2018 TRIALS REVIEW

GROWING AGRICULTURE TOGETHER

Welcome to the Stirlings to Coast Farmers 2018 Trials Review

The following reports are a summary of the project work that has been completed by Stirlings to Coast Farmers in the past 12 months. A lot of effort was made to ensure high quality assessments were conducted and the scientific analysis of the data was appropriate for each individual data set.

Our objective with all field trials, is to provide our members with high quality, relevant, useful data for our unique local conditions. Not every project or trial will suit individual farm businesses, but hopefully most do. SCF aims to investigate solutions to our member's farming problems and present that information to aid farm decision making with local data.

Two of our major projects from the last three years will be finishing this year. The *'Paddock to Plate' Value Chain for Noodle Wheat* (GGRD 2015-0050-AGSC) and the *Specialist Feed Wheat Hub* (GGRD 2015-0014-AGSC) have been projects aimed at addressing the lack of diversity in local cropping systems. History shows that a canola-barley dominant cropping rotation will eventually run into problems with herbicide and fungicide resistance.

Long-season wheats and noodle wheat varieties offer different agronomic and logistical options for SCF members which can lead to substitution of barley to wheat hectares with little difference to profits when managed correctly. The final year's results and conclusions from these two wheat projects are reported in this booklet. A full technical report with agronomic recommendations will be forthcoming.

SCF would like to take the opportunity to thank the farmers who hosted trials in 2018 and gave their time, machinery and expertise to the group as well as the wider agricultural industry. It is also important to recognise the input from sponsors and partners to our project work. By working collaboratively, we can maximise the value obtained from each project and the quality of the information presented to our members.

Stirlings to Coast Farmers (SCF) are a local, not-for-profit farmer group in the southern Albany Port Zone of WA. Our group has a steadily increasing membership of 200 individuals, representing 80 mixed (livestock and cropping) farming businesses and over 350,000 hectares of farmland. SCF has an extensive field trials program, testing a range of cutting-edge research under local conditions to help our members improve their business profitability and sustainability.

For more information about SCF and our current projects, see our website http://www.scfarmers.org.au/

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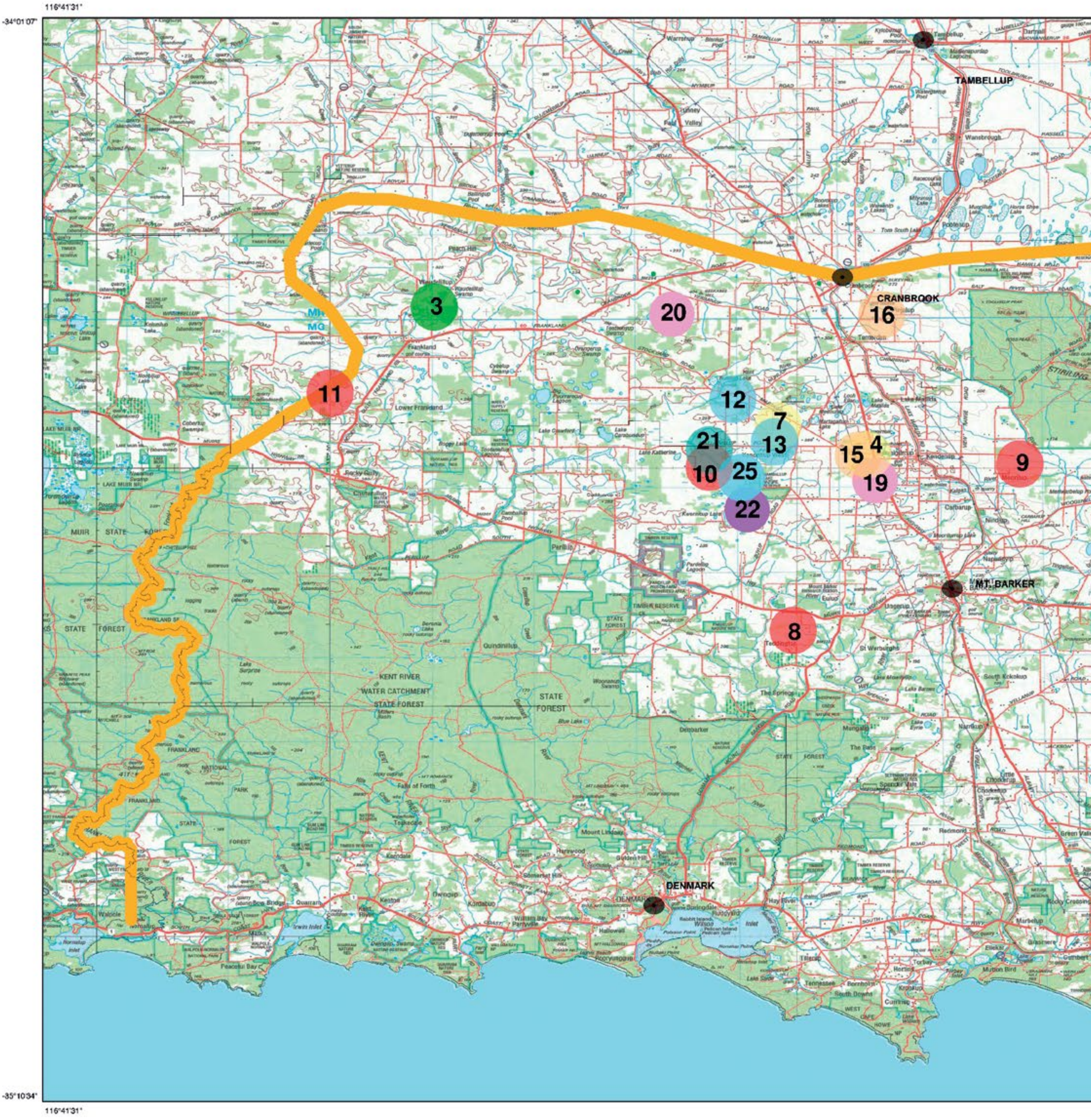

Legend

SCF Trial Sites	.LGA Boundaries
SCF Area	Towns
	Roads & Highways

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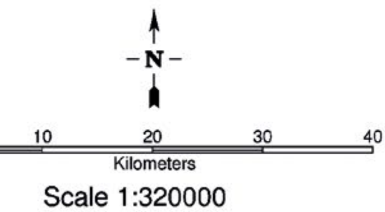
Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

STIRLINGS TO COAST FARMERS

ERS GROUP - TRIAL SITES 2018

Site	Project	Trial name
1	GRDC Ripper Gauge	Goad
2	GRDC Legumes demonstration	Slattery
3		Hilder
4	Long season wheat trial	Mackie plot trial
5		Hood broad scale trial
6		Curwen broad scale trial
7		Slade broad scale trial
8		Lynch broad scale trial
9	Noodle wheat trial	Kirkwood plot trial
10		Hall broad scale trial
11		Beasley broad scale trial
12	MLA Producer demonstration site	Beech's grazing oats
13		Slade's sheep eID tags
14		Curwen's grazing wheat
24		Hood's Summer grazing
15	Lime trial	Mackie- lime sources
16		Tomlinson- lime efficiency
17	Soil health	Goad-DPIRD deep ripping
18		Curwen-DPIRD deep ripping
19		Wood- Nil disturbance trial
20		Preston- Phosphorous rate trial
21	Farmer canola variety trial	Hall
22	Pivotel Cross Farm NBN	Slade "Smart Farm"
23		Adams "Smart Farm"
25	IoTag GPS Collar Grazing trial	Slade grazing demonstration



Acknowledgments:

Background image Oz Explorer 250-Kmosaic

Contents

Paddock to plate value chain for high rainfall zone noodle wheat

BACKGROUND

The aim of the SCF Noodle wheat project has been to demonstrate to grain markets and local farmers that high quality noodle wheat can be grown in the southern HRZ and that it will produce similar profitability to barley and canola.

A secondary aim to the project was to create new marketing opportunities for noodle wheat growers in the HRZ that will provide a more stable and, hopefully, premium price by selling directly into niche markets in the Asian region.

Adding noodle wheat to local cropping rotations will aid in relieving disease and herbicide resistance pressures on barley and canola crops in the area.

SUMMARY:

Both broad-scale noodle wheat trial sites achieved above average yields and the late break to 2018 made the high yields achieved even more significant. The trial at Frankland River, hosted by Jon Beasley, suffered frost damage from an event on 8 November 2018. Grain yields remained high, but grain quality suffered with the falling numbers being poor enough for the wheat to miss the noodle grade specifications. It is likely that the poor falling number of Ninja was caused by the unusual late frost. 2018 was the first season the new ANW variety 'Kinsei' was tested in broad-scale farmer equipment trials. The yield advantages shown by Kinsei in the 2017 plot trials were repeated in the 2018 broad-scale trial data.

NB: *Kinsei was formerly known as IGW-8048 before being released officially in 2018*

SCF farmers are now confident to trial Kinsei plantings in the 2019 season which should lead to widespread adoption in the local area. Kinsei appears to be a very high yielding option for local farmers whilst delivering superior ANW wheat to produce Udon noodles. Growing Kinsei will be favoured by high rainfall zone growers over the long-standing noodle varieties Calingiri and Zen, whilst also yielding competitively with milling varieties Trojan and Scepter.

SEASON OVERVIEW 2018

In broad terms, farming areas in the Mt Barker and Kendenup regions had an excellent cropping season in 2018, despite crops and pastures having a slow start due to late breaking rains. The north eastern regions of Albany, South Stirlings and Green Range experienced a much more challenging season due to low rainfall, multiple wind erosion events and damage from fires in some cases. A planned broad-scale noodle wheat trial site was abandoned in the South Stirlings area due to the farmer host suffering excessive wind erosion in April and again in May.

The 2018 season was characterised overall by very dry conditions and severe wind erosion events through the autumn and early winter periods. Poor sowing conditions made it impossible to sow the broad-scale trials in late May, which would have been our preference.

TRIAL DETAILS

A mixture of broad-scale and small plot trials were established for the 2018 growing season at a range of locations within the Stirlings to Coast Farmers membership region. Table 1 summarises the 2018 trial information.

Table 1: Summary SCF 2018 noodle wheat program and locations / varieties tested.

Farmer	Beasley	Hall	Lynch	Slade	Kirkwood
Trial scale	Farm scale	Farm scale	Farm scale	Farm scale	Small plots
Location	Frankland	West Kendenup	Forest Hill	West Kendenup	Tenterden
Sowing date	4 June	11 June	27 April	9 May	16 June
VARIETY					
Kinsei					
Ninja			na		
Zen			na	na	
Calingiri			na	na	
Trojan			na		

Note: *Green shading indicates trial sites that were sown with that variety*

➤ **Table 2:** Summary of total rainfall and growing season rainfall (in green) for the three noodle wheat trial sites in 2018. Trials were located at Frankland (Beasley), West Kendenup (Hall) and Tenterden (Kirkwood). The numbers represent millimetres of rainfall.

Farmer	J	F	M	A	M	J	J	A	S	O	N	D	Total	GS Rainfall
Beasley	14	7	12	**18**	**25**	**74**	**110**	**141**	**30**	**40**	21	21	512	**437**
Hall	34	8	14	**14**	**21**	**64**	**78**	**118**	**26**	**40**	28	36	481	**362**
Kirkwood	28	13	11	**19**	**17**	**65**	**68**	**112**	**31**	**33**	25	16	439	**345**

Despite difficult seasonal conditions, two trial sites were sown west of the Albany highway in early June. These sites were hosted by farmers Jon Beasley and Anthony Hall at Frankland River and Kendenup respectively. The small plot trial was sown onto a Pea stubble on 16 June 2018. Despite the late sowing date this trial also produced enough biomass to suggest that yields of at least 4t/ha were possible in season 2018. The small trial plots were replicated effectively into two sub-trials. This allowed us to have two harvesting dates to determine the effects on grain quality from harvesting early (as soon as the crop was ripe) compared to leaving the wheat until later in the harvest.

RESULTS – BROADSCALE FARMER TRIALS

Frankland River site

The Frankland River trial site experienced a frost on 8 November, which may have damaged the noodle wheat grain and reduced falling number readings. It is unclear how much the frost event affected final grain yield, given it came so late and yields were still high.

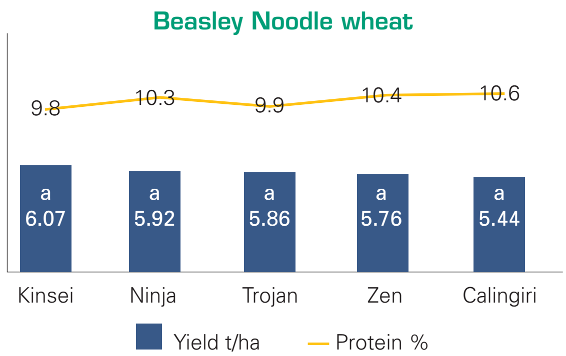


Figure 1: *Summary of grain yields and grain protein content from the broad-scale noodle wheat trial sown on 4 June 2018, in Frankland. Trial was hosted by Jon Beasley.* **NB:** *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Kendenup site

The standout yield performer at the Kendenup wheat trial was the new variety, Kinsei. This broad-scale result backed up the data generated by the 2017 noodle plot trials sown in the same locality. Data from 2017 and 2018 indicate that Kinsei is a good fit for this region and many farmers in the area are keen to grow Kinsei in 2019.

There was no difference between Ninja, Zen and Calingiri but it was interesting to note that they all yielded higher than Trojan (APW) which has been a consistently higher yielding wheat in the last five years in this area. Kinsei had a slightly lower protein percentage in this trial but that is likely due to a yield dilution effect.

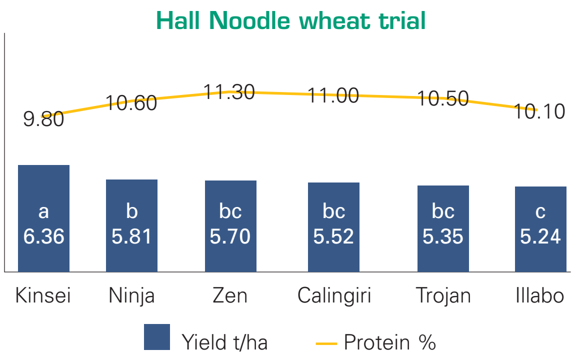


Figure 2: *Summary of grain yields and protein percentages from the broad-scale noodle wheat trial conducted in at Anthony Hall's farm in Kendenup WA. The trial was sown on 11 June 2018.*
NB: *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*
NB: *Illabo is a dual-purpose winter wheat that was included at this site because of late seed arrival. Illabo is a new feed variety from AGT which we are investigating as part of the long-season wheat project.*

Falling numbers

The falling number results were better at the Kendenup farm trial than the Frankland farm trial. New varieties Kinsei and Ninja, however, both failed to average 300 for falling numbers, which means they missed the noodle grade specifications. The reasons for this are unclear but late frosts may have been a factor. Falling number averages for Zen and Calingiri were over the threshold of 300 (Figure 3).

Anthony Hall seeding.

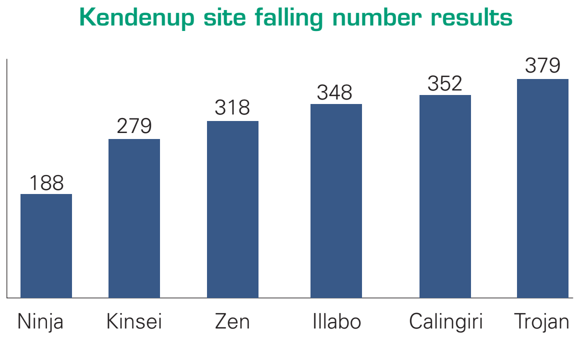


Figure 3: *Summary of falling number averages (three replicates) of the varieties tested at the Kendenup site.*

RESULTS – SMALL PLOT TRIAL

The noodle wheat plot trials were sown on June 16, which was much later than preferred due to the late break to the season. Yield potential was automatically set lower, but SCF researchers believed yields of approximately 4t/ha were still possible from this sowing date. The main aim of the noodle plot trials was to assess the differences in grain quality achieved from harvesting at two distinct timings.

Trial contractors Kalyx were able to harvest on 10 December and 21 December. The most interesting result to note is that the first time of harvest (TOH 1) yielded significantly more than the second (TOH 2). Investigations have not been unable to uncover the reasons for this but it is more likely an environmental effect at the trial site rather than the harvest timings.

WHY IS THE FALLING NUMBER SO IMPORTANT IN NOODLE WHEAT PRODUCTION?

The falling number test gives an indication of the activity of enzymes called alpha amylase and protease in wheat. The presence of alpha amylase and protease are an indication that changes, linked to germination or sprouting, are beginning to occur in the grain. Grains that have begun to germinate contain starch and proteins that are 'damaged', making them unsuitable for products like bread and pasta.

The falling number value is directly related to the dough quality, or its 'strength'. Pasta manufactured from wheat with a low falling number can have reduced shelf life, may lose starch to cooking water, and become unacceptably soft or fragile when cooked.

INDUSTRY COLLABORATION AND NEW MARKET DEVELOPMENT

Plant breeders (Intergrain) are producing new noodle wheat varieties which offer improved yields and better agronomic packages, such as the recently released Kinsei and Ninja. However, selling noodle wheat to the highly regulated but preferred Japanese market is a challenge for plant breeders and marketers. Developing new market opportunities requires a more collaborative effort between WA growers and marketing partners. This includes working together to host business delegations from overseas markets, including tours of the region and meetings with growers.

SCF is in the process of setting up a sheep, beef and grains co-operative for WA farmers for high value niche products from WA farms. China-based consultant, Nick Hunt, has been engaged by SCF to approach Asian customers on our behalf. This work has generated strong interest from many Udon processors in sourcing noodle wheat from our region, through the new co-operative. Nick Hunt has been successful in securing customer interest in Thailand, Vietnam, South Korea, China and Japan.

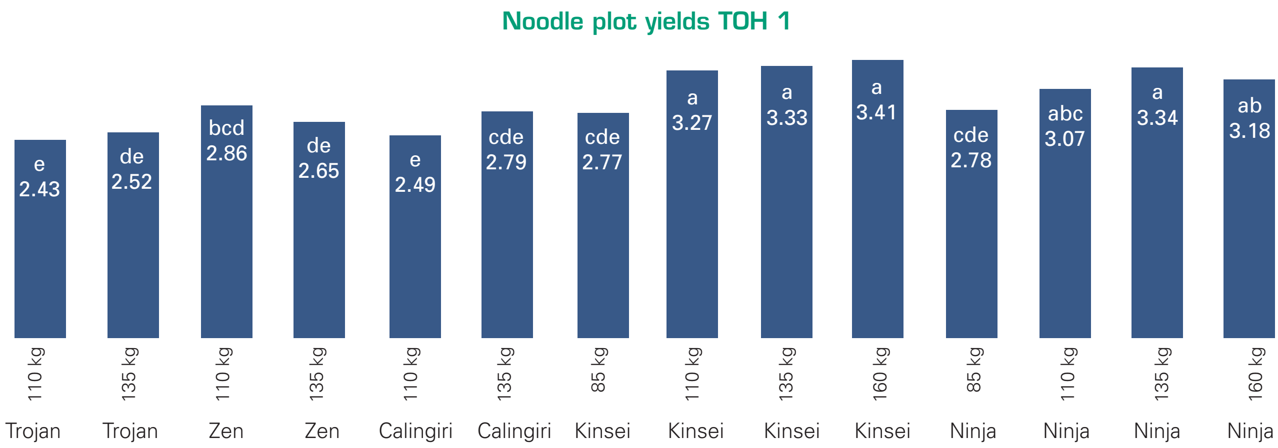


Figure 4: *Average grain yield (t/ha) for first time of harvest (TOH 1) at the Tenterden noodle wheat trial sown on 16 June 2018. Trial was hosted by the Kirkwood family.* **NB:** *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

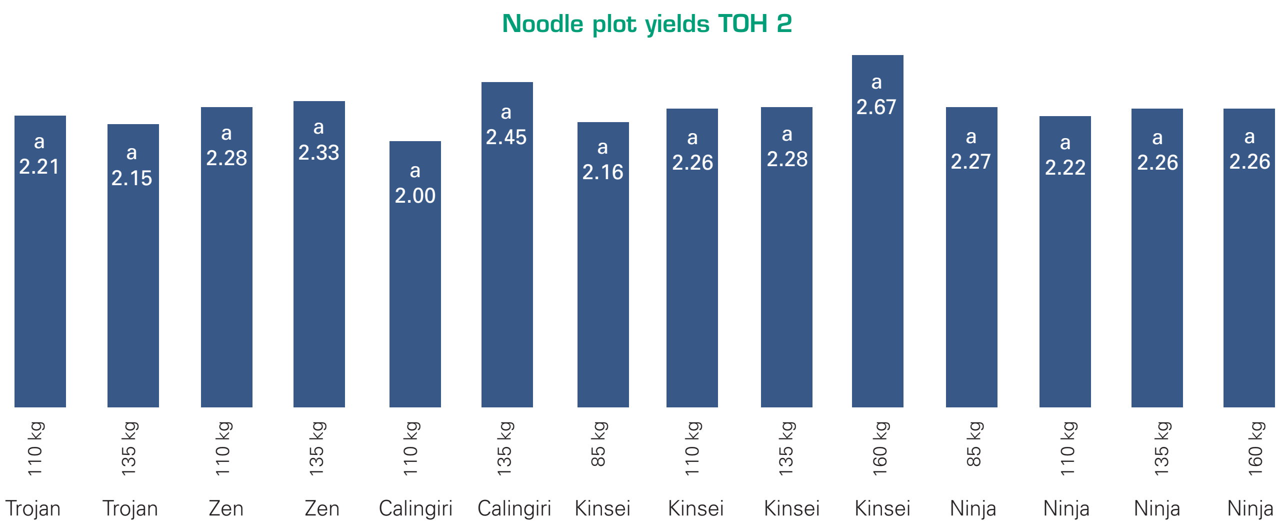


Figure 5: *Average grain yield (t/ha) for second time of harvest (TOH 2) at the Tenterden noodle wheat trial sown on 16 June 2018. Trial was hosted by the Kirkwood family.* **NB:** *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

SCF have sent some small 2018 grain sample consignments from our member's farms to buyers in China, Thailand and Vietnam in May 2019. SCF have partnered with Curtin University to test the noodle wheat samples and send through the university-to-university international distribution channels. SCF will also send a small delegation to China and Vietnam later in the year to meet some of these customers and discuss their view on noodle wheat quality from our region. The aim is to then negotiate terms and expand to container loads or small shipments as we develop longer-term contracts in niche, high value markets.

SCF has also undertaken a short assessment of the costs and benefits of a range of shipping and handling options.

Securing new customers in a range of Asian countries is expected to help expand the local noodle wheat industry and ensure consistent supplies of this crop, which can attract price premiums of up to $50-100/t compared to hard wheats.

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This project was supported by funding from the Department of Primary Industries and Regional Development Grower Group Development R4R fund.

Specialist feed wheat hub: fit for purpose dual use wheat

BACKGROUND

Winter wheat varieties allow wheat growers to sow much earlier than currently practiced, meaning a greater proportion of crops will be seeded in their ideal sowing window. This is especially useful to farmers with large cropping programs. Sowing earlier requires varieties that are slower developing.

For sowing prior to April 20, winter varieties are required, particularly in regions of high frost risk. Winter wheats will not progress to flower until their vernalisation requirement is met (cold accumulation), whereas spring varieties will flower too early when sown early. The longer vegetative period of winter varieties also suits crop grazing.

Flowering time is a key determinant of wheat yield. Winter varieties have stable flowering dates across a broad range of sowing dates. This has implications for variety choice as flowering time cannot be manipulated with sowing date in winter wheats as it can in spring wheat. This means different winter varieties are required to target the varied optimum flowering windows that exist in different environments.

For the last three years Stirlings to Coast Farmers have been investigating the use of long-season wheats into local cropping and grazing systems. By growing farmer-scale trials and small-plot trials we have also been able to identify some of the key agronomic requirements to be successful in our environment.

2018 Season

Time of sowing plot trial

Due to the late break to the season in 2018 and frost damage to the spring wheat varieties in the first time of sowing (TOS), the second time of sowing achieved higher yields for the 12 common varieties from both TOS dates. The 12 common varieties have a mixture of spring wheats and winter-type wheats within the group.

Sowing a spring-type wheat earlier means the flowering date will also be shifted earlier which increases the risk and severity of frost damage. Winter wheats are suited to an earlier sowing date because they have a more stable flowering period compared to spring wheats. The mechanisms controlling variety maturity are a combination of photoperiod and vernalisation which differ for every wheat, winter or spring-type.

Photoperiod response is the plant's response to day length (number of daylight hours in a day). I.e. A winter type wheat will not move into the reproductive stage of development until longer days occur. Varieties responsive to vernalisation require a period of cold temperatures before they will move from the vegetative stage to the reproductive stage. Winter wheats have a stronger vernalisation and/or photoperiod response compared to spring wheats which is why they maintain stable flowering dates when sown earlier.

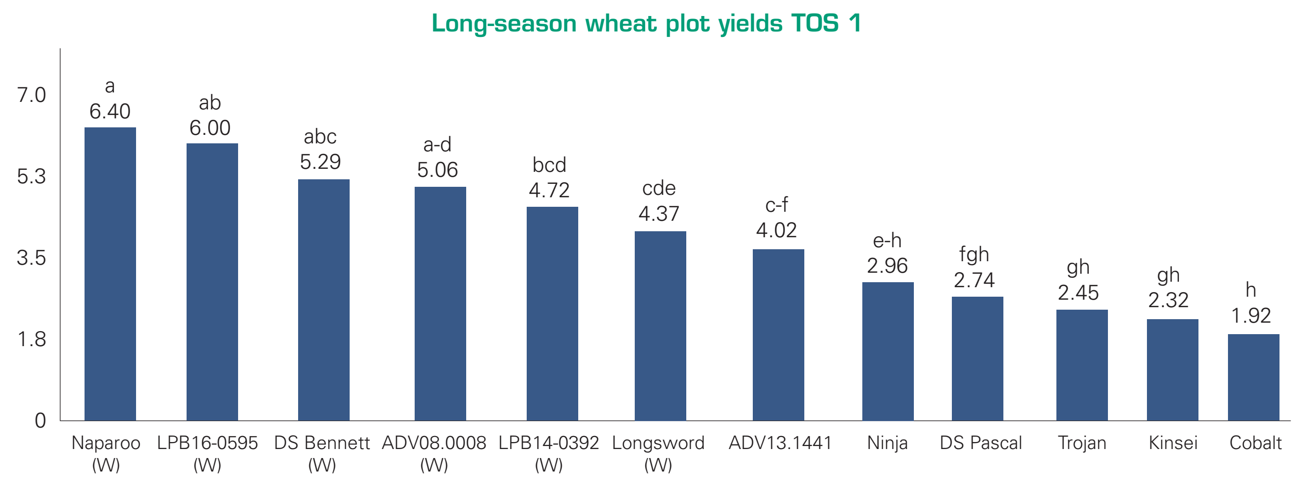

Figure 1: *The yields (t/ha) of 12 wheat varieties grown at Kendenup & sown on 12 April 2018. Variety names followed by a (W) indicate a winter-type wheat.*
Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

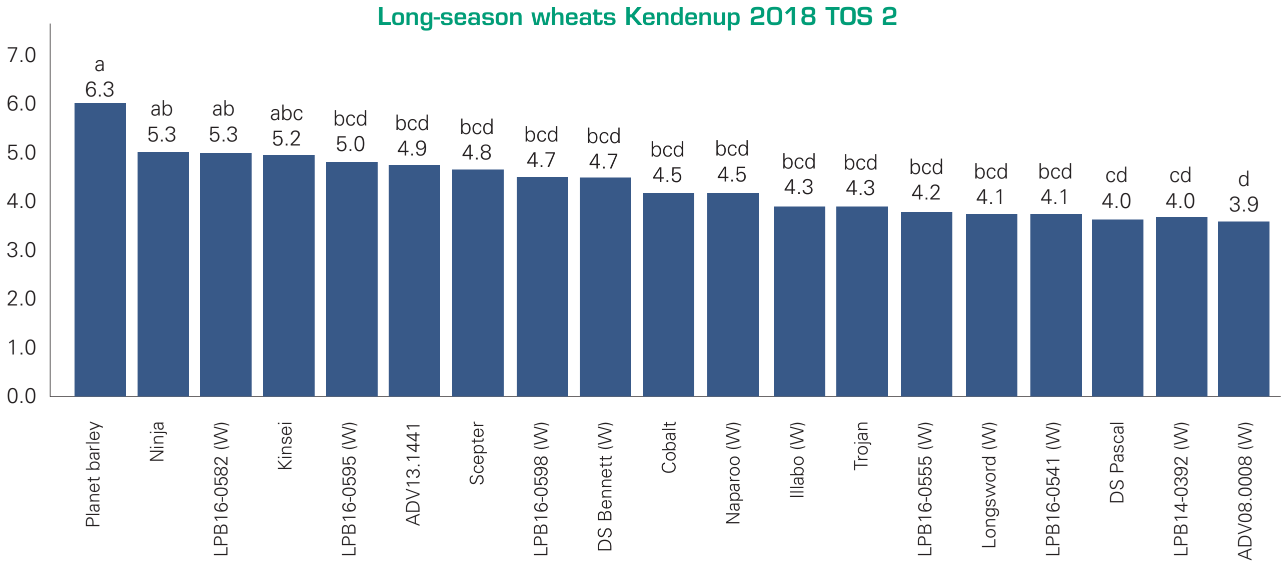

Figure 2: *The yields (t/ha) of 18 wheat and one barley variety grown at Kendenup, sown on May 24, 2018. The lowest yielding variety achieved a yield of 3.9t/ha indicating minimal frost damage occurred at this sowing date. The highest yielding treatment was Planet barley at 6.3 t/ha.*
Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Results

Summary TOS 1- 12 April 2018

- The top six yielding varieties were all winter wheats. Winter wheats achieved higher yields because they flowered outside the frost window despite being sown early.
- The bottom five yielding wheats were spring-type wheats which yielded poorly due to frost damage during grain fill.
- Scepter wheat and Planet barley were planted in TOS 1 but had to be removed from the TOS 1 statistical analysis because of bird damage.

Summary TOS 2- May 24, 2018

- Planet barley yielded 1t/ha greater than the best wheat variety in TOS 2.
- Noodle wheat varieties 'Ninja' and 'Kinsei' yielded equal first and third for wheat treatments in TOS 2.
- A late frost on November 7th & 8th may have reduced grain yields in the winter-type wheats in TOS 2.
- The frosts on September 15th and 16th did not appear to cause yield damage to the spring-type wheats in TOS 2.
- The top yielding wheat variety from TOS 1, Naparoo, yielded much less (1.9t/ha) in TOS 2 indicating the necessity for Naparoo to be sown early.

Summary of TOS 1 and TOS 2 yields combined

- The two stand-out wheat varieties from TOS 1 were Naparoo and the experimental variety, LPB16-0595 from Longreach Plant Breeders.
- The second and third ranked wheat varieties in TOS 1, LPB16-0595 and DS Bennett, maintained reasonable yields in TOS 2. Yield stability at later sowing dates is an important trait for winter-type wheats in our environment.
- All winter type wheats yielded more in TOS 1 compared to TOS 2. Conversely all spring-type wheats yielded more in TOS 2 than TOS 1.
- Five of the six spring wheats yielded significantly less than the winter-type wheats in TOS 1. The exception was ADV13.1441 which statistically equivalent to the lower ranked winter wheats. We suspect the spring-type wheats suffered yield losses due to frost events on September 15-16th and to a lesser extent on August 18-19th, 2018.
- The yields of Longsword and DS Pascal were disappointing in both TOS in 2019. It is likely sowing dates were either too early or too late for optimum yields for each variety.
- Irrigation of TOS 1 was done via disposable drip line. The equivalent of 13mm of rainfall was placed directly onto each row of each plot.
- The third replicate of TOS 1 germinated poorly due to the non-wetting soil. We did not apply enough water for an even germination on that soil type. The third replicate of TOS 1 was discarded from the statistical analysis.

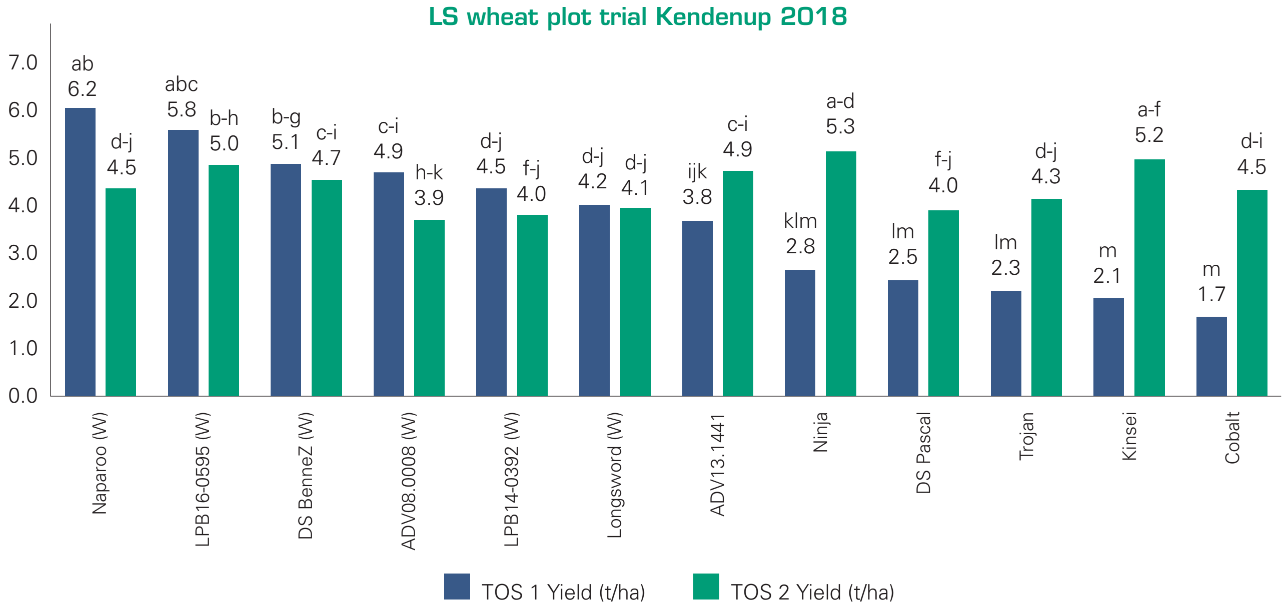

Figure 3: *Shows the yields (t/ha) of the 12 common wheat varieties in TOS One and Two at the Long-season wheat plot trials at Kendenup in 2018. TOS 1 was April 12 and TOS 2 was May 24. Variety names followed by (W) indicate a winter-type variety.*

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Table 1: Summary of grain yields (t/ha) of the broad-scale long-season wheat trials grown in 2018. Sites encountered a range of environmental conditions including frosts. Please interpret data with caution. (W) Indicates a winter-type wheat.

Host	Lynch	Hood	Slade	Curwen
Location	Perillup	Kojaneerup	West Kendenup	South Stirlings
Sowing date	April 27th	May 4th	May 9th	April 12th
GS Rainfall	414 mm	221 mm	362 mm	256 mm
ADV.0008 (W)	6.7ab			3.4a
Cobalt	4.3d	3.6b	4.6b	
DS Bennett (W)	7.3a	3.3bc		3.3a
DS Pascal	5.5bc	3.2c	3.7d	1.3b
Kinsei	5.8bc		4.3bc	
Longsword (W)	5.1cd	3.3bc	4.2c	3.3a
Ninja			4.0cd	
Trojan		2.7d	4.3bc	
Planet Barley		4.8a	6.1a	

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)

Broad-scale long-season wheat trial summary 2018

- The best yielding trial site was Lynch's at Forest Hill in 2018. This site received the most rainfall of the four trial sites. Even higher yields could be achieved, with winter wheats, if sowing was earlier than April 27. In 2019, Brad and Steve Lynch have planted DS Bennett in mid-March to take advantage of the moisture supplied by thunder storm activity. SCF will monitor the crop and update members.

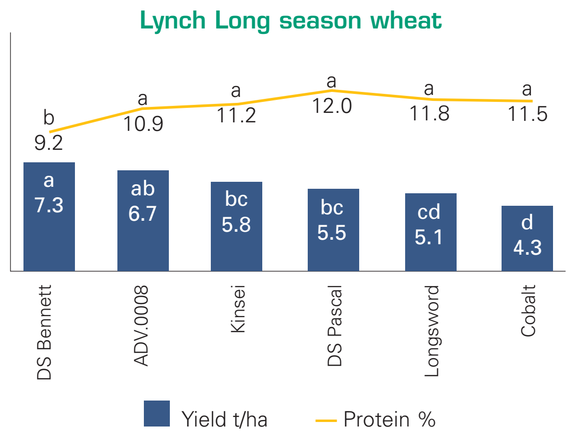

Figure 4: *Summary of the grain yields and percentage protein at the Lynch's Long-season wheat trial at Forest Hill in 2018. Trial was sown on April 27, 2018 and received 414mm of rainfall for the growing season.*

LS wheat plots August 30th 2018

TOS 2 plots August 15th 2018

- The new noodle wheat variety Kinsei (longer spring-type wheat) yielded competitively at the West Kendenup and Forest Hill trial sites.
- Apart from Forest Hill, the other three sites suffered from dry starts, which meant spring-type wheat yields were favoured over winter-wheats. That is why Cobalt was the top-yielding wheat at the Kojaneerup and West Kendenup sites
- Although Cobalt was the top-yielding wheat at Kojaneerup and West Kendenup, it did not match the Planet barley which yielded 1.2 and 1.5t/ha more than Cobalt at each site respectively. The shorter growing season benefitted barley over wheat and the difference in yields in 2018 were significant.
- The West Kendenup site included noodle wheat varieties Kinsei and Ninja. The yield of Kinsei was not significantly different to the top yielding Cobalt whilst Ninja was competitive with all other wheat varieties at the site.
- The Curwen trial site was sown exceptionally early into stored sub-soil moisture. The crop was able to germinate from this moisture but a lack of follow up rain meant it never thrived in 2018. DS Pascal was the shortest season length variety and the yield suffered from frost damage. The other three winter-type varieties yielded similarly as seen in table one above.

LONG-SEASON WHEAT PROJECT SUMMARY

- Winter wheats successfully navigated multiple frosts in 2018 and still achieved high yields in the TOS 1 plot trials located at Kendenup.
- The broad-scale trial at South Stirlings also followed this pattern. The spring wheat DS Pascal was heavily damaged by frost, whereas the winter-wheats yielded much better.
- 2018 provided more evidence that traditional spring-type wheats should not be sown in the first two weeks of April.
- Planet barley yielded significantly higher than wheat in each of the three trials that it was included in. These were the broad-scale trials at West Kendenup and Kojaneerup as well as TOS 2 in the Kendenup plot trials.
- Noodle wheat varieties Kinsei and Ninja yielded competitively at the trial sites they were included in. Both appear to be high yielding wheat options for the area with Kinsei suited to a longer season and earlier sowing date than Ninja.
- SCF data from the last three years indicates that winter wheats sown early will yield the same as Scepter wheat (fast spring-type) sown in early May.
- 2018 marks the last year of the three-year project investigating the potential of long-season wheats for SCF growers. An agronomic package summarising the key methods for growing long-season wheats will be produced for 2020 and beyond. It is expected that plant breeding companies will continue work on winter-type wheats that should lead to even better suited varieties to the southern high rainfall environment in WA. The Grains Research and Development Corporation (GRDC) have also invested in long-season wheat agronomy by including specialised early sown long-season national variety trials (NVT) at Kojonup and South Stirlings in 2019. Data from these trials will be valuable to all growers interested in assessing long season wheat yields and variety performance.

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This project was supported by funding from the Department of Primary Industries and Regional Development Grower Group Development R4R fund.

Demonstrations of legume crops for reliable profitability in the Western region

KEY MESSAGES

- Yields (t/ha) of legume crops & gross revenues ($/ha) were lower than the control crop (canola) at Frankland & Kojaneerup. The benefits from N-fixation are yet to be calculated.
- The late break to the 2018 season made for tough growing conditions for most crops, including legumes.
- The price for Faba beans was very high, which combined with suitable agronomy makes them the most promising legume option from the 2018 demonstrations.
- Field Peas achieved a high biomass at Frankland, before lodging and becoming difficult to harvest. Harvesting with a conventional draper front resulted in yield losses.
- Lentils were difficult to harvest because they were so short. There is also a high risk of rocks in grain.
- The site also experienced frost events during spring.

SUMMARY

The Kojaneerup site suffered from a dry season, which greatly reduced the yield potential. Another legume demonstration site will be grown in 2019 to showcase legumes crops in hopefully a more favourable growing season.

The Frankland site also suffered a dry start but enjoyed steady rainfall from June onwards. Some late frosts likely did some yield damage, but exact impacts were difficult to quantify.

Faba beans and field peas were the better looking legume crops across the two sites. The field peas at Frankland lodged late in the season which made harvesting very difficult. The full yield of the field peas was not collected due to the peas being low on the ground. Additionally, the soil type was a forest gravel and a lot of stones were collected in the grain sample. Faba bean prices in 2018 were unusually high due to high demand and low supply. Future prices at these levels should not be expected.

The Frankland demonstration site suffered a small amount of waterlogging in one section. Faba beans showed much greater resilience in comparison to the other pulse crops which is an important trait for this region.

RESULTS

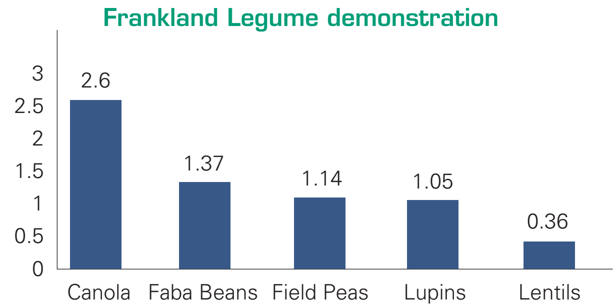

Figure 1: *Summary of the grain yields achieved at the Frankland demonstration site (Simon Hilder). The figures indicate the t/ha of grain yield for each crop. Trial was sown on the 5th of May 2018.*

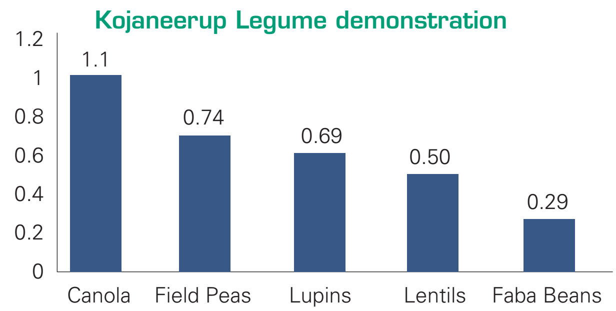

Figure 2: *Summary of the grain yields recorded at the Kojaneerup demonstration site (Slattery). The figures indicate the tonnes/ha of grain yield for each crop. Trial was sown on the 24th of May 2018.*

Legume yields were inferior to canola at the Frankland and Kojaneerup demonstration sites in 2018. Importantly, the same pattern was observed for gross revenue ($/ha), although Faba beans were competitive at the Frankland site. However, at the time of writing the report, the value from the amount of nitrogen fixed from each legume was yet to be tested. This will improve the value of growing legume crops when factored into the legume package.

The Faba bean price was calculated at $1000/tonne on March 6th, 2019. This high price made the Faba bean gross revenue comparable with canola, although still $116/ha less than the Clearfield canola crop. Growers should not expect to see Faba bean prices this high very often.

Figure 3: Aerial image of the Frankland legume demonstration site taken on the 8th of November 2018. The striped plots are the Faba beans replicates where some of the seed blocked the air-seeder tubes.

Plant counts

Most plant counts for each legume crop did not reach the recommended plant numbers, from Pulse Australia, at the Kojonup and Frankland trials sites in 2018. The exception was Faba beans at the Frankland site (See Table 2).

Failure to reach adequate plant establishment can be attributed to the very dry sowing conditions experienced in 2018 and the lack of follow up rainfall. Sub-optimal plant populations automatically reduced yield potential of each crop in 2018 and better plant establishment will hopefully be achieved in the 2019 legume demonstrations.

Table 1: Summary of grain yields (t/ha) from the two legume sites in 2018. Table shows the gross revenue ($/ha) of the crops from each location. Grain prices were calculated on the 6th March 2019, delivered Perth. Canola $570, Chickpeas $750, Faba beans $1000, Field Peas $560, Lentils $530 and Lupins $350.

Location	Kojaneerup		Frankland	
Treatment	YIELD t/ha	Revenue $/ha	YIELD t/ha	Revenue $/ha
***Jurien* Lupin**	0.69[a]	**243**	1.05[a]	**369**
***Samira* Faba Bean**	0.29[c]	**289**	1.37[a]	**1366**
***Bolt* Lentil**	0.50[b]	**267**	0.36[a]	**193**
***Kaspa* Field Peas**	0.74[a]	**417**	1.14[a]	**640**
Canola Control	1.10	**627**	2.60	**1482**

Means followed by the same letter or symbol do not significantly differ (P =.05, LSD). Canola yields were not included in the statistical analysis.

Table 2: Summary of the plant counts for legume crops at the Kojaneerup & Frankland demonstration sites in 2018. Data shows that most populations were sub-optimal to achieve maximum yields. Plant counts recommendations were sourced from the *Pulse Australia* website: www.pulseaus.com.au

Location	Kojaneerup	Frankland	Recommended
Treatment	COUNT /m²	COUNT /m²	COUNT /m²
***Jurien* Lupin**	14[b]	20.8[a]	45
***Samira* Faba Bean**	13[b]	28.75[a]	20-35
***Bolt* Lentil**	43[a]	59.3[a]	100-120
***Kaspa* Field Peas**	22[a]	30.1[a]	40-50
LSD P = 0.05	**15**	**27.154**	
Standard Deviation	**9.4**	**8.532**	
CV	**40.5**	**24.56**	

It was interesting to note that the field peas at the Frankland site did not reach the recommended plant numbers. At the spring field day in September the Field peas looked like the legume crop with the highest yield potential and plant numbers appeared to be adequate.

IMPLICATIONS

The legume demonstration sites experienced many of the challenges in 2018 that growers have traditionally faced when growing pulse crops. Pulse crops need to be sown early to maximise yield potential. There was not an opportunity to do that at either demonstration site last year. Apart from reduced yield, the sites also experienced heavier weed burdens due to reduced plant competition and poor chemical efficacy.

The Frankland trial site experienced a reasonable growing season despite the late start. This enabled the potential of Faba beans, Field Peas and Lupins, to a lesser degree, to be displayed. The high prices achieved by Faba beans in 2019 will generate interest in legume crops despite growers understanding 2018 was a rare year for grain prices.

This year the project will continue with a cereal crop being sown over the 2018 legume plots. The cereal crop will be monitored and harvested to determine the yield in 2019. This will enable any measurable differences in grain yields from the different legume crops grown in 2018 to be assessed. Soil tests will also be taken on each plot in 2019, prior to seeding, to measure the amount of nitrogen that has been fixed by each different legume crop.

There will be further legume demonstration sites sown in 2019, these sites are located at Muradup, Amelup, Gnowellen and Gnowangerup. We look forward to reporting these results to our members in 2019.

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

This project is supported by funding from the Grains Research and Development Corporation.

Ripper Gauge demonstration sites – Albany port zone

KEY MESSAGES

- Most soil amelioration treatments improved grain yields or were statistically equivalent to the untreated controls (UTC) at the Ripper gauge sites in the Albany port zone in 2018.
- Despite a late break to the season, the Albany port zone received a good finish, which meant all ripper gauge trial sites achieved above average yields. Three different crops were grown at each site - canola, lupins and barley.
- The good finish to the 2018 growing season meant the yield penalty for soil compaction was reduced & there was not always a significant yield difference between treatments and the untreated controls.
- Growers are most interested in the results of the ripper gauge demonstrations in the second and third seasons to measure costs of installation compared to lasting yield benefits.

SUMMARY

- Kojaneerup trial site: There were no statistical improvements in yield from any soil amelioration treatment over the untreated control.
- Broomehill trial site: Two of the four amelioration treatments yielded significantly higher than the untreated control. The other two treatments were statistically equivalent to the untreated control.
- Darkan trial site: There were no statistical improvements in yield from the soil amelioration treatments over the untreated control (Nil). Two of the three treatments were equivalent in grain yield to the Nil and one yielded significantly less. The mouldboard plough treatment yielded due to poor plant emergence in the canola crop.

Tilco & Tractor (Hood's tractor at Goad's site)

RESULTS

Kojanneerup Ripper Gauge

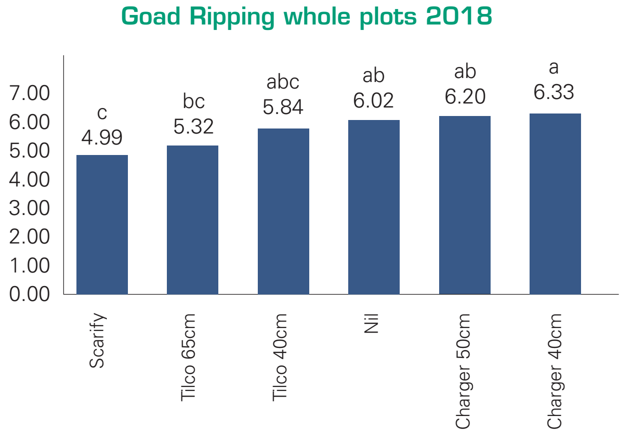

Figure 1: *2018 Ripper gauge site located on the Goad family farm in Kojaneerup WA. This trial was located on a white sandplain soil with depth to gravel varying from 30-80cm. This graph displays barley grain yields in (t/ha) over the whole length of the plots. Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Table 1: Average NDVI readings from the 21st of July and August 26th at the Kojaneerup (Goad) Ripper Gauge demonstration site in 2018. The average plant counts per metre squared were also recorded on July 21st.

Number	Treatment	Average NDVI July 21	Average NDVI Aug 26	Average plant numbers/m²
1	Tilco 40cm	0.39^{a}	0.64^{a}	27.9^{a}
2	Tilco 65cm	0.33^{a}	0.65^{a}	25.8^{a}
3	Depth charger 40cm	0.45^{a}	0.63^{a}	27.7^{a}
4	Depth charger 50cm	0.38^{a}	0.65^{a}	28.0^{a}
5	Nil	0.38^{a}	0.64^{a}	25.8^{a}
6	Scarifier 15cm	0.42^{a}	0.69^{a}	30.6^{a}

Means followed by same letter or symbol do not significantly differ (P=.05, LSD).

There were no statistical differences in any treatments for either of the NDVI data sets or the plant counts (per m^2) that were collected.

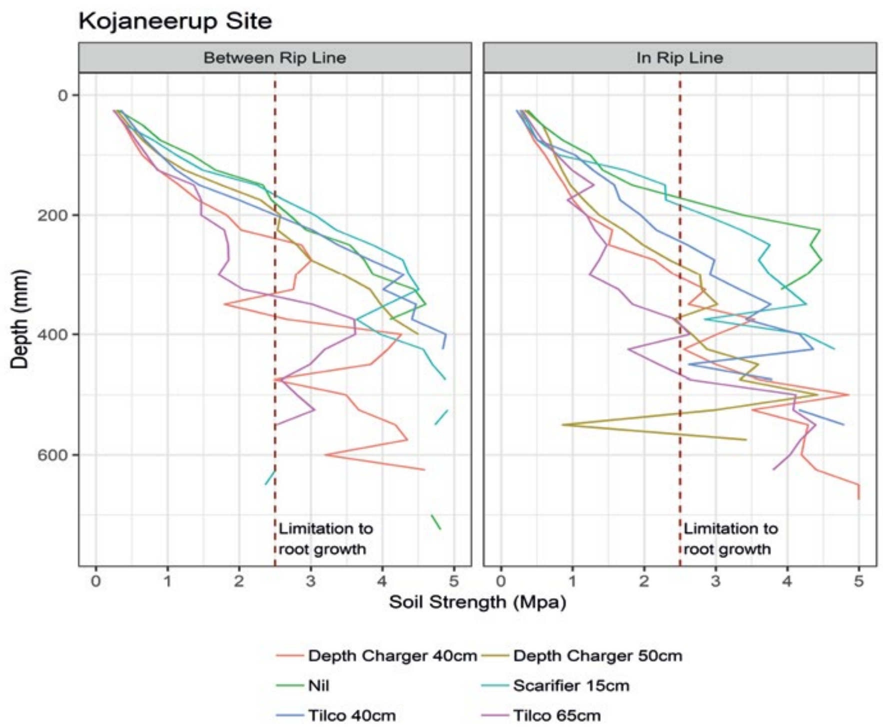

Figure 2: *Summary of the soil strength measurements collected from the Goad Ripper Gauge site at Kojaneerup in 2018. Penetrometer measurements were taken when soil moisture was close to field capacity. At a soil strength of 2.5 (Mpa), plant root growth is restricted.*

Broomehill Ripper Gauge

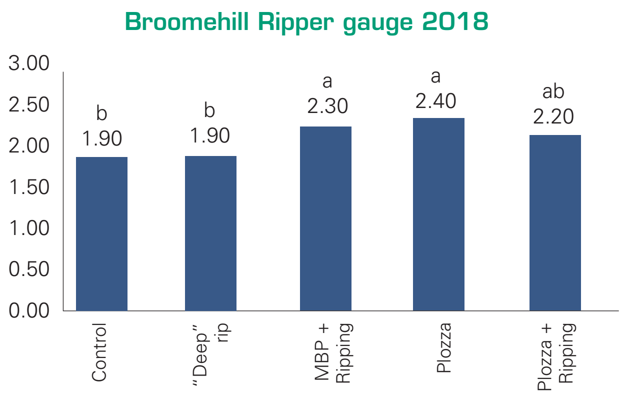

Figure 3: *Lupin yields (t/ha) of the Broomehill Ripper Gauge site hosted by Craig Bignell. This trial site was placed on a gravelly duplex soil type which was non-wetting on the surface. Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Table 2: Summary of the two Normal Different Vegetation Index (NDVI) readings taken from the Broomehill Ripper Gauge site in 2018.

Treatments	NDVI July 17th	NDVI Aug 30th
MBP & Rip	0.21	0.61
Control	0.18	0.56
Deep Rip	0.21	0.62
Plozza & Rip	0.20	0.65
Plozza	0.20	0.62

The NDVI readings from the Broomehill site have not been analysed yet. The NDVI differences between treatments appear to be minimal apart from comparisons between the control treatment and the Plozza & Rip treatment taken on August 30th, 2018.

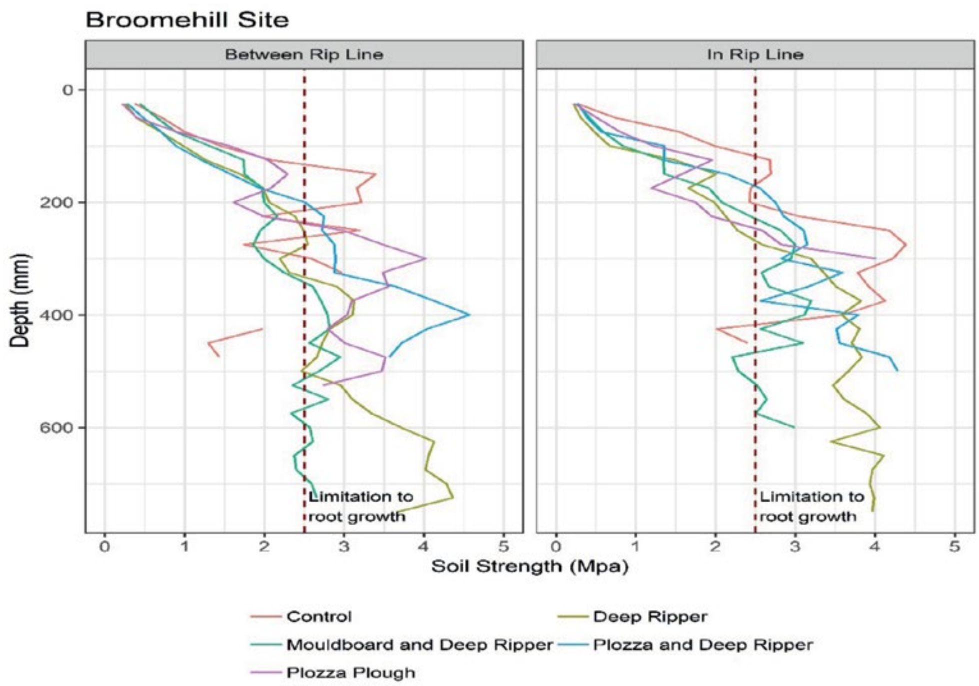

__Figure 4:__ Summary of the soil strength measurements collected from the Bignell Ripper Gauge site at Broomehill in 2018. Penetrometer measurements were taken when soil moisture was close to field capacity. At a soil strength of 2.5 (Mpa), plant root growth is restricted.

Darkan Ripper Gauge

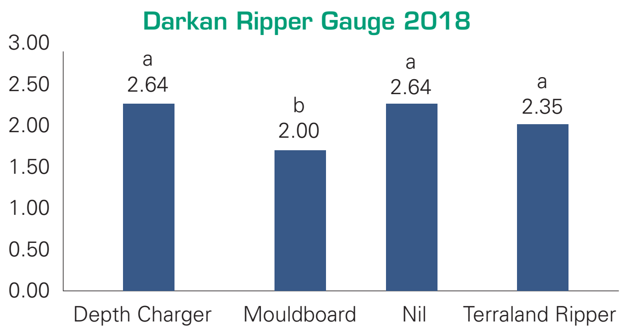

__Figure 5:__ Canola yields (t/ha) in the Darkan Ripper Gauge site hosted by the Duffield family. The trial site was located on a gravelly non-wetting soil. Means followed by same letter or symbol do not significantly differ (P=.05, LSD).

The NDVI data from the Darkan ripper gauge site has not being analysed yet. The pattern from the two NDVI readings times appear consistent to each other, whilst also matching the final grain yields. Researcher and farmer observations were that the mouldboard plough treatments lacked plant numbers. Biomass (NDVI) readings displayed in table three support these observations.

Depthcharger Tambellup (Squibb's)

Table 3: Summary of the two Normal Different Vegetation Index (NDVI) readings taken from the Darkan Ripper Gauge site in 2018. **NB:** Data is yet to be analysed statistically.

Treatments	NDVI Jun 13th	NDVI Aug 21st
Depth Charger	0.19	0.67
Mouldboard	0.13	0.42
Terraland	0.18	0.70
Nil	0.16	0.56

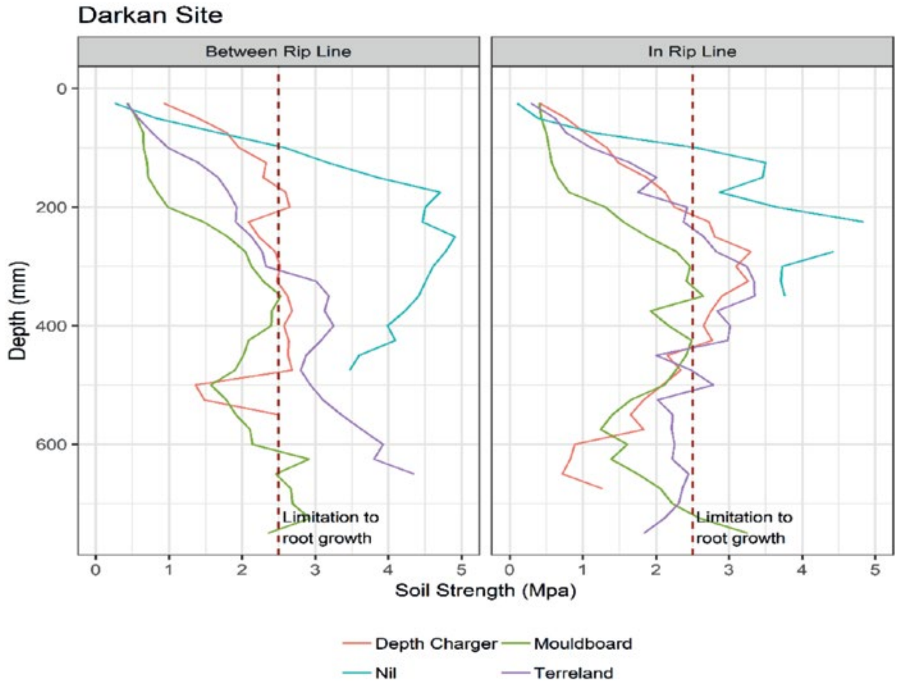

***Figure 6:** Summary of the soil strength measurements collected from the Duffield Ripper Gauge site at Darkan in 2018. Penetrometer measurements were taken when soil moisture was close to field capacity. At a soil strength of 2.5 (Mpa), plant root growth is restricted.*

SUMMARY

Kojaneerup

- Yields indicate no significant improvements in grain yield from any of the tillage treatments compared to the nil treatment in 2018.
- Statistical analysis on the NDVI (biomass) readings on the 21st of July and 26th of August 2019 and plant counts (21st July) recorded no significant differences between any of the treatments.
- The scarifier (15cm) was the only treatment that yielded significantly less than the nil. This is likely due to the soil disturbance exacerbating the non-wetting nature of the soil which delayed plant emergence.
- Wind erosion early in the growing season caused delays in emergence and left some bare patches within the trial area. Josh Goad spot-seeded some of these bare patches after seeding to provide ground cover. The tactic was very effective, and these patches were not visible at harvest time.

Broomehill

- Mouldboard Ploughing (MBP) + Ripping and the Plozza Plough treatments yielded significantly higher than the untreated control.
- Ripping alone (1.9t/ha) and the Plozza + Deep Ripping (2.2t/ha) were statistically equivalent to the untreated control (1.9t/ha).
- A possible explanation for the poor 2018 yield result from the ripping treatment is that the other soil amelioration machinery mixed the soil, which could have alleviated some of the non-wetting top-soil. The ripping treatment was only able to reach a soil depth of 25cm which may not have alleviated the compaction.
- The mouldboard plough reached a soil depth of 35cm, the Plozza 20cm and the ripper only reached 25cm on average.

Darkan

- No amelioration machinery improved the canola yield in 2018 over and above the untreated control (Nil).
- The Mouldboard plough yielded significantly less than the other three treatments, including the untreated control (Nil). This was probably because of a poorer plant germination in the mouldboard plough treatment.
- The 2018 season was kind to the Darkan area with steady rainfall throughout the growing season. This may have contributed to the lack of yield differences between the amelioration treatments and the untreated control (nil).

This project is supported by funding from the Grains Research and Development Corporation.

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Koorda	✓	✓	✓	✓		✓	✓
Albany	✓			✓		✓	✓
Pingelly	✓	✓	✓	✓			✓
Jerramungup	✓	✓	✓	✓		✓	✓
Katanning	✓	✓	✓	✓		✓	✓
Wongan Hills	✓	✓	✓	✓		✓	✓
Narrogin	✓			✓		✓	✓
Corrigin	✓	✓	✓	✓		✓	✓
Lake Grace	✓	✓	✓	✓		✓	✓
Hyden	✓	✓	✓	✓			✓
Kulin	✓	✓	✓	✓			✓
Lake King	✓	✓	✓	✓			✓
Bencubbin	✓		✓	✓			✓
Kalannie	✓	✓	✓	✓			✓
BP Allways		✓	✓	✓		✓	✓
BP Spencer Park		✓	✓	✓		✓	✓
BP Narrogin	✓	✓	✓	✓		✓	✓
BP Wagin	✓	✓	✓	✓		✓	✓
BP Williams	✓	✓	✓	✓	✓	✓	✓
Geraghtys Mukinbudin		✓	✓	✓		✓	✓
Miling	✓	✓	✓	✓		✓	✓
Kukerin OPT	✓		✓	✓			✓
Borden OPT	✓		✓	✓			✓
Wickepin	✓		✓	✓			✓
Trayning OPT	✓		✓	✓			✓
Bruce Rock	✓	✓	✓	✓			✓
Merredin Depot		✓	✓	✓		✓	
Kellerberrin OPT	✓		✓	✓			✓
Carnamah						✓	
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Nungarin OPT	✓		✓	✓			✓
Beacon DCA	✓		✓	✓			✓
Mingenew OPT	✓	✓	✓	✓			✓
Morawa OPT	✓	✓	✓	✓			✓
Geraldton Depot	✓			✓		✓	✓
Kalgoorlie Depot						✓	
Darkan OPT	✓			✓			✓
BP Denmark		✓	✓	✓			✓

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Katanning	08 9821 1766
Wongan Hills	08 9671 1057
Narrogin	08 9881 1962
Corrigin	08 9063 2014
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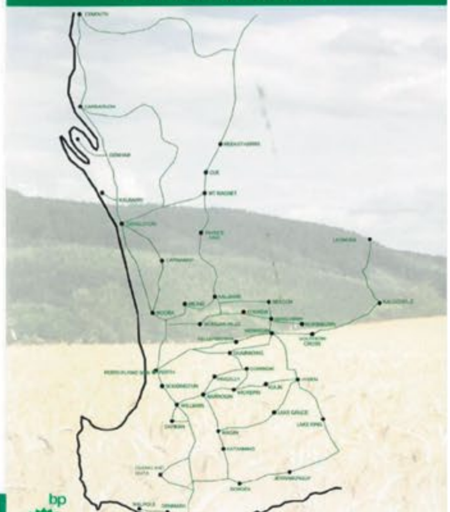

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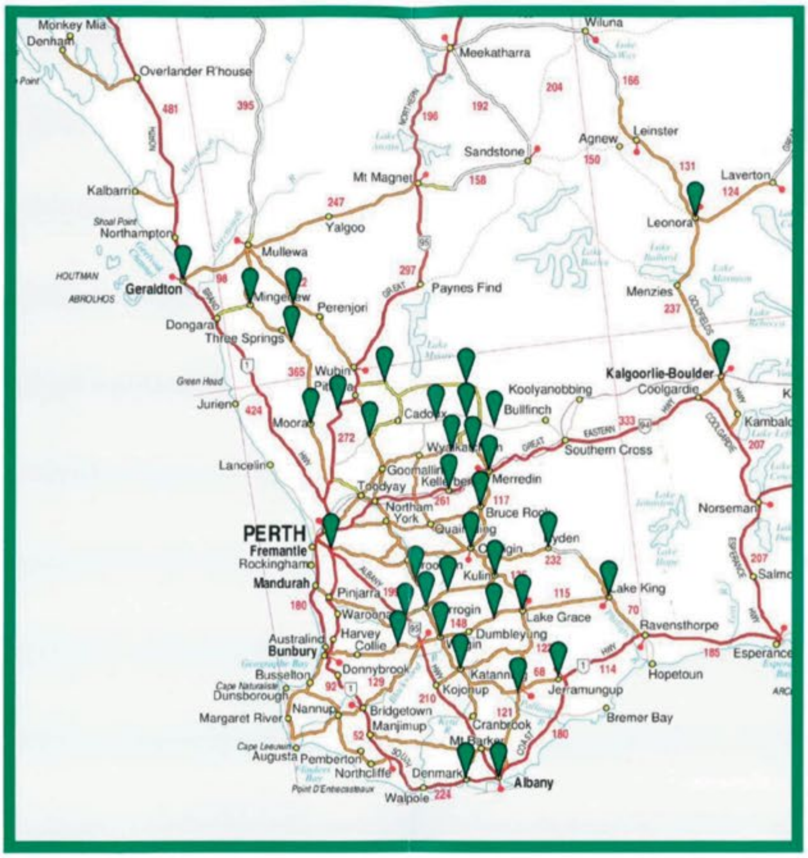
Castrol



Nil Disturbance Seeding Systems trial at Kendenup 2018

PURPOSE

This project hopes to test the potential changes to soil non-wetting and grain yields for three seeding systems with different levels of soil disturbance, over multiple seasons. SCF wants to compare nil disturbance seeding systems, using disc-seeders, against the current district practice of direct drilling using tynes with knife points. A third treatment, full cut tillage systems, was added to exaggerate the level of soil disturbance to maximise the chances of measuring differences between seeding systems.

RESULTS

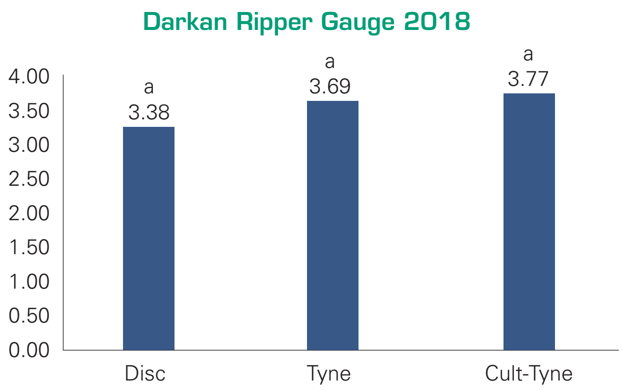


Figure 1: *Grain yields of the Mace wheat crop at the Wood family Nil disturbance seeding trial at Kendenup in 2018. In 2018 cultivation (with a scarifier) before tyne seeding was not carried out due to the risk of wind erosion during a decile 1 Autumn. Means followed by same letter or symbol do not significantly differ (P=.05, LSD)*

SUMMARY

Statistical analysis shows there were no significant yield differences in 2017 (Field Peas) or in the wheat crop in 2018. The 2016 Canola data has not been analysed yet but does not appear to be significantly different between treatments.

NDVI readings taken on the August 13 and September 9 2018, showed the crop sown with the tyne seeder had significantly higher biomass than that sown by the disc seeder. The difference in biomass did not translate to significant differences in grain yields. As is usually observed by growers the disc (slot) sowing, with nil soil disturbance below where the seed is placed, resulted in slower early growth and lower biomass up to early spring. The 2018 winter had low accumulated radiation, so time to full canopy cover affected plant growth rates.

It is expected that potential differences in grain yields between the disc (nil disturbance system) and the tyne seeder systems may take many years to become measurable.

The cultivation prior to tyne seeding treatment (maximum cultivation) was not completed in 2018 due to the severe risk of wind erosion. This meant there was very little difference between the two tyne treatments and this was reflected in the grain yields for 2018.

In 2019, the "maximum tillage" treatment has been deep ripped with the Horsch Tiger to 40cm, and this provides a contrast with the slot seeding Nil Disturbance System. It will be interesting to see what differences this might have on the non-wetting nature of the top-soil and overall

Table 1: Grain yields from 2016-2018 at the Wood family Nil disturbance trial located at Kendenup, WA. Normalized Difference Vegetation Index (crop biomass) readings were collected on the 13th of August and the 9th of September in 2018. *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Crop grown Treatment	'16' Canola Yield (t/ha)	'17' Peas Yield (t/ha)	'18' Wheat Yield (t/ha)	Biomass NDVI 13 Aug	Biomass NDVI 9 Sep
Nil Disturbance disc-seeder (Control)	1.96	1.49[a]	3.38[a]	0.49[b]	0.59[b]
Cultivation followed by Tyne seeder	1.96	1.15[a]	3.77[a]	0.52[ab]	0.65[ab]
Tyne Seeder	2.03	1.08[a]	3.69[a]	0.55[a]	0.69[a]
LSD P = 0.05	**Not analysed**	**0.359**	**0.475**	**3.82**	**7.3**
Standard Deviation	**Not analysed**	**0.207**	**0.274**	**2.21**	**4.22**
CV	**Not analysed**	**16.71**	**7.59**	**4.24**	**6.53**

plant performance. The standard treatments direct drilling with discs (NDS) and direct drilling with tynes will also be continued.

The NDS has been tested over 3 different seasons with three different crops. SCF will continue to test the three seeding systems for different seasons and crop types.

THANK YOU

Thanks to Jeremy and Brad Wood for donating their tractor and time to install the deep ripping treatments at the Nil Disturbance trial site. Thank you also to Max Kerkmans from AFGRI Albany for allowing SCF researchers the use of the *Horsch Tiger* Ripper in this trial and the Ripper Gauge demonstration at Lyndsay Watterson's nearby.

Figure 2: *Jeremy Wood installing the maximum soil disturbance treatments at the NDS site in Kendenup, WA on April 3rd, 2019. NB: This paddock has been under full CTF for at least 10 years and does not carry livestock over the summer.*

Lime Sources trial at Kendenup

INTRODUCTION

The lime sources trial at Kendenup, was established in 2015 to address the lack of long-term lime trials in the southern High Rainfall Zone (HRZ). John Blake (SCF) set-up the original trial with funding from South Coast Natural Resource Management (SCNRM). The aim was to evaluate five different sources of lime, from the south west, to determine if there were differences in soil pH change over time and/or grain yields. SCF has continued to monitor the trial past the original project timeframe.

NB: All soil pH levels quoted in this report were measured in $CaCl_2$ solution.

METHODOLOGY

A two-replicate broad-scale trial was set up in 2015 with plot dimensions of 130m by 30m. The five lime sources were:

1. Bornholm
2. Denmark
3. Lancelin
4. Redgate
5. WALCO
6. Nil control

Each lime source had the product rate (t/ha) adjusted to ensure each plot received the same amount of neutralising value (NV). For example, the reference liming rate was 2t/ha with a NV of 80%. A lime with a slightly lower NV, say 74%, had a higher rate of lime applied to make the NV's even between treatments.

A comprehensive soil testing regime was carried out by soil-sampling contractors to determine the base-line levels of soil acidity in each plot from three separate soil depths; 0-10cm, 10-20cm and 20-30cm in 2015. The locations of the soil sampling were geo-referenced so re-testing years later can be carried out from the exact same position within the plot.

Accurate grain yields were determined from the 2017 canola crop and the 2018 barley crop using the SCF weigh trailer to weigh individual plots after they were harvested with Mackie's header.

In 2019, SCF have employed a soil sampling contractor to re-test the 40 different locations in the trial so we can compare the potential changes in soil pH over the three different soils depths mentioned above.

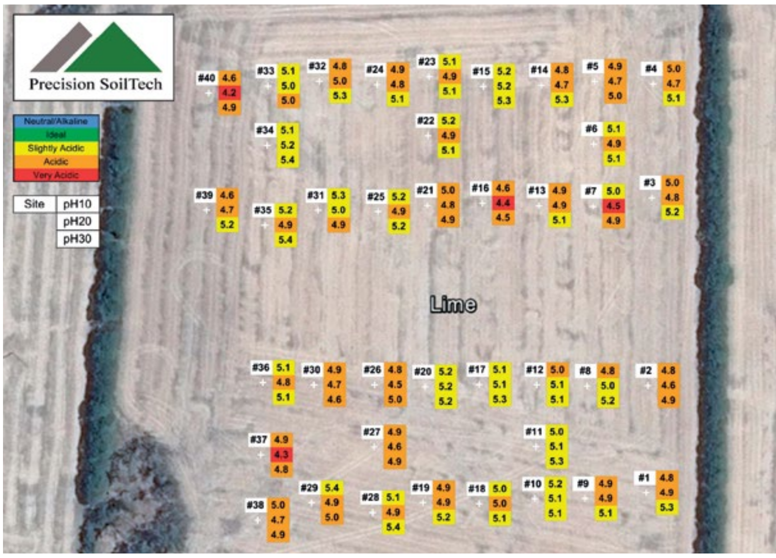


Figure 1: *Summary of the soil pH's ($CaCl_2$) recorded at the Mackie lime sources trial in 2015 at the beginning of the trial. There were 40 sample points tested in total, with three soil depths tested at each; 0.10cm, 10-20cm and 20-30cm.*

SCF plan to continue monitoring this trial site for many years to come to continue monitoring the long-term affects of each different lime source in comparison to each other as well the untreated control plots.

RESULTS

Grain yield data was collected in 2017-18 and no significant differences were recorded between any treatments, including the control treatment (See Figure 2). The lack of yield differences could be due to many factors. Firstly, the baseline soil pH levels in 2015 were 4.99 and 4.84 in the 0-10cm and 10-20cm layers respectively. These soil pH levels are close the recommended guidelines of 5.2 in the topsoil and 4.8 in the subsoil which means nutrient availability was likely not restricted.

Secondly, 2017 and 2018 were high rainfall years, particularly in the second half of the growing season (Figure 3), which translated to excellent grain yields in the respective canola and barley crops. High yields indicate the crops were not lacking access to soil moisture or nutrition late in the season or during the critical grain-filling period.

West Kendenup annual rainfall in the last two years:

- 2017 - 514mm
- 2018 - 481.8mm

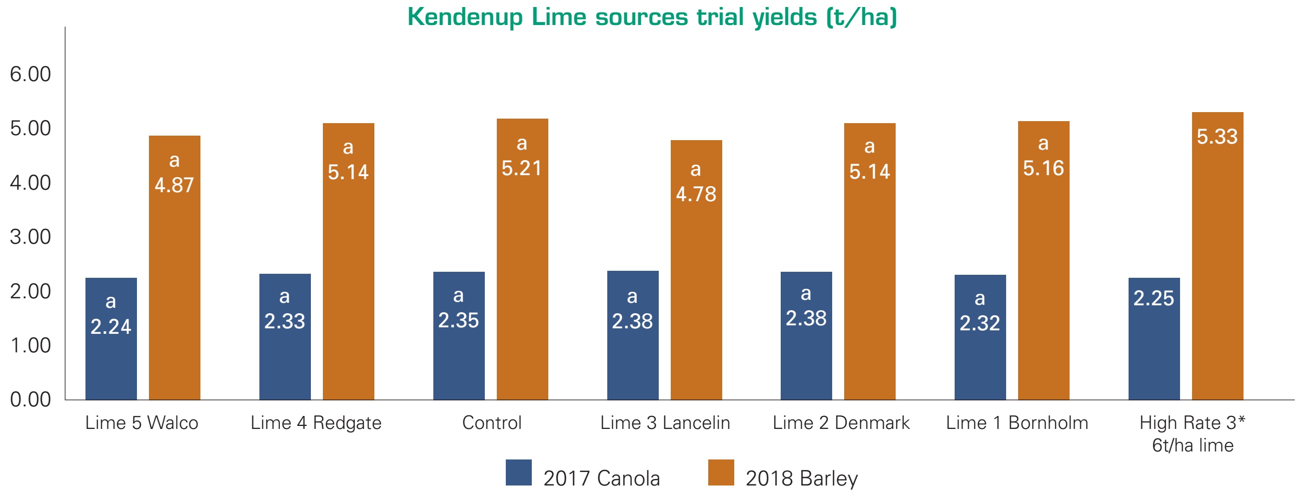


Figure 2: *Grain yields (t/ha) from the Kendenup Lime sources trial in 2017 (canola) and 2018 (barley). The trial was hosted by the Mackie family. Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

NB: *There is only one replicate of the high rate (6t/ha lime treatment) which means we are unable to complete statistical analysis on this treatment.*

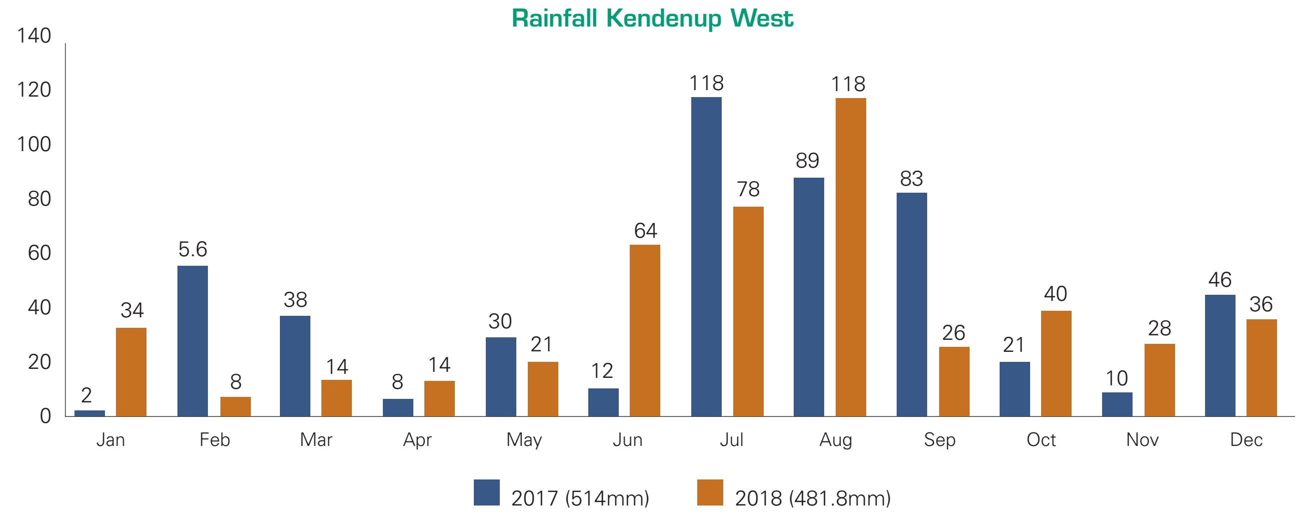


Figure 3: *Summarises the month by month rainfall (mm) for 2017 and 2018 at the Kendenup lime sources trial. Rainfall figures were recorded from the DPIRD Kendenup West weather station.*

Soil pH changes from 2015 to 2019

In April this year SCF employed *Map IQ* to re-sample the 40 sampling sites with the same methods as described above. This allows for direct comparisons of soil pH levels for each lime treatment over the four-year period.

Soil pH measurements are higher overall in 2019 compared to the 2015 data set. This is true of the nil lime (control) treatments and the limed plots. It was expected that the control treatments would be similar or lower in pH as they were not limed in 2015. Two different soil-sampling contractors were used in 2015 and 2019 who may have had subtle differences in their sampling techniques and/or the method for testing soil pH in $CaCl_2$. Therefore, the soil pH differences need to be assessed relative to the control treatments measured in the same year rather than comparing the two year's data.

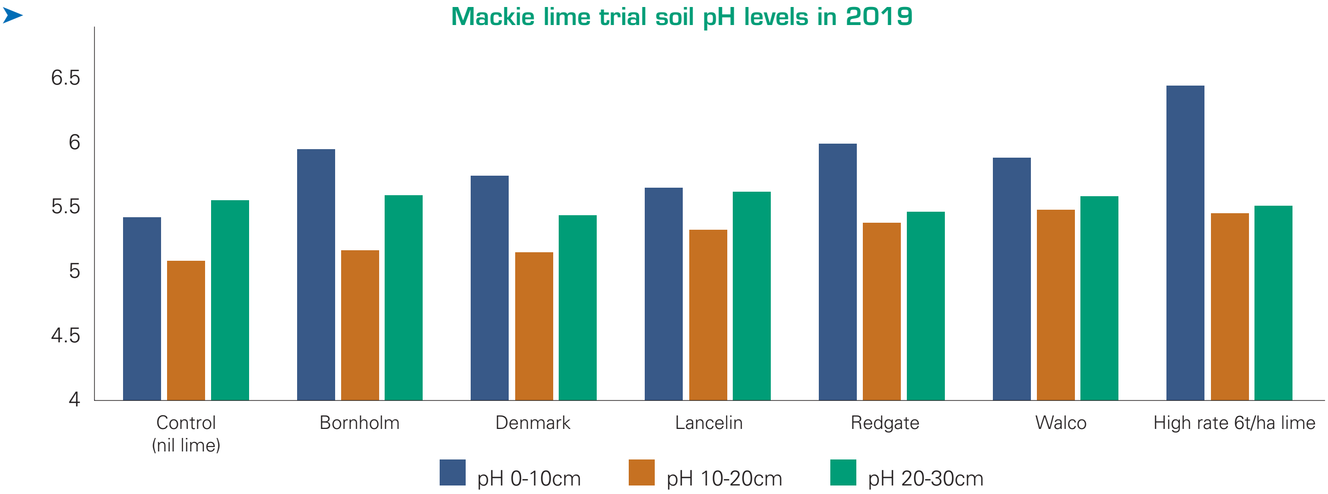


Figure 4: *Summarises the soil pH levels (in $CaCl_2$), measured in April 2019, for the Mackie lime sources trial in Kendenup.*
NB: *The soil pH starts at 4.0 on the y-axis.*

Table 1: Summarises the soil pH levels ($CaCl_2$) measured in April 2019 for the Mackie lime sources trial in Kendenup.

Treatment	pH 0-10cm	pH 10-20cm	pH 20-30cm
Control	***5.43***	***5.09***	***5.58***
Bornholm	5.94	5.18	5.60
Denmark	5.77	5.14	5.44
Lancelin	5.64	5.34	5.63
Redgate	5.99	5.40	5.46
Walco	5.89	5.49	5.60
High rate 6t/ha lime	6.44	5.47	5.53

SUMMARY

- There were no significant yield differences between any treatments in the 2017 canola and the 2018 barley crops.
- All lime treatments measured in 2019, had higher soil pH levels than the control in the 0-10cm and 10-20cm layer.
- Soil pH levels in the 20-30cm layer are very similar to the control and this is expected since lime is unlikely to have moved that deep in the soil profile after only four years.
- Each of the 2t/ha lime (equivalent NV) treatments improved soil pH levels in the topsoil by similar amounts.
- The stand-out liming treatment in the trial was the 6t/ha lime treatment which was tested in only one plot. This treatment has clearly improved soil pH levels at a faster rate than any of the 2t/ha lime treatments. This is reassuring for farmers that have been investing in lime in recent years.
- It is interesting to note that 6t/ha of lime has not led to a soil pH increase in the 10-20cm and certainly not the 20-30cm layer compared to the 2t/ha liming treatments.

FINAL COMMENT

The lack of grain yield differences in 2017 and 2018 is reflective of the adequate starting soil pH levels and the 'soft' seasonal finishes which tends to mask the effects of soil constraints. Despite no yield difference, 2t/ha of lime has lifted the soil pH levels and the un-replicated 6t/ha lime treatment lifted soil pH by even more (>1 pH unit).

After four years, the lack of soil pH changes deeper than 0-10cm shows how slowly lime moves in the profile. For those with subsoil pH levels greater than 4.8, it is easier to maintain pH through regular surface lime applications than to try and fix the problem once it is causing yield losses. Cultivation and incorporation of lime is an option on some soils to ameliorate subsoil acidity, but not all soil types are suitable to deep tillage and the forest gravel in this trial is probably one of them.

The interaction with seasonal conditions and the amount of time it takes for lime to work means that monitoring this trial over multiple seasons is very important. Comprehensive soil testing is not required every year, but it is worthwhile to measure yields annually to see which seasonal conditions give the greatest response to maintaining recommended soil pH levels.

MLA Producer Demonstration Sites

BACKGROUND

Stirlings to Coast Farmers (SCF) currently has several sites operating as part of our Meat and Livestock Australia (MLA) funded Producer Demonstration Sites (PDS). Jeff and Kate Stoney, and the Slade family are adopting electronic identification (eID) tags (NLIS)) and Pedigreescan technology to discover what genetic gains can be made through selection of maternal genetics.

Selecting desired traits based on the dams' genetics is possible because eID tags make the process simple and cost-effective to match lambs and ewes accurately. SCF have been utilising the Pedigreescan system in this project, which works by measuring lambs and ewes passing through a checkpoint and the eID tag records the time of each pass. Based on the timing of the sheep passing through the checkpoint, we can match ewes and lambs with reasonable accuracy.

The Curwen family hosted a 'Grain and Graze' demonstration in 2018 investigating the use of dual-purpose long season wheat to improve early season feed availability. Results for a similar 'Graze and Hay' trial hosted by Jarrod Beech in the 2018 season are also in this report.

METHODOLOGY

Curwen's Grain and Graze

A small paddock was sown by the Curwen family to DS Pascal and Longsword wheat on April 12, 2018, at South Stirlings. This paddock was then split in half, with a temporary fence, so we could graze one half of the paddock. We ended up with four distinct treatments;

1. Ungrazed Longsword
2. Grazed Longsword
3. Ungrazed DS Pascal
4. Grazed DS Pascal

In addition, we added a replicated broad-scale variety trial, sown with the air-seeder, in the ungrazed section. We evaluated the grain yields and basic grain quality of the following varieties;

1. Longsword
2. DS Pascal
3. DS Bennett
4. ADV.08.008 (experimental winter-wheat from DowSeeds)

50 ewes were placed in the 'grazed' section of the paddock on June 15th and removed on July 20th. Due to the ewes being pregnant, we were unable to measure their liveweight at the time of entering the paddock for grazing. We used a Greenseeker to measure the NDVI readings which gave us an estimation of the relative biomass of each treatment on a certain date. *See table two*.

Harvest yields were determined by harvesting the air-seeder strips (known area) and weighing using the SCF weigh trailer.

Beech Grazing Oats trial

The hay yield of two small paddocks of Tuscana oats, sown on the same day, were compared after one was grazed for a two-week period and one was not grazed.

The 7.5 Ha paddock was grazed between July 13th and 27th by 50 merino hoggets.

SCF researchers weighed all 50 hoggets on July 13th and recorded the weights. The sheep were weighed again when they were removed from the paddock on July 27th.

Slade eID site

The Pedigreescan unit was set up at a gate-way leading to a water point in spring 2018 (See figure three). The Slade's stud ewe flock already had eID tags installed while the new season lambs had eID tags fitted prior to the demonstration. The mob had approximately 400 ewes.

The Pedigreescan unit operated from the 14th of September until October 2nd, averaging 1200 reads per day. Results will be analysed from livestock consultant Jonathan England to give an indication of how many matches were made in the mob and what level of confidence the software has in the match.

Andrew Slade will be DNA testing the lambs and ewes from the same mob so we will be able to compare the accuracy of the Pedigreescan unit to DNA matching. This was not part of the original scope of the project but adds an extra layer of data that most farmers will be interested in knowing.

Stoney eID site

Unfortunately, the planned PDS with Jeff and Kate Stoney did not eventuate in 2018 due to them experiencing a very poor season. Although a second eID site was sought we were unable to find an alternative in 2018.

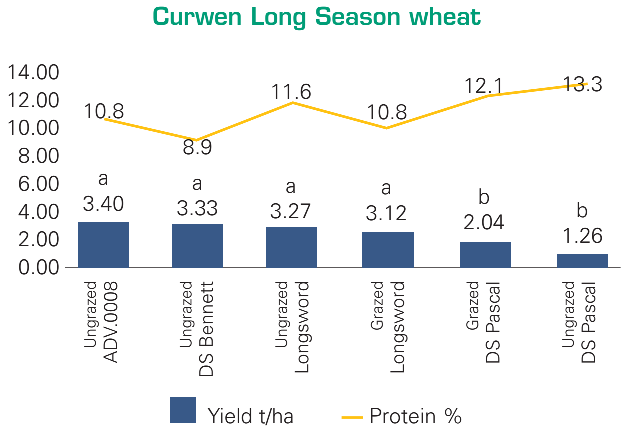


Figure 1: *The grain yields (t/Ha) of the Curwen Grain and Graze PDS at South Stirlings in 2018. The paddock was sown on the 12th of April and harvested on the 22nd of December. Poor yields in the DS Pascal variety were likely due to frost damage. Means followed by the same letter do not significantly differ (P=0.05 LSD).*

RESULTS AND DISCUSSION

Curwen Grain and Graze wheat site

The results above indicate no significant yield difference between the grazed and ungrazed Longsword and DS Pascal treatments. However, the yields achieved in the paddock were below average for the region and it is highly probably that frost events decreased grain yields. South Stirlings suffered a very poor start to the 2018 growing season with dry conditions persisting until mid-June.

The variety with the shortest season-length in the demonstration was DS Pascal. Based on the higher yield in the grazed treatment it can be reasoned that the ungrazed treatment was severely frost damaged. The final yield of 2.04 (t/ha) in the grazed DS Pascal area is still a very poor result for the South Stirlings region. Frost was likely a major constraint on both DS Pascal treatments as well as the dry conditions after seeding.

The varieties tested in this demonstration, from shortest growing season to longest, are listed below. Visual observations of the ADV08.008 and DS Bennett indicate that neither variety were affected by frost. DS Pascal and Longsword appeared to have some frosted grains in the sample.

2018 results indicated the winter-type long-season wheat varieties were well suited to the April 12 sowing window. DS Pascal performed poorly when sown on April 12 in the South Stirlings district, with and without grazing treatments. This is important information to note as 2017 plot data, from a separate project, indicated that DS Pascal would perform well when sown in mid-April.

Table 1: Summary of the four wheat varieties tested in Curwen's grain and graze demonstration at South Stirlings in 2018.

Variety	Classification	Description
DS Pascal	APW	Early-season spring-wheat, suitable for a mid-April to early May sowing date.
Longsword	Feed	A fast maturing winter wheat.
ADV08.008	Unclassified	Winter awnless wheat, suitable for sowing from late March to early May.
DS Bennett	APW (eastern states)	Winter-type milling wheat. Ideal grazing variety with excellent re-growth and grain yield recovery after grazing.

Table 2: Normalised Difference Vegetation Index (NDVI) for the Curwen Grain and Graze demonstration site in 2018. 50 Heavily pregnant ewes were placed in the paddock on June 15th and removed on July 20th with their lambs.

Date	Description	Longsword	DS Pascal
June 15th	Pre-grazing	0.43	0.42
July 13th	During grazing	0.37	0.59
July 20th	End of grazing	0.36	0.49

Longsword was grazed preferentially by the ewes during June-July 2018 (Table 2). NDVI readings recorded on July 20th, showed the sheep started to eat some of the DS Pascal wheat. This was probably because the Longsword wheat had been grazed out by the sheep.

Liveweight gains were not measured at the Curwen demonstration due to the ewes being pregnant at the time of entering the paddock. The wheat crop provided an excellent place for the ewes to lamb with access to feed, shelter and water.

SUMMARY

Previous work from the Grain and Graze projects have indicated that wheat flowering dates can be set back two weeks after heavy grazing. The sheep in this trial did not heavily graze the DS Pascal due to a preference for the Longsword variety. It is unclear if a heavy grazing would have delayed the flowering time enough to avoid the frost damage in DS Pascal last year, given there were multiple frost events. With an early sowing date, it would be less risky for farmers to sow a true winter type wheat that has either vernalization and/or photoperiod triggers to initiate the reproductive phase of development.

The Curwen family were happy with the experiment to sow wheat earlier than "normal" and graze it once. 2018 was a very tough season for local farmers who fed out record amounts of grain to maintain livestock condition. Grain prices were very high due to drought-like conditions across the country at the time, and this made green feed even more valuable. During the June-July period there was no other green feed available on the farm for the ewes to eat. The Curwen's believe that having significant areas planted to long-season wheat is an affordable way to plan for, and mitigate, drought conditions.

Beech grazing oats trial

The Beech's graze and hay demonstration site consisted of a 7.5Ha paddock of Tuscana oats, grazed by 50 merino hoggets for 2 weeks. The sheep were weighed onto the paddock on the 13th of July, at an average weight of 37.43kg and weighed off on the 27th of July with an average weight of 42.70kg, an average weight gain of 5.27kg per animal.

The oats were then locked up for the rest of the year and set aside for hay. Jarrod Beech cut the crop when it was still quite green due to contractor availability. His final hay yield was 7t/ha on the 20th November. Jarrod estimated it was worth $180/t which meant his gross revenue was $1260/ha plus the two weeks of grazing value.

An adjacent paddock of ungrazed Tuscana oats was also made into hay and the hay yield was the same as the grazed paddock at 7t/ha.

Jarrod had some interesting observations about the Tuscana oats in comparison to Bannister oats which he grew in other paddocks. Tuscana stayed greener for a lot longer due to its longer season length. Jarrod feels this is a beneficial trait for the Tenterden/Kendenup area where they often have a longer Spring and cool temperatures during the October/November period. Despite a late break to the season the Tenterden area ended up having an excellent season in 2018.

All sheep grazed on the oats got the scours despite an up to date drenching regime. Jarrod is yet to solve this problem and he sees it as the biggest drawback to the grazing oats system. Jarrod wants to try grazing the oats earlier next year to make sure the crop doesn't build up too much biomass before the sheep graze it. He speculates that keeping the biomass shorter for longer might help the sheep become accustomed to the richness of the feed.

Jarrod was extremely happy with his final hay yield and was surprised that there appeared to be little difference between the grazed and ungrazed paddocks of Tuscana oats. Jarrod will continue growing oats as a dual-purpose hay or grain and graze crop.

Slade eID site

Andrew Slade had great success in getting his stud ewe flock to move through the Pedigreescan race in 2018. Some ewes would have been through the race in 2017, which would have helped train others in the mob.

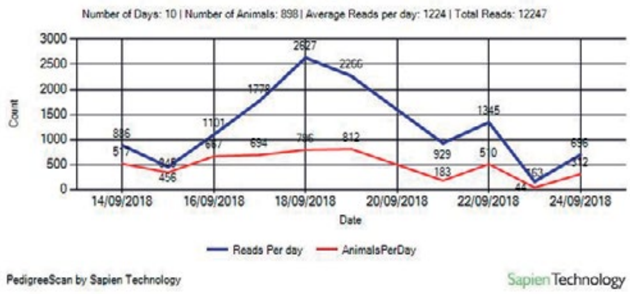


Figure 2: *This graph was created by the Pedigreescan software by Sapien technology. Andrew Slade had 400 ewes in the mob and the average number of reads per day was 1224 between the 14th and 24th of September 2018 (10 days).*

The excel files have been downloaded from the Pedigreescan reader and sent to Jonathan England (*Next Generation Livestock Solutions*) to match the ewes and lambs and provide a measure of accuracy for the match. At the time of writing this report Jonathan had not finished the analysis.

Figure 3: *The Pedigreescan set-up by Andrew Slade at west Kendenup in 2018. Note the simple set-up Andrew used. Sheep had to pass through the make-shift race to get to the dam. This race was set up from September 14th to October 2nd, 2018. Photo courtesy of Andrew Slade.*

Curwen Grain Graze 13th July 2018 (South facing)

Curwen Grain Graze 13th July 2018

WHAT NEXT?

Curwen Grain and Graze wheat site

The Curwen's have normally grazed barley crops for extra sheep feed early in the season. Due to disease pressure and declining yields, they hope to find a suitable wheat variety to replace barley as their grain and graze crop. DS Pascal wheat was considered a potential substitute to barley in their grain and graze system. In a normal sowing window of late April to late May it could fit this objective. However, the Curwen's are interested in long-season wheat varieties that will enable them to start their sowing program earlier and take advantage of substantial rainfall events no matter when they occur.

Through related long-season projects in conjunction with this MLA PDS project, SCF continue to find new varieties that need testing in our conditions. Two new winter type wheat varieties tested in 2018 were Illabo and DS Bennett.

At the Curwen 2018 site DS Bennett was not a stand-out, but it was a tough growing season in South Stirlings. In another farm-scale variety trial at west Mt Barker, DS Bennett topped the yields with an April 27 sowing date. DS Bennett yielded > 600kg/ha than the next best variety in the trial.

In another trial, Illabo was sown on June the 11th due to the late break to the season. The winter-type wheat was not expected to yield well due to the short growing season available after the late sowing date. As mentioned earlier in the report the Tenterden/Kendenup area had a very kind spring and Illabo was able to yield 5.24t/ha. This was much less than the top yielding spring-type wheat at the site which yielded 6.36t/ha. However, it shows that Illabo can maintain yield in a shorter growing season. We look forward to testing this variety with an earlier sowing date in 2020.

Slade eID demonstration

Once the Pedigreescan "Stockbook" analysis is obtained from Jonathan England we will be able to see which ewes and lambs were able to be matched and what degree of confidence the software has in each match.

Andrew Slade has taken DNA samples from his stud ewes and lambs, so their parentage can be determined. This offers a great opportunity to compare the results of the Pedigreescan with DNA testing. The Pedigreescan system is cheaper and easier than collecting DNA samples from the lambs and ewes. The accuracy of PedigreeScan will be key to Andrew Slade and others adopting the cheaper method for matching lambs and ewes.

In the last two years Andrew has completed the Pedigreescan work in September, so we can expect to be gathering the data in a similar time-frame in 2019.

Stoney sheep eID site

Jeff and Kate Stoney will be hoping for a much kinder season in 2019. Hopefully we can run the Pedigreescan unit again on Kate's lambs, so we can match them to the ewes. The aim for this project has been to match ewes and lambs so Jeff and Kate can measure the 100-day weaning weights of the lambs. The Stoney's want to use the information gained to cull ewes with poor performing lambs. This will hopefully drive productivity growth in the Stoney's prime lamb enterprise.

This project is supported with funding from Meat and Livestock Australia

MEAT & LIVESTOCK AUSTRALIA

SCF Snail projects and extension in 2018

SNAILS, SLUGS AND SLATERS IN WA: CASE STUDIES OF GROWERS IN SOUTHERN WA

GRDC project 9176105

In early 2018 Stirling to Coast Farmers was awarded a Grains Research and Development Corporation grant to write a guidebook that would summarise the best management practises for snails, slugs and slaters and present grower case studies concerning these pests.

SCF liaised with Department of Primary Industries and Regional Development (DPIRD) researchers, commercial agronomists and other grower groups to plan and conduct the grower case studies to ensure a good coverage of pests, regions and experiences were captured. This included working with three grower groups in the Great Southern to write some of the grower case studies. Working with neighbouring grower groups allowed SCF to reach a wider range of growers and ensure that experiences from different parts of southern WA were shared. SCF supported these grower groups with background information, interview questions and advice on how to conduct interviews and write the case studies. The collaboration helped build capacity and experience within the smaller groups and reinforced SCF partnerships in the region.

SCF consulted with GRDC, DPIRD, the South Australian Research and Development Institute (SARDI), CSIRO and the University of Melbourne to include relevant research updates on snails, slugs and slaters. The aim of these updates was to share relevant research that is being conducted around Australian to help growers better manage these pests.

Two SCF staff and an SCF grower member travelled to the Yorke Peninsular to talk to growers about their snail mitigation efforts and seek advice. This provided two grower case studies from South Australia for the guidebook and increased the knowledge of SCF staff and members in snail mitigation options. Information from the SA trip has also been presented at the SCF field day and in newsletters and eNews articles.

"Mitigating snails, slugs and slaters in southern Western Australia" has now been published and is available on the SCF website or at http://bit.ly/2V1GC7d . This guidebook provides a compilation of current information about mitigation options and practises for snails, slugs and slaters in Australia. For SCF growers, the timing is particularly good as snail numbers appear to be increasing and the range where snails can be found widening, with more growers affected by this problem. The guidebook will provide members with more confidence about selecting control options that will best suit their farming system and is likely to help slow, but not prevent, the speed with which snail numbers seem to be increasing in WA. This project has also provided an opportunity for grower groups and researchers to work more collaboratively together and ensure the key research findings reach growers to help inform them about the options they currently have for mitigation.

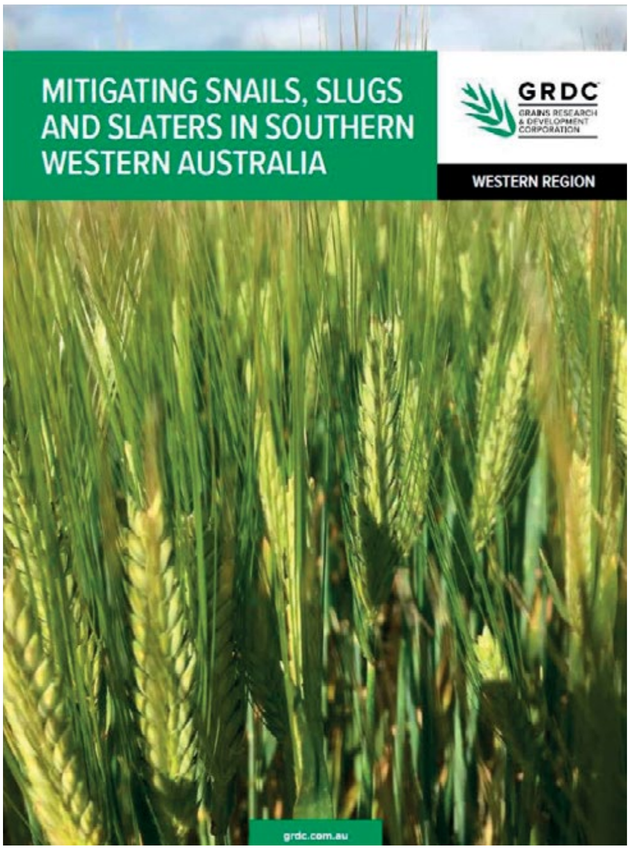


Figure 1: *The cover of the SCF booklet Mitigating snails, slugs and slaters in southern Western Australia.*

The snail, slug and slater case studies project was supported by funding from the Grains Research and Development Corporation

DPIRD SNAIL PROJECT

In early 2018 SCF also entered a partnership project with DPIRD to improve snail extension in our region.

Snail camera

In 2018 SCF was provided with updates from the DPIRD managed snail camera which provided our growers with timely information on snail activity in order to inform management strategies. In 2019 SCF has taken over the management of the snail camera and is now sharing this information with our members and DPIRD. Our first alerts of snail activity have already been communicated to members by tweets and text messages following early autumn rainfall. Snails from the SCF region have been collected for dissections to determine if the albumen gland is beginning to swell, which indicates snails are ready to mate. If there are clear indications of this, SCF growers will again be the first to know.

Figure 2: *SCF snail camera located at South Stirlings. The first 2019 snail activity was detected on 9th March which gave growers a good chance to bait snails prior to breeding.*

Biosecurity and snail management extension

Another aspect of the DPIRD snail project is delivering regular extension to SCF growers on snail management and biosecurity. The purpose of regular snail extension activities is to keep snail management on growers' minds and remind members at timely intervals of relevant strategies to manage snails throughout the year. In 2018 SCF presented articles on snail extension and biosecurity in three SCF eNews editions, three SCF Focus Newsletters and included snail presentations at the SCF Spring Field Day and the 2019 SCF Crop Updates.

Figure 3: *SCF member Mark Adams presents a grower's perspective of snail management at the 2019 GRDC Crop Updates.*

Figure 4: *The SCF grain cleaning snail roller demonstration: cleaning snails out of barley. Further testing is required to provide growers with clear advice on the capacity of these rollers to remove small conical snails from grain.*

Snail roller demonstrations

Another aspect of the DPIRD project was to provide growers with more information about the grain cleaning snail roller that SCF purchased in 2017. In early 2019, SCF conducted two snail roller demonstrations on barley and canola in collaboration with CBH and DPIRD to show growers how the roller works and provide more information about how these machines can help to clean snails out of grain. Information from the demonstration was included in the Autumn Focus newsletter. SCF plans to conduct more rigorous trials of the grain cleaning snail roller and rotary grain cleaners to determine what growers can expect from these machines and provide more certainty given in the tightening of grain receival standards next harvest.

FUTURE SCF SNAIL RESEARCH AND EXTENSION

The 2018-19 trial of a limit on snail numbers in canola, and further tightening of snail receival standards for canola and barley in the 2019/20 harvest, has led to a high level of concern among SCF growers about the difficulty of removing small conical snails from grain. The snail case studies provide useful information to guide growers on their cleaning options, including rotary grain cleaners and snail rollers, but further research is urgently needed to help growers investigate new solutions for cleaning snails out of grain. In addition, trials are required to test the effectiveness of established snail control methods, originally developed for round snails, on small conical snails, which behave quite differently. Moreover, some of the current recommendations for stubble management to kill snails and destroy their habitats do not suit farming systems with high rainfall and light soils, which are common in the SCF region. Snail mitigation is a high priority for SCF, and we see a need to continue our investigations beyond the scope of these projects. SCF will continue to work collaboratively with DPIRD, CBH, GRDC and other grower groups and researchers to find alternative mitigation solutions and investigate options for grain cleaning into the future.

Snail extension and Grain Roller work is supported by funding from the Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA
Department of **Primary Industries and Regional Development**

Anthony and Murray Hall TT Canola variety trial

Trial sown

June 4th

Trial harvested

December 4th, 2018

Seeding rate

4.5kg/ha for Open-pollinated (OP) varieties and 2.5kg/ha for Hybrid varieties.

Plant counts were completed post-seeding after some damage caused by RLEM. Plots averaged >30 plants/m^2. Data not shown.

Seed dressings

Please note that seed dressings were not uniform across the trial. Different seed dressings have the potential to alter the final yields. Please interpret the data with this in mind.

Fertiliser details

110 kg/ha Agflow and 20 kg/ha MOP mix treated with Impact (500) 2.5 L/tonne of fertiliser

100kg/ha NS31- July 15th

80kg/ha Urea - August 17th

BACKGROUND

Anthony Hall is planning to plant 1300ha of canola in 2019, which is above average for his cropping program. Anthony wanted to know which variety he should be growing in 2019, to achieve the highest profit? When varieties have a similar yield, the oil bonuses paid, can be the tiebreaker that decides which one farmers should grow.

Table 1: Total monthly rainfall at West Kendenup in 2018.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
33.6	7.8	14.2	14.2	21.2	64.2	78	118.4	25.8	40.4	27.6	36.4

Growers are well-aware of the extra costs associated with purchasing hybrid seed. Over the years, farmers have been less inclined to grow hybrid TT varieties compared to Round-up Ready (GM) hybrid varieties. This is because the perceived benefits, of hybrid canola, are not seen by farmers in TT varieties.

Anthony wanted to validate NVT trial data with his own broad-scale variety trial in 2018. With help from his agronomist, Tim Trezise from Frankland Rural; and John Blake from SCF, Anthony set up a trial with the following varieties.

Varieties tested

ATR Gem (OP), ATR Mako (OP), ATR Bonito (OP), ATR Stingray (OP), InVigorT4510 (Hybrid) and Hyola 650 (Hybrid).

NB: *ATR Gem had three replicates including two replicates from new seed purchased in 2018 and one replicate from Anthony Hall's retained seed. The yields were very similar between the two seed sources (Data not shown), so we combined the Gem plots into one treatment.*

Anthony reasoned that a variety yielding, just 200kg/ha less than maximum potential, was going to cost him a lot of money over a 1300ha program.

For example:
200kg/ha multiplied by 1300 ha = 260 tonnes
260 tonnes multiplied by $500 (conservative farm gate price) = $130,000

In this context, Anthony's trial is worth a lot of money to his business. It should be noted that all trials are a one off snap-shot. The data set created, is reflective of what happened in that season, on that soil type, with that amount of rainfall etc. It is dangerous to make decisions based on one data set. This is where the NVT system is more valuable than many growers realise. The ability to analyse multiple trial sites over multiple seasons gives growers and agronomists very accurate information on varieties strengths, weaknesses and yield potential.

RESULTS

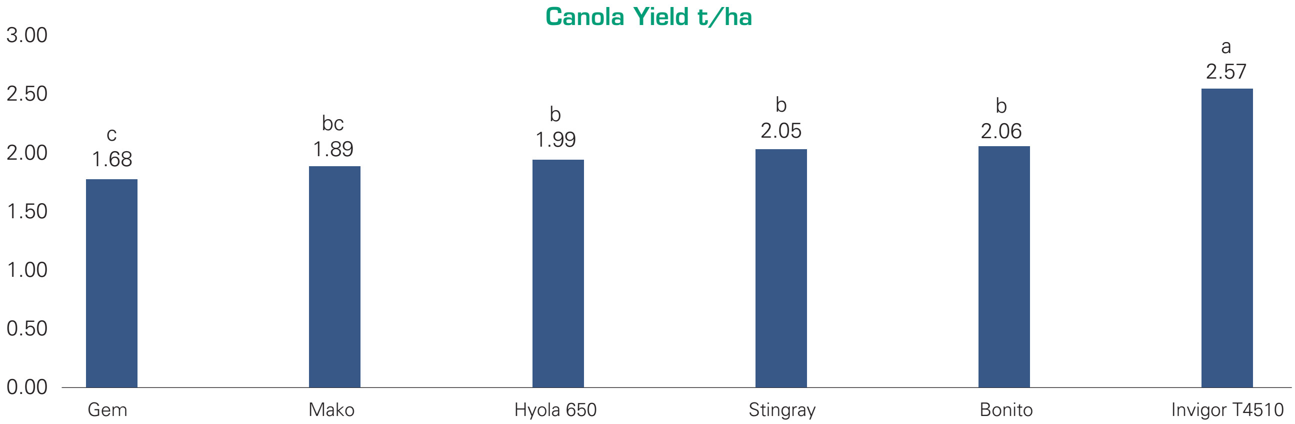


***Figure 1:** Yield (t/ha) of Anthony Hall's replicated Triazine Tolerant (TT) canola variety trial at west Kendenup in 2018. Trial was sown on the 4th June and harvester on the 4th of December. Means followed by the same letter do not significantly differ (P = .05 LSD).*

Table 2: Shows the gross revenue of certified non-GM canola in Albany on Dec. 7th, 2018. The base price used was $570 and the oil bonus was calculated by multiplying price by 0.015 by % amount above 42%. Seed costs were calculated at $3/kg for OP varieties whilst the hybrids were calculated at $24.75 and $28.60 Inc. GST for InVigorT4510 and Hyola 650 respectively. **NB:** ATR Mako and ATR Bonito attract a $5/tonne end point royalty.

Variety	Yield t/ha	Ave. Oil %	Revenue (Price + oil bonus)	Seed costs	Revenue - seed costs
Gem	1.68	43.25	975.56	15	960
ATR Mako	1.89	44.15	1117.9	24.45	1093
Hyola 650	1.99	44.55	1184.7	61.88	1123
ATR Stingray	2.04	44.7	1218.7	15	1204
ATR Bonito	2.06	45.4	1239.2	25.3	1214
Invigor T4510	2.56	45.1	1537.9	71.5	1466

DISCUSSION

The results of this broad-scale trial have been extremely beneficial to the Hall family. Anthony was planning to grow ATR Gem next season. These results have shown that Gem would have been his worst possible result with nearly 1t/ha difference between ATR Gem and InVigorT4510.

InVigorT4510 was the stand out performer in this trial and the extra investment in the hybrid seed was well and truly worth it, with a $252/ha advantage over the next best variety. When you multiply $252 by 1300ha the total is $325,000. This figure is unrealistic in a sense, because the trial paddock was one of the Hall's better performers and they probably won't average 2.6t/ha over their entire canola program. However, even if you halved that number, the financial benefit is massive!

The other hybrid variety, Hyola 650, yielded the same as the best OP varieties. On the surface you could say that Hyola 650 is not worth the extra cost of the seed. However, the June 4th sowing date does not suit a mid-season variety (6) in comparison with the others in this trial that were all early season varieties rated a (4), except for Stingray being a (3).

Mako's yield was down a little but was not significantly different to Stingray, Bonito, or Hyola 650. Gem yielded significantly less than all other varieties except for Mako, whose yield was statistically equivalent. Stingray and Bonito were very hard to split, and either appear to be good options for the Hall's. Stingray has a better blackleg resistance rating and has a different grouping (C) to Bonito (A) which could be advantageous if there is a lot of Bonito grown in your area. On the other hand, Bonito has better early vigour and will probably tolerate stresses, such as water-logging, deeper seed placement or insect pressure better than Stingray.

How did this trial compare to local NVT data?

A very useful NVT data analysis table can be found in the *2019 Canola variety sowing guide for Western Australia, page 11*.

https://www.agric.wa.gov.au/sites/gateway/files/DPIRD%20canola%20variety%20sowing%20guide%202019%20Bulletin%204897.pdf

This table has summarised the NVT canola data for Agzone 3, from 2013-2017. This data set indicated that InVigorT4510 was yielding 111% better than the trial mean for the 2.0-2.5t/ha (mid) yield range. The other varieties in this trial were all yielding below the average trial means, with 90% Gem, 91% Mako, 92% Bonito, 93% Stingray and 104% for Hyola 650. The basic rankings from the NVT dataset are very similar to the results Anthony obtained in his 2018 trial.

Figure 2: *Drone image of the Hall family TT canola variety trial at west Kendenup. The photo was taken on the 11th of October 2018.*

SUMMARY

Anthony did a great job of managing this broad-scale canola variety trial in 2018. Controlling all variables in broad-scale trials is difficult to do and small compromises are often made. Having said that, the data produced was consistent between the two replicates. Anthony is much more confident in his canola plan for next season. Farmers often don't value the results generated from the NVT program. This trial validated the previous four-year NVT data set for Agzone three canola. Farmers may gain a greater appreciation of the NVT system in the future, if more trials like this were generated.

ACKNOWLEDGEMENTS

SCF would like to acknowledge the Hall family, and specifically Anthony for sharing the data. Thanks also to Tim Tresize, from Frankland Rural, for helping Anthony source the trial seed and encouraging Anthony to run the trial. Finally, thank you to SCF Gold sponsors the CBH Group, and specifically Brendan Simmons, for allowing us to test the canola samples at the port, in the middle of harvest.

Canola grain samples for this project were kindly tested at CBH Albany Port facility

CBH GROUP

Preston P-rate trial

BACKGROUND

The Preston family began a seeding (starter) fertiliser trial in 2014 on a newly acquired piece of land in west Cranbrook. The fertiliser used in the trial is a mix of MAPZSC and Muriate of Potash (MOP) in a ratio of 75:25. The aim was to refine the amount of fertiliser they should be sowing to maximise yields and minimise costs. All other cropping inputs, including nitrogen and chemicals applied remained the same each year.

For three years different fertiliser rates were applied, and yield results observed using their harvest yield monitor. There were no measurable differences between treatments in these years. In 2017 SCF staff aided in collecting yield data. It was expected that yield differences in the lower treatments would eventuate due to the export of more phosphorous (P) in grain than was being re-applied each year. In the first three years yields remained the same due to existing levels of excess P in the soil that was available to the crop.

TRIAL AIM

The purpose of the trial was to answer the question of how long it would take to deplete the soil P reserves and therefore what starter fertiliser rates would be most economical?

SCF research staff used the weigh trailer to accurately measure grain yields from each plot in the 2017 canola crop and the 2018 barley crop.

NB: *Although the plots were split into different soil types, the replicates are not fully randomised, which means the statistical analysis would not be acceptable for scientific publications.*

RESULTS

- For three years between 2014-16, the Preston's felt there were no measurable yield differences based off data collected from the harvester's yield monitor *(Data not shown)*.
- In 2017, the optimum fertiliser rate to maximise profit was equal between 100 and 140kg/ha of seeding fertiliser on the canola crop. *(Table 2)*
- In 2018, the optimum fertiliser rate to maximise profit was 100kg/ha of seeding fertiliser on the barley crop. *(Table 1)*
- In both years the grain yield differences between sowing 100kg/ha and 140kg/ha of seeding fertiliser were not statistically significantly.
- In 2018 there was a significant yield difference between 80 and 100kg/ha of seeding fertiliser.
- In 2017 there was not a significant difference between these two rates, yet the difference in gross revenue minus seeding fertiliser costs, was $82/ha.
- In 2018 there was no significant difference in grain yields between the 40, 60 and 80kg/ha seeding fertiliser rates.

NB: *All cropping input costs, apart from the seeding fertiliser, were equal in this farm-scale trial. Gross Revenue minus the cost of seeding fertiliser is a simplistic way to compare the changes in revenue for each different seeding fertiliser rate tested.*

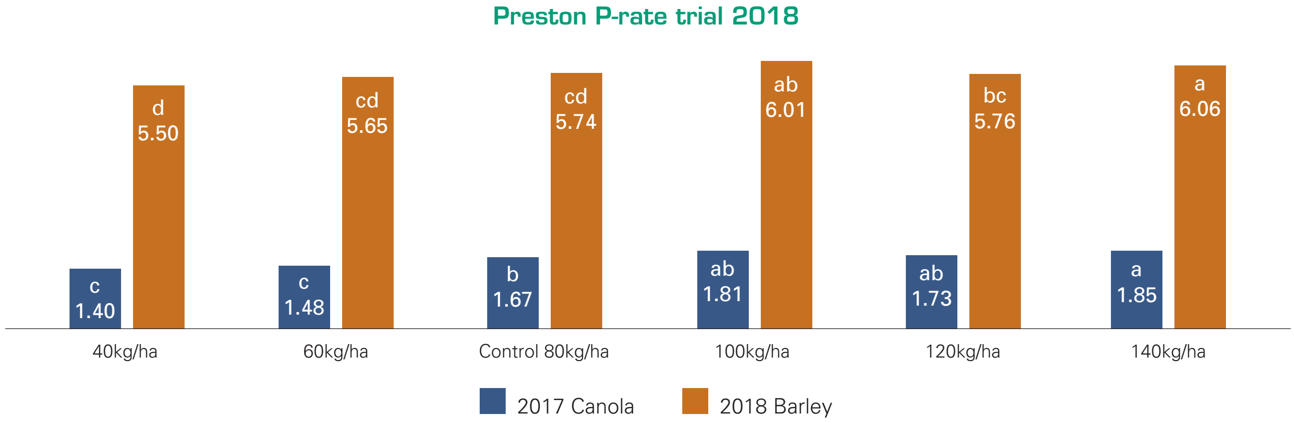


***Figure 1:** Grain yields (t/ha) from 2017 and 2018 at the Preston's Phosphorous rate response trial in west Cranbrook. The fertiliser used in the trial was a MAPSZC:MOP mix (75:25) and the rates tested (kg/ha) are labelled on the horizontal axis. The grain yields have been analysed separately each year. **NB:** Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Table 1: Barley grain yields (t/ha) and seeding fertiliser cost ($/ha) comparisons of the Preston's phosphorous rate response trial in 2018. Gross revenue is based on a barley price of $250/tonne (on farm) multiplied by the yield. The starter fertiliser costs were calculated at a cost of $576/tonne. **NB:** *Means followed by same letter or symbol do not significantly differ (P=.05, LSD).*

Seeding Fert. Rate (kg/ha)	Units of Phosphorous (P)	Barley Yield 2018 (t/ha)	Gross revenue ($/ha) on-farm	Seeding Fert. Cost $/ha	Gross revenue minus Seeding Fert. $/ha
40	5.9	5.50[d]	1375	23.04	1352
60	8.9	5.65[cd]	1412.50	34.56	1378
80-control	11.9	5.74[cd]	1435	46.08	1389
100	**14.8**	**6.01[ab]**	**1502.50**	**57.60**	**1445**
120	17.8	5.76[bc]	1440	69.12	1371
140	20.8	6.06[a]	1515	79.66	1435

Table 2: Canola grain yields (t/ha) and seeding fertiliser cost ($/ha) comparisons of the Preston's phosphorous rate response trial in 2017. Gross revenue is based on a canola price of $550/tonne (on farm) multiplied by the yield. The starter fertiliser costs were calculated at a cost of $650/tonne.

Seeding Fert. Rate (kg/ha)	Units of Phosphorous (P)	Canola Yield 2017 (t/ha)	Gross revenue ($/ha) on-farm	Seeding Fert. Cost $/ha	Gross revenue minus Seeding Fert. $/ha
40	5.9	1.40[c]	768	26	742
60	8.9	1.48[c]	813	39	774
80-control	11.9	1.67[b]	899	52	847
100	**14.8**	**1.81[ab]**	**994**	**65**	**929**
120	17.8	1.73[ab]	950	78	872
140	**20.8**	**1.85[a]**	**1020**	**91**	**929**

DISCUSSION

The yield data collected from 2017 and 2018 follows a similar pattern. In both years the optimal seeding fertiliser rate was 100kg/ha, although in 2017 gross revenue minus seeding fertiliser costs were identical for the 100 and 140kg/ha rates ($929/ha). Most farmers would choose to spend $26/ha less on the 100kg/ha rate because it is less risky.

At 120kg/ha, there was a slight dip in grain yields, although not significantly different to the 100 or 140kg/ha rates. At 140kg/ha the grain yields in 2017 and 2018 were almost identical to the 100kg/ha rate. In both years there was no advantage to applying more than 100kg/ha of seeding fertiliser.

The Preston family have sowed their cropping program at 80kg/ha of MAPSZC:MOP mix (75:25) for last three years and before that they were sowing at 100kg/ha. 2018 was the first year that a significant yield difference was measured between the 80 and 100kg/ha seeding fertiliser rates.

When the difference in gross revenue minus seeding fertiliser costs is calculated, there is a combined difference of $138/ha for 2017 and 2018.

Although yields were not statistically different between 80 and 100kg/ha in 2017, the difference in gross revenue minus seeding fertiliser costs was $82/ha.

In 2018, there was a statistically significant yield difference between the 80 and 100kg/ha seeding fertiliser rates and a gross revenue minus seeding fertiliser costs difference of $56/ha.

Assuming the first three years of the trial didn't show yield differences between any of the fertiliser rates, including the low 40kg/ha treatment, it is not likely that any yield potential is being lost at the 80kg/ha rate in the short term. However, based on the higher gross margins measured at 100kg/ha in the last two years it would suggest that a return to 100kg/ha of seeding fertiliser is needed to maximise profitability.

New projects for 2019

SCF has been successful in securing funding for several new projects for 2019 and onwards from both Commonwealth and State government programs. SCF now manages over $2.8m worth of projects from various funders for member's benefit. An outline and preliminary details of the new projects follows below.

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

HIGH RAINFALL ZONE (HRZ) YIELD GAP

Funded by Grains Research and Development Corporation

The high rainfall zone (HRZ) of Southern Western Australia is defined as the arable areas where annual rainfall is between 450-800mm. This area represents approximately 1.2 million Ha in WA and nearly all the Stirlings to Coast Farmers membership base. Grain yields have stagnated over the last decade, which is somewhat surprising since there have been significant technology advances in this time. For example, the benefits of auto-steering technology, seed placement, new herbicide modes of action, liquid fertilisers and the like have not out-paced soil nitrogen depletion, increased disease pressure and developing herbicide resistance. Stagnating yields in the last decade also highlight the lack of viable solutions for mitigating waterlogging and the need to address major soil constraints such as non-wetting topsoils, acidity and soil compaction.

It has been estimated that potential grain yield for wheat grown in the HRZ, is in the range of 5-9 t/ha and 3-5t/ha for canola. However, current crop yields are only about 50% of these potentials at 2.7t/ha for cereals and 1.4 t/ha canola (Robertson et al 2016). Research from the mid to late 2000's indicate that higher yields are possible in modelled scenario's as well as small plot trial research. Researchers and crop modellers believe there are major constraints to crop production which are stopping farmers from reaching their optimum yield potentials.

This project, in conjunction with a similar DPIRD led collaboration, aims to identify the main yield constraints to grain growers in the HRZ and how do growers implement the changes required to boost yields. In 2019, SCF will work with the SEPWA grower group, DPIRD, CSIRO and the Foundation for Arable Research (FAR) Australia to create a survey for growers and agronomists to complete so we can identify the key agronomic constraints to achieving high grain yields in the HRZ. Concurrently, the DPIRD led collaboration will be conducting small plot trial research to begin investigating some of the expected yield constraints in cereal and canola crops.

In 2020-22, SCF and SEPWA will grow two broad-scale trials each, using farmer equipment, that will demonstrate the yield potential in the HRZ when some of these constraints have been mitigated. Each grower group will host an HRZ Cropping field day annually, where we will visit the broad-scale and small plot trials as well hear from expert speakers from around Australia in HRZ cropping agronomy. SCF ask that you keep an eye out for the survey which will be emailed to members and agronomists very soon.

HRZ yield constraints in cropping workshop

As part of this project, SCF will be hosting a workshop at the Green Range Country Club on the 24th of July. This will be a great opportunity to engage with specialist HRZ cropping researchers and inform them what our most pertinent and difficult challenges are. This will be fully catered for and free for everyone to attend. SCF strongly encourage all agronomists to come along to convey your local knowledge and experiences. Check the SCF website and eNews for further details.

NON-WETTING MANAGEMENT OPTIONS FOR GROWERS IN THE ALBANY PORT ZONE

Funded by the Grains Research and Development Corporation

This investment is to improve the confidence in diagnostic methods for delineating and implementing methods to overcome non-wetting in most soil types and improve the confidence of growers in the decision making for improving soil productivity. Growers want the ability to confidently maximise water use efficiency (WUE) on various previously repellent soils which will promote more even establishment of both crops and weeds which will lead to better yields and more effective weed control. Additionally, the Albany port zone RCSN members and growers are keen to explore alternative methods of amelioration excluding ripping and other deep soil measures, which they feel can cause more problems or simply not be possible on some soil types.

This investment will assist growers to identify subsoil management zones, know which non-wetting management options are applicable to their situation and use appropriate technologies accordingly after demonstration field site events. Four demonstration sites in the Albany port zone, two with SCF and two hosted by Southern Dirt, will be developed to look at a range of non-wetting management options including claying, seeds coated with wetting agents, ploughing (Plozza plough, Terraland and Speedtiller), and wetter's in-furrow or surface applied.

Australian Government
Department of Agriculture and Water Resources

BANDING AND MID-ROW BANDING OF NITROGEN TO IMPROVE NITROGEN USE EFFICIENCY IN CROPPING SYSTEMS

Funded by the Federal Government's National Landcare Program Smart Farms Small Grants

The major aim of this project is to determine proof of concept for mid-row banding (MRB) in the HRZ of WA using farm-scale equipment. Initial Australian research was limited to Victorian conditions and we would like to confirm the results on our acidic sandy soils in WA. CSBP have also conducted plot trial work in 2018, with encouraging results, and they are continuing to test MRB in 2019 in their trial program. SCF will collaborate with CSBP on this project in 2019 to share trial design ideas and methodologies.

A component of the project will also be to assess if farmers' current levels of GPS guidance technology can implement MRB without major upgrades to their guidance systems. Current levels of GPS accuracy should be sufficient for MRB for most farmers and this will increase the chances of swift adoption.

Our ability to test MRB is only possible through collaboration with machinery dealership *Direct Seeding and Harvesting Equipment*. This group are willing to develop and donate the use of a prototype machine which we can utilise to implement farm-scale demonstrations at seeding time and in June-July when farmers are adding N fertiliser. The machinery group will also provide expertise and labour to apply the N applications to the crop demonstrations.

Research conducted in Victoria, 2016-17, showed MRB was more efficient in delivering N to the wheat plant in comparison to other application methods. A CSBP plot trial in Scaddin 2018, found that NUE and profit from N was doubled with banding N compared to streaming it onto the crop at Z30 (stem elongation). In crop MRB is likely to have the best fit where there is a high requirement for N fertiliser and where there are high residue levels. It also has the benefits of reducing losses to immobilisation (compared to surface applications) and leaching (compared to earlier applications). CSBP have planned five more trials on the benefits of MRB of N in 2019, including one at Gnowellen.

Assuming the application costs for MRB of N are not significantly different to spreading granules or spraying liquid-N there is significant potential to reduce farmer fertiliser costs for farmers in the future.

LIMING FOLLOWED BY RIPPING WITH INCLUSION PLATES TO AMELIORATE SUBSOIL ACIDITY AND COMPACTION

Funded by the Federal Government's National Landcare Program Smart Farms Small Grants

Many farmers in the South Stirlings & Green Range areas have deeply compacted soils and subsoil acidity where the soil pH is below the recommended 4.8 in $CaCl_2$. Some SCF members have been spreading lime on the surface to treat top-soil acidity for over a decade and have patiently waited for lime to move into the sub-soil.

SCF members have started to deep rip their compacted sandplain soils which is offering significant yield improvements, measured in SCF and DPIRD research in the area in recent years.

This project, funded through the National Landcare Program (NLP) Small Farms Small Grants, aims to determine if deep ripping with inclusion plates after surface applied lime improves subsoil acidity (raises the pH) at a faster rate than surface applied lime applications only.

Inclusion plates are designed to allow for topsoil to relocate deeper into the soil profile down the back of the ripper tyne. If lime has been applied on the soil surface, then some of that lime should also move into the subsoil where it can react with acidity and increase soil pH. If subsoil acidity can be ameliorated faster than the traditional surface lime applications, then productivity gains could occur sooner which accelerates payback.

SCF researchers want to determine if subsoil compaction and acidity can be treated in the same pass of a ripping machine. The only extra cost of this strategy is the wear on the inclusion plates and the extra drag created by them, increasing fuel costs, tractor hours, and depreciation.

A secondary trial site was established at the Curwen's property on Bloxidge Road at South Stirlings. The objectives are the same as the Willis trial site described above.

Australian Government
Department of Agriculture and Water Resources

SMART FARM REGENERATION HUB FOR SOIL HEALTH AND CLIMATE RESILIENCE ACTIVITIES FOR FARMERS IN SOUTHERN HIGH RAINFALL ZONES.

Funded by the Federal Government's National Landcare Program Smart Farms Small Grants

This project will have a strong focus to help farmers become more resilient in the way they deal with soil degradation in a changing climate by making the most of new digital tools and 'Internet of Things' (IoTs) that can help them to make better decisions in real time and aid in reducing farming impacts on natural resources at the same time as improving productivity.

A 'Smart Farm Hub' will be established with two demonstration farms in high rainfall Mt Barker / Albany zones in southern WA. These demonstration farms will have a focus on technology and best practice for improving:

- Climate resilience - ability to predict, plan, respond and recover from adverse seasonal conditions; and
- Soil health and fertility - reducing soil acidity, compaction, waterlogging and chemical and pesticide use.

The main objective of the NLP2 project is to increase the skills, knowledge, confidence, aspiration, motivation and adoption of best practice soil remediation techniques and new technology for managing seasonal events by farmers.

Funding from the Department of Primary Industries and Regional Development IoT Decision Ag grants will support the demonstration of how a fully NBN connected farm can be set up with new technology so that other farmers can learn how, and which types of technology are most applicable to cropping and livestock operations. New digital technology tools, such as sensors, weather stations, drones, security cameras and other IoT tools will be installed on the farms and used to demonstrate how farmers can take advantage of new technology in their farming systems to improve long term efficiency and sustainability. We have also partnered with Hitachi to then establish a system to collate this data in a way that it can send tailored warnings and information to the farm manager. The project starts in June and you can expect to hear a lot more about it later in the year. In 2020, demonstrations, field days and workshops will be run to introduce the digital tools and systems to farmers in the region.

Denmark students with SCF staff

Australian Government
Department of Agriculture and Water Resources

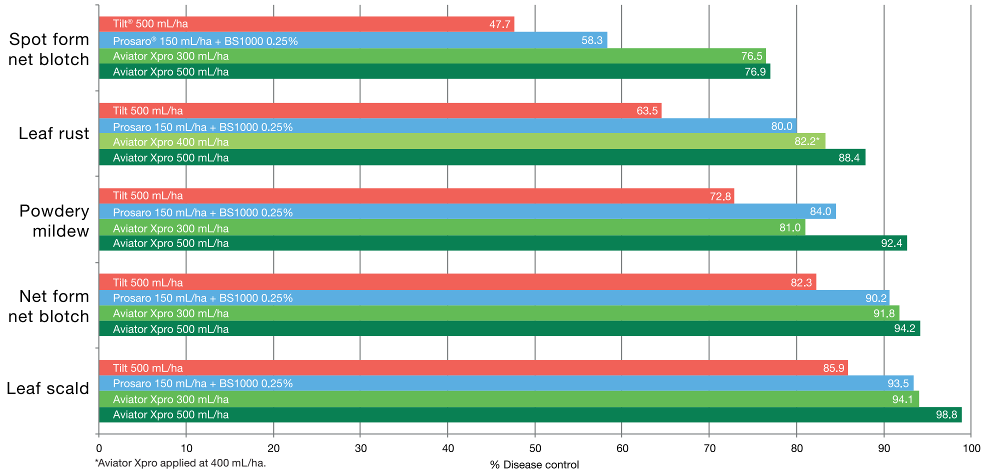
FUTURE FARMERS STUDENT CONNECT

Funded by the Federal Government's National Landcare Program Smart Farms Small Grants

SCF are excited to announce new partnerships with Mt Barker Community College and Great Southern Grammar, along with the continued partnership with WA College of Agriculture, Denmark to participate in the student membership and mentoring program – Future Farmers Student Connect.

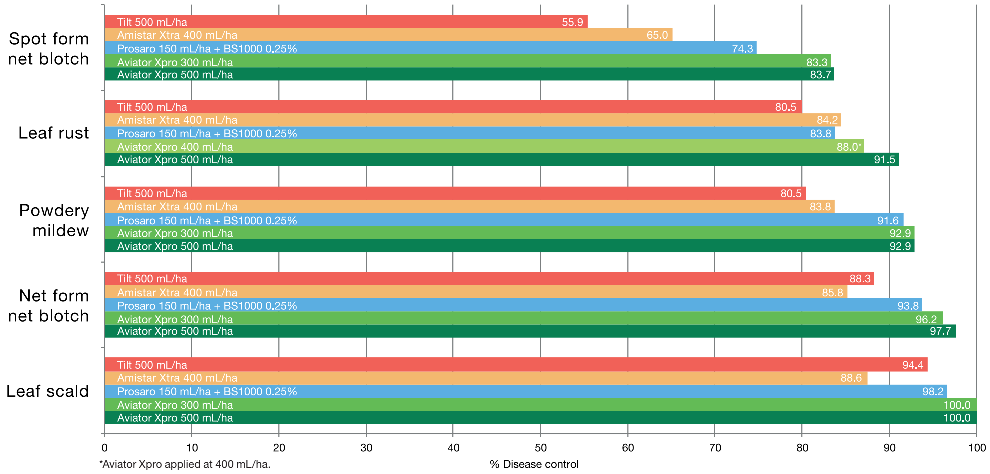
SCF is proud to support the youth and the future of our industry by providing better links between farmers, industry and agricultural students. The program aims to better equip students by connecting them to farmers and industry professionals, helping to enlighten them to the wide range of industry employment the Ag sector provides. This will be achieved through sustainable farming innovation demonstrations, lectures and mentoring throughout the year. Some specific activities we are planning include guest lectures on agricultural technology and applied agricultural research, student field walks, scholarship program, work experience and hosting 'Careers in Agriculture' information sessions for each school. The project is supported by funding from the Federal Government's National Landcare Program Smart Farms Small Grants program.

Barley – disease control compared to untreated

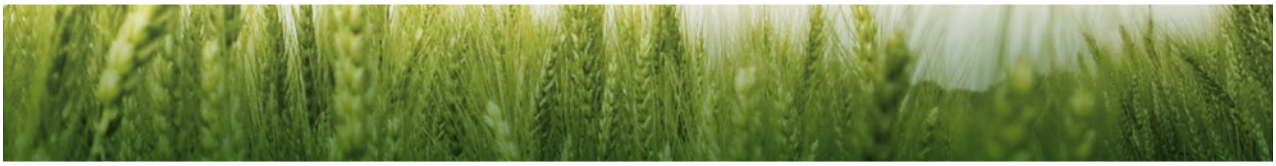


DISEASE	NO. TRIALS	UTC DISEASE LEVEL (% SEVERITY OR INCIDENCE)	TRIAL ID					
SPOT FORM NET BLOTCH	6	22.3%	13VB02	13WA27	13WA07	15WE01	15WE03	16VD23
LEAF RUST	4	26.0%	13WB03	14SA34	14SA35	15SB18		
POWDERY MILDEW	5	59.5%	13WA26	13WB01	13WB03	14VB39	15WE01	
NET FORM NET BLOTCH	6	32.5%	13WA06	13WA26	13WB02	15SB18	16SB12	16SB14
LEAF SCALD	5	25.7%	13WB02	14VB36	15SB18	16SB12	16VD23	

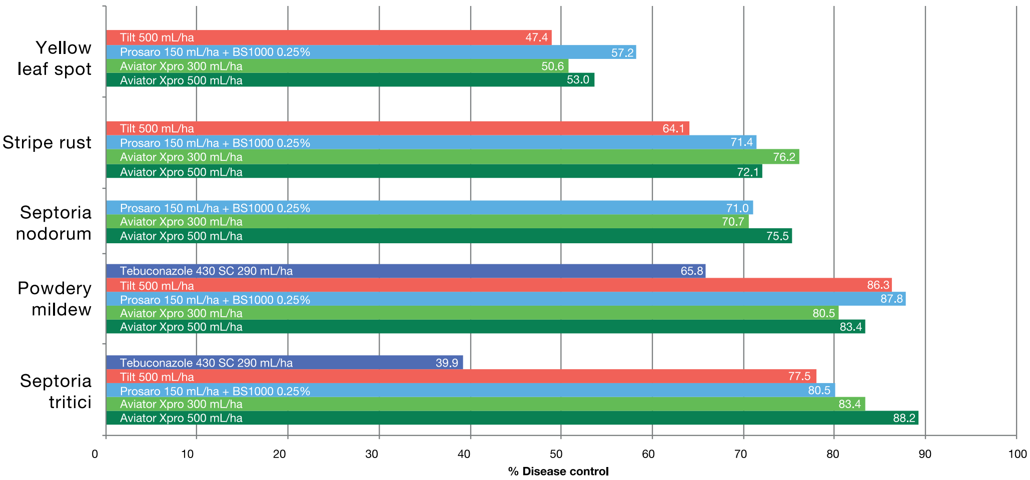
Barley – disease control compared to Amistar® Xtra



DISEASE	NO. TRIALS	UTC DISEASE LEVEL (% SEVERITY OR INCIDENCE)	TRIAL ID		
SPOT FORM NET BLOTCH	3	5.4%	15WE01	15WE03	16VD23
LEAF RUST	2	1.8%	14SA34	15SB18	
POWDERY MILDEW	1	30.8%	WE01		
NET FORM NET BLOTCH	3	18.0%	15SB18	16SB12	16SB14
LEAF SCALD	2	5.4%	15SB18	16VD23	



Wheat – disease control compared to untreated



DISEASE	NO. TRIALS	UTC DISEASE LEVEL (% SEVERITY OR INCIDENCE)	TRIAL ID					
YELLOW LEAF SPOT	6	38.7%	13NW05	13WA03	13WA24	13WA04	13SA11	15WE02
STRIPE RUST	2	36.5%	13SA07	15SB19				
SEPTORIA NODORUM	2	7.9%	13WA25	16WE01				
POWDERY MILDEW	4	9.8%	15VA21	15VB21	15WA23	15WA24		
SEPTORIA TRITICI	5	20.4	13SA11	14SA31	14SA32	14SA33	16SB13	

How does Aviator Xpro compare to competitors?

PRODUCT^	FORM	ACTIVE INGREDIENT(S)	g a.i./L	MOA Grp	APPLICATION RATE mL/ha	ADJUVANT REQUIRED?	BARLEY					WHEAT					
							Leaf rust	Scald	Spot form net blotch	Net form net blotch	Powdery mildew	Stripe rust	Septoria tritici	Septoria nodorum	Yellow leaf spot	Powdery mildew	Eyespot
AVIATOR® XPRO®	EC	Bixafen Prothioconazole	75 150	7 3	300	No	-	★★★	★★★★	★★★★	★★★	★★	★★★★	★★★	★★★	★★★	★★★★
					400	No	★★★	★★★	★★★★★	★★★★★	★★★	★★	★★★★	★★★	★★★	★★★	★★★★
					500	No	★★★★	★★★★	★★★★★	★★★★★	★★★★	★★★	★★★★★	★★★★	★★★★	★★★★	★★★★★
PROSARO®	SC	Prothioconazole Tebuconazole	210 210	3	150	Yes	★★★	★★	★★	★★★	★★★	★★★	-	★★★	★★★	★★★	-
					300	Some diseases	★★★★	★★★	★★★	★★★	★★★★	★★★★	-	★★★★	★★★	★★★★	-
TILT®	EC	Propiconazole	250	3	250	No	-	-	nd	★★	nd	★★	nd	★★	nd	nd	-
					500	No	-	★★★	★★	★★★	★★	★★	★★★	★★	★★★	★★★	-
EPOXICONAZOLE	EC	Epoxiconazole	125	3	250	No	★★	nd	-	nd	★★★	nd	-	nd	-	★★★	-
					500	No	★★★	-	-	★★	-	nd	-	★★	-	-	-
TEBUCONAZOLE	SC	Tebuconazole	430	3	145	Yes	-	nd	-	-	nd	★★★	-	★★	★★	-	-
					290	Yes	-	-	-	-	nd	★★★★	★★	★★	★★★	-	-
AMISTAR® XTRA	SC	Azoxystrobin Cyproconazole	200 80	11 3	200	Adigor® 2%	★★★	-	★★	★★	-	-	-	-	-	-	-
					400	Optional	★★★★	-	★★★	★★★	★★★	★★★	-	-	★★★	★★★	-

★★★★★	Best available
★★★★	Better than commercial standard
★★★	Same level as commercial standard
★★	Moderate efficacy
-	Not registered
nd	No comparative data

^The ratings in this disease matrix are indicative only and developed from field trials (different data points are supported by data from variable number of trials). Talk to your agronomist for the best recommendation for your situation.

Aviator Xpro

Label Information

CROP	RATE	DISEASE SPECTRUM	COMMENTS
Canola	550 to 650 mL/ha	Blackleg (*Leptosphaeria maculans*)	Apply at the 4 to 6 leaf crop stage **See label for full instructions.**
	550 to 800 mL/ha	Sclerotinia stem rot (*Sclerotinia sclerotiorum*)	Apply at the 20 to 50% (full bloom) flowering. **DO NOT apply after 50% (full bloom) flowering growth stage.** **See label for full instructions.**
Chickpeas	400 to 600 mL/ha	Ascochyta blight (*Phoma rabiei*)	Aviator Xpro is most effective when applied before an infection event occurs (e.g. before rain). A maximum of two applications may be made per crop. **Chickpeas** DO NOT apply after late flowering (BBCH 69) **All other pulse crops** DO NOT apply after early flowering (BBCH 60/61) **See label for full instructions.**
Faba beans	600 mL/ha	Rust (*Uromyces viciae-fabae*)	
		Chocolate spot (*Botrytis fabae*)	
	400 to 600 mL/ha	Ascochyta blight (*Ascochyta fabae* f.sp. *fabae*)	
		Cercospora leaf spot (*Cercospora zonata*)	
Lentils	400 to 600 mL/ha	Ascochyta blight (*Ascochyta fabae* f.sp. *lentis*)	
		Botrytis grey mould (*Botrytis cinerea* and *B fabae*)	
Field peas	600 mL/ha	Black spot complex (*Mycosphaerella pinodes, Phoma medicaginis var. pinodella, Ascochyta pisi*)	
Barley	300 to 500 mL/ha	Net form net blotch (*Pyrenophora teres* f. *teres*)	A maximum of two applications may be made per crop. **DO NOT apply after Z45 (boot with the sheath opening but the head not visible).** **See label for full instructions.**
		Spot form net blotch (*Pyrenophora teres* f. *maculata*)	
		Powdery mildew (*Blumeria graminis* f.sp. *hordei*)	
		Leaf scald (*Rhynchosporium secalis*)	
	400 to 500 mL/ha	Leaf rust (*Puccinia hordei*)	
Wheat	300 to 500 mL/ha	Stripe rust (*Puccinia striiformis*)	
		Yellow leaf spot (*Pyrenophora tritici-repentis*)	
		Septoria nodorum - glume blotch (*Parastagonospora nodorum*)	
		Septoria tritici blotch (*Zymoseptoria tritici*)	
		Powdery mildew (*Blumeria graminis* f.sp. *tritici*)	
		Eyespot (*Oculimacula yallundae*)	

Approved for aerial application:
Apply product using a minimum spray volume of 20 L/ha and a MEDIUM spray quality as defined by the ASABE S572 Standard.

P nutrition for cereals: is your yield being compromised by a decline in subsoil fertility?

Years of no-till farming, plant nutrient redistribution from sub- to topsoils and continuous topsoil fertiliser applications of relatively immobile nutrients like phosphorus (P) have caused a stratified soil nutrient profile. In conjunction with a dry start or early sowing this can cause limited P uptake from 10-30cm below the surface and thereby limited yield potential. CSBP tested the effect of low subsoil nutrition on yield responses last season.

CSBP's phosphorus (P) trials were located in 5 locations across the grain belt. All of those locations revealed a sharp decline in subsoil Colwell P values from topsoil levels. Topsoil Colwell P on those sites suggested that maintenance fertiliser rates may have been sufficient, but wheat responded to much higher P rates to produce more profitable returns.

Depth (cm)	Trayning		Dandaragan		Williams		Kojonup		Mt Madden	
	Col P	PBI_{+ColP}	Col P	PBI_{+ColP}	Col P	PBI_{+ColP}	Col P	PBI_{+ColP}	Col P	PBI_{+ColP}
0-10	18	22	15	32	40	119	60	154	14	23
10-20	4	39	6	29	10	15	14	167	7	14
20-30	2	54	2	36	4	52	5	182	8	13

Soil tests:

The pH was generally good across all sites, except Dandaragan, where sub soil compaction was a constraint. Two of the sites were gravelly (Williams, Kojonup).

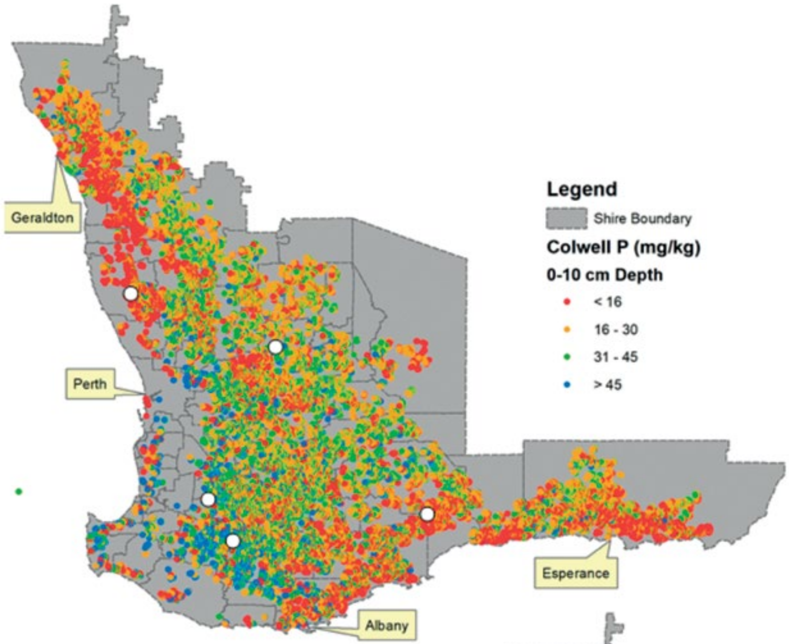
Site locations, placed on the background of soil test results from the last 3 seasons:

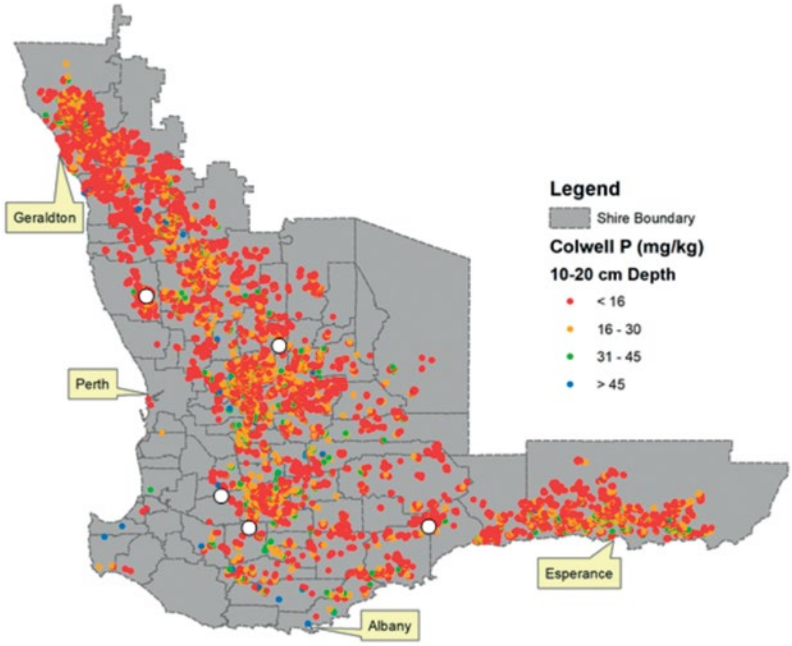
Fig. 1 *(see following page)* visualises the decline in subsoil P values. If only topsoil analysis is used for recommendations then this can be misleading and potentially costing yield. Deeper soil sampling and/or plant testing is highly recommended.

Yield responses:

Across the sites, a P application of 20 kg/ha returned about 95% (or higher) relative yield. It indicates the importance of knowing and then integrating subsoil nutrition into an improved fertiliser recommendation. Maintenance rates for P would have been insufficient on most sites and would have left up to 20% of yield potential unrealised, costing gross margin (assumptions: wheat price 300 $/t, P cost = 3.2 $/kg).

P applied (kg/ha)	Trayning		Dandaragan		Williams		Kojonup		Mt Madden	
	Yield (t/ha)	Gross margin ($/ha)	Yield (t/ha)	Gross margin ($/ha)	Yield (t/ha)	Gross margin ($/ha)	Yield (t/ha)	Gross margin ($/ha)	Yield (t/ha)	Gross margin ($/ha)
0	1.52	456	1.8	540	1.7	510	2.2	660	1.2	360
10	1.86	526	2.4	688	2.2	628	2.8	808	1.4	388
20	**1.98**	**530**	**2.7**	**746**	**2.4**	**656**	**3.3**	**926**	**1.6**	**416**
40	2.00	472	2.9	742	2.4	592	3.5	922	1.6	352





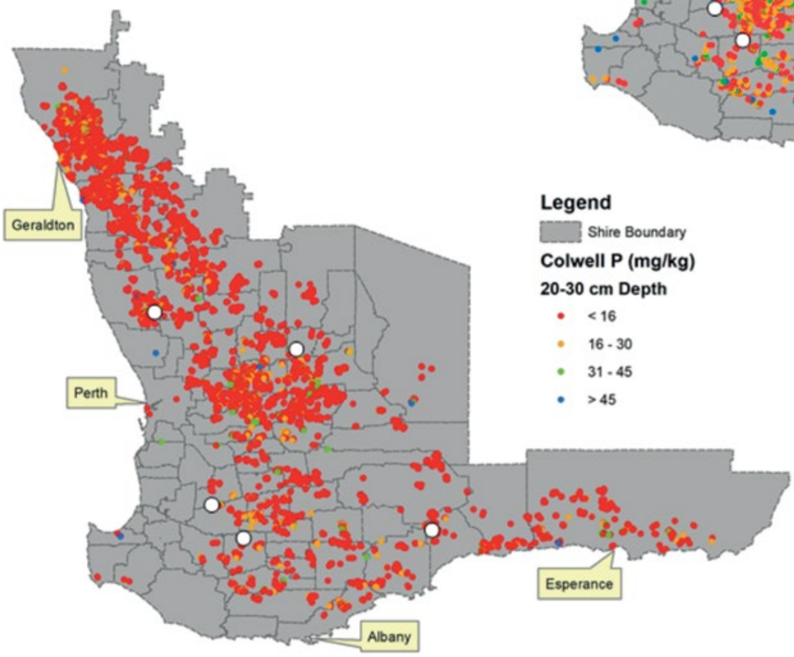


Figure 1: *Colwell P readings from 0-10cm (top), 10-20cm (middle) and 20-30cm (bottom). Trial locations are indicated by white circle. Coloured dots are soil samples analysed by CSBP laboratory within the last 3 seasons (red = < 16, orange = 16-30, green = 31-45, blue = > 45).*

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