

## 2.1.6 Wheat variety evaluation - Symmons Plains, Tas

### Location:

"Symmons Plains" Tasmania.

**Author:** Geoff Dean - SFS/TIAR

ph: 03 6336 5233,

email: geoff.dean@dpiw.tas.gov.au

### Researchers:

Geoff Dean, Brett Davey - SFS/TIAR,  
Rob Howard - TIAR.

**Acknowledgments:** Thanks to  
Andrew Legro and Andrew Youl.

**Funding:** HRZ wheat breeding  
program with GRDC funding.

### Background/Aim:

With the release of new varieties, greater awareness of potential yields and improved management practices, there has been a large increase in the area sown to wheat in Tasmania. In particular the CSIRO/HRZ wheat varieties have shown adaptation to the Tasmanian environment and have dominated recent plantings. Mackellar was the first commercial wheat variety with Barley Yellow Dwarf Virus (BYDV) resistance and several new BYDV resistant lines from CSIRO were evaluated for the first time. In response to perceived concerns about red wheat in dairy rations a number of new white wheat entries were evaluated. Seven varieties and lines from Europe and New Zealand were also tested, following good performances from some of these materials in previous years in Tasmania.

With new races of rust appearing, it is important that information on response to disease is gathered. There have also been some differences in disease susceptibility in Tasmania compared with other parts of Australia.

The aim of these trials was to compare existing wheat varieties, evaluate new breeding material and to assess the disease responses of germplasm (particularly stripe rust). The performance of varieties and advanced lines was also evaluated under irrigation in a University of Tasmania trial at Hagley (Quamby Farm).

### Take home messages:

- Average grain yield from wheat varieties was 5.1 t/ha but due to differences in disease resistance there was a broad range from 6.9 to 1.6 t/ha.
- The top ranking lines including Mackellar tended to be either resistant or possibly possess some tolerance to Barley Yellow Dwarf Virus (BYDV). Unfortunately the top BYDV resistant CSIRO lines were also moderately susceptible to leaf rust.
- The worst performing varieties Wheat T, Chara and Kellalac were moderately susceptible to stripe rust.
- Two white grain breeding lines yielded well and seed of one of these (Preston) will be available in 2010. Some of the current mainland white grain varieties performed reasonably well but for most this is only the first year of evaluation.
- A number of CSIRO lines and Beaufort performed well and will be evaluated further.

### Trial information:

Fifty six wheat lines and varieties were sown at Symmons Plains and a subset under irrigation at Hagley (data not presented). Most of the breeding lines were from CSIRO but also two from Crop and Food Institute, New Zealand. To avoid accidental introduction of Wheat Streak Mosaic Virus (WSMV) no new wheat material has been introduced into Tasmanian wheat trials for 2 years. However, with the detection of this virus on several commercial seed lots of Tennant in 2007 this imperative was reduced. Never the less, as the disease has not yet been visually sighted in-crop, seed for trials was sourced from Victoria where the incidence of WSMV has been negligible compared with NSW.

The trial design was a randomised complete block with 4 replicates. The previous crop was tick-beans and the trial was sown on 3<sup>rd</sup> June at 250kg/ha 9:13:14:3. Two fungicides were applied at Growth Stages (GS) 32-33 and GS43-55. With reasonably good soil N levels and a very dry season with virtually no soil moisture, the decision was made to avoid detrimental effects from excess N and apply only 25kg N/ha (foliar application). To provide information on variety disease ratings and management only two replicates of the trial received the fungicide plus nitrogen (high input treatments). The trial was harvested for grain on 23<sup>rd</sup> and 29<sup>th</sup> January.

**Growing season rainfall (Apr-Nov):** 269 mm

Main entries, their origin/breeding program and seed licensee are listed below:

Tennant, Brennan, Mackellar	CSIRO/HRZ Wheat	AWB Seeds
95102.1 (ex 95102.1)	CSIRO/HRZ Wheat	SQP Co-op.
Amarok, Teesdale, Alberic	Europe ex PGGWrightsons	GrainSearch
Beaufort	France/LongReach	GrainSearch
Kellalac	Vic DPI	-
Chara	Vic DPI	AWB Seeds
Sentinel	France/LongReach	AWB Seeds
EGA Eaglehawk	NSW DPI	PlantTech
GBA Ruby	GBA	PlantTech
Naparoo	Uni of Sydney	AGT Seeds
Bolac	AGT Seeds	ABB Grain

### Results and discussion:

The season could be best described as very stop/start. There was a very dry autumn (Decile one) and it wasn't until the end of May that there was sufficient soil moisture to sow into. However, there were not good rains until mid June to top up depleted soil moisture levels. Consequently plants were slow to establish.

After a very dry winter there were good soaking rains in September which turned the season around but rainfall in October was virtually non-existent (7 mm) being one of the driest on record. October 22<sup>nd</sup> and 23<sup>rd</sup> and also saw two severe frosts between -3 and -4°C. There was good rain in November which saved the severely moisture stressed crop. This continued on and off until late December.

In mid October along with the lack of rainfall, most plots began to wilt and turn a paler green. By late October it was obvious that the greenest plots were those carrying BYDV resistance and this effect carried through to near maturity. Consequently, from Table 1, the stand-out group of lines in the trial were those with BYDV resistance (98048.72, 98048.75 and Mackellar). This effect is more striking when examining yields from the plots that did not receive a fungicide - the top 3 lines were all BYDV resistant. While it is difficult to split the effects due to fungicide and N in the high input plots, examination of disease scores for both stripe and leaf rust suggests that the varieties most responsive to higher inputs were those that had the worst disease ie application of fungicides had a greater effect than N. Yields may have been limited by insufficient N, but the very low soil moisture and reasonable soil N levels at stem elongation suggested caution.

There was uniform infection of BYDV across the trial site and differences in the response of some varieties were evident which although visually not resistant showed less BYDV symptoms than other material. In particular HRZ03.0003, H150.2, 98047.68, 98047.25 and 98048 were less affected and yielded well. In contrast the lines with most obvious BYDV effects were Brennan, Teesdale and some of the poorer performing CSIRO material which is not listed here. However, breaking the pattern, Beaufort also showed strong BYDV symptoms and yielded comparatively well which may relate to the relatively early maturity of this variety.

Unfortunately, the good performance of the 2 new BYDV resistant lines (98048.72, 98048.75) is tempered by their moderate susceptibility to leaf rust, having the same genes for leaf rust resistance as Mackellar. Therefore, it is likely they cannot be released (Mackellar was released before this resistance broke down). Unsprayed plots of these 2 lines demonstrated higher yields than most other material however, it can be argued that increased disease pressure from susceptible varieties leads to greater pressure on other genes that are resistant.

Another disappointment was the relatively poor performance of 95102.1. After 5 years of excellent results, this is the first year this line has turned in a less than convincing yield. However, the yield of 95102.1 was not statistically different to Mackellar. 95102.1 also performed below expectations at the irrigated site at Hagley. While BYDV was not obvious at Hagley, the high yield of Mackellar relative to other varieties points to BYDV also being present at this site.

The BYDV at Symmons Plains was not caused by autumn flights of aphids with characteristic and distinct "holes" in the crop; rather, it was from spring infection with a general effect across the whole trial. It is possible that the effects of spring infection with BYDV are more visible when accompanied by low rainfall and this may also have occurred when Mackellar was first trialled in Tasmania. As BYDV affects the plants internal plumbing, this seems plausible. Alternatively, the absence of necrotic leaf tipping and/or general leaf yellowing symptoms may not be entirely due to BYDV resistance, only linked with this resistance ie on the same segment of chromosome as the BYDV resistance gene(s).

The NZ line HRZ03.0003 yielded very well with only a minor response to fungicides. This line performed well in past trials but was dropped at the end of 2006-07 due to high levels of stem rust in an irrigated trial. However, at the national centre for rust screening the level of stem rust resistance has been rated as acceptable (moderately resistant) and the line was reintroduced into trials in Tasmania. Interestingly, one of the parents of this line, B2262 from CSIRO, yielded exceptionally well in trials in Tasmania 10 years ago but could not be released. B2262 is also a parent of some of the other top ranking CSIRO lines.

**Table 1:** Wheat grain yields (t/ha) at Symmons Plains 2008-09.

Variety/Line	Grain type	Yield - low input (t/ha)	Yield - high input (t/ha)	Low / high input % diff	Average yield (t/ha)	% Mackellar
98048.72	red	6.52	7.28	90	6.90	119
HRZ03.0003	white	6.11	6.46	95	6.29	109
98048.75	red	5.87	6.54	90	6.21	107
170	red	5.98	6.24	96	6.11	106
K37.18	red	5.85	6.37	92	6.11	106
V 311	red	5.84	6.37	92	6.10	106
98049	red	5.74	6.25	92	5.99	104
97942.29	red	5.59	6.22	90	5.90	102
H150.2	white	5.51	6.07	91	5.79	100
Mackellar	red	5.07	6.50	78	5.78	100
Beaufort	red	5.16	6.35	81	5.75	100
98047.68	red	5.03	6.42	78	5.72	99
K89.44	red	5.70	5.59	102	5.65	98
98047.25	red	5.39	5.81	93	5.60	97
97826	red	5.18	5.98	87	5.58	97
98507.6	white	5.13	5.95	86	5.54	96
Ruby	white	5.51	5.49	100	5.50	95
98048	red	5.14	5.83	88	5.49	95
97265.111	red	5.23	5.65	93	5.44	94
H123.1	red	5.19	5.60	93	5.40	93
98330	red	5.06	5.72	88	5.39	93
95102.1	red	5.32	5.41	98	5.36	93
98208	white	5.32	5.39	99	5.35	93
98072.84	red	4.66	5.94	78	5.30	92
Bolac	white	4.78	5.68	84	5.23	90
Teesdale	red	4.64	5.48	85	5.06	88
CFR03.1010.3	white	4.31	5.50	78	4.90	85
Naparoo	white	4.49	5.27	85	4.88	84
Sentinel	white	4.71	5.04	93	4.87	84
Eaglehawk	white	4.14	5.27	79	4.71	81
Amarok	red	4.39	4.86	90	4.62	80
Brennan	white	4.02	4.98	81	4.50	78
Tennant	red	3.86	4.30	90	4.08	71
Kellalac	white	3.14	4.74	66	3.94	68
Chara	white	2.02	3.80	53	2.91	50
Wheat T	red	0.54	2.73	20	1.63	28
<b>F prob</b>					<b>&lt;0.001</b>	
<b>LSD P=0.05</b>					<b>0.511</b>	
<b>CV%</b>					<b>7.1</b>	

The major characteristic of HRZ03.0003 is white grain and with associated current marketing advantages. Multiplication of this line has commenced (now officially to be known as Preston) and seed will be available in Tasmania in 2010. HRZ03.0003 is also somewhat of an anomaly, being high yielding and of milling quality. Unfortunately, it is a spring type and consequently not suitable for very early sowing to graze (probably not before early April). However, the CSIRO white grain line H150.2 is a winter type and as such was advanced into the dual purpose trial at Longford in 2008-09. It performed well for both dry matter and grain production, in addition to the high yields at Symmons Plains. To date it has shown good disease resistance.

Of the mainland white wheats GBA Ruby yielded the highest, but statistically the average yield was not higher than that of Bolac. Ruby has good rust resistance (also no difference between sprayed and unsprayed plots) but is very early maturing which may be a handicap with a more favourable spring. Along with Naparoo and Eaglehawk, this is the first year of trialling these white wheats and further trials are required before making more comprehensive recommendations. Sentinel has been planted in dryland trials the previous 2 years and has not exactly starred. However, it has been suggested it needs good conditions to yield well and was trialled under irrigation at Hagley in 2008-09 where it was one of the better performers. White wheats tend to have lower yields than red wheats but this is more of a function of resources for breeding high yielding white wheats for the HRZ in Australia.

All the high yielding parents from Europe (UK in particular) used for crossing in the CSIRO breeding program are red wheats. One production advantage of red wheats is lack of sprouting prior to harvest (by the end of March it is hoped initial results from a dairy feeding trial comparing red and white wheats will be available and the red grain issue can be satisfactorily resolved later in the year).

Other first year red grained material to perform well was 170, V311 and Beaufort all of which have yielded well previously in interstate trials. The lines K37.18 and K89.44 have both produced high yields in dual purpose and grain-only trials in Tasmania over a number of years but have been generally over-shadowed by 95102.1. Poorer performing CSIRO lines (significantly less than the yield of Mackellar) are not presented here as they are a mass of numbers with little meaning.

The lowest yields were from Chara and Wheat T both being moderately susceptible to stripe rust (the "Jackie" pathotype) and Kellalac moderately susceptible to moderately resistant. Yields from unsprayed plots of these varieties were very low. Yield data from plots receiving the fungicide application were probably biased as the disease had already commenced on the earlier maturing plots when the first spray was applied. However, these lines would still have ranked poorly and with such a large range in variety maturity, it will always be difficult for optimum timing. All of the new CSIRO material was resistant to stripe rust - the main rust issue is obviously with sufficient leaf rust resistance.

The BYDV resistant material rated the worst of all CSIRO lines for susceptibility to leaf rust.

There was frost damage in some of the earlier flowering material, but this was limited to 1-2% losses apart from Chara, Eaglehawk and Kellalac. Minor frost damage was also present in one plot of Tennant which is unusual given the later flowering of this variety. It would appear that a minor frost (-0.3°C) on 17<sup>th</sup> Nov (four days after a 27°C day) and three frosts in early December (lowest temperature of -1.4°C on 4<sup>th</sup> Dec) damaged the developing grain embryo. Differences in flowering date appeared to have little effect on yield, i.e. there were late and early flowering lines at both ends of the rankings.

Earlier maturing material may be less able to capitalise on more favourable spring conditions. Average yields of wheat were around 1t/ha higher than nearby plots of triticale but the range was similar, with the best performing triticale (Hawkeye) yielding 6.2 t/ha and the poorest, 1.7 t/ha. However, due to the susceptibility of all triticale lines to stripe rust, the whole triticale trial was sprayed with 2 fungicides.

### Summary:

Yields overall seemed disappointing, but considering the low rainfall and soil moisture, potential yields were only in the order of 4t/ha and most varieties exceeded this value, some by a large margin.

The top ranking lines tended to be either resistant or possibly tolerant to Barley Yellow Dwarf Virus (BYDV). The worst performing material was moderately susceptible to stripe rust. As well as providing critical information on BYDV resistance, the trial also proved very useful in screening for leaf rust. It is unfortunate that the top BYDV resistant CSIRO lines were moderately susceptible to leaf rust.

The performance of the CSIRO line 95102.1, was disappointing given the very high rankings across 5 years of evaluation, in both dual purpose and grain-only trials. Lack of BYDV resistance would appear to be a major factor in this result justifying further application of insecticides.

Given the perceived problems of red wheat in dairy rations, it is some relief to note that two white grain lines yielded well and multiplication of one of these (Preston) is advanced. Unfortunately seed will not be available until 2010.

Some of the current mainland white grain varieties performed well, but for most this is only the first year of evaluation.

Overall, the performance of the European and NZ lines was reasonably good but only 2 lines could match the best CSIRO lines, both of which are relatively early and may not be able to fully capitalise on a more favourable spring. New lines from overseas will be evaluated in 2009-10.



Above: Wheat trials at Inverleigh, July 2008