	bcd	98
Untreated	-	-	7.65	a-d	100	7.85	abc	100	7.52	bcd	100
	+	-	7.77	abc	102	7.46	bcd	95	7.75	a-d	103
	-	+	7.48	bcd	98	7.28	cd	93	7.1	d	94
	+	+	7.82	abc	102	7.59	a-d	97	7.62	a-d	101
<i>Mean</i>			7.72			7.62			7.56		
<i>LSD (5%)</i>	<i>Cultivars</i>		0.23								
	<i>Fungicides</i>		0.38								
	<i>Cult x Fung</i>		0.65								