Optimising high rainfall zone cropping for profit in the Western and Southern Regions (DAW1903-008RMX)

A Grains Research & Development Corporation (GRDC) investment

2020 FINAL CEREAL RESULTS

Research hosted by:

WA CROP TECHNOLOGY CENTRE (ESPERANCE)

WA CROP TECHNOLOGY CENTRE (ALBANY)

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Final Report – 16th March 2021

Contents

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2020 Crop Technology Centre (Esperance)

Sown: 16 April 2020, (Trial 5 sown 10 May)
Harvested: 8 December 2020 (wheat), 13 November 2020 (barley)
Rotation position: 1st Cereal after Canola
Soil type & Management: Sand Plain, Sand over Clay.

All results have been analysed through ARM software.

Trial 1. Early sown wheat nutrition on ameliorated soils

Trial Code: FAR WAE W20-01

cv. Illabo (winter wheat)

Objectives: To examine the influence of different soil amelioration and establishment methods on the performance of early sown wheat (mid-April).

Key Messages:

- Increased dry matter (dry matter) in the spade seeded blocks as a result of more even establishment failed to deliver benefits in grain yield.
- Increased competition from ryegrass and lack of herbicide options for spade seeding reduced the benefits observed in crop establishment.
- There was a trend for deep ripping in 2020 to increase harvest dry matter and yield compared to control but it was not statistically significant (p=0.352, 0.155).
- When the amelioration treatments were averaged there was evidence that yields were increased by the treatments where additional nutrients had been supplied (see inputs).
- Additional PKS (P: 1.9kg, K: 8kg, S: 14.2kg/ha) increased yield by 0.22t/ha and an additional application of N alone (34.5kg N/ha) by approximately 0.28t/ha.
- The additional nutrition treatments were associated with significant increases in protein and although harvest dry matter was higher the differences were not statistically significant.

Whole trial area was deep ripped commercially to a depth of 600mm in 2019. On 17th February the trial area was marked out based on three treatments i) deep ripped to 800mm – Tyne DBS 16th April, ii) deep ripped to 800mm and spade seeded 16th April and iii) left untreated (deep ripped in 2019) – Tyne DBS 16th April. Each treatment block (18 x 25 m) was replicated four times. Superimposed on these plots were small nutrition plots (2.5m x 18m) where three nutrition treatments were evaluated: i) Standard nutrition, ii) standard plus extra PKS and iii) Standard plus 25% extra N.

Table 1. Influence of soil management (amelioration) and nutrition on dry matter at the start of grain fill (GS71) and crop maturity (GS89) (t/ha), harvest index (%) and Yield (t/ha),

	GS71 Dry matter		GS89 Dry matter		Harvest Index		Yield	
	t/ha		t/ha		%		t/ha	
2019 Ripped, Tyne DBS								
Standard nutrition	11.10	-	10.96	d	30.3	-	3.83	-
Standard plus 25% extra PKS	10.43	-	12.90	bcd	28.5	-	4.12	-
Standard plus 25% extra N only	10.87	-	11.54	d	29.3	-	3.79	-
2019 + 2020 Ripped, Tyne DBS								
Standard nutrition	12.67	-	12.84	bcd	29.5	-	4.28	-
Standard plus 25% extra PKS	10.54	-	14.77	ab	27.8	-	4.58	-
Standard plus 25% extra N only	12.21	-	12.56	cd	31	-	4.80	-
2019 + 2020 Ripped, Spade Seeder								
Standard nutrition	14.06	-	13.71	abc	25.8	-	3.88	-
Standard plus 25% extra PKS	12.44	-	12.38	cd	28.3	-	3.92	-
Standard plus 25% extra N only	14.77	-	15.16	a	24.8	-	4.23	-
Mean	12.12		12.98		28.3		4.16	

LSD	2.16	2.03	3.92	0.35
P Value	0.676	0.016	0.152	0.067
CV	11.97	10.46	9.22	5.68

There was a significant interaction between soil amelioration and nutrition superimposed in dry matter accumulated at harvest where by the 2019 + 2020 Ripped, Spade Seeder was the only amelioration treatment not to respond to standard nutrition plus 25% PKS. When nutrition treatments were meaned there was evidence that the spade seeded blocks produced more dry matter at the start of grain fill (Table 2). When soil amelioration treatments were meaned there was evidence that additional nutrition treatments significantly increased grain yield over the standard nutrition treatment approach (Table 3).

Table 2. Influence of soil management on dry matter at the start of grain fill (GS71) and crop maturity (GS89) (t/ha), Harvest Index (%) and Yield (t/ha) (mean of nutrition treatments).

	GS71 Dry matter		**GS89 Dry matter**		**Harvest Index**		**Yield**	
	t/ha		t/ha		%		t/ha	
2019 Ripped, Tyne DBS	10.80	b	11.80	-	29.4	-	3.91	-
2019 + 2020 Ripped, Tyne DBS	11.81	ab	13.39	-	29.4	-	4.55	-
2019 + 2020 Ripped, Spade Seeder	13.76	a	13.75	-	26.3	-	4.01	-
Mean	12.12		12.98		28.3		4.16	
LSD	2.28		3.22		4.3		0.75	
P Value	0.049		0.352		0.199		0.155	

Table 3. Influence of nutrition on dry matter at the start of grain fill (GS71) and crop maturity (GS89) (t/ha), Harvest Index (%) and Yield (t/ha) (mean of soil management treatments).

	GS71 Dry matter		**GS89 Dry matter**		**Harvest Index**		**Yield**	
	t/ha		t/ha		%		t/ha	
Standard nutrition 164kg N/ha	12.61	a	12.50	-	28.5	-	3.99	b
Standard nutrition plus 25% extra NPK: 164kg N/ha + PKS (P: 1.9kg, K: 8kg, S: 14.2kg/ha)	11.14	b	13.35	-	28.2	-	4.21	a
Standard plus 25% extra N only 198kg N/ha	12.62	a	13.09	-	28.3	-	4.27	a
Mean	12.12		12.98		28.3		4.16	
LSD	1.24		1.17		2.3		0.20	
P Value	0.033		0.322		0.944		0.026	

Table 4. Influence of soil management (amelioration) and nutrition on grain yield (t/ha) and quality (%, kg/hL).

	Yield		Protein		Test weight		Screenings	
	t/ha		%		Kg/hL		%	
2019 Ripped, Tyne DBS								
Standard nutrition	3.83	-	9.4	-	73.9	-	2.9	-
Standard plus 25% extra PKS	4.12	-	10.5	-	73.5	-	3.6	-
Standard plus 25% extra N only	3.79	-	10.6	-	73.3	-	3.9	-
2019 + 2020 Ripped, Tyne DBS								
Standard nutrition	4.28	-	9.2	-	75.4	-	2.0	-
Standard plus 25% extra PKS	4.58	-	9.7	-	75.7	-	2.3	-
Standard plus 25% extra N only	4.80	-	9.9	-	75.7	-	2.2	-
2019 + 2020 Ripped, Spade Seeder								
Standard nutrition	3.88	-	9.5	-	73.7	-	2.6	-
Standard plus 25% extra PKS	3.92	-	10.3	-	73.8	-	2.5	-
Standard plus 25% extra N only	4.23	-	10.5	-	74.0	-	2.7	-
Mean	4.16		10.0		74.3		2.7	
LSD	0.351		0.4		0.6		0.9	
P Value	0.067		0.203		0.150		0.496	
CV	5.68		2.65		0.53		22.58	

Table 5. Influence of soil management on grain yield (t/ha) and quality (%, kg/hL), (mean of nutrition treatments).

	Yield		Protein		Test weight		Screening	
	t/ha		%		Kg/hL		%	
2019 Ripped, Tyne DBS	3.91	-	10.2	-	73.6	b	3.5	a
2019 + 2020 Ripped, Tyne DBS	4.55	-	9.6	-	75.6	a	2.2	b
2019 + 2020 Ripped, Spade Seeder	4.01	-	10.1	-	73.8	b	2.6	ab
Mean	4.16		10.0		74.3		2.8	
LSD	0.75		0.7		0.7		0.9	
P Value	0.155		0.183		0.001		0.041	

Table 6. Influence of nutrition on grain yield (t/ha) and quality (%, kg/hL), (mean of soil management treatments).

	Yield		Protein		Test weight		Screening	
	t/ha		%		Kg/hL		%	
Standard nutrition 164kg N/ha	3.99	b	9.4	b	74.3	-	2.5	-
Standard nutrition plus 25% extra PKS: 164kg N/ha + PKS (P: 1.9kg, K: 8kg, S: 14.2kg/ha)	4.21	a	10.2	a	74.3	-	2.8	-
Standard plus 25% extra N only 198kg N/ha	4.27	a	10.3	a	74.3	-	2.9	-
Mean	4.16		10.0		74.3		2.7	
LSD	0.20		0.2		0.3		0.5	
P Value	0.026		<0.001		0.998		0.222	

Table 7. Details of trial management (kg, g, L, ml/ha).

Sowing date:	**14 April**	
Sowing rate:	180 Seeds/m2	
Sowing Fertiliser:	100kg 50% Vigour, 50% MAPZCS	
Nutrition:		
Standard N applied:	164kg N/ha	
Standard N + PKS applied:	164kg N/ha + PKS (P: 1.9kg, K: 8kg, S: 14.2kg/ha)	
Standard N + 25% extra N applied	Total 198kg N/ha	
PGR:	Nil	
Fungicide:	10 August	ProTeb 300mL/ha
	4 September	Opus 250mL/ha
	18 September	Amistar Xtra 400mL/ha
Herbicide:		
Summer knockdown:	30 March: Roundup - 2L/ha, Ester - 0.8L/ha	
Pre sowing:	3 April: Gramoxone - 1.2L/ha	
IBS/PSPE:		
2019 Ripped, Tyne DBS	14 April: Treflan 3L/ha, Sakura 118g/ha, Gramoxone 1L/ha	
2019 + 2020 Ripped, Tyne DBS	14 April: Treflan 3L/ha, Sakura 118g/ha, Gramoxone 1L/ha	
2019 + 2020 Ripped, Spade Seeder	22 May: Boxer Gold – 2.5L/ha	
In crop:	23 May: Velocity – 1L/ha, Lontrel – 40g/ha, Plantocrop oil – 1%	

All other inputs of insecticides and herbicides were standard across the trial.
**Timings of PGRs and fungicides were adjusted to take account of the differences in spring and winter wheat phenology (development).*

Table 8. Nutrition application rates and timings

		Standard	Plus 25% PKS	Plus 25% N	Additional Information
	At sowing	12	12	12	P 12, K 22, S 7.7, Cu 10, Zn 19.5, Mn 0.3
Farm	27-May	46	46	46	100kg/ha Urea + 20kg/ha MOP
Top up	10-Jun			11.5	100kg/ha Urea + 20kg/ha MOP
Farm	19-Jun	46	46	46	100 kg /ha Urea
Top up	26-Jun			11.5	25 kg/ha Urea
Farm	31-Jul	46	46	46	100 kg /ha Urea
Top up	4-Aug			11.5	25 kg/ha Urea
Top up	4-Aug		14		PKS blend at 100kg/ha (13.5%N)
Top up	4-Aug	14		13.5	Units of N as Urea (28.3 kg/ha Urea)
	Total N	164	164	198	

Trial 2. Early sown wheat disease management on ameliorated soils

Trial Code: FAR WAE W20-02

cv. Illabo (winter wheat)

Objectives: To examine the influence of different soil amelioration and establishment methods on the requirement for fungicide input in early sown wheat (mid-April).

Key Messages:

- Deep ripping at 800mm in autumn 2020 gave a significant yield increase (0.45t/ha) over the control (note the whole trial area was deep ripped in autumn 2019) when sown in mid-April, in the winter wheat cv Illabo.
- Spade seeding following deep ripping in autumn 2020 produced no yield benefits and was compromised by lack of ryegrass control with this establishment option.
- Disease levels of Glume blotch *Stagonospora nodorum* were very low in the trial and different fungicide treatments superimposed on the soil amelioration treatments produced no significant differences in the low levels of disease observed.
- There were small effects of fungicide on yield and screenings, associated with fungicide application based on QoI and SDHI chemistry, which were difficult to relate to low levels of disease.

The whole trial area was deep ripped commercially to a depth of 600mm in autumn 2019. On 17th February 2020 the trial area was marked out based on three treatments i) deep ripped to 800mm – Tyne DBS 16th April, ii) deep ripped to 800mm and spade seeded 16th April and iii) left untreated (deep ripped in 2019) – Tyne DBS 16th April. Each treatment block (18 x 25 m) was replicated four times. Superimposed on these plots were small fungicide plots (2.5m x 18m) where four different disease management approaches were evaluated based on three timings GS31, GS39 and GS59 (Table 1).

Table 1. Disease management strategy

	GS31 Fungicide	GS39 Fungicide	GS59 Head wash
Untreated			
Standard Disease Management	Folicur 146ml/ha	Opus 500ml/ha	Tilt 500ml/ha
High Input – GS39 onwards	Prosaro 300ml/ha	Aviator 416ml/ha	Radial 840ml/ha
High Input – GS31	Aviator 416ml/ha	Radial 840ml/ha	Tilt 500ml/ha

Table 2. Influence of soil management (amelioration) and disease management strategy on grain yield (t/ha) and quality (%, kg/hL)

	Yield		Protein		Test weight		Screenings (<2.2mm)	
	t/ha		%		Kg/hL		%	
2019 Ripped, Tyne DBS								
Untreated	3.76	-	9.3	-	74.4	-	3.0	-
Standard Disease Mgt. Approach	3.92	-	9.1	-	74.2	-	2.6	-
High Input – GS39 onwards	3.94	-	9.1	-	74.0	-	2.4	-
High Input – GS31	4.13	-	9.1	-	75.1	-	2.3	-
2019 + 2020 Ripped, Tyne DBS								
Untreated	4.31	-	9.8	-	74.5	-	2.9	-
Standard Disease Mgt. Approach	4.18	-	9.8	-	74.1	-	3.1	-
High Input – GS39 onwards	4.51	-	9.7	-	74.3	-	2.5	-
High Input – GS31	4.55	-	10.0	-	75.0	-	2.8	-
2019 + 2020 Ripped, Spade Seeder								
Untreated	3.22	-	9.8	-	74.4	-	3.0	-
Standard Disease Mgt. Approach	3.61	-	9.5	-	73.9	-	2.3	-
High Input – GS39 onwards	3.77	-	9.5	-	74.2	-	1.8	-
High Input – GS31	3.95	-	9.4	-	75.7	-	1.7	-
Mean	3.99		9.5		74.5		2.5	
LSD	0.25		0.3		1.1		0.9	
P Value	0.053		0.301		0.834		0.535	
CV	4.30		2.4		1.0		23.0	

Table 3. Influence of soil management on grain yield (t/ha) and quality (%, kg/hL), (mean of disease management strategies treatments).

	Yield		Protein		Test weight		Screenings (<2.2mm)	
	t/ha		%		Kg/hL		%	
2019 Ripped, Tyne DBS	3.94	b	9.1	b	74.4	-	2.6	-
2019 + 2020 Ripped, Tyne DBS	4.39	a	9.8	a	74.5	-	2.8	-
2019 + 2020 Ripped, Spade Seeder	3.64	b	9.5	ab	74.6	-	2.2	-
Mean	3.99		9.5		74.5		2.5	
LSD	0.30		0.5		1.7		1.3	
P Value	0.003		0.040		0.980		0.541	

Table 4. Influence of disease management strategy on grain yield (t/ha) and quality (%, kg/hL), (mean of soil management treatments).

	Yield		Protein		Test weight		Screenings (<2.2mm)	
	t/ha		%		Kg/hL		%	
Untreated	3.76	b	9.6	-	74.4	b	3.0	a
Standard Disease Mgt. Approach	3.90	b	9.5	-	74.1	b	2.7	ab
High Input – GS39 onwards	4.07	a	9.4	-	74.2	b	2.2	b
High Input – GS31	4.21	a	9.5	-	75.3	a	2.2	b
Mean	3.99		9.5		74.5		2.5	
LSD	0.14		0.2		0.6		0.5	
P Value	<0.001		0.206		<0.001		0.009	

Table 5. Details of trial management (kg, g, L, ml/ha).

Sowing date:	**14 April**
Sowing rate:	180 Seeds/m2
Sowing Fertiliser:	100kg 50% Vigour, 50% MAPZCS
Nutrition:	
27 May	46 kg N/ha
19 June	46 kg N/ha
31 July	23 kg N/ha
Total N (including 12 at sowing)	164 kg N/ha
PGR:	Nil
Fungicide:	As per treatment list

Trial 3. Early sown germplasm (winter v spring) x management interaction trial

Trial Code: FAR WAE W20-03

Objectives: To assess a comparison of early sown winter and spring wheat germplasm managed under different levels of management (mid-April sown).

Key Messages:

- Sown in small plots in mid-April the highest yields (5.7 – 5.9 t/ha) came from the spring wheat cultivars and the shorter season winter wheat cultivars Illabo and LPB19-14343.
- Despite earlier sowing and emergence by the 25th April severe winds in early May retarded the development of all cultivars relative to the early sowing date.
- Longer season winter wheats DS Bennett, RGT Accroc and Anapurna were significantly lower yielding and gave less early competition to a background ryegrass population at the site.
- Mechanical defoliation simulating grazing had greater negative impact on the highest yielding cultivars with no statistically significant impact on the lower yielding winter types (despite the later defoliation of the winter types).
- All cultivars responded positively to a greater input of applied nitrogen, PGR and fungicide (High Input), the effect of which appears to be primarily associated with additional nutrition.

The trial was established on land that was deep ripped and spaded prior to small plots being established. Seven cultivars were sown on 16th April into good moisture and subsequent farmed under three levels of management input; i) Standard input ii) standard with defoliation (GS30) and iii) High input (see Table 6). Yields are presented in Table 1.

Table 1. Influence of cultivar on grain yield (t/ha) under different canopy management regimes.

	Canopy Management (Grain Yield t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	4.66	b	4.05	def	5.82	a	4.78	a
DS Bennett (Winter)	3.85	efg	3.88	efg	4.58	b	4.00	b
LPB19-14343 (Winter)	4.46	bc	3.57	gh	5.74	a	4.75	a
Cutlass (Spring)	4.72	b	4.15	cde	5.86	a	4.91	a
Annapurna (Winter)	3.31	hi	3.09	i	4.07	def	3.49	c
RGT Accroc (Winter)	3.89	efg	3.73	fg	4.40	bcd	4.01	b
Scepter (Spring)	4.52	bc	3.97	ef	5.80	a	4.76	a
Mean	**4.20**	**b**	**3.78**	**b**	**5.18**	**a**		
LSD Cultivar p = 0.05		0.23			**P Value**	<0.001		
LSD Management p=0.05		0.54			**P Value**	0.002		
LSD Cultivar x Management P=0.05		0.39			**P Value**	0.001		

Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).

**"Grazed standard" – simulated grazing using mechanical defoliation*

There was a significant interaction between cultivar and management level with greater impacts of defoliation on higher yielding cultivars than the lower yielding winter wheats such as DS Bennett and Anapurna (Table 1). Grain quality was affected by management and cultivar with higher proteins produced under high input and by the spring wheat Scepter (Table 2 & 3). Screenings (%) suggested that the later maturing winter wheats (DS Bennett, Anapurna and RGT Accroc) were unable to properly fill the grain with screenings that were significantly higher than cultivars such as Scepter and the coded winter wheat line. There was a significant interaction between cultivar and management level when test weight and thousand seed weight were considered (Table 4 & 5).

Table 2. Influence of cultivar on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)	
Cultivar (Type)	t/ha		%		Kg/hL		%	
Illabo (Winter)	4.78	a	8.6	c	75.1	d	2.8	cd
DS Bennett (Winter)	4.00	b	7.8	d	80.2	a	8.1	a
LPB19-14343 (Winter)	4.75	a	8.6	c	79.3	b	2.4	de
Cutlass (Spring)	4.91	a	8.7	c	79.1	b	3.2	c
Anapurna (Winter)	3.49	c	9.0	b	79.3	b	8.4	a
RGT Accroc (Winter)	4.01	b	7.9	d	78.3	c	5.0	b
Scepter (Spring)	4.76	a	10.0	a	79.8	ab	1.9	e
Mean	4.39		8.6		78.7		4.5	
LSD	0.23		0.2		0.8		0.7	
P Value	<0.001		<0.001		<0.001		<0.001	
CV	6.26							

Table 3. Influence of management level on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)	
	t/ha		%		Kg/hL		%	
Standard Management	4.20	b	8.5	b	78.8	-	4.2	-
Standard Grazed Management	3.78	b	8.1	b	78.3	-	4.6	-
High Input Management	5.18	a	9.3	a	79.2	-	4.8	-
Mean	4.39		8.6		78.7		4.5	
LSD	0.54		0.5		1.1		0.9	
P Value	0.002		0.004		0.251		0.346	

Table 4. Influence of cultivar on Test weight (kg/hL) under different canopy management regimes.

	Standard Input		**"Grazed" Standard***		**High Input**	
Cultivar (Type)	Kg/hL		Kg/hL		Kg/hL	
Illabo (Winter)	74.7	g	78.5	cde	76.4	f
DS Bennett (Winter)	80.4	ab	74.3	g	80.9	a
LPB19-14343 (Winter)	79.1	bcd	79.4	bcd	80.3	ab
Cutlass (Spring)	79.3	bcd	78.2	de	79.9	abc
Annapurna (Winter)	79.7	abc	79.7	abc	78.7	cde
RGT Accroc (Winter)	78.7	cde	78.5	cde	77.7	ef
Scepter (Spring)	79.5	bcd	79.6	abc	80.3	ab
LSD Cultivar p = 0.05		1.1		**P Value**	<0.001	
LSD Management p=0.05		0.8		**P Value**	0.251	
LSD Cultivar x Management P=0.05		1.3		**P Value**	0.025	

**"Grazed standard" – simulated grazing using mechanical defoliation*

Table 5. Influence of cultivar on Thousand grain weight (grams) under different canopy management regimes.

	Standard Input		**"Grazed" Standard***		**High Input**	
Cultivar (Type)	grams		grams		grams	
Illabo (Winter)	34.0	ghi	36.5	def	35.1	fgh
DS Bennett (Winter)	33.1	ij	33.4	hij	31.7	jk
LPB19-14343 (Winter)	37.6	cd	31.9	jk	37.7	cd
Cutlass (Spring)	39.2	c	36.9	de	37.1	de
Annapurna (Winter)	31.9	jk	31.7	jk	30.2	k
RGT Accroc (Winter)	35.6	efg	35.0	fgh	31.7	jk
Scepter (Spring)	45.6	ab	44.0	b	46.6	a
LSD Cultivar p = 0.05		1.0		**P Value**	<0.001	
LSD Management p=0.05		1.0		**P Value**	0.006	
LSD Cultivar x Management P=0.05		1.8		**P Value**	0.002	

Note. Grain was dried at 70°C for 24 hours prior to weighing.

**"Grazed standard" – simulated grazing using mechanical defoliation*

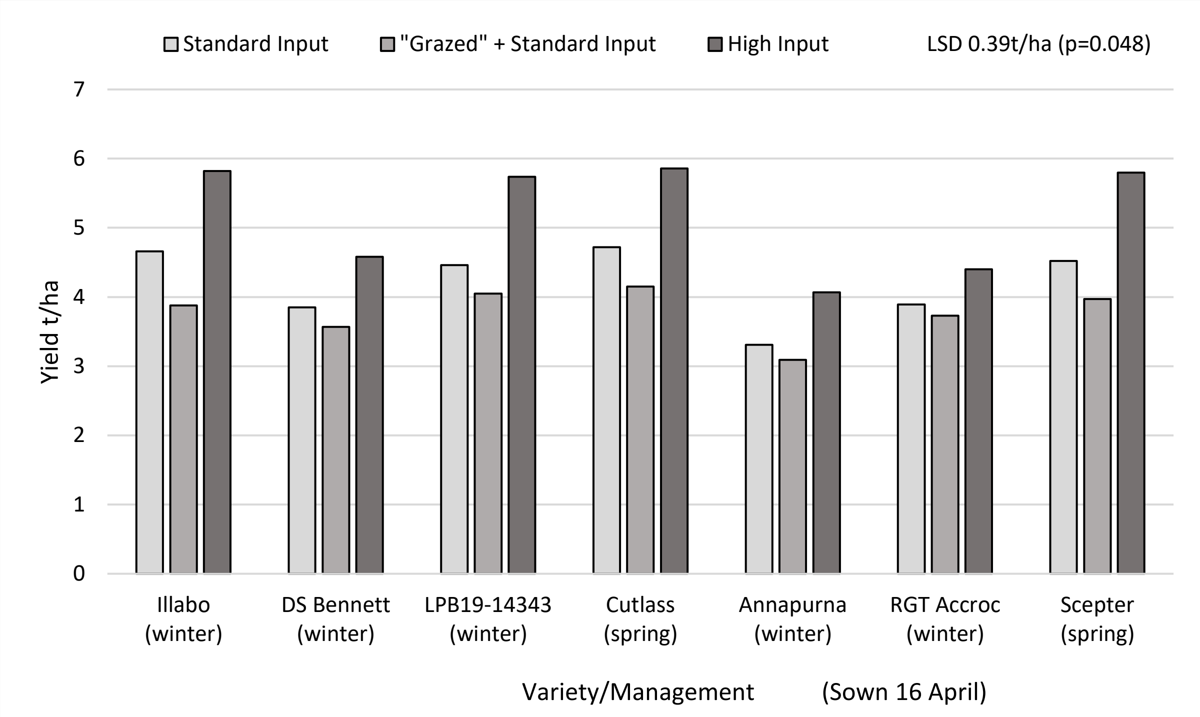

Figure 1. Influence of management and cultivar on grain yield (t/ha)

The crop emerged quickly but was subject to severe winds on 6 May which buried and damaged plants at the 1 -2 leaf stage. The crop then re-emerged but development of all cultivars was retarded slightly relative to the mid-April sowing date. The phenology data (Table 6) clearly indicates the more rapid development of the spring wheat cultivars and the large differences in winter wheat development with Illabo and LPB19-14343 being the faster of the winter wheats and RGT Accroc being the slowest.

Phenology assessments indicated that the spring wheats reached GS30 in early June when sown in mid April (Table 6) almost two months before the long season winter wheat RGT Accroc. Scepter started to flower when RGT Accroc reached GS30 on the 3rd August. The earliest winter wheat to flower was Illabo on 1 September with the coded line at the same time and the late season winter wheats on 30 September to 15 October. With a shorter vegetative period until GS30 Scepter produced fewer tillers per unit area than longer season spring and winter wheats (Table 7). This also translated to similar differences in head numbers which were not significant (p=0.08).

Table 6. Calendar date that each cultivar reached stem elongation (GS30) and the beginning of flowering (GS61).

Cultivar (type)	Date GS30	Date GS61
Scepter (Spring)	8 June	3 August
Cutlass (Spring)	8 June	15 August
Illabo (Winter)	15 June	1 September
LPB19-14343 (Winter)	15 June	2 September
DS Bennett (Winter)	26 June	30 September
Anapurna (Winter)	21 July	10 October
RGT Accroc (Winter)	3 August	15 October

Table 7. Influence of cultivar on plants, tillers and heads/m2 under standard management.

	Canopy structure					
Cultivar (Type)	Plants/m2		Tillers/m2		Heads/m2	
Illabo (Winter)	209	a	309	ab	353	b-f
DS Bennett (Winter)	167	bc	302	ab	379	a-d
LPB19-14343 (Winter)	152	c	286	b	386	a-d
Cutlass (Spring)	191	ab	312	ab	264	gh
Anapurna (Winter)	210	a	291	b	286	e-h
RGT Accroc (Winter)	141	c	330	a	348	b-f
Scepter (Spring)	196	ab	247	c	226	h
Mean	181		297		330	
LSD	31		38		80	
P Value	0.001		0.008		0.080	

Note: Heads/m2 is a subset of data as all treatments were assessed

Dry matter production at the start of stem elongation was significantly higher in those wheats that had a longer vegetative period up to GS30 such as the longer season winter wheats. Scepters' above ground dry matter production at GS30 was a little under 500kg/ha compared to RGT Accroc at 2.3t/ha at the same growth stage nearly two months later.

There was no significant interaction between cultivar and management in terms of dry matter production at harvest, however when treatment variables were meaned across management levels and cultivars there were significant differences in final harvest dry matter (Figures 3 & 4). At harvest the defoliated plots (simulated grazed management) produced significantly less dry matter than the high input that received extra N input (46 kg N/ha) and was left undefoliated (Figure 3). The short season winter wheats Illabo and LPB19-14343 along with DS Bennett had significantly more harvest dry matter than Anapurna which also produced the lowest yields in the trial (Figure 4).

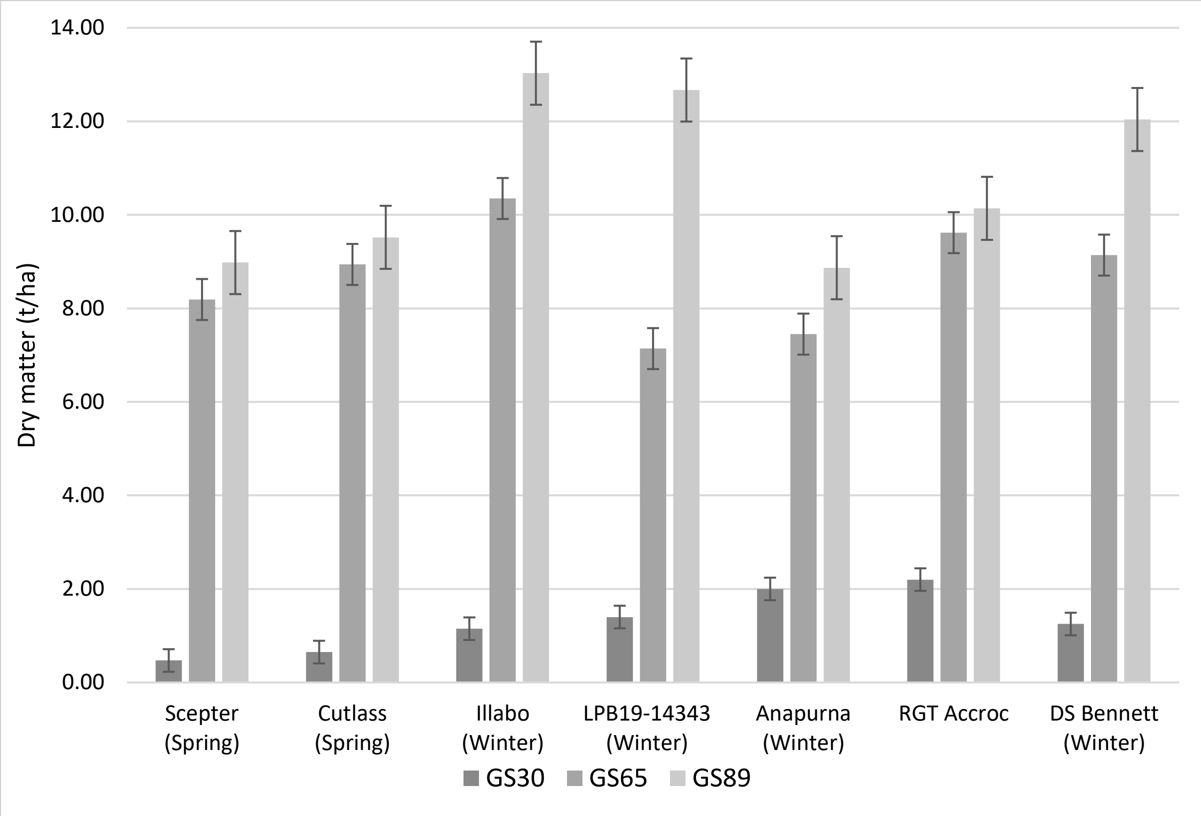

Figure 2. Influence of cultivar on dry matter (t/ha) production – standard management.

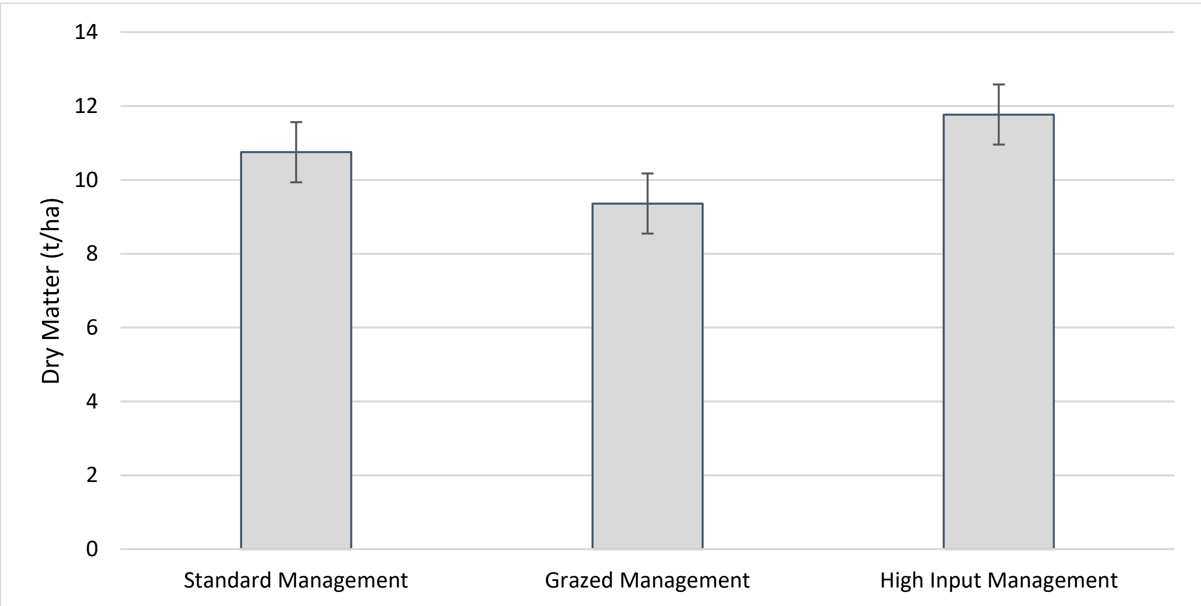

Figure 3. Influence of management level on dry matter production (t/ha) at harvest – mean of seven cultivars (LSD1.6, P Value 0.030)

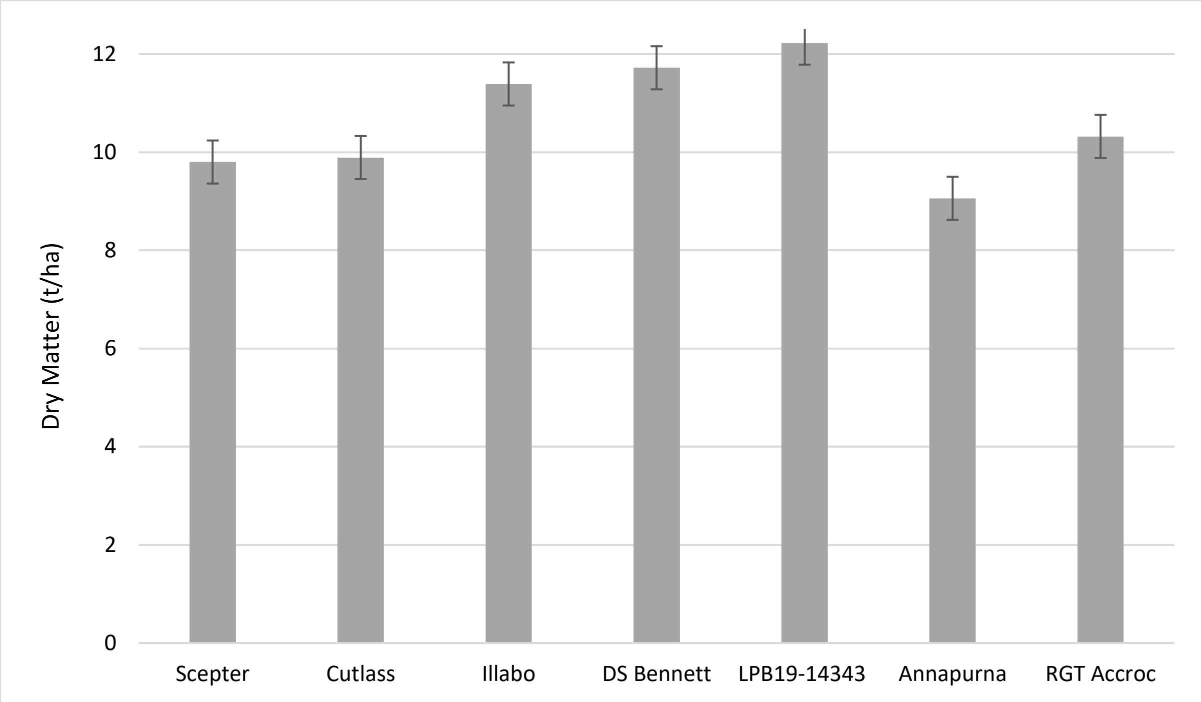

Figure 4. Influence of cultivar on dry matter (t/ha) production – mean of management levels (LSD 1.6, P Value <0.001)

Table 6. Details of the three management levels (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2 (150 plants/m^2 target)		
		Standard	**Standard Grazed**	**High Input**
Grazed:		----	✓	----
Seed treatment:			Vibrance/ Gaucho	
Basal Fertiliser:	16 April		100kg/ha 50% Vigour, 50% MAPZCS	
Nitrogen:	27 May	46 kg N	46 kg N	57.5 kg N
	19 June	46 kg N	46 kg N	57.5 kg N
	31 July	23 kg N	23 kg N	46.0 kg N
Total N (With 12 N at sowing)		**127kg N**	**127kg N**	**173kg N**
PGR:	GS31	----	----	Moddus Evo. 100ml Errex. 650mL
Fungicide:	GS00			Systiva
	GS31-32	Prosaro 150ml	Prosaro 150ml	Prosaro 300ml
	GS39	Opus 500ml	Opus 500ml	Amistar Xtra 600ml

**Timings of PGRs and fungicides were adjusted to take account of the differences in spring and winter wheat phenology (development).*

Trial 4. Wheat Early sowing germplasm screening trial – winter and spring (unyielded).

Trial Code: FAR WAE W20-04

Objectives: 20 lines sown in small plots (5m) with standard nitrogen management but no fungicide or PGR input and not taken to yield.

Key Messages:

- Based on the performance of the wheats in Trial 3 the following wheats in this screening trial had similar phenology (particularly with respect to flowering period) to the winter wheat coded line in LPB19-14343 in this screening trial; V12167-048, V13079-049, V110100-064, Denison and Sun945A, BX7932-074A and Illabo.
- Scepter was the quickest developing variety in the screening trial. The following lines were the next quickest developing from a 16 April sowing date, Sun945A, V110100-064 (Coota), BX7932-039, Denison, W12069-076 and V12167-048 which flower early but were also stem elongating GS30 in June.
- Disease levels were low making it difficult to observe disease differences in the absence of fungicide management and none of the cultivars screened lodged due to lack of PGR input.

Table 1. Zadoks growth Stages (GS00-99) of each cultivar on 15 June, 26 July, 21 July, 3 August, 2 September, 15 October, 30 October.

Variety	15 Jun	26 Jun	21 Jul	3 Aug	2 Sept	15 Oct	30 Oct
Sun945A	30	31	34	57	65	85	89
Einstein	VE	VE	VE	31	37	65	71
LRPB 3364C-19-03	VE	VE	30	32	55	73	89
DMIS-1-64-3-04	VE	VE	30	32	51-55	71	79
LRPB 364D-71-06	VE	VE	30	33	55-59	73	85
V110100-064 (Coota)	31	31	33	55	65	85	89
BX7932-039	30	30	32	33	55	83	85
BX7932-074A	VE	VE	31	33	61	85	85
WAGT-734 / Denison	30	30	33	55	65-69	85	87
W12069-076	30	30	31	33	51	71	91
SFR86-090	VE	VE	VE	30	32	65	71
SFR86-071	VE	VE	VE	VE	32	65-69	71
SFR86-092	VE	VE	VE	30	31	65-69	71
V12167-048	30	30	33	49-55	65-69	85	89
V13079-049	VE	VE	31	47	65	79	87
LPB19-14343	VE	VE	31	39	65	79	87
Scepter	31	32	55	69	83	85-89	89
Illabo	VE	VE	31	37	61	79	81
Anapurna	VE	VE	VE	31	33	65-69	71
SFR86-085	VE	VE	VE	VE	31	61	70

*VE = Vegetative/Tillering – pre GS30.

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		**16 April**
Seed Rate:		180 seeds/m^2
Sowing Fertiliser:		100kg/ha 50% Vigour, 50% MAPZCS
Seed Treatment:		Vibrance & Gaucho
Grazing:		Nil
Nitrogen:	27 May	46kg N
	19 June	46kg N
	31 July	23kg N
PGR:		Nil
Fungicide:		Nil

Trial 5. Main season sowing germplasm evaluation (TOS 2 for the site)
Trial Code: FAR WAE W20-05

Objectives: To assess the performance of wheat sown in the traditional May sowing window (sown 10th May).

Key Messages:

- The spring wheat cultivars Scepter, Rockstar and Vixen were significantly higher yielding than the two winter wheat cultivars tested, Illabo (short season) and Anapurna (long season).
- Though not statistically comparable to adjacent 16 April sowing it was clear that the long season wheat Anapurna was not suited to May sowing.
- With a total of 127kg N/ha applied to the trial the proteins of the highest yielding cultivars lay between 8 – 9%.
- This protein level suggested that yields could have been pushed higher with more N applied as yield with milling wheat would usually be maximised at higher protein levels (approximately 11%).
- There were no significant differences amongst the varieties at assessment of harvest dry matter which averaged 9.6t/ha (range 8 – 11.9t/ha). In the adjoining 16 April sown trial the range in dry matter at harvest was 8.87 – 13.03t/ha.

Table 1. Influence of cultivar on Yield (t/ha), dry matter at harvest (GS89) (t/ha) and Harvest Index (%)

	Yield		Dry matter		Harvest Index	
Cultivar (Type)	t/ha		t/ha		%	
Scepter (Spring)	5.39	ab	10.1	-	46	-
Illabo (Winter)	4.33	c	8.8	-	45	-
Anapurna (Winter)	2.99	d	8.0	-	34	-
Rockstar (Spring)	5.45	ab	11.9	-	41	-
Vixen (Spring)	5.51	a	9.1	-	54	-
Trojan (Spring)	4.96	abc	10.5	-	42	-
Catapult (Spring)	4.75	bc	8.9	-	49	-
Mean	4.77		9.6		45	
LSD	0.71		2.5		15	
P Value	<0.001		0.074		0.214	
CV	10.06					

Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).

Table 2. Influence of cultivar on grain yield (t/ha) and quality (%, kg/hL, grams) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)		Thousand grain weight.	
Cultivar (Type)	t/ha		%		Kg/hL		%		grams	
Scepter (Spring)	5.39	ab	9.0	bc	79.2	abc	1.5	b	38.5	b
Illabo (Winter)	4.33	c	9.2	b	74.9	d	1.6	b	30.4	d
Anapurna (Winter)	2.99	d	10.1	a	77.8	c	4.1	a	28.6	d
Rockstar (Spring)	5.45	ab	8.3	c	80.7	a	2.0	b	40.9	a
Vixen (Spring)	5.51	a	9.1	b	78.6	bc	1.8	b	36.9	b
Trojan (Spring)	4.96	abc	9.1	bc	79.7	ab	1.6	b	33.9	c
Catapult (Spring)	4.75	bc	9.4	ab	78.2	bc	1.6	b	32.5	c
Mean	4.77		9.2		78.4		2.0		34.5	
LSD	0.71		0.8		1.6		0.9		1.9	
P Value	<0.001		0.011		<0.001		<0.001		<0.001	
CV	10.06									

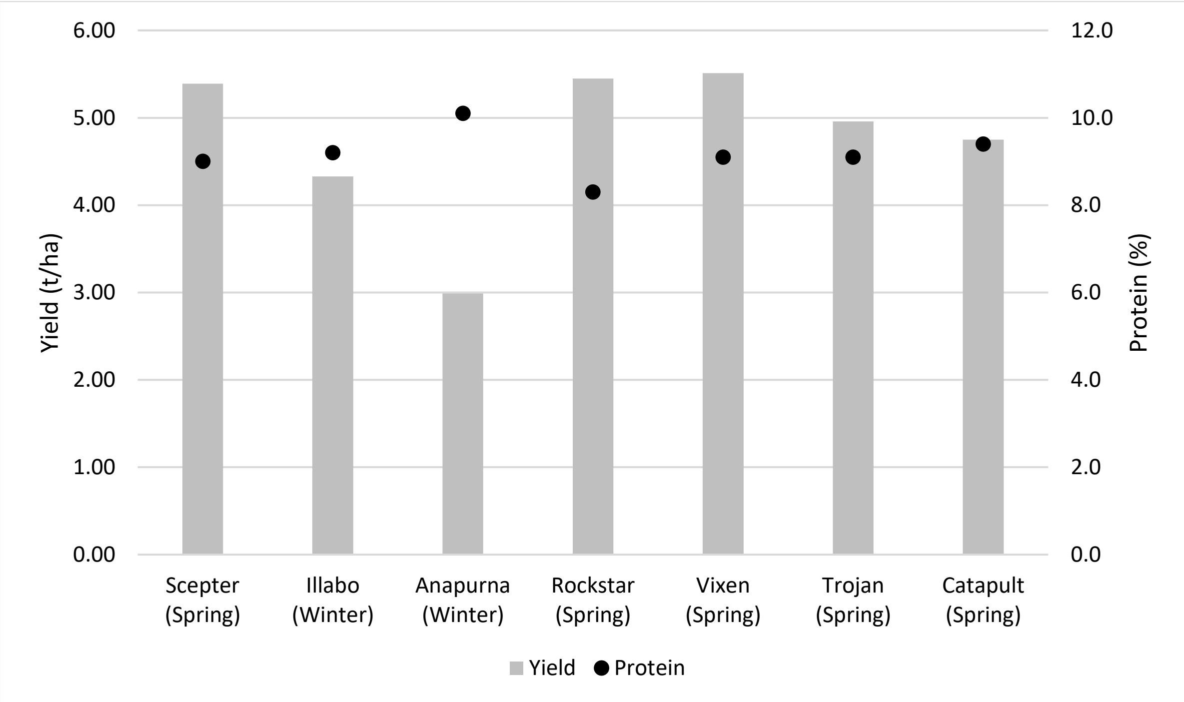

Figure 1. Influence of cultivar on Yield (t/ha) and Protein (%) – sown 10 May.

Trial 6. Early sown barley germplasm (winter v spring) x management interaction trial

Trial Code: FAR WAE B20-06

Objectives: To assess a comparison of early sown winter and spring barley germplasm managed under different levels of management (16 April sown).

Key Messages:

- In a season with a dry start, NV8 Nitro under a higher input canopy management approach was the highest yielding barley on the trial site at 7.23 t/ha.
- There was a significant interaction between cultivar and management approach on grain yield, with the French cultivar Cassiopee being the only cultivar not to respond to higher input.
- The earlier maturing winter barley Urambie responded similarly to the spring barleys, although with higher dry matter accumulation at GS30.
- Four of the five cultivars responded to higher input, a result that appears to be linked to additional nitrogen.
- The later development of the winter barley Cassiopee resulted in double the dry matter accumulation by GS30 but significantly lower grain yields compared to all other cultivars.
- Overall defoliation 'simulated grazing' had little influence on grain yield in any of the cultivars, a result that may have been linked to the early sowing.

Table 1. Influence of cultivar on grain yield (t/ha) under different canopy management regimes.

	Canopy Management (Grain Yield t/ha)					
	Standard Input		**"Grazed" Standard***		**High Input**	
Cultivar (Type)	t/ha		t/ha		t/ha	
Cassiopee (Winter)	4.33	e	4.37	e	4.31	e
Urambie (Winter)	5.55	d	5.47	d	6.33	b
RGT Planet (Spring)	5.78	cd	6.19	bc	6.86	a
HV8 Nitro (Spring)	6.17	bc	6.33	b	7.23	a
Rosalind (Spring)	5.85	cd	5.93	bcd	6.82	a
Mean	**5.53**	**b**	**5.36**	**b**	**6.31**	**a**
LSD Cultivar p = 0.05	0.27				**P Value**	<0.001
LSD Management p=0.05	0.46				**P Value**	0.012
LSD Cultivar x Management P=0.05	0.48				**P Value**	0.030

Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).
"Grazed standard" – simulated grazing using mechanical defoliation

Table 2. Influence of cultivar on grain protein (%) under different canopy management regimes.

	Canopy Management (protein %)					
	Standard Input		**"Grazed" Standard***		**High Input**	
Cultivar (Type)	t/ha		t/ha		t/ha	
Cassiopee (Winter)	10.3	-	9.6	-	11.1	-
Urambie (Winter)	10.4	-	9.5	-	10.5	-
RGT Planet (Spring)	11.6	-	10.4	-	11.6	-
HV8 Nitro (Spring)	10.4	-	9.5	-	10.9	-
Rosalind (Spring)	10.7	-	10	-	11.1	-
Mean	**10.7**	**a**	**9.8**	**b**	**11.0**	**b**
LSD Cultivar p = 0.05	0.4				**P Value**	<0.001
LSD Management p=0.05	0.5				**P Value**	0.003
LSD Cultivar x Management P=0.05	0.6				**P Value**	0.717

Table 3. Influence of cultivar on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		**Protein**		**Test weight**		**Screenings (<2mm)**		**Thousand seed wt.**	
Cultivar (Type)	t/ha		%		Kg/hL		%		Grams	
Cassiopee (Winter)	4.26	d	10.3	bc	66.2	d	2.1	b	38.6	d
Urambie (Winter)	5.68	c	10.1	c	68.2	c	2.9	a	37.9	d
RGT Planet (Spring)	6.17	b	11.2	a	71.2	a	0.3	c	45.5	a
HV8 Nitro (Spring)	6.46	a	10.3	bc	70.3	b	0.6	c	44.0	b
Rosalind (Spring)	6.09	b	10.6	b	68.8	c	0.7	c	41.7	c
Mean	5.73		10.5		68.9		1.3		41.5	
LSD	0.27		0.4		1.0		0.6		1.0	
P Value	<0.001		<0.001		<0.001		<0.001		<0.001	
CV	5.63									

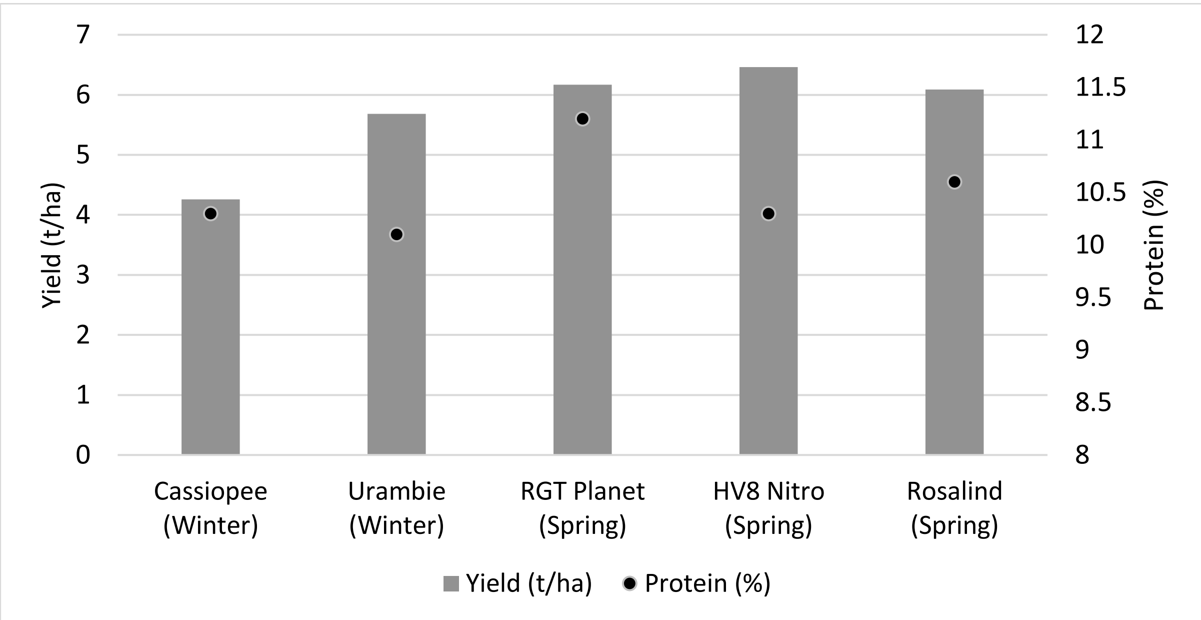

Figure 1. Influence of Cultivar on Grain Yield (t/ha) and Protein (%) (mean of canopy management strategies).

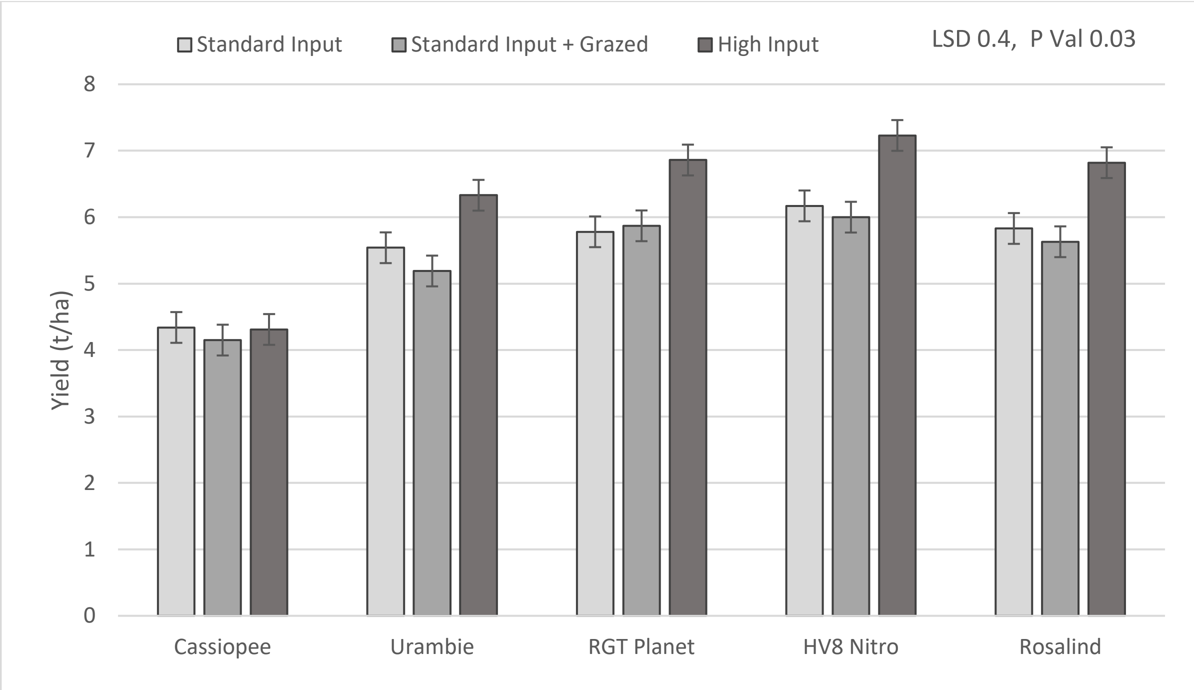

Figure 2. Influence of cultivar and management regime on grain yield (t/ha).

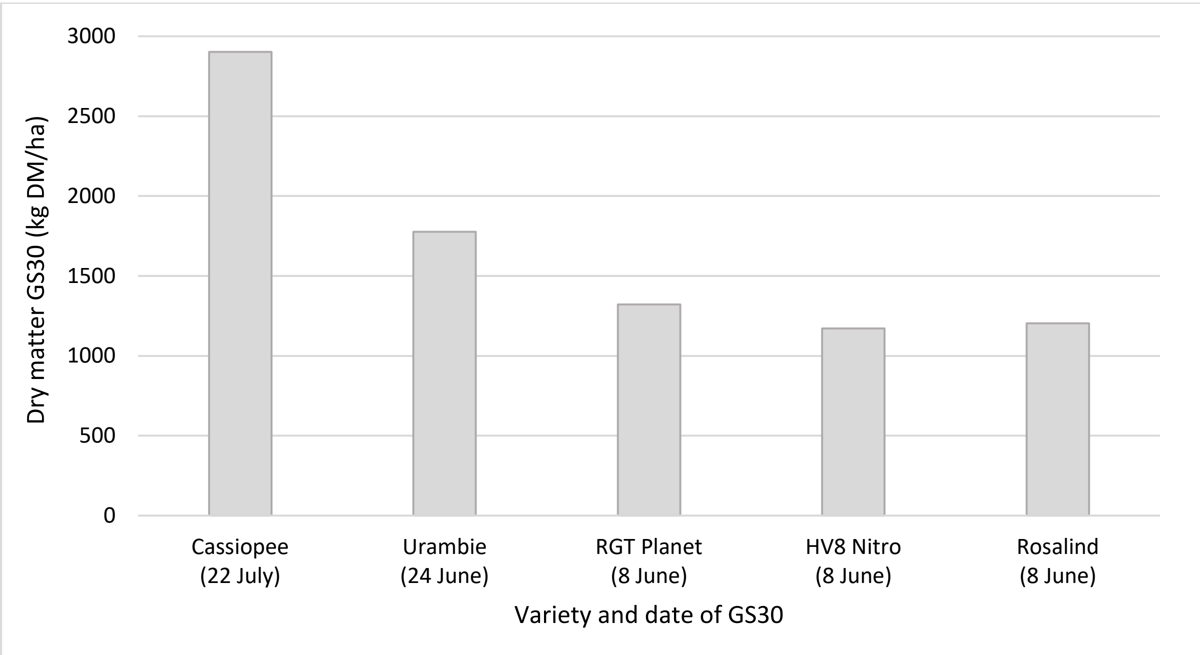

Figure 3. Influence of variety on total above ground dry matter production on Grazed Management at the start of stem elongation (GS30).

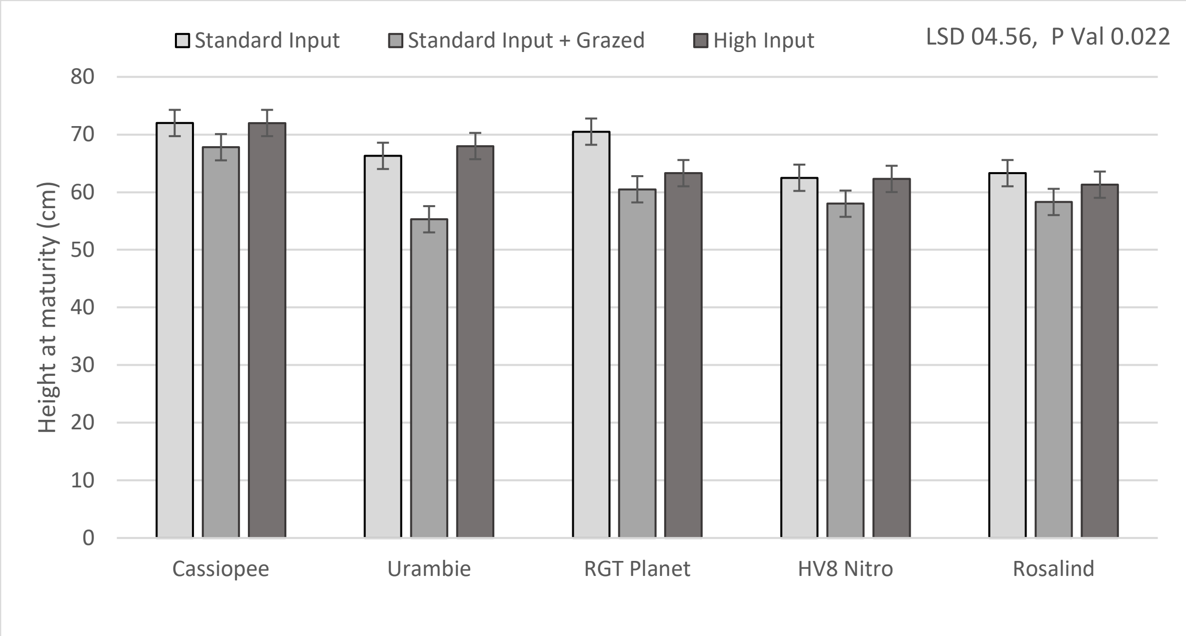

Figure 4. Influence of management on plant height at Maturity (cm)

Table 4. Details of the three management levels (kg, g, ml/ha).

Plant pop'n:		180 seeds/m² (150 plants/m2 target)		
		Standard	**Standard Grazed**	**High Input**
Grazed:		----	✓	----
Seed treatment:		Rancona Dimension/ Gaucho	Rancona Dimension/ Gaucho	Rancona Dimension/ Gaucho
Basal Fertiliser:	16 April	100kg 50% Vigour, 50% MAPZCS	100kg 50% Vigour, 50% MAPZCS	100kg 50% Vigour, 50% MAPZCS
Nitrogen:	27 May	46 kg N	46 kg N	57.5 kg N
	19 June	46 kg N	46 kg N	57.5 kg N
	31 July	23 kg N	23 kg N	46 kg N
Total N (With 12 N at sowing)		**127kg N**	**127kg N**	**173kg N**
PGR:	GS31	----	----	Mod. 100ml*
	GS37	----	----	Mod. 100ml**
Fungicide:	GS00			Systiva
	GS31-32	Prosaro 150ml	Prosaro 150ml	Prosaro 300ml
	GS49	Opus 500ml	Opus 500ml	Amistar Xtra 600ml

All other inputs of insecticides and herbicides were standard across the trial. Mod. - Moddus

**Timings of PGRs and fungicides were adjusted to take account of the differences in spring and winter barley phenology (development). ** Rosalind did not receive this input. Available Soil Nitrogen, 22 February 57 kg N/ha (0 – 80cm)*

2020 WA Crop Technology Centre (Albany)

The trial site was on a sandy soil over clay into canola stubble. The area of the paddock where the trials were positioned had been clayed with ~400t/ha in 2017, smudged in 2019 and there are areas of the paddock adjacent to the planned trial site that remain un-ameliorated.

The research programme at this site aims to repeat some of the research proposed for Esperance but with the focus on late April sowing. Three trials will be pursued that allow the research team to compare the economics of wheat and barley, winter and spring germplasm sown in the traditional ANZAC day sowing window.

Sown: 1 May 2020
Harvested: 17 December 2020
Rotation position: 1st Cereal after canola, 2018 pasture, 2017 barley.
Soil type: Shallow duplex sand over gravel over clay.

Trial 1. April sown germplasm (winter v spring) x management interaction trial - Clayed

Trial code: FAR WAA W20-01a

Clayed: Clayed 2017, Smudged 2019/20.

Objectives: To assess a comparison of winter and spring wheat germplasm managed under different levels of management sown on 1 May on soil that was **clayed**.

Key Messages:

- Despite differences in dry matter at flowering there was no significant yield difference due to management input, however higher N input did significantly increase protein (11 to 12%).
- There were statistically significant differences in yield due to cultivar (p=0.001) with Scepter (spring) and LPB19 -14343 (winter) being significantly higher yielding than other wheats tested except Cutlass.
- Winter wheat germplasm produced significantly more tillers per unit area as a result of a longer vegetative period (sowing – GS30).
- The consequence of a longer vegetative period was greater dry matter production by the time the crop reached GS30 (longer period of potential grazing in a mixed cropping system).
- Short season winter wheats LPB 19-14343 and Illabo flowered in the period 25-30 September compared to the long winter wheats (Anapurna and RGT Accroc) in the period 10-15 October.
- Stem elongation of the spring wheat cultivars took place prior to heavy rainfall in early August and significantly reduced the dry matter recorded at the flowering stage in these cultivars, growth post flowering during grain fill showed considerable compensation.
- This was in contrast to the winter wheats where stem elongation occurred after heavy rains in early August and flowering dry matter was significantly higher but post flowering growth was reduced relative to the spring wheats
- With higher N input (136N) there was significantly greater dry matter production at flowering compared with standard management (86N) but this did not translate into more grain yield.

Winter wheats spend more time in the vegetative period before stem elongating in the spring. The length of this period depending on whether it's a short season winter or long season winter wheat. As a consequence, winter wheats produce more tillers per unit area, more dry matter for potential grazing and flowered later in a generally less frost prone periods of spring (Table 1, 2 & 3). Unfortunately, later development pushes key growth periods pre and post flowering into warmer months and reduces grain yield. In this trial decile 1 rainfall conditions significantly affected the accumulation of dry matter in the spring wheats up to flowering, compared to the winter wheats which stem elongated after heavy rain fell in early August (Table 4). However, by harvest there was no significant difference in harvest dry matters amongst cultivars as the spring wheats compensated with higher growth rates during grain fill compared to winter wheats. In this trial conducted on clayed ground the spring wheat Scepter significantly out yielded the majority of winter wheats except the earliest flowering coded winter wheat (Table 6, 7 & 8).

Table 1. Influence of cultivar on plants and tillers under standard management.

	Canopy structure			
Cultivar (Type)	Plants/m2		Tillers/m2	
Illabo (Winter)	113	-	314	bc
DS Pascal (Spring)	147	-	270	c
LPB19-14343 (Winter)	137	-	400	ab
Cutlass (Spring)	168	-	262	c
Anapurna (Winter)	150	-	441	a
RGT Accroc (Winter)	142	-	418	a
Scepter (Spring)	124	-	234	c
Mean	140		334	
LSD	43		95	
P Value	0.204		0.001	

Table 2. Growth Stage (GS) that each cultivar was at on 13 July; 30 July; 25 August and 15 October

Cultivar (Type)	**13 July**	**30 July**	**25 Aug**	**29 Sept**	**15 Oct**
Scepter (Spring)	31	39	69	75	77
Cutlass (Spring)	30	37-39	57	71	73
DS Pascal (Spring)	30	39	59	73	77
Illabo (Winter)	Vegetative	30	32-33	65	69
LPB19-14343 (Winter)	Vegetative	30	37-39	65-69	73
Anapurna (Winter)	Vegetative	Vegetative	30-31	39-41	65
RGT Accroc (Winter)	Vegetative	Vegetative	30	37	61

Table 3. Dry matter (t/ha) removed with simulated grazing (mechanical defoliation) at GS30 and total above ground dry matter at GS30 – Standard Management with defoliation

	Dry Matter (t/ha)			
Cultivar (Type)	Removed		Total	
Illabo (Winter)	1.00	a	2.06	a
DS Pascal (Spring)	0.31	b	0.78	b
LPB19-14343 (Winter)	0.96	a	1.85	a
Cutlass (Spring)	0.38	b	0.96	b
Anapurna (Winter)	1.03	a	2.05	a
RGT Accroc (Winter)	0.93	a	1.91	a
Scepter (Spring)	0.35	b	0.87	b
Mean	0.71		1.50	
LSD	0.18		0.29	
P Value	<0.001		<0.001	

Residual dry matter after defoliation ranged from 0.47-1.07t/ha depending on the cultivar and how prostrate the canopy it was when mechanically defoliated.

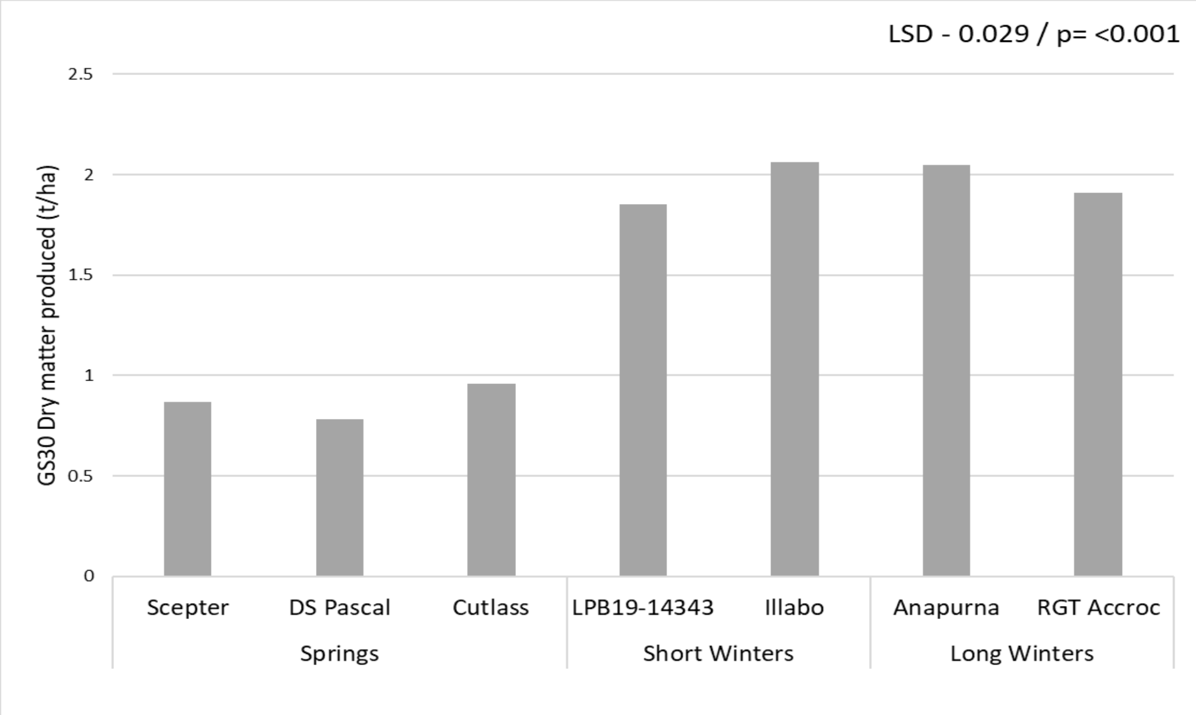

Figure 1. Influence of cultivar on dry matter accumulation at GS30 under standard management.

Table 4. Influence of cultivar on Dry matter at GS65 during full flowering (t/ha) under different canopy management regimes.

	Canopy Management (Dry matter t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	9.84	-	9.28	-	10.99	-	10.03	ab
DS Pascal (Spring)	3.66	-	3.47	-	4.25	-	3.79	d
LPB19-14343 (Winter)	10.36	-	9.57	-	12.09	-	10.67	a
Cutlass (Spring)	4.44	-	3.74	-	4.26	-	4.14	d
Anapurna (Winter)	7.92	-	8.47	-	9.90	-	8.76	c
RGT Accroc (Winter)	9.89	-	9.03	-	9.25	-	9.39	bc
Scepter (Spring)	3.97	-	3.56	-	4.17	-	3.90	d
Mean	**7.15**	**b**	**6.73**	**b**	**7.84**	**a**		
LSD Cultivar p = 0.05			0.776		**P Value**	<0.001		
LSD Management p=0.05			0.678		**P Value**	0.019		
LSD Cultivar x Management P=0.05			1.344		**P Value**	0.208		

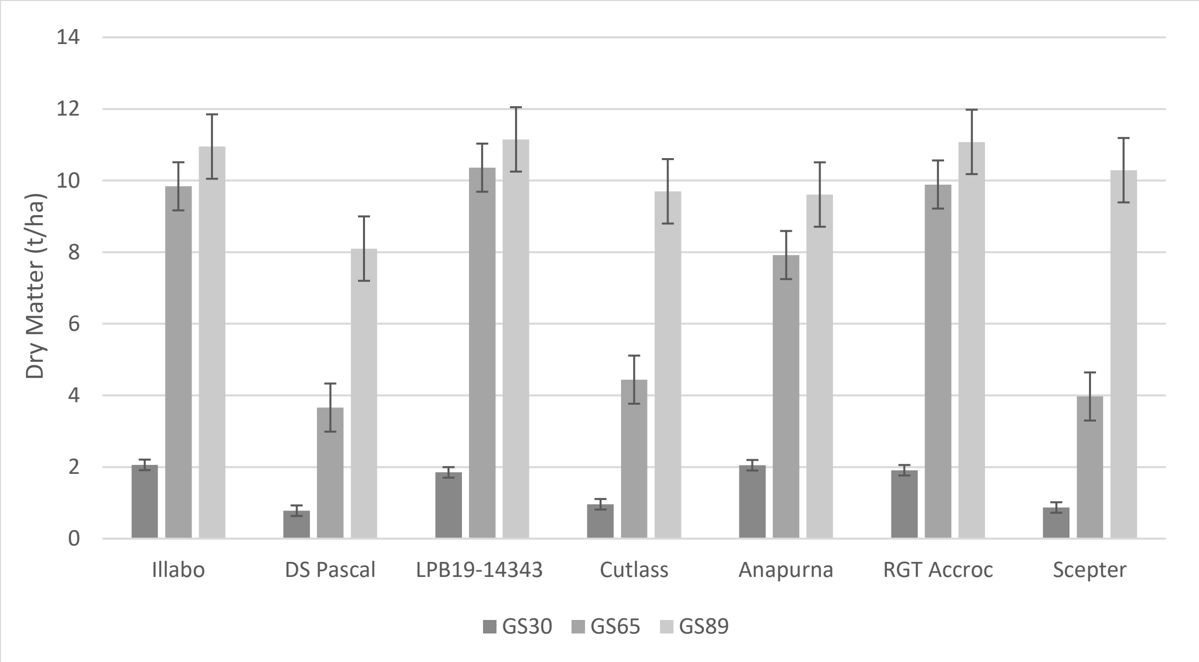

Figure 1. Influence of cultivar on dry matter accumulation under standard management.

Table 6. Influence of cultivar on grain yield (t/ha) under different canopy management regimes.

	Canopy Management (Grain Yield t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	3.05	-	2.97	-	3.19	-	3.07	d
DS Pascal (Spring)	2.88	-	2.75	-	2.86	-	2.83	d
LPB19-14343 (Winter)	3.79	-	3.59	-	3.73	-	3.70	ab
Cutlass (Spring)	3.24	-	3.61	-	3.63	-	3.49	bc
Anapurna (Winter)	2.82	-	2.90	-	3.23	-	2.98	d
RGT Accroc (Winter)	3.56	-	3.37	-	3.04	-	3.32	c
Scepter (Spring)	3.89	-	3.62	-	3.96	-	3.82	a
Mean	**3.32**	**-**	**3.26**	**-**	**3.38**	**-**		
LSD Cultivar p = 0.05			0.249		**P Value**	<0.001		
LSD Management p=0.05			0.275		**P Value**	0.593		
LSD Cultivar x Management P=0.05			0.431		**P Value**	0.179		

Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).

**"Grazed standard" – simulated grazing using mechanical defoliation*

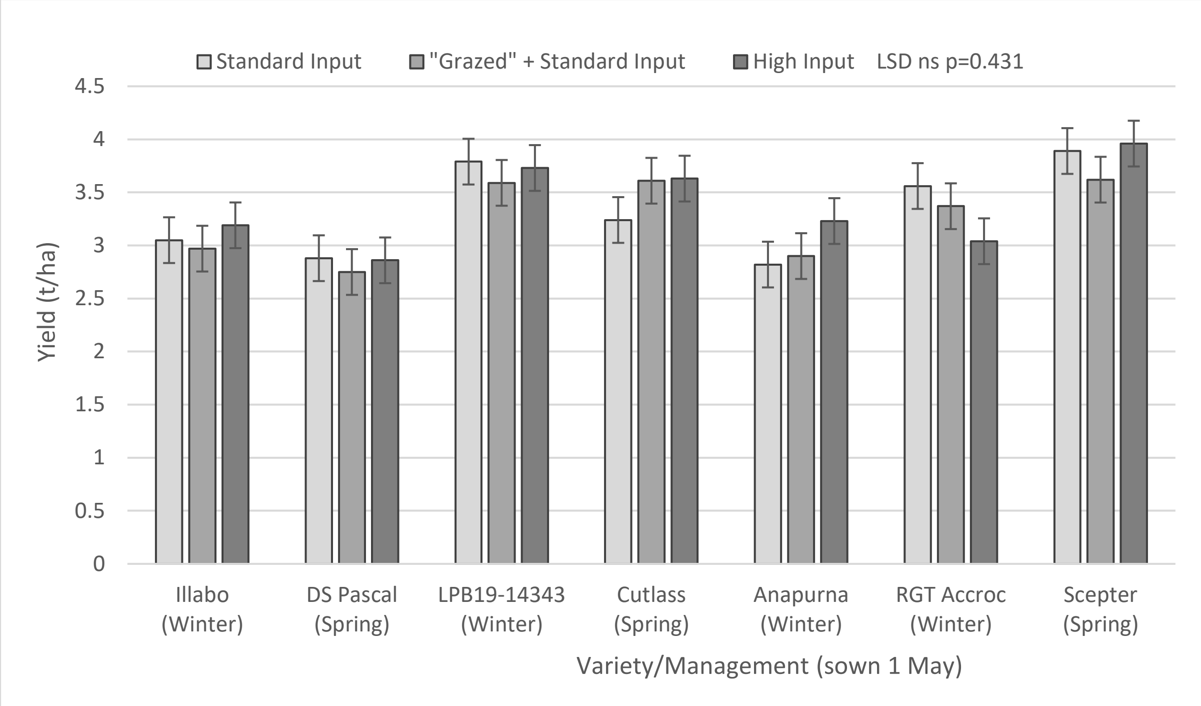

Figure 2. Influence of variety and management package on grain yield (t/ha)

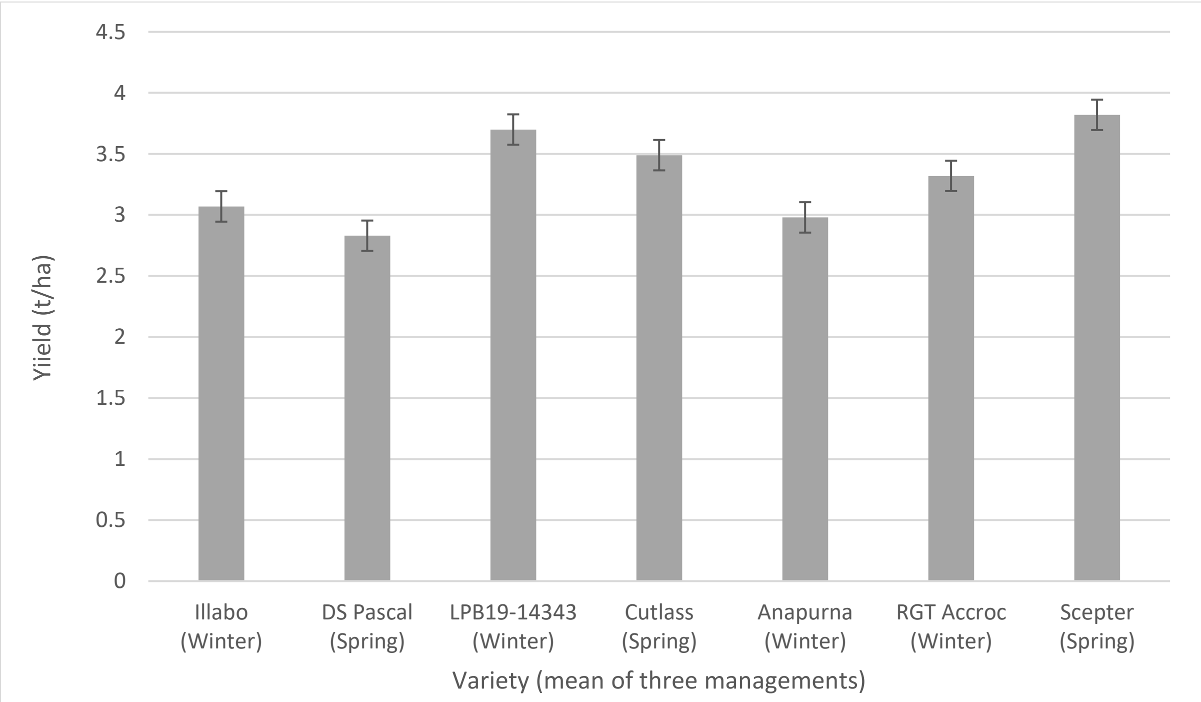

Figure 3. Influence of cultivar on yield (mean of three management levels)

Table 7. Influence of cultivar on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)	
	t/ha		%		Kg/hL		%	
Cultivar (Type)								
Illabo (Winter)	3.07	d	10.7	c	72.4	d	1.8	a
DS Pascal (Spring)	2.83	d	11.6	b	74.5	c	1.4	bc
LPB19-14343 (Winter)	3.70	ab	10.7	c	77.0	b	1.7	ab
Cutlass (Spring)	3.49	bc	11.0	c	76.3	b	1.1	c
Anapurna (Winter)	2.98	d	12.4	a	78.6	a	2.0	a
RGT Accroc (Winter)	3.32	c	11.4	b	78.2	a	1.2	c
Scepter (Spring)	3.82	a	10.7	c	78.8	a	1.2	c
Mean	3.37		11.5		78.5		1.5	
LSD	0.25		0.4		1.2		0.3	
P Value	<0.001		<0.001		<0.001		<0.001	
CV	9.16							

Table 8. Influence of management level on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)	
	t/ha		%		Kg/hL		%	
Standard Management	3.32	-	11.0	b	76.6	-	1.6	-
Grazed Management	3.26	-	10.6	b	77.3	-	1.3	-
High Input Management	3.38	-	12.0	a	75.7	-	1.6	-
Mean	3.37		11.5		78.5		1.5	
LSD	0.28		0.44		1.72		0.34	
P Value	0.593		0.001		0.165		0.182	

Table 9. Details of the three management levels (kg, g, L, ml/ha).

Plant pop'n: 180 seeds/m^2 (150 plants/m^2 target)

		Standard	Standard Grazed	High Input
Grazed:		----	✓	----
Seed treatment:		Vibrance/ Gaucho		
Basal Fertiliser:	1 May	90Kg MAP		
	13 May	50Kg Potash		
Nitrogen:	19 May	33.3 Kg N	33.3 Kg N	33.3 Kg N
	2 August	27.6 Kg N	27.6 Kg N	27.6 Kg N
	11 August	16.6 Kg N	16.6 Kg N	16.6 Kg N
As per variety reaching	GS30	---	---	50.0 Kg N
Total N (With 9 N at sowing)		**86.5 Kg N**	**86.5 Kg N**	**136.5 Kg N**
PGR:	GS31	----	----	Moddus Evo. 100ml Errex. 650mL

Fungicide:	GS00	---	---	Systiva
	GS31	Opus 250mL	Opus 250mL	Radial 840mL
	GS39	Prosaro 300mL	Prosaro 300mL	Aviator Xpro 420mL

All other inputs of insecticides and herbicides were standard across the trial.

**Timings of PGRs and fungicides were adjusted to take account of the differences in spring and winter wheat phenology (development).*

Trial 2. April sown germplasm (winter v spring) x management interaction trial – Un-Clayed

Trial code: FAR WAA W20-01b

(This trial was set up as a mirror image trial opposite the clayed trial (Trail 1)

Objectives: To assess a comparison of winter and spring wheat germplasm managed under different levels of management sown on 1 May on soil that was **un-clayed**.

Key Messages:

- Though not statistically comparable this mirror image trial yielded almost identically to Trial 1 with an average yield of 3.50t/ha compared to 3.32t/ha on the clayed soil.
- Many of the same trends were observed in this trial as for Trial 1.
- There were statistically significant differences in yield due to cultivar (p=0.001) with RGT Accroc (winter) and LPB19 -14343 (winter) being significantly higher yielding than other wheats tested.

Table 1. Influence of cultivar on plants, tillers and heads/m2 under standard management.

	Canopy structure					
Cultivar (Type)	**Plants/m2**		**Tillers/m2**		**Heads/m2**	
Illabo (Winter)	118	-	305	-	332	-
DS Pascal (Spring)	93	-	181	-	336	-
LPB19-14343 (Winter)	87	-	320	-	343	-
Cutlass (Spring)	137	-	169	-	298	-
Annapurna (Winter)	119	-	373	-	354	-
RGT Accroc (Winter)	73	-	340	-	325	-
Scepter (Spring)	108	-	166	-	298	-
Mean	105		265		326	
LSD	63		113		89	
P Value	0.423		0.002		0.101	

Table 1. Influence of cultivar on plants and tillers/m2 under standard management.

	Canopy structure			
Cultivar (Type)	**Plants/m2**		**Tillers/m2**	
Illabo (Winter)	118	-	305	-
DS Pascal (Spring)	93	-	181	-
LPB19-14343 (Winter)	87	-	320	-
Cutlass (Spring)	137	-	169	-
Annapurna (Winter)	119	-	373	-
RGT Accroc (Winter)	73	-	340	-
Scepter (Spring)	108	-	166	-
Mean	105		265	
LSD	63		113	
P Value	0.423		0.002	

Table 2. Growth Stage (GS) that each cultivar was at on 13 July; 30 July; 25 August and 15 October

Cultivar (Type)	**13 July**	**30 July**	**26 August**	**29 September**	**11 November**
Scepter (Spring)	33	49-51	69	75	87
Cutlass (Spring)	31	39	57	71	85
DS Pascal (Spring)	32	41-43	59	73-75	83-85
Illabo (Winter)	Vegetative	30-31	33	69	83
LPB19-14343 (Winter)	30	31	39	69-71	85
Anapurna (Winter)	Vegetative	Vegetative	30	37-41	77-83
RGT Accroc (Winter)	Vegetative	Vegetative	30	37-39	75-77

Table 3. Dry matter (t/ha) removed when grazed at GS30

	Dry matter (t/ha)			
Cultivar (Type)	Removed		Total	
Illabo (Winter)	1.15	a	1.77	bc
DS Pascal (Spring)	0.41	c	0.77	d
LPB19-14343 (Winter)	0.87	b	1.53	c
Cutlass (Spring)	0.48	c	0.91	d
Annapurna (Winter)	1.26	a	2.27	a
RGT Accroc (Winter)	1.10	ab	2.02	ab
Scepter (Spring)	0.37	c	0.75	d
Mean	0.80		1.43	
LSD	0.27		0.40	
P Value	0.000		<0.001	

Residual dry matter after defoliation ranged from 0.36-1.01t/ha depending on the cultivar and how prostrate the canopy it was when mechanically defoliated.

Table 4. Influence of cultivar on Dry matter at GS65 during full flowering (t/ha) under different canopy management regimes.

	Canopy Management (Dry matter t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	8.68	-	9.11	-	9.87	-	9.22	a
DS Pascal (Spring)	2.81	-	2.39	-	3.78	-	2.99	b
LPB19-14343 (Winter)	8.34	-	8.89	-	9.27	-	8.83	a
Cutlass (Spring)	3.47	-	3.28	-	3.75	-	3.50	b
Annapurna (Winter)	8.71	-	7.66	-	10.45	-	8.94	a
RGT Accroc (Winter)	9.01	-	8.96	-	9.51	-	9.16	a
Scepter (Spring)	2.96	-	2.39	-	3.48	-	2.94	b
Mean	**6.28**	**-**	**6.10**	**-**	**7.16**	**-**		
LSD Cultivar p = 0.05		1.02		**P Value**	<0.001			
LSD Management p=0.05		1.01		**P Value**	0.087			
LSD Cultivar x Management P=0.05		1.76		**P Value**	0.873			

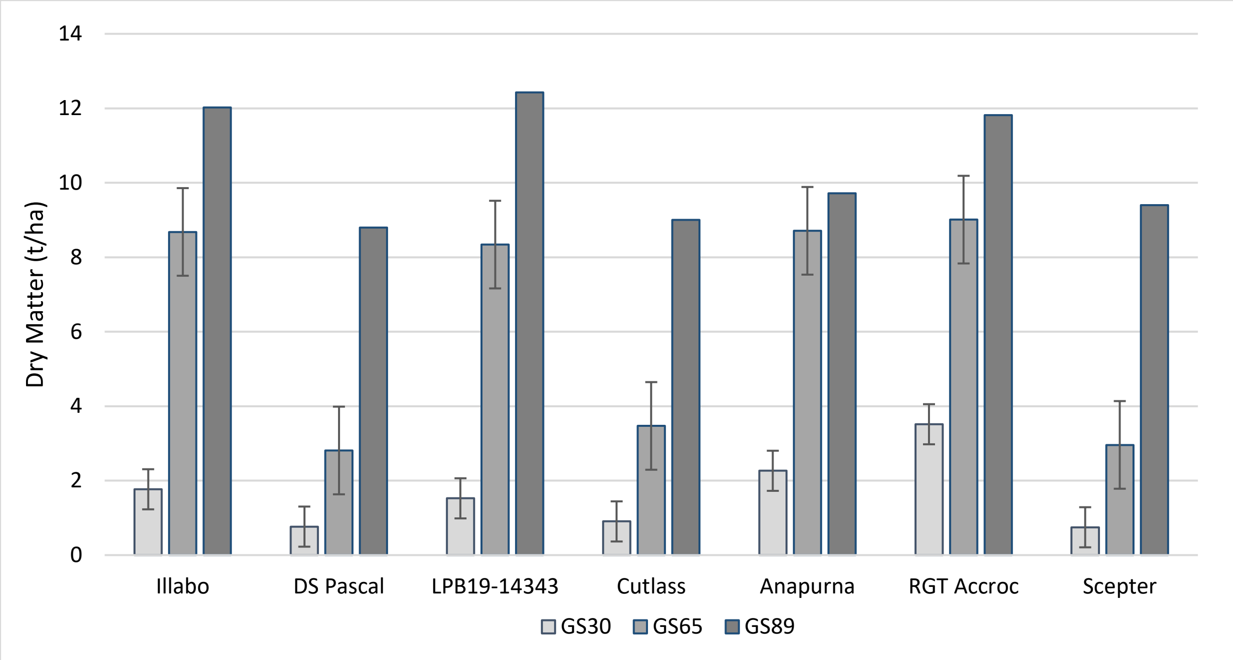

Figure 1. Influence of cultivar on dry matter accumulation under standard management.

Table 5. Influence of cultivar on Dry matter at GS89 at crop maturity (t/ha) under different canopy management regimes.

	Canopy Management (Dry matter t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	12.02	-	11.35	-	10.62	-	11.33	a
DS Pascal (Spring)	8.80	-	9.42	-	9.95	-	9.39	cd
LPB19-14343 (Winter)	12.43	-	9.60	-	10.55	-	10.86	ab
Cutlass (Spring)	9.00	-	9.74	-	10.03	-	9.59	bcd
Anapurna (Winter)	9.72	-	10.87	-	10.82	-	10.47	abc
RGT Accroc (Winter)	11.82	-	11.45	-	10.24	-	11.17	a
Scepter (Spring)	9.40	-	7.55	-	10.57	-	9.17	d
Mean	**10.45**	**-**	**10.00**	**-**	**10.39**	**-**		
LSD Cultivar p = 0.05			1.29		**P Value**	0.003		
LSD Management p=0.05			1.71		**P Value**	0.784		
LSD Cultivar x Management P=0.05			2.23		**P Value**	0.103		

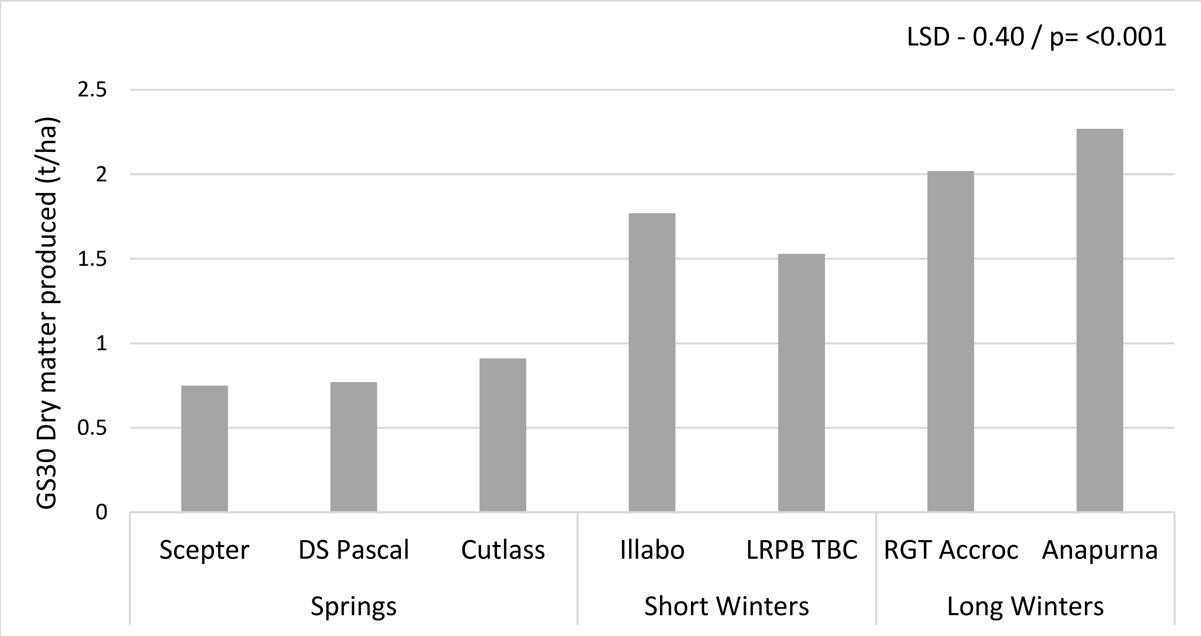

Figure 1. Influence of cultivar on dry matter accumulation at GS30 under standard management.

Table 6. Influence of cultivar on grain yield (t/ha) under different canopy management regimes.

	Canopy Management (Grain Yield t/ha)							
	Standard Input		**"Grazed" Standard***		**High Input**		**Mean**	
Cultivar (Type)	t/ha		t/ha		t/ha		t/ha	
Illabo (Winter)	3.49	-	3.13	-	3.47	-	3.36	bc
DS Pascal (Spring)	3.20	-	2.89	-	3.16	-	3.08	c
LPB19-14343 (Winter)	3.98	-	3.76	-	3.88	-	3.87	a
Cutlass (Spring)	3.45	-	3.41	-	3.50	-	3.46	b
Anapurna (Winter)	3.41	-	3.35	-	3.48	-	3.41	b
RGT Accroc (Winter)	3.86	-	3.70	-	3.75	-	3.77	a
Scepter (Spring)	3.41	-	3.30	-	3.50	-	3.41	b
Mean	**3.54**	**-**	**3.36**	**-**	**3.53**	**-**		
LSD Cultivar p = 0.05		0.29			**P Value**	<0.001		
LSD Management p=0.05		0.43			**P Value**	0.548		
LSD Cultivar x Management P=0.05		0.51			**P Value**	0.999		

Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).

**"Grazed standard" – simulated grazing using mechanical defoliation*

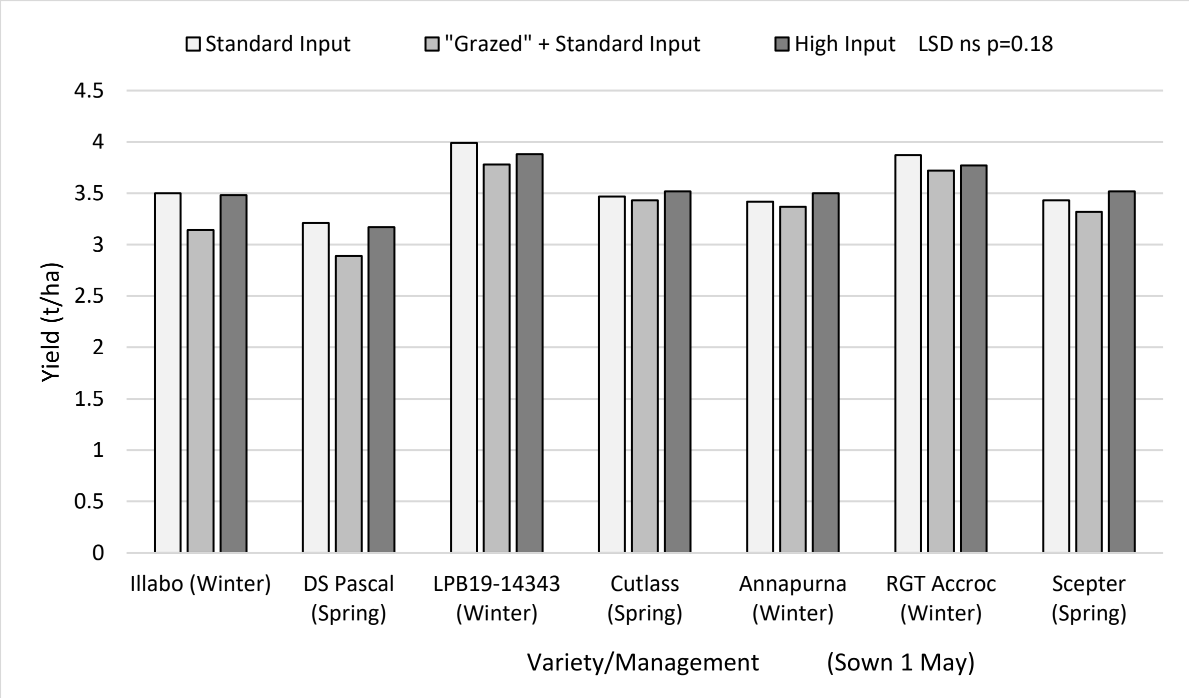

Figure 2. Influence of variety and management package on grain yield (t/ha)

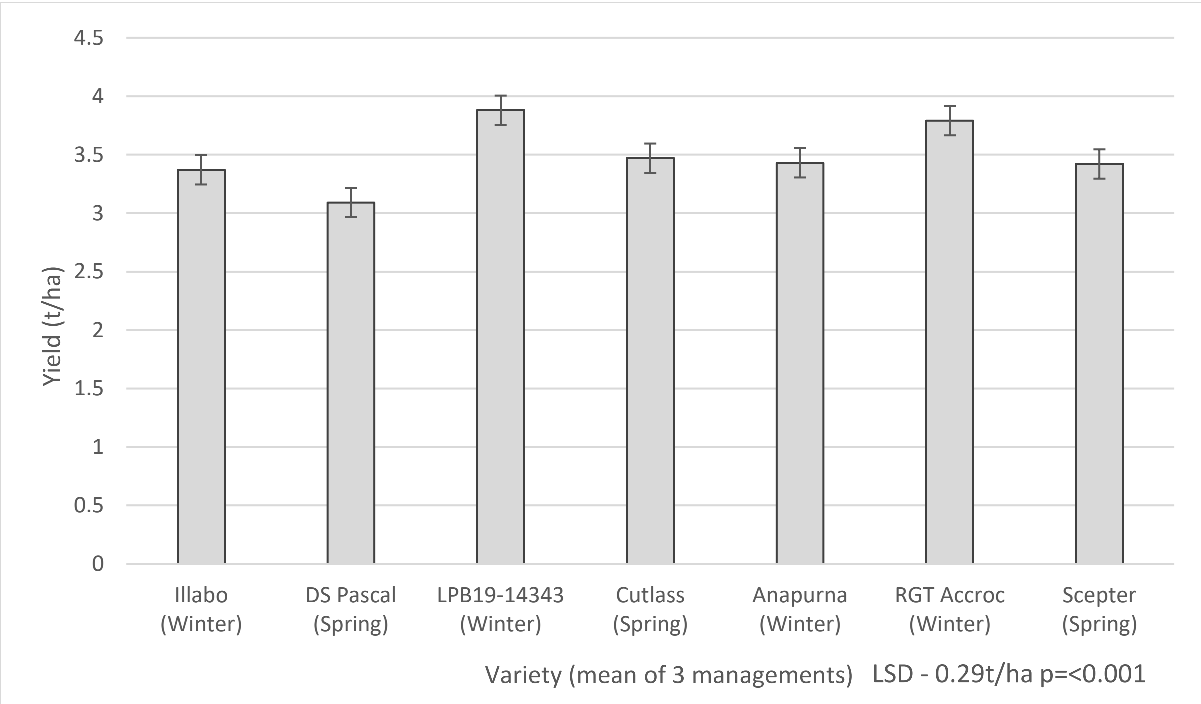

Figure 3. Influence of cultivar on yield (mean of three management levels)

Table 7. Grain yield (t/ha) and quality (%, kg/hL).

	Yield		Protein		Test weight		Screening	
Cultivar (Type)	t/ha		%		Kg/hL		%	
Illabo (Winter)	3.36	bc	11.0	b	73.5	e	1.3	b
DS Pascal (Spring)	3.08	c	11.5	a	76.7	d	1.0	c
LPB19-14343 (Winter)	3.87	a	10.5	c	78.6	c	1.2	b
Cutlass (Spring)	3.46	b	11.0	b	77.3	d	1.1	bc
Anapurna (Winter)	3.41	b	11.6	a	79.2	bc	1.5	a
RGT Accroc (Winter)	3.77	a	10.4	c	80.1	a	0.7	d
Scepter (Spring)	3.41	b	10.9	b	79.7	ab	1.1	bc
Mean	3.48		11.0		77.9		1.1	
LSD	0.29		0.3		0.9		0.2	
P Value	<0.001		<0.001		<0.001		<0.001	
CV	10.26							

Table 8. Influence of management level on grain yield (t/ha) and quality (%, kg/hL) (mean of canopy management strategies).

	Yield		Protein		Test weight		Screenings (<2mm)	
	t/ha		%		Kg/hL		%	
Standard Management	3.54	-	10.7	b	77.7	b	1.1	-
Standard Grazed Management	3.36	-	10.6	b	78.7	a	1.1	-
High Input Management	3.53	-	11.6	a	77.2	b	1.2	-
Mean	3.47		10.9		77.9		1.1	
LSD	0.66		0.3		0.9		0.3	
P Value	0.548		<0.001		0.024		0.825	
CV	18.89							

Trial 3. Wheat April sowing germplasm screening trial – winter and spring (not taken to yield)

Trial code: FAR WAA W20-02

Objective: To examine the phenology, disease resistance and standing power of new wheat germplasm established in the traditional late April/early May sowing window relative to current practice, sown May 1.

Treatments: 25 lines sown in small plots (5m) with standard nitrogen management with no fungicide or PGR input, not taken to yield

Key Points

- 25 lines were screened to examine the phenology of new coded lines versus Scepter (spring wheat) and Illabo (winter wheat).

Table 1. Zadoks growth Stages (0-99) of each cultivar on 14 July, 30 July, 26 August, 29 September, 28 October, 10 November.

Variety	14 July	30 July	26 Aug	29 Sept	28 Oct	10 Nov
Scepter	31	33	49	73	79	~60%
Illabo	VE	31	32	61	56	~10%
Anapurna	VE	VE	30	33	63	73
SFR86-085	VE	VE	30	32	65	73
SFR86-090	VE	31	41	71	81	87
SFR86-071	32	49	67	75	81	89
SFR86-092	VE	32	49	71	85	87
V13079-049	32	40	69	75	81	87
V101006-064	32	33	49	73	65	89
BX7932-039	VE	30	32	61	79	85
BX7932-074A	VE	30	32	65	79	~20%
WAGT-734 (Denison)	VE	31	37	69	81	87
W12069-076	VE	31	33	59	79	73
SUN945A	31	33	40	73	79	87
LPB 332-27-U5	31	37	57	75	65	~80%
364C-19-03	VE	VE	30	32	65	73
DMIS-01-64-3-04	VE	31	37	71	79	75
364D-71-06	VE	30	33	59	79	79
LPB17-4713	31	3	55	75	81	85
LPB16-0598	VE	VE	31	45	61	75
Kinsei	31	31	33	61	85	~20%
IGW6563	VE	31	32	59	65	85
IGW6496	VE	31	32	35	75	~40%
IGW4502	30	37	55	71	81	87
V12167-048	31	37	57	75	79	85
GSP-19-105-W	VE	VE	30	37	71	75
GSP-18-107-W	VE	VE	31	39	65	71

*VE = Vegetative/Tillering – pre GS30, % grain filled.

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		**2 May**
Seed Rate:		180 seeds/m^2
Sowing Fertiliser:		90Kg MAP
Seed Treatment:		Vibrance & Gaucho
Grazing:		Nil
Nitrogen:	23 June	69 N kg/ha
	7 August	69 N kg/ha
PGR:		Nil
Fungicide:		Nil

Appendices

Appendix 1. Esperance Crop Technology Centre

i) Overall Site inputs

Crop Rotation:	2019 Canola, 2018 Barley, 2017 Wheat	
Crop Nutrition:		
IBS	100kg/ha 50% Vigour, 50% MAPZCS	
27 May	46kg N	
19 June	46kg N	
31 July	23kg N	
Crop Protection:		
30 March	Roundup - 2L/ha Ester - 0.8L/ha	Summer knockdown
3 April	Gramoxone - 1.2L/ha	
14 April	Treflan - 3.0L/ha Sakura - 118g/ha Gramoxone - 1L/ha	Pre - emergent over Wheat small plots and DBS sown areas
13 May	Treflan - 3.0L/ha Sakura - 118g/ha Boxer Gold - 2.5L/ha	TOS 2 Wheat block pre-emergent
22 May	Boxer Gold - 2.5L/ha Trojan - 15mL/ha	Barley, Spade seeded wheat Whole site
23 May	Velocity – 1L/ha Lontrel – 40g/ha Plantocrop oil – 1%	Whole site
20 August	Chlorpyrifos – 600mL/ha	Whole site

ii) Meteorological Data

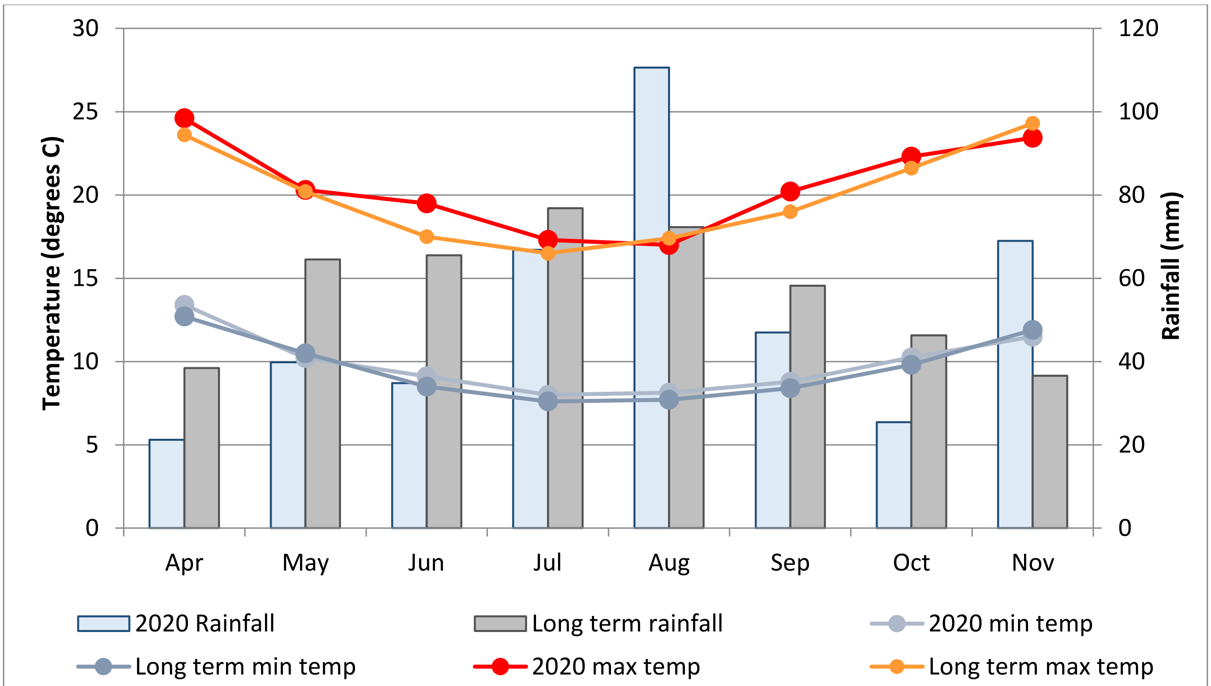

Figure 1. 2020 growing season rainfall and long-term rainfall, 2020 min and max temperatures and long- term min and max temperatures recorded **Esperance Aerodrome** (1950-2020) for the growing season (April-November).

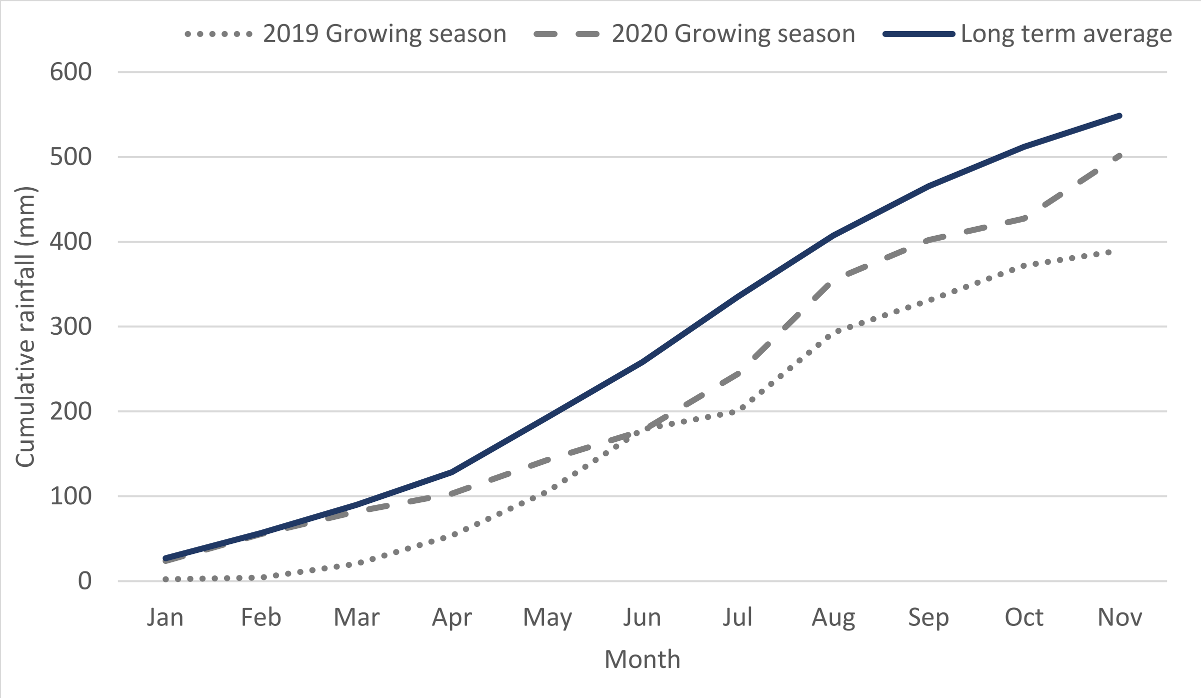

Figure 2. 2019 rainfall, 2020 rainfall and long-term average rainfall for **Esperance Aerodrome** (1950-2020).

iii) Soil Test Results (Esperance Crop Technology Centre)

SUMMIT FERTILIZERS

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Organisation FERTCARE®

Shepwok Downs

22/Feb/2020 to 22/Feb/2020

Date	Paddock Name	Site Number	Depth	pH (w)	pH (CaCl)	Al (mg/kg)	PBI	P Col (mg/kg)	K Col (mg/kg)	S (mg/kg)	EC (dS/m)	OC (%)	Nitrate NO3 (mg/kg)	NH4 (mg/kg)	Column1	Available	Cu (mg/kg)	Zn (mg/kg)	Mn (mg/kg)	Fe (mg/kg)	Gravel (%)	Texture
22/02/2020	FAR Australia	1	0-10	6.7	6.2	0.1	12	10	75	32	0.16	1.63	13	1	14		0.38	2.1	2.3	29	0	Sand
22/02/2020	FAR Australia	1	10-20	7.1	6.4	0.1	9	8	36	11	0.08	0.36	3	1	4		0.08	0.26	0.3	11	0	Sand
22/02/2020	FAR Australia	1	20-60	7	6.3	0.1	11	9	29	9	0.05	0.14	3	1	4		0.08	0.1	0.3	9	0	Sand
22/02/2020	FAR Australia	1	60-80	7.3	6.4	0.1	103	5	220	27	0.06	0.18	3	1	4		0.08	0.08	0.3	8	75	Sandy loam
22/02/2020	FAR Australia	3	0-10	6.4	5.6	0.1	11	14	57	8	0.07	0.95	18	1	19		0.16	1.1	1.6	27	0	Sand
22/02/2020	FAR Australia	3	10-20	5.6	4.6	0.7	12	18	27	4	0.03	0.31	3	1	4		0.09	0.21	0.4	37	0	Sand
22/02/2020	FAR Australia	3	20-60	6.4	5.6	0.1	14	17	27	5	0.04	0.16	3	1	4		0.1	0.17	0.3	23	0	Sand
22/02/2020	FAR Australia	3	60-80	6.7	6	0.1	67	6	170	18	0.04	0.17	4	1	5		0.08	0.09	0.3	9	75	Sand
22/02/2020	FAR Australia	4	0-10	5.7	4.8	1.1	12	12	25	10	0.06	0.81	4	2	6		0.38	0.69	0.9	26	0	Sand
22/02/2020	FAR Australia	4	10-20	5.1	4.3	3.5	19	33	25	4	0.03	0.31	2	1	3		0.15	0.12	0.3	30	0	Sand
22/02/2020	FAR Australia	4	20-60	5.1	4.3	5.6	32	20	30	7	0.03	0.25	2	1	3		0.14	0.1	0.3	32	0	Sand
22/02/2020	FAR Australia	4	60-80	6.4	5.7	0.1	73	5	110	16	0.04	0.17	3	1	4		0.08	0.08	0.3	10	75	Sandy loam
22/02/2020	FAR Australia	6	0-10	5.5	5	0.9	12	6	28	34	0.36	0.92	20	1	21		0.16	0.55	0.7	35	0	Sand
22/02/2020	FAR Australia	6	10-20	5.2	4.4	2.4	12	11	25	6	0.04	0.4	3	1	4		0.13	0.15	0.3	24	0	Sand
22/02/2020	FAR Australia	6	20-60	5.4	4.6	1.3	19	19	25	7	0.04	0.27	2	1	3		0.16	0.12	0.3	21	0	Sand
22/02/2020	FAR Australia	6	60-80	6.5	5.9	0.1	66	5	76	23	0.06	0.19	2	1	3		0.08	0.19	0.3	8	75	Sand

Appendix 2. Green Range (Albany Crop Technology Centre)

i) Overall Site inputs

Crop Rotation:	2019 Pasture, 2018 Barley, 2017 RR Canola
Crop Nutrition:	
IBS	90kg/ha MAP
13 May	50kg/ha Potash
19 May	33.3 kg N/ha
2 Aug	27.6 kg N/ha
11 Aug	16.6 kg N/ha
Crop Protection:	
1 May (IBS)	Treflan 2L Boxer Gold 2.5L Diuron 200g Gramoxone 2L Wetter 1%
1 July	Legacy 1L Alpha – Cyhalorin 100mL
16 Aug	Verno – Manganese 500g/ha Verno – Copper 600g/ha
9 Sept	Trojan 15mL Chlorpyrifos 150mL/ha

ii) Meteorological Data

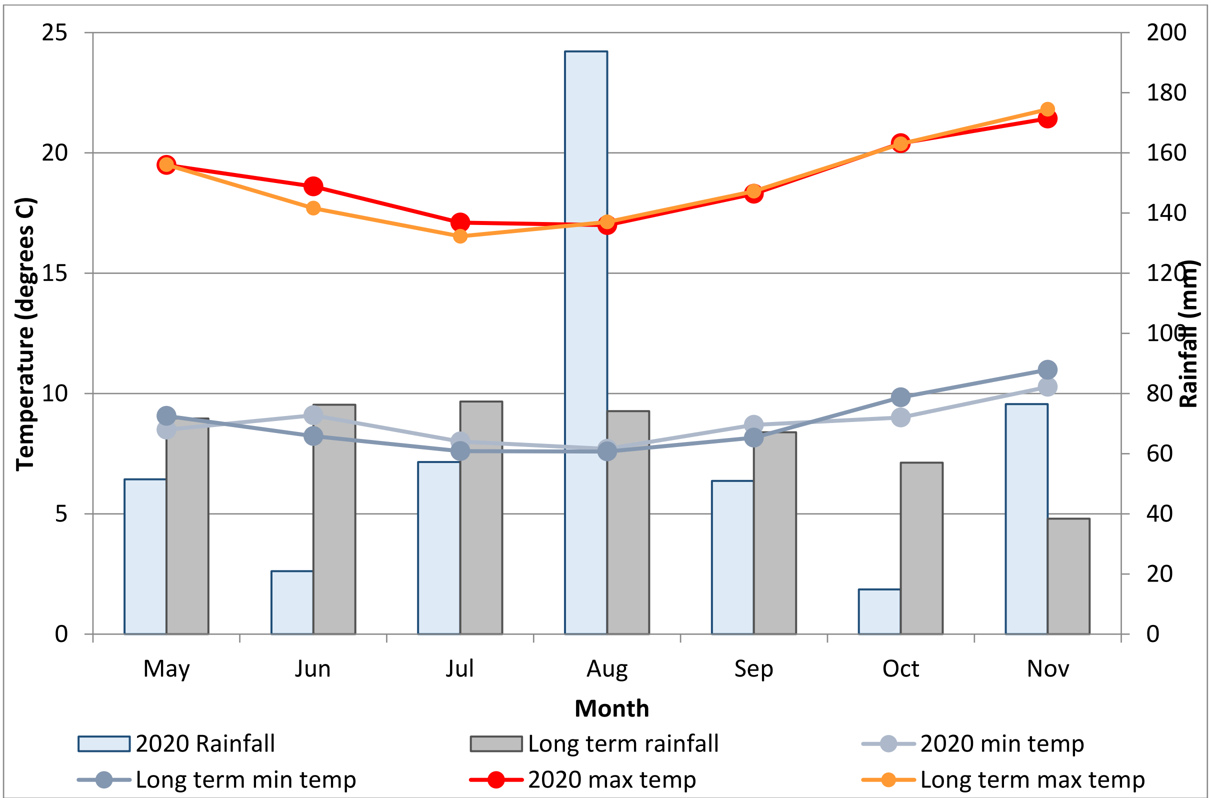

Figure 1. 2020 growing season rainfall and long-term rainfall, 2020 min and max temperatures and long-term min and max temperatures recorded at **Warriup near Green Range** (1919 to 2020) for the growing season (May to October).

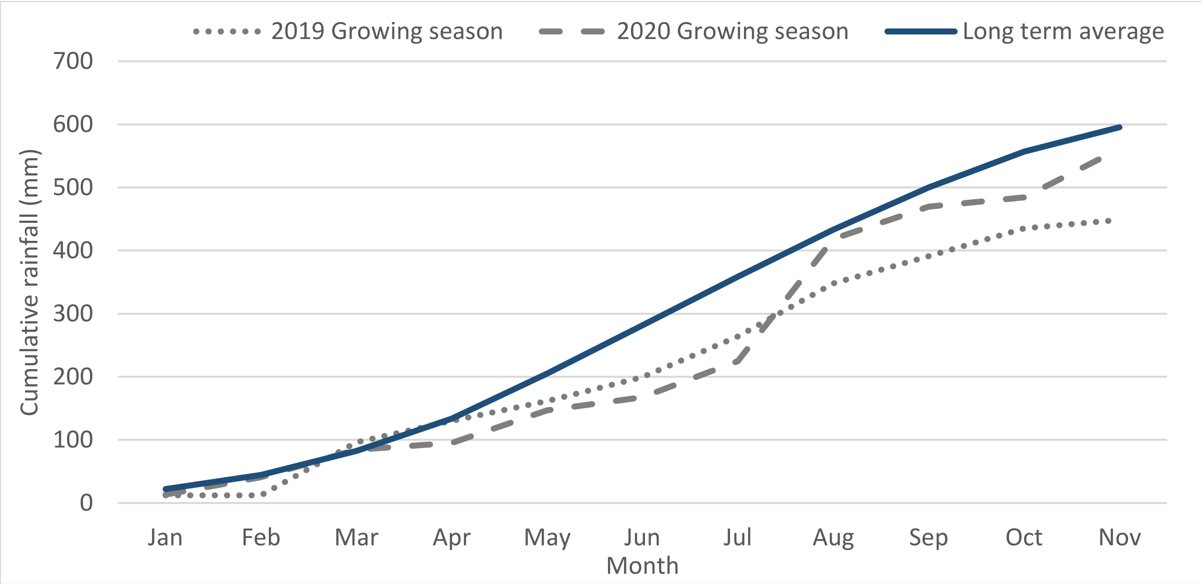

Figure 2. 2019 rainfall, 2020 rainfall and long-term average rainfall for Warriup (1919 to 2020).

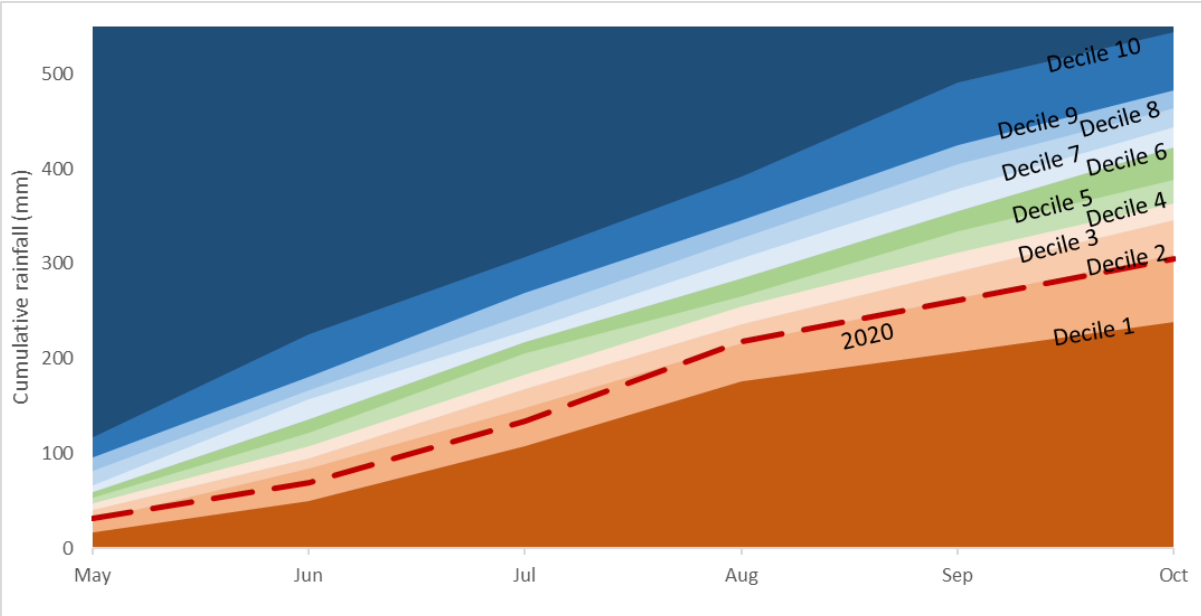

Figure 3. Cumulative Growing Season (May to October) Rainfall Deciles and 2020 Rainfall recorded at Warriup (1919 to 2020).

iii) Soil Test Results (Clayed - Albany)

Interpreted Results

Paddock	A	B	C	E	D	F
	(-	(-	(-	(-	(-	(-
Site	Green Range 2020 clayed	Green Range 2020 clayed	Green Range 2020 clayed	Green Range 2020 clayed	Green Range 2020 clayed	Green Range 2020 clayed
Lab Number	YAS20014	YAS20007	YAS20008	YAS20009	YAS20013	YAS20010
Sample Depth:	0-10 cm	10-20 cm	20-30 cm	30-40 cm	40-50 cm	50-60 cm
pH [1:5 soil/CaCl2] {4B1}	5.1 <	4.9 <	5.8 OK	5.9 OK	6.1 OK	6.1 OK
pH [1:5 soil/water] {4A1}	5.9	6.0	6.5	6.7	6.8	6.8
EC [1:5] (dS/m) {3A1}	0.234 OK	0.056 OK	0.042 OK	0.043 OK	0.047 OK	0.095 OK
OC [W&B] (%) {6A1}	2.8 OK	1.2 OK	0.3 <<	0.1 <<	0.2 <<	0.4 <<
N	Low	Low	Low	Low	Low	Low
NO3-N [KCl] (mg/kg) {7C1c}	68 High	17 Marginal	9 Low	8 Low	6 Low	10 Low
NH4-N (mg/kg) {7C1a}	14	1	0	1	1	3
P [Colwell] (mg/kg) {9B1}	28 Marginal	9 Low	24 Marginal	15 Marginal	9 Low	4 Low
PBI+ColP {912a}	23 <	17 <	18 <	11 <<	26 <	89 >
K [Colwell] (mg/kg) {18A1}	135 Sufficient	33 Low	20 Low	20 Low	41 Low	85 Sufficient
S [KCl-40] (mg/kg) {10D1}	21 High	7 Sufficient	4 Marginal	4 Marginal	7 Sufficient	21 High
Ca - exch (cmol/kg) {15A1}	6.85 OK	2.61 <	1.16 <	0.87 <	1.12 <	2.28 <
Mg - exch (cmol/kg) {15A1}	1.17 OK	0.41 <	0.16 <	0.14 <	0.22 <	0.50 <
K - exch (cmol/kg) {15A1}	0.27 <	0.07 <	0.04 <	0.05 <	0.09 <	0.20 <
Na - exch (cmol/kg) {15A1}	0.23 <	0.13 <	0.08 <	0.09 <	0.13 <	0.36 OK
Al - exch (cmol/kg) {15A1}	0.090 <	0.110 OK	0.060 <	0.070 <	0.200 OK	0.120 OK
Mg - % of CEC [EMP (calc)]	13.6 OK	12.3 OK	10.6 OK	11.5 OK	12.5 OK	14.4 OK
Na - % of CEC [ESP (calc)]	2.6 OK	3.9 OK	5.5 OK	7.3 >	7.2 >	10.5 >
ECEC (cmol/kg) {15J1}	8.61 OK	3.33 <	1.50 <<	1.22 <<	1.76 <<	3.46 <

Paddock	A	B	C	E	D	F
Site	(- Green Range 2020 clayed	(- Green Range 2020 clayed	(- Green Range 2020 clayed	(- Green Range 2020 clayed	(- Green Range 2020 clayed	(- Green Range 2020 clayed
Lab Number	YAS20014	YAS20007	YAS20008	YAS20009	YAS20013	YAS20010
Sample Depth:	0-10 cm	10-20 cm	20-30 cm	30-40 cm	40-50 cm	50-60 cm
Ca/Mg ratio {15M1}	5.9 OK	6.4 OK	7.3 OK	6.2 OK	5.1 OK	4.6 OK
Cu [DTPA] (mg/kg) {12A1}	0.78 Sufficient	0.39 Sufficient	0.21 Marginal	0.36 Sufficient	0.40 Sufficient	0.21 Marginal
Zn [DTPA] (mg/kg) {12A1}	4.46 High	6.12 High	1.26 High	0.84 High	0.86 High	1.45 High
Mn [DTPA] (mg/kg) {12A1}	3.61	0.59	0.16	0.20	0.10	0.30
Fe [DTPA] (mg/kg) {12A1}	110	42	19	12	13	13
B [CaCl2] (mg/kg) {12C1}	0.90 Sufficient	0.41 Sufficient	0.22 Sufficient	0.24 Sufficient	0.32 Sufficient	0.80 Sufficient
% Clay (%)	5.98	5.88	3.80	5.67	5.77	9.56
% Course Sand (%)	69.20	66.98	70.15	65.91	69.70	63.37
% Fine Sand (%)	20.77	27.14	24.10	28.41	22.58	25.14
% Sand (%)	89.97	94.12	94.25	94.32	92.28	88.51
% Silt (%)	4.05	0.00	1.95	0.00	1.96	1.93
MIR% Clay (%)	11.52	4.05	1.57	3.24	2.44	13.01
MIR% Sand (%)	83.42	91.69	89.38	89.56	86.11	83.67
MIR% Silt (%)	5.06	4.26	9.05	7.20	11.45	3.32
Soil Stability	OK	<	OK	OK	OK	<

iv) Soil Test Results (un-Clayed - Albany)

Interpreted Results

Paddock	G	H	I	J	K	L
	(-	(-	(-	(-	(-	(-
Site	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed
Lab Number	YAS20012	YAS20018	YAS20016	YAS20015	YAS20011	YAS20017
Sample Depth:	0-10 cm	10-20 cm	20-30 cm	30-40 cm	40-50 cm	50-60 cm
pH [1:5 soil/CaCl2] {4B1}	5.5 <	4.6 <<	4.9 <	4.9 <	5.9 OK	6.0 OK
pH [1:5 soil/water] {4A1}	6.3	5.5	6.0	6.0	6.5	6.6
EC [1:5] (dS/m) {3A1}	0.150 OK	0.218 OK	0.110 OK	0.048 OK	0.030 OK	0.058 OK
OC [W&B] (%) {6A1}	2.5 OK	2.1 OK	1.5 OK	0.8 <	0.1 <<	0.1 <<
N	Low	Low	Low	Low	Low	Low
NO3-N [KCl] (mg/kg) {7C1c}	35 High	25 Sufficient	21 Sufficient	9 Low	5 Low	6 Low
NH4-N (mg/kg) {7C1a}	3	11	16	2	1	1
P [Colwell] (mg/kg) {9B1}	62 High	90 High	46 Marginal	41 Marginal	6 Low	3 Low
PBI+ColP {912a}	51 OK	53 OK	33 <	39 OK	16 <	85 >
K [Colwell] (mg/kg) {18A1}	126 Sufficient	74 Sufficient	60 Low	45 Low	33 Low	47 Low
S [KCl-40] (mg/kg) {10D1}	25 High	45 High	20 High	7 Sufficient	5 Marginal	18 High
Ca - exch (cmol/kg) {15A1}	5.52 OK	4.08 <	2.68 <	1.35 <	0.63 <	0.72 <
Mg - exch (cmol/kg) {15A1}	0.70 <	0.56 <	0.32 <	0.20 <	0.18 <	0.30 <
K - exch (cmol/kg) {15A1}	0.32 <	0.20 <	0.14 <	0.09 <	0.07 <	0.10 <
Na - exch (cmol/kg) {15A1}	0.24 <	0.39 OK	0.18 <	0.12 <	0.04 <	0.21 <
Al - exch (cmol/kg) {15A1}	0.080 <	0.180 OK	0.160 OK	0.180 OK	0.070 <	0.040 <
Mg - % of CEC [EMP (calc)]	10.2 OK	10.3 OK	9.2 OK	10.3 OK	18.3 OK	22.0 OK
Na - % of CEC [ESP (calc)]	3.5 OK	7.3 >	5.2 OK	6.0 OK	3.7 OK	15.0 >>

Paddock	G	H	I	J	K	L
	(-	(-	(-	(-	(-	(-
Site	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed	Green Range 2020 - unclayed
Lab Number	YAS20012	YAS20018	YAS20016	YAS20015	YAS20011	YAS20017
Sample Depth:	0-10 cm	10-20 cm	20-30 cm	30-40 cm	40-50 cm	50-60 cm
ECEC (cmol/kg) {15J1}	6.86 OK	5.41 OK	3.48 <	1.94 <<	0.99 <<	1.37 <<
Ca/Mg ratio {15M1}	7.9 OK	7.3 OK	8.4 OK	6.8 OK	3.5 OK	2.4 OK
Cu [DTPA] (mg/kg) {12A1}	0.49 Sufficient	0.53 Sufficient	0.46 Sufficient	0.32 Sufficient	0.25 Marginal	0.15 Low
Zn [DTPA] (mg/kg) {12A1}	5.72 High	2.79 High	1.84 High	0.99 High	0.49 High	0.52 High
Mn [DTPA] (mg/kg) {12A1}	1.04	0.99	0.71	0.40	0.14	0.13
Fe [DTPA] (mg/kg) {12A1}	238	287	214	183	51	13
B [CaCl2] (mg/kg) {12C1}	0.84 Sufficient	0.76 Sufficient	0.48 Sufficient	0.29 Sufficient	0.25 Sufficient	0.33 Sufficient
% Clay (%)	8.01	5.88	7.96	5.85	3.87	7.40
% Course Sand (%)	67.65	60.21	55.99	68.12	65.56	56.23
% Fine Sand (%)	22.31	29.93	36.05	26.03	28.59	34.49
% Sand (%)	89.96	90.14	92.04	94.15	94.15	90.72
% Silt (%)	2.03	3.98	0.00	0.00	1.98	1.87
MIR% Clay (%)	13.34	7.90	14.03	5.60	2.16	6.56
MIR% Sand (%)	84.93	91.10	81.01	87.83	92.70	92.44
MIR% Silt (%)	1.73	1.00	4.96	6.57	5.14	1.00
Soil Stability	OK	OK	OK	OK	OK	OK