SA Grain Legume Development and Extension Project

Summary of 2021 Field Trial Results

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

THE UNIVERSITY of ADELAIDE

Government of South Australia
Department of Primary Industries and Regions

SARDI RESEARCH AND DEVELOPMENT INSTITUTE

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HART SA's premier cropping field site

AIR EP Ag Innovation & Research Eyre Peninsula

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Project management

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Project Investment

Grains Research and Development Corporation: project UOA2105-013RTX "Development and extension to close the economic yield gap and maximise faming systems benefits from grain legume production in South Australia"

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Cover image: Melrose salt tolerant lentil variety trial, 10 September 2021

INTRODUCTION

The project aims to deliver local development and extension to close the economic yield gap and maximise faming systems benefits from grain legume production in South Australia.

Over the lifeline of the project (2021-2025), the proposed investment will:

- Address the current yield gap in grain legumes and drive its closure through supporting increased technical efficiency of growers with extension of best practice grain legume agronomy;
- Support grain growers and their advisers (100 per hub, 20 per spoke) in the target regions (Figure 1) to maximise system profitability by incorporating grain legumes in rotation;
- Drive and support sustainable expansion of the area grown to grain legumes; and
- A targeted 45% of growers adopt or intend to adopt new and novel practices emerging from linked proof-of concept and innovation research

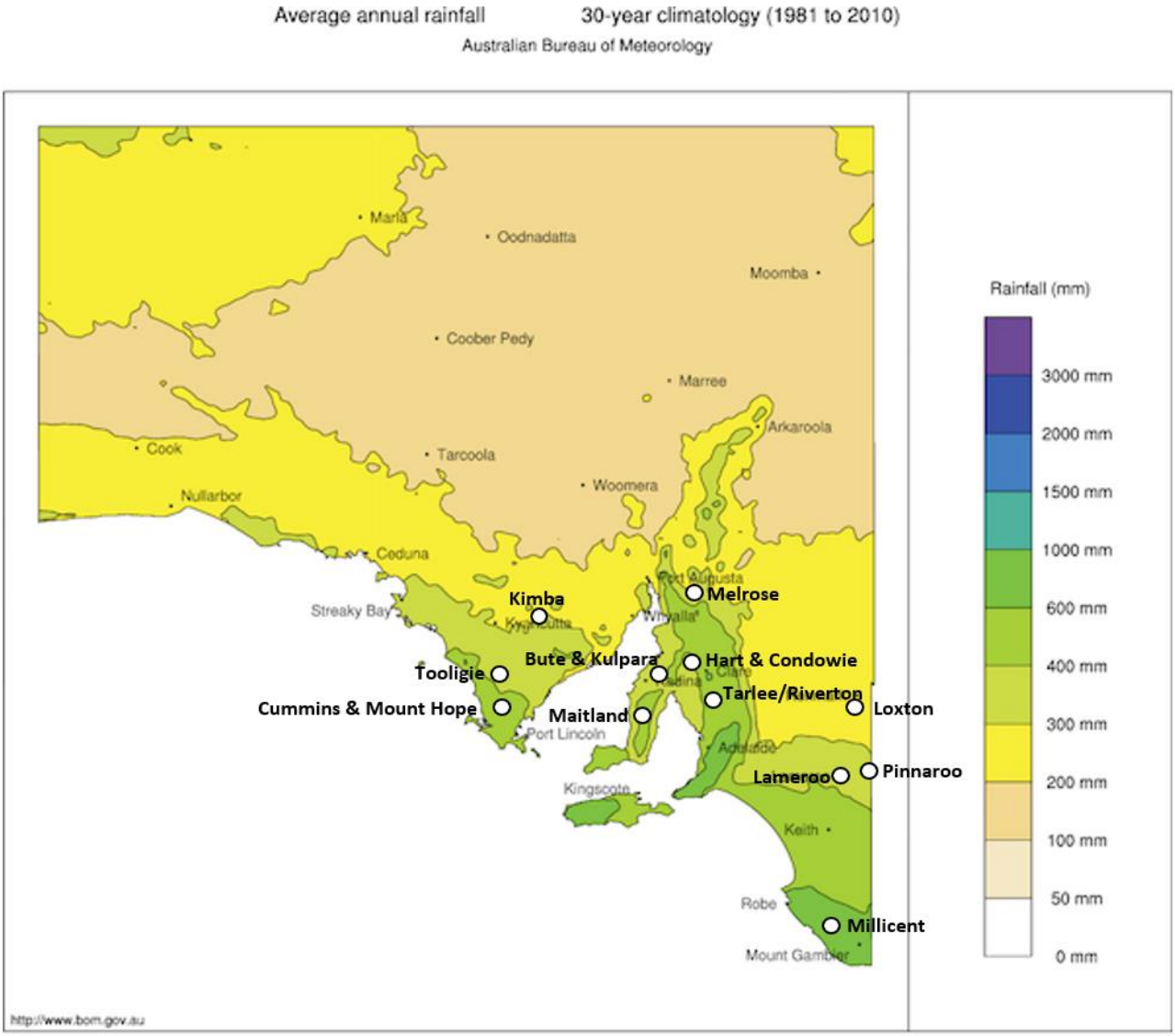

Figure 1. Trial locations for SA Grain Legume hub and spoke sites in 2021, selected by collaborators to represent the range of environments and soil types across the state's legume cropping regions.

HART AND CONDOWIE

SITE SUMMARY

Table 1. Site soil characteristics for Hart, 2021.

Depth (cm)	NH_3-N	NO_3-N	P (mg/kg)	K	S	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-15	1	11	10	304	5.2	0.97	0.177	7.0	8.2
15-35	1	9	16	229	6.2	0.68	0.197	7.0	8.3
35-55	1	11	23	306	4.8	0.71	0.257	7.4	8.7
55-75	1	5	11	260	34.5	0.37	0.510	7.4	9.4
75-105	1	4	20	308	70.2	0.40	0.675	7.9	9.4

Depth (cm)	Cu	Fe	Mn (mg/kg)	Zn	B	Exc Ca	Exc Mg	Exc K (meq/100g)	Exc Na	Exc Al
0-15	1.19	11.8	3.48	1.20	2.76	23.21	3.65	0.98	0.50	0.08
15-35	1.27	12.3	3.16	0.30	2.22	19.97	4.59	0.68	0.78	0.08
35-55	1.24	11.2	3.85	0.83	3.37	17.25	5.27	0.79	1.60	0.05
55-75	1.25	9.6	2.21	0.47	8.48	11.88	6.20	0.67	4.32	0.04
75-105	0.95	7.8	2.09	0.41	16.04	10.72	6.08	0.78	5.34	0.06

Rainfall during the first 6 months of 2021 was similar to the long-term average experienced at Condowie (Figure 2), this aided early and even crop establishment. Rainfall was above average in July, supporting late vegetative and early reproductive developments. Despite the rainfall in July, conditions were windy, reducing the risk of disease infection in crop canopies. Spring rainfall was reduced compared to the long-term average, reducing the potential for pod and seed set, particularly in chickpea as they are later maturing then other pulse crops. Average grain yield at the site was 0.5 t/ha for lentil and 0.43 t/ha for chickpea.

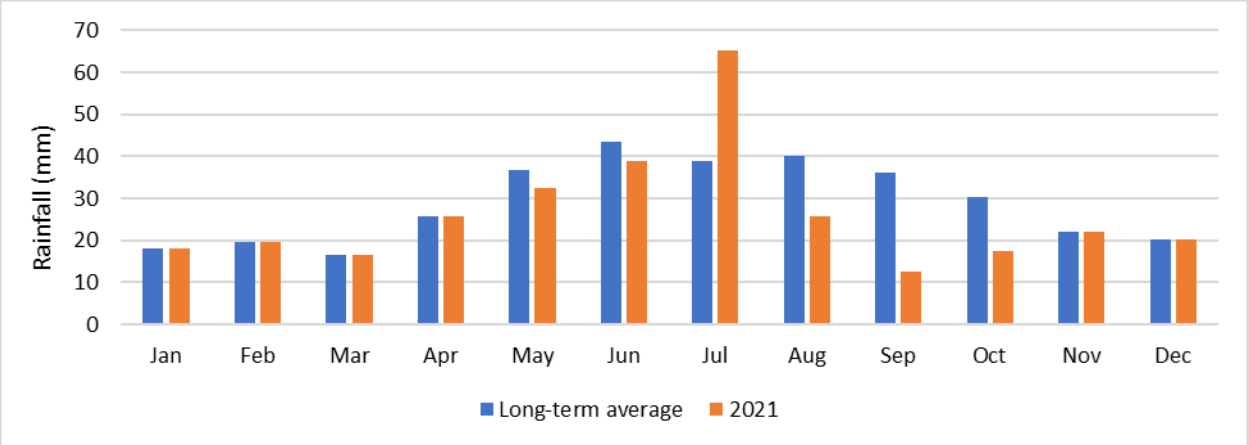

Figure 2. Monthly rainfall at Condowie, in 2021, compared to the long-term average recorded at Snowtown (Condowie) BOM weather station (#21015).

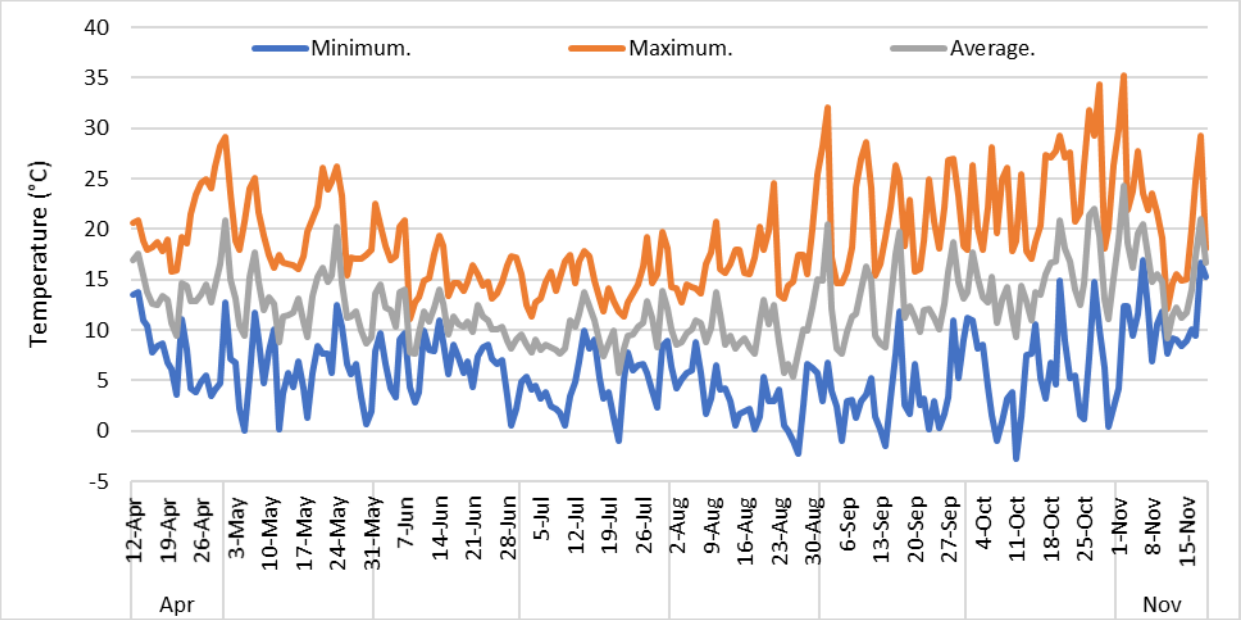

Figure 3. Minimum, maximum and average temperature recorded at the trial site at Condowie, 2021.

Table 2. Site soil characteristics (dark grey clay to grey-brown clay loam) at Condowie, 2021.

Depth (cm)	NH_3-N	NO_3-N	P (mg/kg)	K	S	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-10	4	24	30	609	9.7	0.99	0.223	7.0	8.4
10-30	1	8	9	268	11.9	0.72	0.231	7.8	8.9
30-60	2	6	9	230	9.1	0.47	0.331	7.9	9.3
60-90	2	6	12	289	30.5	0.39	0.469	7.9	9.3
90-120	1	3	6	265	66.3	0.25	0.643	8.1	9.6

Depth (cm)	Cu	Fe	Mn (mg/kg)	Zn	B	Exc Ca	Exc Mg	Exc K (meq/100g)	Exc Na	Exc Al
0-10	1.05	10.7	5.40	1.02	2.87	21.00	5.21	1.70	0.67	0.05
10-30	1.06	9.5	2.18	0.65	3.76	21.18	7.17	0.83	1.79	0.05
30-60	1.01	11.1	1.72	0.40	6.74	17.46	8.22	0.73	3.15	0.06
60-90	1.22	9.1	2.17	0.73	12.27	14.87	8.46	0.88	4.07	0.04
90-120	0.7	5.3	0.89	0.31	15.07	10.99	7.59	0.70	4.91	0.04

IMPROVING CHICKPEA HARVESTABILITY

Sarah Day, Penny Roberts. ***SARDI***

Aim: This trial aims to improve the plant height and harvestability of chickpea.

Methodology:

Plant height was measured prior and two (2) weeks post application of a Plant Growth Regulator (PGR) by recording the height of 5 randomly selected plants within each plot, excluding the edge rows.

Lowest pod height was recorded immediately prior to harvest, by recording the height of the lowest pod on 5 randomly selected plants within each plot, excluding the edge rows.

Plots were harvested at crop maturity and grain yield was converted from kg/plot to t/ha.

Grain quality parameters, such as grain weight and grain size, were assessed on harvested grain samples. Grain weight was determined by weighing 300 seeds and converting the weight to g/100seeds. Grain size was assessed by separating a 100g sample into seed size classes using a 6 mm and 7 mm sieve.

Data was analysed using a two-way ANOVA in Genstat 21st Edition.

Treatments:

Varieties: CBA Captain – erect plant type, medium-tall plant height
PBA Slasher – semi-spreading plant type, short-medium plant height

Agronomic treatments: See Table 3.

Table 3. Agronomic treatments applied to chickpea to improve harvestability, at Condowie 2021.

Treatment	Details
Untreated control	-
PGR early	PGR applied pre-flowering
PGR late	PGR applied at early to-mid podding
Canola	Canola sown at a reduced rate (1 kg/ha) as a companion species

PGR = plant growth regulator

Table 4. Site details including sowing date and fertiliser, at Condowie 2021.

Trial design	RCBD
Replicates	3
Sowing date	17/5/21
Plant density	50 plants/m2
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	2/11/21

Key messages

- Newly released chickpea variety PBA Captain provides a height advantages and grain yield increase compared to older variety PBA Slasher.
- The use of a Plant Growth Regulator had no beneficial effect on plant height, yield, grain size or height to the lowest pod.

Results and Discussion:

CBA Captain had 4 cm height advantage over PBA Slasher during the growing season at Condowie, 2021 (Table 5). Early application of a Plant Growth Regulator (PGR) did not increase or reduce plant height, compared to the untreated control. The late application of the PGR also did not increase plant height. However, when plant height was measuring during podding, chickpea height was reduced where canola was sown with chickpea as a companion species. Canola as a companion species also reduced pod set, with very few pods observed on edge row plants prior to harvest.

Lowest pod height was not influence by variety selection or treatment applied to improve harvestability (P>0.05, data not shown). The average height of the lowest chickpea pod was 19.5 cm from the furrow.

Average chickpea grain yield was 0.43 t/ha at Condowie, 2021. Grain yield was influenced by an interaction between variety selection and treatment applied to improve harvestability (Figure 4). CBA Captain treatments, except for where it was sown with canola, were the highest yielding treatments. Sowing chickpea with canola as a companion species was detrimental to pod set and grain yield in this environment. Chickpea have been successfully intercropped with canola in other environments, and there is potential to see productivity grains (Roberts & Day, 2022).

Grain weight of chickpea was low, likely influenced by moisture stress from dry spring conditions at Condowie, 2021 (Table 6). PBA Slasher had a larger grain weight than CBA Captain. However, CBA Captain had a larger proportion of grains greater than 7 mm.

Table 5. Plant height (cm) of chickpea measured prior to and post the applications of a Plant Growth Regulator (PGR) treatment to determine a growth response, at Condowie, 2021. ns = not significant (P>0.05).

Treatment	Plant height (cm)											
	Pre-"early PGR"			Post-"early PGR"			Pre-"late PGR"			Post-"late PGR"		
	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg
Control	33.60	29.93	*31.77*	46.67	41.47	*44.07*	50.20	45.53	*47.87*	50.53	44.67	*47.60*
Early PGR	34.67	29.60	*32.13*	47.80	44.27	*46.03*	50.67	49.07	*49.87*	50.13	46.93	*48.53*
Late PGR	34.80	29.73	*32.27*	46.13	39.93	*43.03*	50.73	44.93	*47.83*	50.27	44.47	*47.37*
Canola	34.60	30.07	*32.33*	45.80	44.40	*45.10*	45.07	45.53	*43.43*	42.00	41.47	*41.83*
Average	*34.42*	*29.83*	*31.12*	*46.60*	*42.52*	*44.56*	*49.17*	*45.33*	*47.25*	*48.23*	*44.38*	*46.31*
LSD (P<0.05)												
Treatment x variety	ns			ns			ns			ns		
Treatment	ns			ns			3.754			3.899		
Variety	1.055			1.754			2.805			3.123		

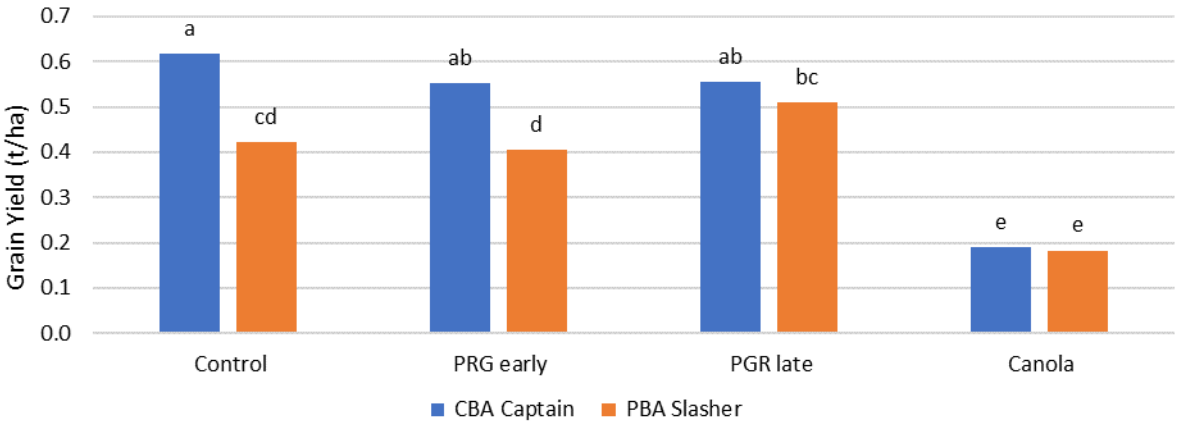

Figure 4. Grain yield (t/ha) was influenced by an interaction between variety selection and treatment applied to improve harvestability at Condowie, 2021. Bars labelled with the same letters are not significantly different (P<0.05).

Table 6. Grain quality parameters assessed on chickpea grain samples harvested from Condowie, 2021. ns = not significant (P>0.05).

Treatment	Grain quality											
	Grain weight (g/100 seeds)			Grain size <6 mm (%)			Grain size 6-7 mm (%)			Grain size >7 mm (%)		
	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg	CBA Captain	PBA Slasher	Avg
Control	13.58	13.15	*13.37*	21	30	*26*	44	48	*46*	35	22	*29*
Early PGR	12.99	16.04	*14.51*	26	22	*24*	45	49	*47*	30	29	*30*
Late PGR	13.18	13.89	*13.54*	24	27	*26*	44	45	*45*	31	27	*29*
Canola	13.24	14.37	*13.80*	24	26	*25*	44	47	*46*	32	26	*29*
Average	*13.25*	*14.36*	*13.80*	*24*	*26*	*25*	*44*	*47*	*46*	*32*	*26*	*29*
LSD (P<0.05)												
Treatment x variety	1.525			6.3			ns			ns		
Treatment	ns			ns			ns			ns		
Variety	0.762			ns			ns			4.2		

REFERENCES

Roberts, P., & Day, S. (2022). Intercropping improves productivity in low to medium rainfall environments. 20th Agronomy Australia Conference, Toowoomba, QLD.