3.3 Disease Management Trials

3.3.1 Adult Plant Resistance and Strategic Fungicide Use for Integrated Management of Cereal Rust - Lake Bolac, Vic

Location: Lake Bolac Research Site.

Funding:
This is a Sydney University led project funded by GRDC

Researchers:
Toby Campbell (SFS), Bruce Dixon (SFS), Nick Poole and Tracey Wylie.

Authors:
Nick Poole & Tracey Wylie (Foundation for Arable Research).

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

Summary of findings:

- The maximum response to fungicide was 17% (0.65 t/ha) with Bolac, 40% (1.24 t/ha) with Yipti and Chara 73% (2.11 t/ha).
- Impact (flutriafol) was particularly effective at delaying the build up of stripe rust in the Chara which has a susceptible rating to the disease.
- The effect of flutriafol was less evident in more resistant cultivars or where stem rust was the principal disease (Yipti).
- Foliar fungicides at GS32-33 (2nd – 3rd node) gave their greatest benefits where Impact had not been applied, however its use was still positive with Impact treated crops.
- A flag leaf spray was the most influential component of the fungicide strategies evaluated irrespective of cultivar.
- The flag leaf spray reduced late stem rust pressure and controlled the earlier infection of stripe rust on the flag leaf itself.

Rainfall:

Avg. Annual:	540mm
Avg. G.S.R.:	401mm *(Apr – Nov)*
2010 Total:	748mm
2010 G.S.R:	506mm

Trials details: *(FAR Trial Code - FAR W10/12)*

Rotation position: 1st cereal after canola

Cultivars: Chara, Yipti and Bolac
Three cultivars of varying resistance to stripe rust (Puccinia stromiformis) were established on June 23rd and managed with eight different fungicide management strategies

Treatment application:
Fungicides were applied at two different dates an early timing at second node (GS32) on 17th October and a later timing (GS39) on 25th October. The original GS32 fungicide applied on 12th October was washed off with rain less than 30mins after application.

1. Impact in furrow 400ml/ha (full rate)
2. Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha (GS32)
3. Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha (GS39)
4. Impact in furrow 400ml/ha (full rate) f.b. Folicur 145 ml/ha x 2 (GS32 plus GS39)
5. Untreated fertiliser f.b. Folicur 145ml/ha (GS32)
6. Untreated fertiliser f.b. Folicur 145 ml/ha (GS39)
7. Untreated fertiliser f.b. Folicur 145 ml/ha x 2 (GS32 plus GS39)
8. Untreated fertiliser

f.b. – followed by

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

	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: October 21st 2010
Date stem rust first observed: November 9th 2010

Disease Assessments

Disease was assessed at this trial site on the following dates:

ι)	September 2nd	– GS21-23
ιι)	October 5th	– GS31-32
ιιι)	October 21st	– GS38-45
ιϖ)	November 9th	– GS59
ϖ)	November 25th	– GS71
ϖι)	December 13th	– GS83

Stripe Rust infection

Chara was the only cultivar to develop significant stripe rust, which appeared from early flag leaf emergence (GS37) onwards. This infection increased in severity such that by early grain fill 15% of the flag leaf was infected with disease. In contrast, Yipti at the same stage of grain fill had less than 3% flag leaf infection, Bolac had less than 1% infection. In general the stripe rust ratings were confirmed by these results generated in the field.

When assessed at grain fill (GS71) the results illustrated that those treatments incorporating a flag spray applied at GS39 gave the best stripe rust control in Chara. Though at that stage in the season (and on that leaf) the influence of Impact was minimal, at earlier assessments up to booting its effects were clearly evident. Where an early GS32 fungicide was applied and not followed up, the control of stripe rust was inferior to flag leaf spraying but still superior to the untreated or Impact only treatments.

Stem rust infection

The odd pustule of stem rust was detected in Yipti in early November (ear emergence) and increased dramatically over the next 5 weeks such that nearly 50% of the leaf sheath was infected by mid December. At the late grain fill stage, stem rust control was better where flag leaf sprays had been applied than at the earlier GS32 spray, though this difference was not always statistically significant. At the end of grain fill there was no evidence of a positive effect from Impact on stem rust control, presumably since through degradation the influence of the fungicide would have been minimal by this growth stage.

With Chara which also had low levels of stem rust, the untreated crop had less than 2% stem rust infection and a trend for slightly higher levels in the treated crops. These differences were not significant, but can be observed when fungicide protects against one disease (in this case stripe rust) protecting more green leaf which allows another disease to build up, if the fungicide has faded or is ineffective against that disease.

Table 1: Influence of fungicide treatment and cultivar on stripe rust infection (% severity and % disease control of that infection) on the flag leaf assessed at GS71-72 – 25th November.

Treatment	Fungicides		Bolac (R)			Yipti (MR-MS)			Chara (MS-S)		
	GS32	GS39			%			%			%
Impact	-	-	0.93	d	-	1.65	d	40	15.2	a	0
	+	-	0	d	-	0.01	d	100	6.1	c	60
	-	+	0	d	-	0.05	d	98	0.9	d	94
	+	+	0	d	-	0.15	d	95	0.4	d	97
Untreated	-	-	0	d	-	2.75	d	0	15.1	a	0
	+	-	0	d	-	0.33	d	88	9.2	b	39
	-	+	0	d	-	1.58	d	43	0.6	d	96
	+	+	0	d	-	0	d	100	0.8	d	95
Mean			**0.12**			**0.81**			**6.02**		
LSD (5%)	Cultivars		**1.07**								
	Fungicides		**1.74**								
	Cult x Fung		**3.01**								

Table 2: Influence of fungicide treatment and cultivar on stem rust infection (% severity and % disease control of that infection) on the flag leaf sheath assessed at GS83 – 13th December.

Treatment	Fungicides		Bolac (R)			Yipti (MR-MS)			Chara (MS-S)		
	GS32	GS39			%			%			%
Impact	-	-	0.7	e	-	45.8	a	2	1.7	e	-
	+	-	0.5	e	-	24.4	bc	49	2.6	e	-
	-	+	0.5	e	-	19.8	bc	57	1.7	e	-
	+	+	0.3	e	-	14.0	cd	70	2.2	e	-
Untreated	-	-	0.4	e	-	47.0	a	0	1.1	e	-
	+	-	0.5	e	-	26.5	b	43	2.9	de	-
	-	+	0.8	e	-	18.3	bc	62	1.2	e	-
	+	+	0.4	e	-	17.6	bc	62	2.9	de	-
Mean			**0.5**			**26.7**			**2.0**		
LSD (5%)	Cultivars		**4.0**								
	Fungicides		**6.5**								
	Cult x Fung		**11.2**								

Yield data (t/ha, % untreated control)

The maximum response to fungicide was 17% (0.65 t/ha) with Bolac, 40% (1.24 t/ha) with Yipti and Chara 73% (2.11 t/ha). The influence of Impact alone was particularly evident with Chara (0.77t/ha) where stripe rust infection was apparent from flag leaf emergence onwards and developed to the greatest extent (15% flag infected at the start of grain fill). With the more resistant cultivars Bolac and Yipti, Impact alone created no significant benefits in terms of either disease control during grain fill or in resultant yield.

Table 3. Influence of fungicide treatment and cultivar on grain yield (t/ha) and (% of untreated cultivar yield)

Trt			Bolac			Yipti			Chara		
Seed trt	Fungicides		Yield			Yield			Yield		
	GS32	GS39	t/ha		%	t/ha		%	t/ha		%
Impact	-	-	4.51	a-e	105	3.27	h-j	107	3.66	g-i	127
	+	-	4.16	d-g	97	3.74	f-i	122	4.40	a-f	152
	-	+	4.12	d-g	96	4.14	d-g	135	4.61	a-d	159
	+	+	5.05	a	117	4.31	c-g	140	5.00	ab	173
Untreated	-	-	4.30	c-g	100	3.07	ij	100	2.89	j	100
	+	-	4.60	a-d	107	3.86	e-h	126	4.14	d-g	143
	-	+	4.73	a-d	110	4.33	b-g	141	4.91	abc	170
	+	+	5.01	a	116	4.15	d-g	135	4.58	a-d	159
Mean			**4.56**			**3.86**			**4.27**		
LSD (5%)	Cultivars		**0.24**	***							
	Fungicides		**0.39**	***							
	Cult x Fung		**0.68**	*							

Margin after fungicide cost and application ($/ha)

Margins ranked according to cultivar rating for disease Chara producing higher returns than Yipti which was in turn higher than Bolac. The greatest influence from a foliar fungicide at GS32 was where the variety had an intermediate or susceptible rust rating and no Impact protection at seeding. Impact gave its greatest benefits with Chara by delaying the onset of stripe rust infection. In all cultivars the benefit of a flag spray was evident, preventing either stripe rust infection on the flag leaf or by reducing the level of stem rust on the flag sheath.

Table 4. Influence of fungicide treatment and cultivar on margin after fungicide cost and application cost ($/ha)

Trt			**Bolac**	**Yipti**	**Chara**
Seed trt	**Fungicides**		**Yield**	**Yield**	**Yield**
	GS32	**GS39**	**$/ha**	**$/ha**	**$/ha**
Impact	-	-	44	41	184
	+	-	-57	146	356
	-	+	-69	239	398
	+	+	148	268	480
Untreated	-	-	0	0	0
	+	-	-13	185	300
	-	+	92	294	479
	+	+	147	237	386

** Grain costed at $250/t, wheeling damage from GS39 sprays at 2.5% and application cost at $8/ha*