Specialist Feed Wheat Hub: fit for purpose dual use wheat

2017 Field component of the dual-purpose feed wheat research

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Farmer 2017 trial hosts: John Howard, Curwen family, Steve & Brad Lynch, David Pyle and Preston family.

Note: In 2017, long season wheat trials were included in WA, for the first time, as part of the National Variety Trials (NVT) program. One long season NVT wheat trial was located at South Stirlings in 2017.

Figure 1: *Steve and Brad Lynch's broad-scale long season wheat trial at Perillup in 2017. This was the highest yielding trial site grown by SCF in 2017.*

Introduction

Stirlings to Coast farmers (SCF) sowed two small plot trials and four broad-scale farmer trials in 2017. A generally wet summer produced optimism for reasonable sowing conditions for winter wheats to be sown in late March to mid-April. Unfortunately, by April the soil profile was starting to dry out and the break in the season was delayed. This meant that most seeding dates were between the 20th of April and the 12th May, apart from Curwen's broad-scale trial which was sown on March 30th.

We confirmed that a late April sowing date suits the long spring type wheats like DS Pascal, Trojan or main season wheats like Scepter and Cobalt. At these sowing dates, there was no yield advantage to growing winter type wheats (like Naparoo, Manning or Longsword) over spring type varieties. DS Pascal is a new APW variety that is approximately 10 days longer than Mace wheat. DS Pascal has a good overall disease resistance package, is high yielding and possesses outstanding sprouting tolerance to pre-harvest rain. NVT yields for DS Pascal have been poor at South Stirlings, Kendenup and Kojonup in 2016 and 17. However, most NVT trial sowing dates were mid-May and our data suggests that DS Pascal is better suited to a mid-April sowing date.

The newly released "Longsword" (formerly RAC-2341) was tested by SCF in 2017. In the main variety trial with two times of sowing (TOS) it yielded nearly 1t/ha less (5t/ha) than the top yielding variety at the site (6t/ha). However, in the intensive nitrogen by seeding rate trial, Longsword and DS Pascal yielded 5.51t/ha and 5.74t/ha respectively from more replicates. Longsword is a winter type wheat, and its ability to achieve 5.51t/ha from a May 12th sowing date is pleasantly surprising. SCF aims to test if an earlier sowing date could increase yields further and if Longsword suits the practice of grain and grazing.

Feed grade wheats did not yield any better than established spring type varieties like Trojan and Scepter. Additionally, Trojan and Scepter are classified as APW and AH respectively, which means they fetch a much higher price than feed grade wheats. SCF research staff speculate that winter type wheats may only achieve competitive yields when sown before April 15th.

The other opportunity for long season wheats is an enhanced ability to graze them with minimal yield penalty and greater management flexibility. SCF will be conducting trials in 2018 to provide data that to address each of these possibilities. A grazing wheat that has a robust final yield and achieves a APW or higher would be a perfect fit for the high rainfall zone in the lower great southern. DS Pascal and Longsword are the two most likely varieties to achieve this goal.

NB: Longsword is currently rated as feed wheat. Wheat Quality Australia is currently assessing Longsword for an Australian Hard (AH) classification.

CBH are currently testing all samples from the 2017 broad-scale and plot trials. It is hoped that a high yielding

feed wheat variety like Cobalt or Naparoo could potentially be blended with another milling wheat or be have an alternate use that would attract a price premium over and above feed wheat.

Both large plot and small plot intensive field experiments were conducted in 2016 and 2017 to examine possibilities for specialised feed wheat production in the SCF target area. The aim of the experiments was to begin investigations that will lead to practical guidelines or agronomic packages for production of wheat suitable for the high energy feed wheat market.

Methods

Potential, specialty feed wheats were tested at four farm sites and sown at, or close to the break of the season in late March or April. At each farm-scale site we measured the farmers "standard practice" wheat or barley package versus the long-season wheat agronomic package. Not all varieties were tested at all sites. Varieties that have a vernalisation, or cold requirement (e.g. Manning) were included, as well as some later maturing spring types such as Trojan and DS Pascal. Main season wheats such as Scepter and Cobalt were also tested at the various sowing dates in 2017.

The main plot trial at Manypeaks included 10 varieties each with two separate times of sowing (TOS) for a total of 20 treatments. The two sowing dates were April 20th and May 12th, 2017, approximately three weeks apart. Kalyx did a fantastic job ensuring that each sowing time was matched to rainfall events. This provided two excellent plant germinations from each TOS date, which meant we could make fair comparisons between the sowing dates.

The plot trials at Manypeaks also included an intensive nitrogen by seeding rate trial for two varieties; DS Pascal and Longsword. Using two varieties to explore nitrogen and seeding rates meant we were able to conduct more intensive treatments to develop the agronomic package for long season wheats.

The small-scale plots were visually rated for plant establishment and early growth, plus regular phenology scoring was conducted by Emma Clarke, DPIRD researcher, from mid-August until physiological maturity. Heavy spring rainfall caused water-logging at the plot trial site, plus the farm-scale sites at Pyle's and Prestons. Curwen's also received heavy rain during this period, but the trial site was very well drained. At Perillup, the amount of spring rainfall received was not excessive and allowed the wheat to achieve excellent final yields.

Results and discussion

Excellent yields were achieved at both the trial plot site and the farm-scale trial sites. Brad and Steve Lynch's trial site, in Perillup, was a stand-out, achieving a top of 7.31t/ha for Cobalt wheat. Prestons's broad-scale trial site was very dry in the April to June period. However, the season turned around with significant rainfall coming in July and continuing for the remainder of the growing season. This site also suffered water-logging late in the season. David Pyle's farm-scale trial also got very wet in the spring from flooding rains. Some of the trial site plots were removed from the data set, due to water-logging damage. Curwen's trial site was seeded into good sowing conditions for winter wheats in WA. We demonstrated that March 30th is far too early to be planting Cobalt, main season wheat in this region. The poor yields from Cobalt were likely due to frost damage because it matured so early. We also included Rosalind barley in the Curwen trial, sown at the later date of May 10th. Rosalind achieved the highest yield at the site by a significant margin. This highlights the local areas suitability to growing barley.

Table 1: Variety by time of sowing (TOS) mean yields at the Manypeaks plot trial site in 2017. TOS 1 was April 20th and TOS 2 was May 10th. Mean yields followed by the same letter do not significantly differ (P =0.05 LSD).

Variety	TOS	Yield t/ha	Significance	Grade	Ranking
Naparoo	1	6.06	a	Feed	1
DS Pascal	2	5.94	a	APW	2
DS Pascal	1	5.80	abc	APW	3
Cobalt	1	5.78	abc	Feed	4
Scepter	2	5.69	a-d	APW	5
Naparoo	2	5.67	a-d	Feed	6
Trojan	2	5.54	a-e	APW	7
Trojan	1	5.40	a-f	APW	8
Cobalt	2	5.40	a-f	Feed	9
Edge-086B10	2	5.37	a-f	N/A	10
Planet barley	2	5.15	b-g	Feed	11
Longsword	1	5.04	c-g	Feed	12
Scepter	1	5.02	c-g	H2	13
Longsword	2	4.97	d-g	Feed	14
Edge-086B10	1	4.84	e-h	N/A	15
Manning	1	4.78	e-i	Feed	16
Sunlamb	2	4.73	f-i	Feed	17
Sunlamb	1	4.14	hij	Feed	18
Planet barley	1	4.05	ij	Feed	19
Manning	2	3.94	j	Feed	20
LSD P = 0.05					***0.7811***
Standard Deviation					***0.4753***
CV					***9.26***

➤ The plot trials top yielding variety was Naparoo, which was sown on the 20th of April. Naparoo is a true winter type that needs early sowing to be successful in WA. The next best performers in the plot trials were Cobalt, DS Pascal and Scepter. DS Pascal achieved little yield differences between the two seeding dates. This indicates that April 20th – May 12th appears to be a suitable window to seed that variety in the local area. Scepter had a big yield difference between each TOS indicating that it was much better suited to the May 12th sowing date. Trojan and Longsword were also very stable between each TOS indicating suitability to this sowing window. Longsword is a true winter type that currently has little WA data available. Further TOS trial data is required to investigate how much earlier the variety can be sown and whether this will lead to increased yields.

Sunlamb was much better suited to the second TOS. However, the yields of Sunlamb across all trial sites were generally poor, indicating a poor fit for our environment. The coded line from Edstar Genetics, Edge0618B10, is a long spring type wheat. Yield performance was fair in this trial and warrants further testing in 2018. Manning wheat was the latest maturing variety in this data set. The yield achieved at TOS 1 was still inferior to other varieties in the trial. At the Curwen trial site, located only 10km north of the plot trials, Naparoo yielded 0.74t/ha more than Manning, with a March 30th sowing date. Trial results from 2016 and 2017 suggest that Manning and Sunlamb are not suitable to our local environment.

Finally, the new barley variety "Planet" was included in this trial as a reference. TOS data indicate that May 12th was a more suitable sowing date than April 20th. Barley traditionally yields more than wheat in the local area. In this trial, the wheat yielded higher and achieved greater revenue per hectare.

Although Naparoo topped the yields of the plot trials, its highest achievable grade is only feed. Farmers are more interested in revenue generated per hectare, rather than yields alone. Revenue was calculated by multiplying yield by price. Table two shows the top five revenue grossing varieties, are all milling grades or higher. Naparoo (TOS 1), the highest yielding variety, is sixth on this list and achieves a gross revenue of $185 less than Scepter (TOS 2).

Table 2: Variety by time of sowing (TOS) yields and gross revenue ($/ha) at the Manypeaks trial site in 2017. TOS 1 was April 20th and TOS 2 was May 12th. Mean yields followed by the same letter do not significantly differ (P =0.05 LSD). Wheat prices were calculated on the 14th of February 2018.

Variety	TOS	Grade	Price $/tn	Revenue ($/ha)	Difference $	Ranking
DS Pascal	2	APW	270	1603	0	1
DS Pascal	1	APW	270	1565	-38	2
Scepter	2	APW	270	1537	-67	3
Trojan	2	APW	270	1497	-107	4
Trojan	1	APW	270	1458	-145	5
Naparoo	1	Feed	240	1454	-149	6
Scepter	1	H2	288	1445	-158	7
Planet barley	2	Feed	275	1417	-186	8
Cobalt	1	Feed	240	1386	-217	9
Naparoo	2	Feed	240	1360	-243	10
Cobalt	2	Feed	240	1295	-308	11
Edge-086B10	2	N/A	240	1288	-315	12
Longsword	1	Feed	240	1209	-395	13
Longsword	2	Feed	240	1192	-412	14
Edge-086B10	1	N/A	240	1162	-441	15
Manning	1	Feed	240	1147	-456	16
Sunlamb	2	Feed	240	1134	-469	17
Planet barley	1	Feed	275	1113	-490	18
Sunlamb	1	Feed	240	993	-610	19
Manning	2	Feed	240	945	-658	20

Table 3: Summary of mean yields (t/ha) of the the nitrogen (N) rates by seed rates (kg/ha) trial, conducted at Manypeaks in 2017. All treatments received 125kg/ha Gusto Gold (12.5 units N) at sowing. Urea was applied by hand. N1 & N2 had Urea applied from two applications. N3 & N4 had Urea applied with four separate applications.

N Treatment	DS Pascal 90 kg/ha	Protein %	DS Pascal 140 kg/ha	Protein %	Longsword 90 kg/ha	Longsword 140 kg/ha
N1- 71 units	5.67a-e	11.2	5.52b-e	11.4	4.88f	5.33c-f
N2- 101 units	5.21ef	11.1	5.50b-e	11.4	5.25def	5.35c-f
N3- 145 units	5.88abc	12.8	6.16a	11.2	5.72a-e	5.77a-e
N4- 182 units	5.81a-d	13.0	6.19a	13.2	5.75a-e	6.05a-b
LSD P = 0.05						***0.57***
Standard Deviation						***0.27***
CV						***4.7***

The yield benefits from feed wheats, are not high enough to compensate for the lower price achieved in SCF trials. At a mid-April sowing date, local farmers should be growing traditional spring wheats that achieve grades of APW or higher. To test the yield performance of winter type wheats further, we need to get more data from early April sowing dates. We also need to further evaluate the benefits of grazing winter wheats to add value to the mixed farming enterprise. Plans are under way to test each of these objectives in 2018.

Table three shows no significant differences between seeding rates of 90 to 140kg/ha. However, there is a trend towards greater yields at the higher sowing rate, with three of the four 140kg/ha treatments, yielding higher than the 90kg/ha treatments. Increasing N rates tended to increase mean yields for all treatments as would be expected.

DS Pascal shows a significant difference between the N2 (101 units) rate and the N3 (145 units) rate. Longsword shows a similar trend between these two N rates, but the difference is not statistically significant. Neither variety has significant differences between the N1 and N2 treatments or the N3 and N4 treatments. This indicates the optimum N application in this trial, for N use efficiency and yield, is N3 (145 units) for both varieties at both sowing rates.

Table four summarises the broad-scale yields for each of the four sites. The broad-scale sites work in tandem with the plot trials to validate the data in more realistic farming conditions. The control treatment for each trial site was Trojan wheat, except for Curwen's trial site, where Rosalind barley was used.

Table 4: Grain yield (t/ha) from the broad-scale dual-purpose long season wheat trials in 2017. The asterisk indicates a result based on one replicate only. Interpret these numbers with caution. Yield's in bold indicate the top yield at that trial site.

Farmer	Curwen	Lynch	Pyle	Preston
Variety	**t/ha**	**t/ha**	**t/ha**	**t/ha**
Rosalind	5.23			
DS Pascal		6.64	4.72	3.8
Trojan		6.92	3.57*	4.12
Cobalt	2.8	7.31	4.5	4.78
Naparoo	4.55	6.62	3.97	3.87
Longsword			4.46	4.51
Mace -3/6				3.32
Manning	3.81			
Sunlamb	3.01	4.95	3.6*	3.2
Site mean	3.88	6.49	4.14	3.94
Location:	**S. Stirlings**	**Perillup**	**Manypeaks**	**Cranbrook**
Sowing date:	**March 30th**	**April 27th**	**April 26th**	**April 20th**

In two of the four trials, the farmer control had the greatest revenue and a third site, Prestons's, Trojan was ranked second. Trojan remains a very well adapted variety in local conditions. New varieties and agronomic packages need to be measured against this varieties performance.

The same trends were evident in the broad-scale trials as the plots. Cobalt yielded extremely well with a mid-late April sowing date. Naparoo was a solid achiever

➤ **Table 5:** Revenue per hectare ($/t) in the broad-scale long-season wheat trials in 2017. Revenue was calculated by the price (February 14th 2018) multiplied by the yield (t/ha). The asterisk indicates a result based on one replicate only. Interpret these numbers with caution.

Farmer	Curwen	Lynch	Pyle	Preston	Revenue Ave.	Difference
Variety	**$/ha**	**$/ha**	**$/ha**	**$/ha**	**$/ha**	**$/ha**
Rosalind	1438				1438	0
DS Pascal		1793	1227	988	1336	-102
Trojan		1868	964	1112	1315	-123
Cobalt	672	1754	1080	1147	1163	-275
Naparoo	1092	1589	953	929	1141	-298
Longsword			1070	1082	1076	-362
Mace -3/6				956	956	-482
Manning	914				914	-524
Sunlamb	722	1188	864	768	886	-553
Site mean	$968/ha	$1638/ha	$1026/ha	$998/ha		
Location:	**South Stirlings**	**Perillup**	**Manypeaks**	**Cranbrook**		
Sowing date:	**March 30th**	**April 27th**	**April 26th**	**April 20th**		

across all sites without being exceptional. DS Pascal and Longsword generally performed very well, although there was only enough seed to include Longsword at two sites. Longsword is currently undergoing evaluation by Wheat Quality Australia, for an Australian Hard (AH) grading. A classification of AH will make a massive difference to profitability compared to its current grade of feed. DS Pascal was granted APW classification in WA in 2017.

SCF have identified Longsword and DS Pascal as two varieties with a potential fit for our area. Both varieties have limited yield data available in WA conditions. DS Pascal has performed poorly in NVT trials at South Stirlings and Kendenup in 2016 and 2017. However, the sowing dates for each of these trial sites has been mid-May. SCF 2017 trial data suggests mid-April is the ideal sowing time for DS Pascal. Longsword is a true winter type, which make its yield stability with sowing dates from April 20th to May 10th, somewhat surprising. SCF aim to test the yield potential of Longsword with earlier sowing dates and to test its suitability for grazing.

Cobalt remains a very high yielding feed wheat that should be sown in the traditional "main" season wheat sowing window. Farmers remain pessimistic about growing feed grade wheats in their programs. Quality testing of all long-season wheats in the 2017 SCF program is ongoing with CBH, AEGIC and Agrifoods. Cobalt ultimately needs a boost in price to achieve any level of adoption from SCF members. Naparoo needs more data with earlier sowing dates to fairly test its viability in our local environment.

Grain yield results from the 2016 and 2017 season were reviewed based on growing seasonal rainfall. For example, for a location where the growing season rainfall (GSRF) was 450mm and an average one third of it was lost due to soil evaporation, run-off and deep drainage, and the transpiration use efficiency is assumed to be 20kg/ha/mm, then the potential grain yield can be estimated as < Ypot= (GSRF - GSRF/3) x 20 or (450-150) x 20 = 6t/ha >.

The small plot experiment produced yields approaching this estimated potential indicating that the varieties and management variables tested were satisfactory for the season. The chief challenge for farmers in all seasons is to match the management to the seasonal conditions.

We have identified some varieties that will be suitable for our farming systems in the lower Albany port zone. Precise quality specifications are not yet known and end product testing is in progress with CBH, AEGIC and Agrifoods. Collaboration with plant breeders from Australian Grain Technologies (AGT) and Dow AgroSciences is being negotiated to test new "unreleased" varieties in the SCF long-season wheat trials in 2018. These varieties will replace Manning and Sunlamb which are unsuitable to our local environment.

Figure 2: *Curwen's feed wheat trial site in 2017 at South Stirlings. This trial was sown into a moist soil profile on March 30th.*