5. VARIETY TRIALS

5.1 WHEAT

5.1.1 ASSESSING THE IMPACT OF STRIPE RUST CONTROL ON THE YIELD AND GRAIN QUALITY OF DIFFERENT WHEAT VARIETIES (INVERLEIGH, VIC)

Abstract:
The trial shows clearly the impact of Stripe Rust on wheat yield and grain quality. All varieties had their yield depressed as a result of Stripe Rust, with an average yield reduction of approximately 21%. Those varieties with lower levels of resistance to Stripe Rust were more severely affected, with Silverstar for example suffering a 44% yield penalty. The extra profit generated by controlling foliar disease was on average $81.30 per hectare. The worst affected variety by fungal leaf disease (Silverstar) generated a further $207.72 per hectare profit when sprayed with a fungicide.

Stripe Rust had a significant effect of grain quality. Grain test weights and one thousand grain weights were reduced significantly in the unsprayed treatments. There was less effect on grain protein.

Background:
There are many wheat varieties available for sowing in SW Victoria. Many of these varieties have been commercially available for several years, however, with the privatisation of plant breeding within Australia, there are many new varieties coming onto the market from several seed companies, many of which do not have much agronomic data available to the producer.

The standard varietal testing has mainly involved a "plant and forget" policy, where varieties are left unsprayed for leaf disease. This has resulted in many varieties of high yield potential having been discarded because of their susceptibility to disease and resultant poor yield performance. In a commercial situation however, these varieties would have been treated appropriately for disease, by the grower. This is not to say that breeding varieties for genetic resistance is not an ideal aim, however with the rapid mutation of disease pathogens, this strategy is not always successful or long lasting.

There have been some advances made in canopy management over recent years. Simply growing varieties on nutrients applied at sowing is no longer appropriate. This trial aimed to apply the most appropriate canopy management principles by adjusting seeding rates and nitrogen timings for each of the varieties being grown. Sowing rates were calculated from the individual grain weights and germination tests for each variety being grown.

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Location: Inverleigh Vic.

Aims:
- To assess the impact of foliar disease control on the yield and quality of different wheat varieties
- To gather further data on the agronomic performance of various wheat varieties

Methodology:

Disease Control:
A total of 17 wheat varieties were grown in a replicated trial. These reps were arranged in bays with the front 2 bays being sprayed with Folicur ® at 145 ml/ha to control leaf disease, principally Stripe Rust. The aim was to keep all varieties as clean as possible, hence 3 spray applications occurred on 21st September, 5th October and 19th October. The sprays were applied between late tillering and mid flowering, depending on the variety. All varieties received 3 spray applications. The back 2 bays (reps) were left unsprayed.

Growing Season Rainfall (Aprl – Nov): 388 mm

Sowing Date: 11th June 2004

Sowing Rate:
Seeding rate was adjusted according to germination test and 1,000 grain weights. One thousand grain weights ranged from 28 grams for Amarok, to 42.6 grams for GBA Sapphire. The check variety Kellalac had a thousand grain weight of 36 grams. An established population of 220 plants per square metre was aimed for.

Plot design:
Each variety was sown 2 metre wide raised beds. The plot length was 11 metres.

Harvest Date: 01/01/2005

Fertiliser:
Soil tests were conducted which indicated very low levels of nitrogen (practically zero at 0-60 cm) and lower than ideal quantities of Copper and Zinc. This was largely reflecting the 32 year continual cropping history. Consequently 100 kg/ha Granulock CuZn was used at sowing, with 100kg/ha Urea being topdressed on 3rd September and 1st October, giving a total of 92 kg/ha nitrogen applied post sowing.

Weed Control:
- Broadleaf herdicide spray was applied on the 2nd August, Eclipse 7gms/ha + Bromicide Ma + Zinc 250mls/ha + Fastac 100mls/ha, using 90 litres water/ha
- Grass herbicide spray was applied on the 16th August, Achieve 500gm/ha, Supercharge 1ltr/ha, using 90 litres waterlha

Results and Discussion:
The trial was extremely uniform for plant stand, with good levels of weed control. There is no reason to suspect any variation between each of the bays due to soil type changes or waterlogging problems. There is a high degree of confidence in the results.

Given that the trial was divided into 2 bays (reps) unsprayed for leaf disease and 2 bays (reps) sprayed, the statistician has advised that we have to consider them as 2 separate trials, each of 2 reps. With this in mind, the results are presented below.

Table 1: Yield and Ranking for Each Variety Sprayed and Unsprayed with Fungicide

Entry	Variety	Stripe Rust Rating Pathotype 134 E16 A+	Yield sprayed for leaf disease kg/ha	Yield Rank – sprayed	Yield Unsprayed kg/ha	Yield Rank - unsprayed	% Yield reduction	Yield penalty kg/ha
6	GS 1078	NA	4367	1	3706	1	15.14%	661
16	Mitre	MS-S	3648	2	2254	15	38.21%	1394
15	Chara	MS-S	3598	3	2227	16	38.10%	1371
12	Marombi	R	3535	4	3096	3	12.42%	439
4	Teesdale	NA	3526	5	3215	2	8.82%	311
13	Braewood	R	3502	6	2627	9	24.99%	875
7	GBA-sapphire	MS	3499	7	2673	7	23.61%	826
9	GBA-Hunter	R	3383	8	2648	8	21.73%	735
11	Brennan	R	3370	9	2372	12	29.61%	998
10	MacKellar	MR	3309	10	2562	10	22.57%	747
8	GBA-combat	S	3284	11	2340	13	28.75%	944
17	Silverstar	MS-S	3284	12	1830	17	44.28%	1454
14	Kellalac	MR-MS	3223	13	2287	14	29.04%	936
1	AGHW001	NA	3195	14	2917	4	8.70%	278
3	Amarok	NA	3122	15	2785	6	10.79%	337
5	Frelon	NA	2893	16	2856	5	1.28%	37
2	AGSW001	NA	2845	17	2410	11	15.29%	435
CV			**11.08**		**19.80**			
LSD 5%			**520**		**619**			
Avg			**3387**		**2636**		**21.96%**	**752**

Stripe Rust Rating:
NA = not available,
MS-S = moderately susceptible to susceptible,
MR – MS = moderately resistant to moderately susceptible,
S = susceptible,
R = resistant
(Source : Plant Breeding Institute Cobbitty NSW)

Stripe Rust was the principal disease affecting the varieties during the course of the trial. This disease became evident at the late tillering stage and progressively became worse during the growing period. The plots unsprayed with foliar fungicide were showing low to very high levels of stripe rust infection by the end of the growing period. The plots that were sprayed with fungicide generally showed very low levels of infection with Stripe Rust. There were very low levels of leaf rust and other foliar diseases present, however they cannot be discounted all together.

Table 1 shows the effect of the Stripe Rust on the yield of the various varieties. There are a number of important messages contained within the results, namely:

- Some varieties such as GS 1078 (GrainSearch) yielded very well in both a sprayed and unsprayed situation
- The average yield depression caused by Stripe Rust was 21.96%, although some varieties were affected worse than others. Silverstar, Mitre and Chara were very badly affected by stripe rust.
- Varieties carrying higher levels of resistance the Stripe Rust pathotype 134 E16 A+ generally showed less yield depression in the unsprayed treatment, although even the resistant varieties did respond positively to the fungicide treatment.
- Good yields were obtained from varieties such as Mitre and Chara under the sprayed treatment. Mitre slipped in yield rank from 2 to 15 and Chara from 3 to 16 when left unsprayed.

Table 2 : The Impact of Disease Pressure on Profit

Entry	Variety	Yield penalty kg/ha	Income lost/ha	Spray Cost $/Ha	Profit by spraying $/ha
6	GS 1078	661	$118.98	$54.00	$64.98
16	Mitre	1394	$250.92	$54.00	$196.92
15	Chara	1371	$246.78	$54.00	$192.78
12	Marombi	439	$79.02	$54.00	$25.02
4	Teesdale	311	$55.98	$54.00	$1.98
13	Braewood	875	$157.50	$54.00	$103.50
7	GBA-sapphire	826	$148.68	$54.00	$94.68
9	GBA-Hunter	735	$132.30	$54.00	$78.30
11	Brennan	998	$179.64	$54.00	$125.64
10	MacKellar	747	$134.46	$54.00	$80.46
8	GBA-combat	944	$169.92	$54.00	$115.92
17	Silverstar	1454	$261.72	$54.00	$207.72
14	Kellalac	936	$168.48	$54.00	$114.48
1	AGHW001	278	$50.04	$54.00	-$3.96
3	Amarok	337	$60.66	$54.00	$6.66
5	Frelon	37	$6.66	$54.00	-$47.34
2	AGSW001	435	$78.30	$54.00	$24.30
Avg		**752**	**$135.30**	**$54.00**	**$81.30**

Table 2 shows the profit reduction as a result of not spraying. The cost of the 3 spray applications takes account of both chemical and application cost. Wheat is valued at $180 per tonne.

In the worst case, Silverstar showed a profit reduction of $207.72 per hectare with the non spray treatment. Varieties such as Mitre and Chara were also badly affected.

In the case of Frelon and AGHW001, the cost of spraying was not recovered with the extra yield. Teesdale and Amarok ahowed an approximate breakeven situation.

Table 3: Impact of Disease Control on Protein %

Entry	Protein - sprayed treatment	Protein % - unsprayed
14	11.60	11.40
13	11.40	9.95
11	11.35	10.95
15	11.10	10.50
5	11.00	11.50
9	10.95	11.20
1	10.90	11.30
8	10.85	11.25
10	10.65	9.70
3	10.60	10.75
17	10.60	11.60
12	10.50	10.90
16	10.35	10.85
7	10.25	10.55
4	10.20	11.00
2	10.05	10.90
6	9.65	9.55
CV	**6.90**	**7.13**
LSD 5%	**1.61**	**1.46**
Avg	**10.71**	**10.81**

The reaction of each variety in terms of grain protein % was different. Some varieties increased and some decreased in grain protein when sprayed compared to when not sprayed. Overall, grain protein levels were slightly higher in the unsprayed treatment compared to the sprayed treatment. Entry 13 (Braewood) showed the greatest decline in grain protein as a result of not spraying. Entry 6 (GS 1078) had the lowest grain protein levels for both the sprayed and unsprayed treatments. This is no doubt that the variety was able to convert nitrogen into yield better than the other varieties, given it topped the yield table for both the sprayed and unsprayed treatments.

Table 4: Impact of Disease Control on Grain Test Weight (kg/hl)

Entry	Grain Test Weight - sprayed	Grain Test Weight - unsprayed	% reduction
13	79.29	79.26	0.04%
16	79.11	72.63	8.19%
7	78.94	73.46	6.94%
8	78.47	73.08	6.87%
2	78.18	76.76	1.82%
14	77.87	77.11	0.98%
10	77.53	75.63	2.45%
11	77.36	76.02	1.73%
17	77.28	67.48	12.68%
15	77.04	73.12	5.09%
12	76.59	75.83	0.99%
3	75.93	76.49	-0.74%
9	75.91	74.66	1.65%
1	75.60	74.79	1.07%
6	75.47	75.03	0.58%
4	75.11	73.97	1.52%
5	74.09	75.75	-2.24%
CV	**2.08**	**3.43**	
LSD	**1.59**	**1.70**	
Avg	**77.05**	**74.77**	**2.95%**

This variety could possibly have responded to even higher nitrogen applications.

The reduction in grain yield can be explained partly by the figures in Table 4. Those varieties showing a dramatic reduction in grain yield eg entries 15, 16 and 17 in the unsprayed treatment, also showed a significant reduction in grain test weight. In the case of Silverstar (entry 17), grain test weight declined from 77.28 to 67.48, a dramatic result. Those varieties showing less yield reduction due to disease, generally had small changes in grain test weights.

Table 5: Impact of Disease Control on 1,000 Grain Weight (TGW)

Entry	TGW - sprayed	TGW - unsprayed	% reduction
2	48.99	44.38	9.41%
1	48.17	43.59	9.51%
9	47.58	41.95	11.83%
7	44.72	36.14	19.19%
8	44.70	35.81	19.89%
11	43.41	41.53	4.33%
4	43.30	43.15	0.35%
6	43.20	41.46	4.03%
12	43.19	41.24	4.51%
13	42.62	42.14	1.13%
14	40.99	36.84	10.12%
16	40.97	34.83	14.99%
15	40.70	24.32	40.25%
17	40.30	32.80	18.61%
5	39.99	41.34	-3.38%
10	38.39	38.06	0.86%
3	38.13	38.28	-0.39%
CV	**8.42**	**14.67**	
LSD	**5.05**	**8.38**	
Avg	**42.90**	**38.70**	**9.80%**

On average, the effect of not spraying for foliar disease resulted in an average 1,000 grain weight (TGW) drop of 4.2 grams. This is quite significant. In all varieties, apart from entries 5 and 3, TGW reduced in the unsprayed treatment. The impact of not spraying entry 15 (Chara) was dramatic, with a reduction of 40.25% in TGW, down from 40.30 grams to 24.32 grams. Once again, those varieties which had a relatively low yield reduction in the unsprayed treatment, generally had smaller reductions in their TGW.

Table 6: Impact of Disease Control on Screenings

Entry	Screen - sprayed	Screen - Unsprayed	% increase
13	1.76	3.00	41.40%
8	2.52	4.20	39.93%
2	2.64	2.24	-18.12%
12	3.13	2.77	-12.82%
1	3.51	4.08	14.09%
7	3.58	4.25	15.67%
16	3.79	4.59	17.45%
15	3.84	4.92	21.97%
9	3.84	3.51	-9.42%
14	4.22	4.78	11.82%
11	7.59	9.26	18.03%
6	7.73	6.96	-10.99%
5	7.93	7.41	-7.09%
17	8.78	9.80	10.36%
3	9.33	7.03	-32.65%
4	10.48	9.17	-14.29%
10	11.14	11.24	0.89%
CV	**58.29**	**47.96**	
LSD	**3.84**	**2.03**	
Avg	**5.63**	**5.83**	**3.43%**

The varieties AGHW001 and AGSW001 had an extremely high TGW in the sprayed treatment. These varieties may be more suited to the drier environments, as their yield was not as high as some of the longer season varieties.

Table 6 gives the effect on grain screenings. The CV indicates a high degree of variability, however some trends are evident. Those varieties that were low yielding generally had higher screenings, although this was not always the case. Entry 10 (MacKellar) has thrown up high screenings in previous trials and again this has occurred in this particular trial.