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

FRONTIER FARMING SYSTEMS

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HART SA's premier cropping field site

AIR EP Ag Innovation & Research Eyre Peninsula

MID NORTH HIGH RAINFALL ZONE

Acknowledgements

The research undertaken as part of the GRDC-invested SA Grain Legume Validation project (UOA2105-013RTX) is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, and the authors would like to thank them for their continued support. The continued support from industry and breeding organisations for the provision of chemical products and pulse varieties for use in field trials is also gratefully acknowledged and appreciated.

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

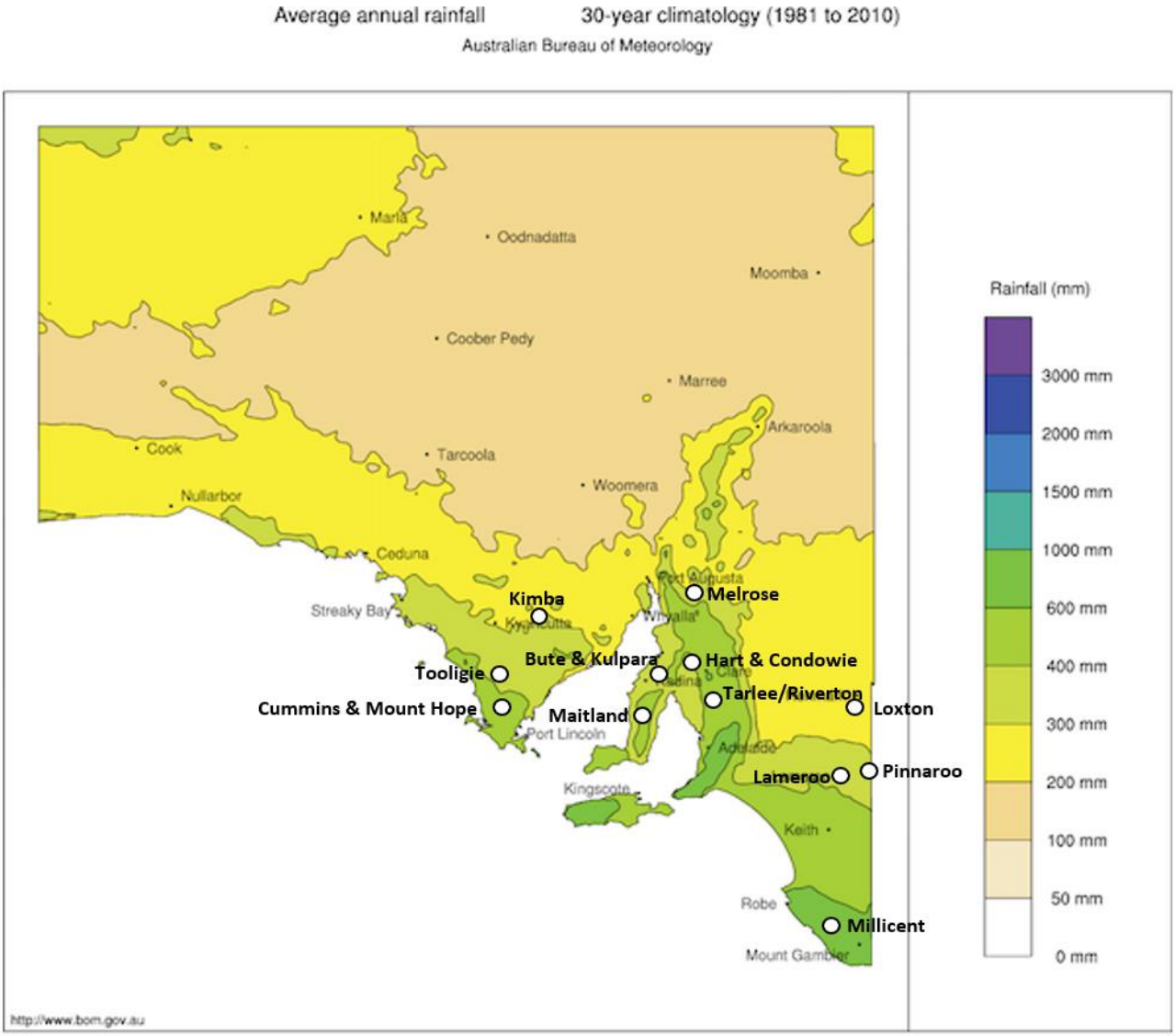

Figure 1. Trial locations for SA Grain Legume hub and spoke sites in 2021, selected by collaborators to represent the range of environments and soil types across the state's legume cropping regions.

CUMMINS

SITE SUMMARY

Cummins is in the medium rainfall zone on the lower Eyre Peninsula. Above average rainfall during late spring and into harvest 2020, followed by below average rainfall in March/ April 2021 saw soil moisture levels approximately at 50% of plant available water capacity at the end of April at the Cummins site, 2021. Season breaking rainfall did not occur until 26 May 2021. Trials were sown on 29 May. Rainfall received during June and July at the site was above average for that period (Figure 2). Rainfall was below average in August and much below average in September, followed by a wetter than average finish to the growing season. Both maximum and minimum temperatures were below long-term averages from August to the end of October, providing cool temperatures for crops to mature at Cummins in 2021 (Figure 3). Pulse grain yields averaged 1.5 t/ha for lentil, 1.8 t/ha for faba bean, 2.1 t/ha for lupin and 1.2 t/ha for vetch across the site.

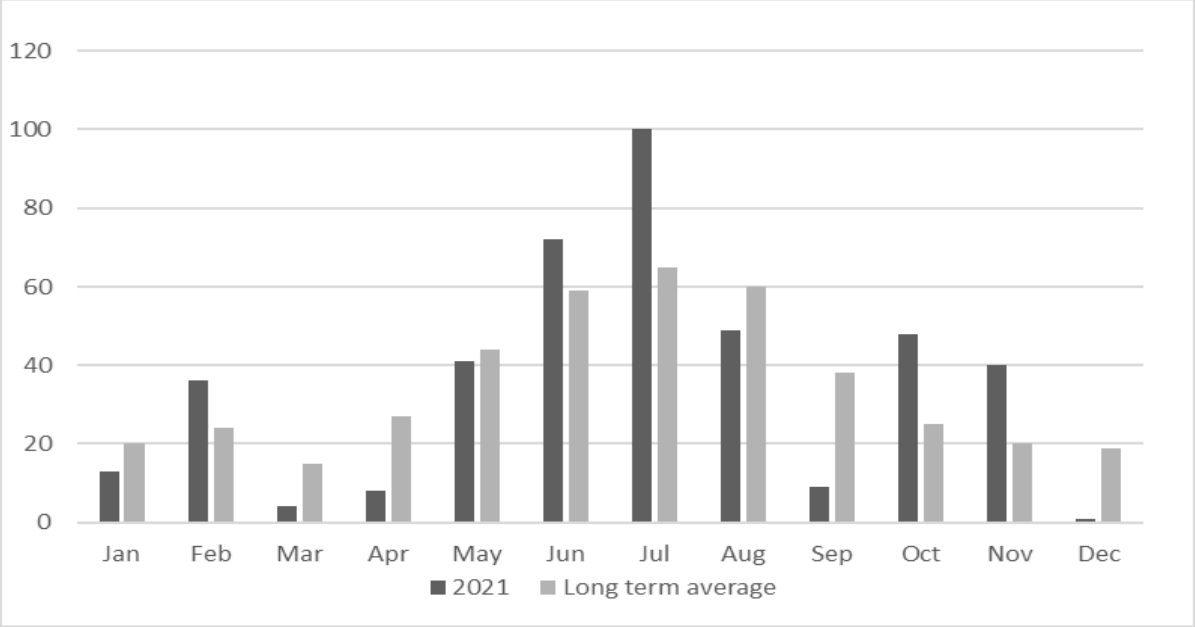

Figure 2. Monthly rainfall recorded at Cummins in 2021 compared to the long-term average rainfall from the Cummins Aero Bureau of Meteorology weather station, 2021 (#18217).

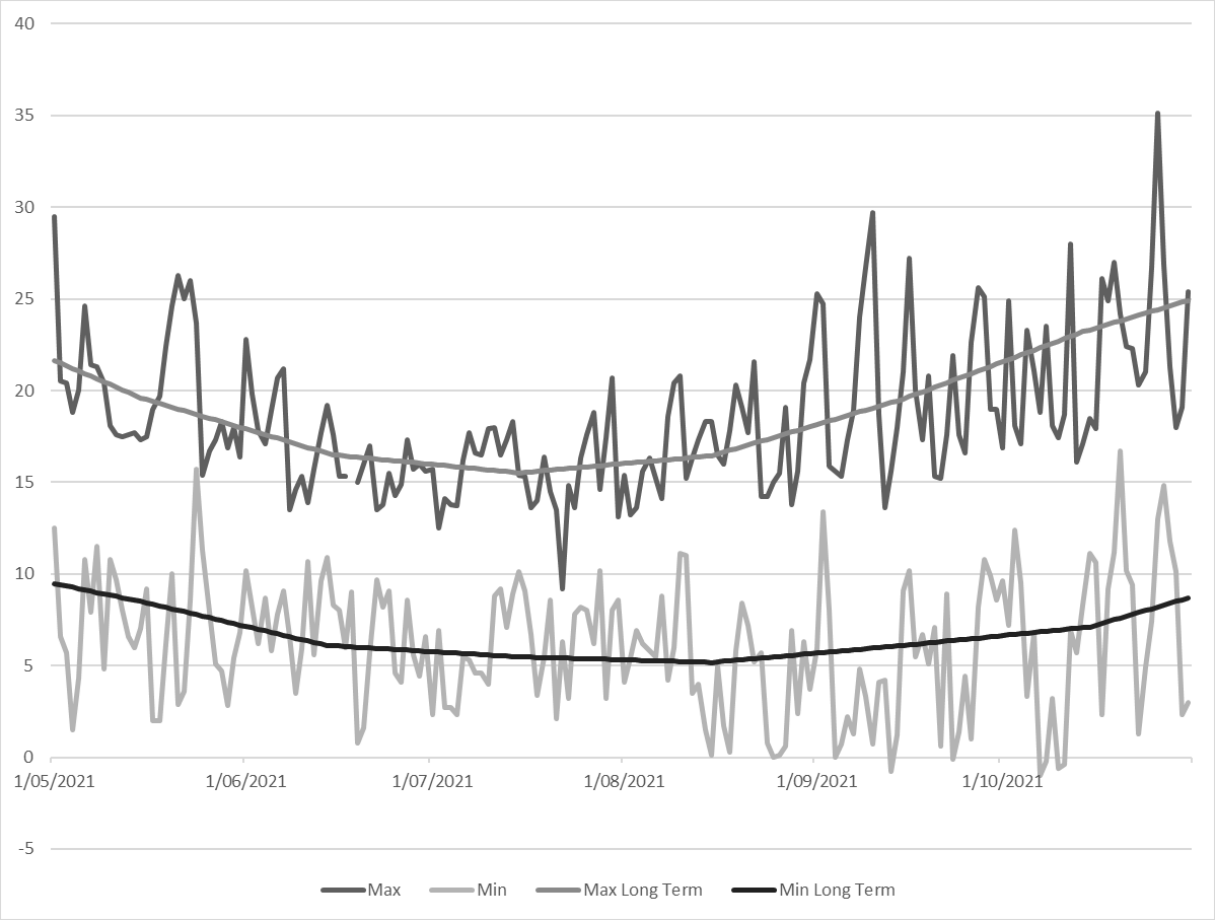

Figure 3. Long term average, minimum and maximum temperature (°C) recorded during the growing season at Cummins Aero Bureau of Meteorology weather station, 2021 (#18217).

Table 1. Soil test results for Cummins trial site, Eyre Peninsula, 2021.

Depth (cm)	NH3-N	NO3-N	Cow. P (mg/kg)	PBI + Col P	Sulfur (S)	OC (%)	Texture mg/kg	pH (H_2O)	pH ($CaCl_2$)
0-10	3.2	15	23	25.0	7.2	1.42	S	7.33	6.92
10-30	<1	3.8			6.7		C	8.40	7.70
30-60	<1	2.9			18		CL	9.18	8.14
60-100	<1	1.7			54		CL	9.56	8.34

Depth (cm)	B	Fe	Mn (mg/kg)	Cu	Zn	Salinity EC dS/m	Ece dS/m
0-10	0.37	38	3.6	0.31	7.4	0.26	5.9
10-30	2.6					0.28	1.6
30-60	5.3					0.31	2.7
60-100	6.2					0.54	4.7

INOCULANT TRIALS

Andrew Ware, Mark Saunders, Rhaquelle Meiklejohn, and Gary Miller, ***EP AG Research***

Aim: To demonstrate and quantify the benefits of differing inoculants in both dry and wet sown lentil and faba bean.

Methodology:

Sowing occurred at two dates: 18 May (dry sown) and 29 May (wet sown). Both trials received 100 kg/ha MAP fertiliser at seeding and a foliar trace element spray of 3 L/ha Smart Trace Triple® (Table 2). Weeds were controlled with 1 L/ha propyzamide and 500 ml/ha clethodim across all treatments, 1.1 kg/ha simazine (applied PSPE) on faba beans and 400 g/ha simizine + 400 g/ha diuron (applied PSPE) to lentils. 60 ml/ha alpha-cypermethrin was applied during grain fill to control insect damage. No seed dressing fungicides were used at this site. 500 ml/ha carbendazim was applied to lentil and faba beans in mid-August to control botrytis grey mould and chocolate spot.

Faba bean (cv PBA Bendoc) was sown at 30 plants/m^2, and lentil (cv PBA Hurricane XT) was sown at 120 plants/m^2.

Despite reasonably effective pre-emergent herbicides being applied, the site had some capeweed emerge in plots, which may have influenced grain yield.

Inoculants used were in granular and peat form, both Tag Team® products. They were applied at x1 and x2 label rates. Label instructions for application were adhered to for both products. The peat inoculant was applied to seed day of sowing. Each crop was managed as per best practice for that crop.

Data was analysed using ANOVA in Genstat 19th Edition.

Treatments:

Time of sowing: Dry (18 May); Wet (29 May)
Inoculant rate: recommended (x1) label rate and x2 label rate
Inoculant type: Tag Team Granular and Tag Team Peat

Table 2. Trial details, including sowing and harvest date, at Yeltukka, 2021.

Trial design	**split plot**
Replicates	**four**
Sowing date	**18/5/21 and 29/5/21**
Plant density	**Lentil 120 plants/m^2; faba beans 30plants/m^2**
Row spacing	**25 cm**
Fertiliser	**100 kg/ha MAP**
Harvest date	**17/11/21**

Key messages

- Using granular inoculant increased lentil grain yields in a paddock with no background levels of rhizobia, compared to peat inoculant.
- Faba bean grain yield was not affected by inoculant type, rate or sowing dry.
- No response was observed to applying above label rates of inoculant.

Results and Discussion:

rNod soil testing of the site (to determine the levels of inoculant present) found no strains of the desired group E&F present. Testing at the end of the season only found sufficient levels of inoculant present after growing faba beans sown in wet soil, but all other samples collected were lower than the desired levels (Table 3).

In the lentil inoculant trial, use of the granular inoculant resulted in higher yields compared to the peat treatments (Table 4). There were no yield differences when looking at rate applied or sowing time (either wet or dry). Nodulation scores of the lentil trial found no differences between any treatments either early or late in the season, and nodules were at a level considered adequate (but not ample) to meet the plant's needs across the trial. When looking at the faba bean trial, there were also no differences observed when looking at any measurements taken, including NDVI, biomass or grain yield (Table 5). Nodulation scores conducted on the faba bean during the season found nodules at abundant levels for both dry and wet TOS, despite differences observed in rNod soil tests taken after harvest.

While there was no background of the correct rhizobia strains at this site, both the lentil and faba bean trials were able to show there was no effect from applying higher than label rates and that seeding dry eight days before the break of the season did not affect yield or nodulation.

These trials will be planted to wheat in 2022.

Table 3. rNod soil test of rhizobia numbers following 2021 trials at Yeltukka.

Sample	Rhizobia Group E & F kDNA copies/g sample
Bare Soil	0
Bean wet sow	1044
Bean dry sow	82
Lentil wet sow	431
Lentil dry sow	550

Note: levels of around 1000 kDNA copies/g are considered adequate.

Table 4. Emergence, nodulation, biomass (NDVI and dry matter cut) and grain yield of lentil treated with either a granular or peat inoculant, 2021. *ns* = not significant (P>0.05).

Inoculant form	Time of sowing	Label rate	Emergence 5 June (plants/m^2)	Nodulation 5 June	NDVI 5 June	Nodulation 8 Sept	Biomass 11 Oct (t/ha)	Grain yield (t/ha)
Granular	Dry	x1 rate	117	4.5	0.25	4.4	2.2	1.09
		x2 rate	109	4.4	0.26	4.6	2.85	1.05
	Wet	x1 rate	97	3.9	0.21	5.1	2.7	0.98
		x2 rate	105	4.1	0.21	4.7	2.28	1.14
Peat	Dry	x1 rate	113	3.8	0.25	4.1	1.97	0.66
		x2 rate	112	4.2	0.26	4.0	2.28	0.86
	Wet	x1 rate	116	3.6	0.23	4.2	2.55	0.69
		x2 rate	114	4.1	0.22	4.6	2.74	0.80
	LSD (P=0.05)	*Rate*	*ns*	*ns*				*ns*
		Product						*0.22*
		TOS	*ns*					*ns*

Table 5. Emergence, nodulation, biomass (NDVI and dry matter cut) and grain yield of faba bean treated with either a granular or peat inoculant, 2021. *ns* = not significant (P>0.05).

Inoculant form	Time of sowing (TOS)	Label rate	Emergence 5 June (plants/m^2)	Nodulation 5 June	NDVI 5 June	Nodulation 8 Sept	Biomass 11 Oct (t/ha)	Grain Yield (t/ha)
Granular	Dry	x1 rate	27	3.4	0.35	7.9	4.1	2.21
		x2 rate	30	3.3	0.32	7.8	4.7	2.01
	Wet	x1 rate	29	3.1	0.37	7.7	3.9	1.77
		x2 rate	34	3.4	0.34	7.7	5.0	1.94
Peat	Dry	x1 rate	28	1.7	0.28	7.0	4.4	1.50
		x2 rate	28	1.6	0.29	7.6	3.6	2.19
	Wet	x1 rate	24	1.0	0.29	7.6	4.8	2.12
		x2 rate	29	2.3	0.29	7.6	4.1	1.84
	LSD (P=0.05)	*Rate*	*ns*	*ns*				*ns*
		Product						*ns*
		TOS	*ns*					*ns*