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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UNFS Upper North Farming Systems

HART SA's premier cropping field site

AIR EP Ag Innovation & Research Eyre Peninsula

MID NORTH HIGH RAINFALL ZONE

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Project management

Penny Roberts and Sarah Day, SARDI Agronomy

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"

Contributions and Trial Management

Melrose, Palmer, Lameroo, Riverton, Hart and Condowie: Sarah Day, SARDI Agronomy Clare sarah.day@sa.gov.au

Kimba and Tooligie: Amy Keeley (née Gutsche) and Brianna Guidera, **SARDI Agronomy Port Lincoln** amy.gutsche@sa.gov.au

Loxton and Pinnaroo: Michael Moodie, **Frontier Farming Systems** michael@frontierfarming.com.au

Mount Hope and Cummins: Andrew Ware, **EP AG Research** andrew@epagresearch.com.au

Millicent: Max Bloomfield, **FAR Australia** max.bloomfield@faraustralia.com.au

Maitland, Bute and Kulpara: Sam Trengove, **Trengove Consulting** samtrenny34@hotmail.com

Extension Hosts

Loxton, Pinnaroo and Lameroo: Tanja Morgan, **Mallee Sustainable Farming** tanja.morgan@msfp.org.au

Mount Hope, Cummins, Kimba and Tooligie: Naomi Scholz, **AIR EP** eo@airep.com.au

Millicent: Max Bloomfield, **FAR Australia** max.bloomfield@faraustralia.com.au

Maitland, Bute and Kulpara: Sam Trengove, **Trengove Consulting** samtrenny34@hotmail.com

Melrose: Ruth Sommerville **Upper North Farming Systems** unfs@outlook.com

Riverton: Jarred Tilley **Mid North High Rainfall Zone** greenwith.invermay@outlook.com

Hart and Condowie: Sandy Kimber, **Hart Field Site Group** admin@hartfieldsite.org.au

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

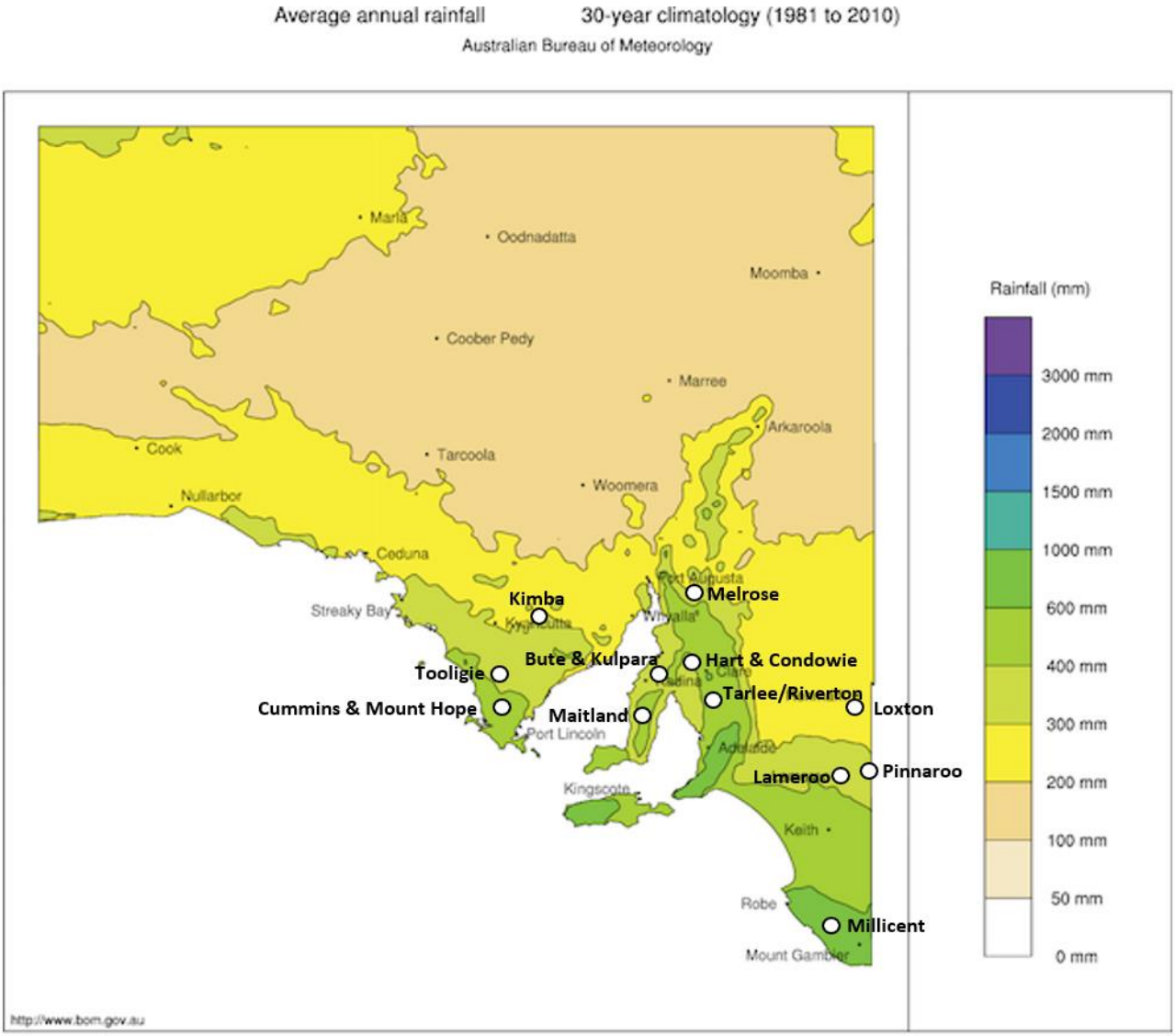

Figure 1. Trial locations for SA Grain Legume hub and spoke sites in 2021, selected by collaborators to represent the range of environments and soil types across the state's legume cropping regions.

MILLICENT

SITE SUMMARY

January to April rainfall (156 mm) at the Millicent spoke site was slightly above the long-term average (140 mm), providing an ideal start at sowing (Figure 2). May rainfall was below average, but winter rainfall (June to August) far exceeded the long-term average. This did not cause any waterlogging issues due to the free-draining and highly fertile organosol soil at the trial site. The soil profile maintained good moisture content throughout spring (September to November), despite below average rainfall. Broad beans produced large canopies that were able to out-compete weeds. However, weeds were uncontrolled in faba bean plots due to staff being unable to travel to the site from Victoria as per tight border restrictions during the pandemic. The total annual rainfall in 2021 (740 mm) was in line with the long-term average (746 mm).

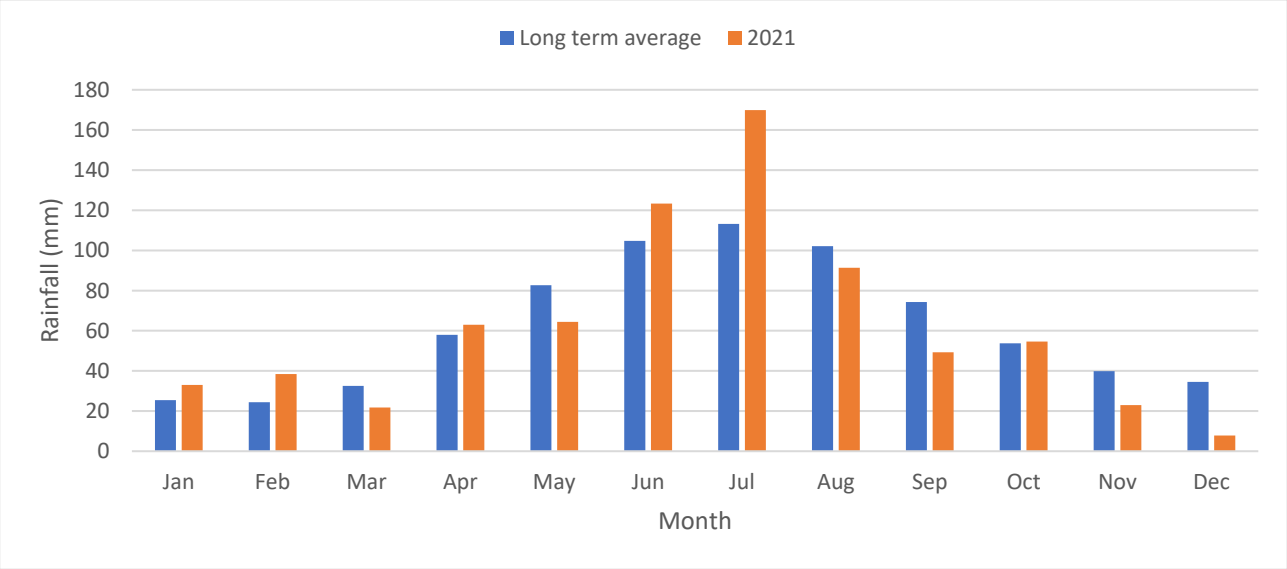

Figure 2. Monthly rainfall at Millicent in 2021 compared to the long-term average. Data from Millicent BOM weather station (#026018).

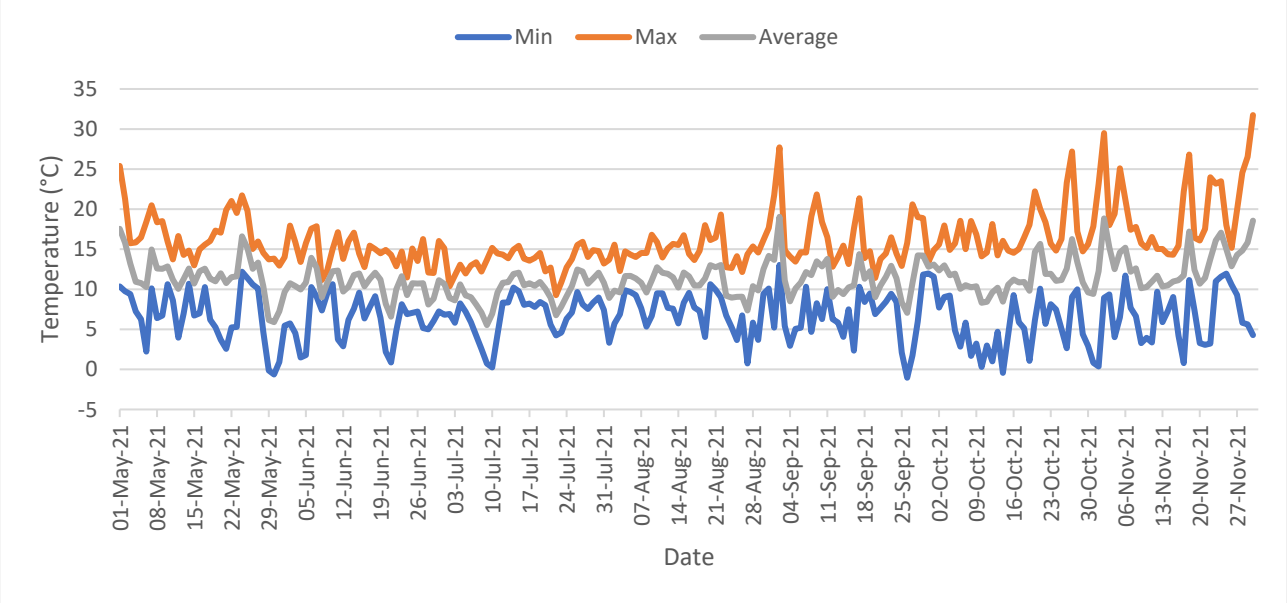

Figure 3. Daily minimum, maximum and average temperatures recorded at the Millicent spoke site in 2021.

Table 1. Soil analysis at the Millicent spoke site (0-10 cm) in 2021, sampled 1 June.

NO_3-N	P	K (ppm)	S	Cu	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)	
133	56	508	50	1.1	9.7	0.47	7.7	8.2	
B	**Fe**	**Mn (ppm)**	**Zn**	**Ca**	**Exc Ca**	**Exc Mg**	**Exc K (meq/100g)**	**Exc Na**	**Exc Al**
1.8	9	0.9	3.4	7509	37.54	2.00	1.30	0.4	0.07

NUTRITION AND N FIXATION IN FABA BEAN AND BENCHMARKING BROAD BEAN

Objective: Maximise faba bean productivity and benchmark faba bean production (Biomass and N fixation) with other higher value crops such as broad beans and spring sown lentil.

Treatments: Four nutrient treatments (Table 2) were applied to one cultivar of faba bean (PBA Amberley) and one cultivar of broad bean (Aquadulce), at Millicent 2021.

Table 2. Nutrition treatments, products and nutrient contents, and application rates and timings.

	Treatment	Product	Nutrients	Rate	Application timing
1	**Untreated**				
2	**Micronutrients (standard)**	Smartrace Triple	Zn 4% Mn 5% Cu 1.5% S 4.9%	5000 mL/ha	5 August, 5 October
		Boly	B 5% Mo 3% N 3%	4000 mL/ha	
3	**Micronutrients (standard) + 100 kg N/ha**	Smartrace Triple and Boly (as above) Extra N (Urea)	 N 46%	 217 kg/ha	 5 July
4	**Micronutrients (region)**	Rapisol Combi 7	Fe 3% Zn 3% Mn 3% Cu 1% Mg 1% B 0.65% Mo 0.3%	1500 g/ha	5 August, 5 October

Key messages:

- Broad beans grew larger, had greater early vigour and were more tolerant of the potential trace element constraints in the organosol soil, leading to better weed suppression than faba beans.
- Adding 100 kg N/ha reduced harvest dry matter of faba beans.

Faba beans were less adapted to this soil type and had poor early vigour, showing symptoms of yellowing and trace element deficiency. This factor led to poor early growth in the faba beans and reduced weed competition. The broad beans in the nutrition management trial were not as affected due to their larger

canopy and height providing denser canopies that better suppressed weeds, showing their greater adaptability.

Biomass of faba bean varied from ~8 to 11.4 t/ha (Figure 4) under the four treatments, the Rapisol Combi 7 treatment achieved 11.4 t/ha of dry matter, whereas the lignosulfonates (standard) achieved 9.68 t/ha, similar to the untreated. There was no evidence of additional biomass with applied N.

Yield and harvest index, and nitrogen removal results have not been processed at the time of publication. However, based on our estimates (and using 20 kg N fixed per tonne of dry matter) this equates to between 160 – 220 kg N.

There were no significant differences in yield of broad bean (3.92 to 4.23 t/ha) or faba bean (1.60-1.87 t/ha) under the four treatments (Data not shown).

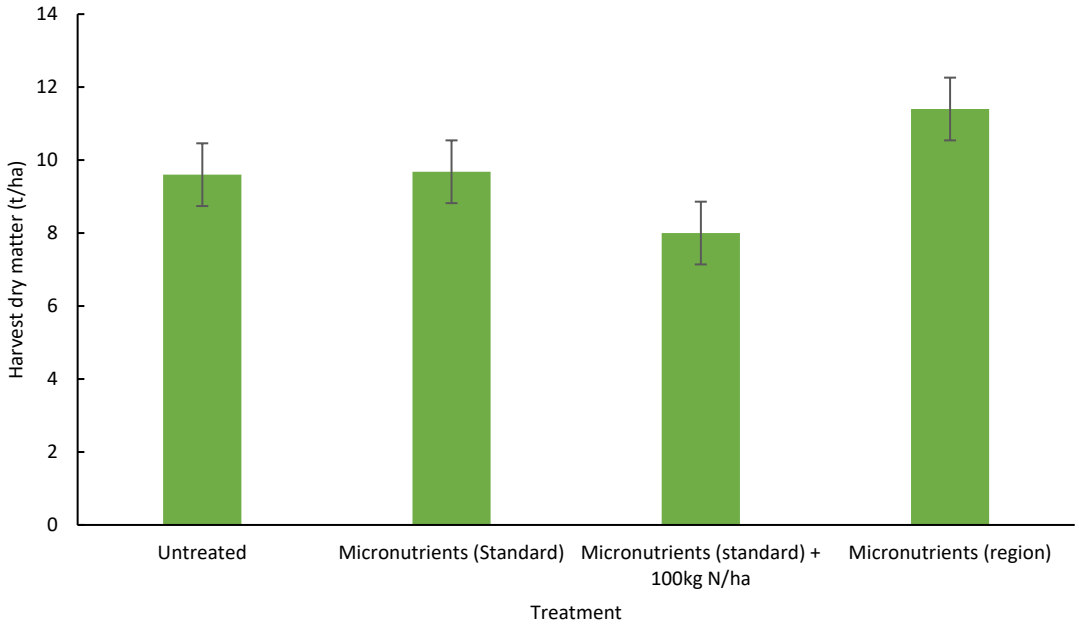

Figure 4. Harvest dry matter (t/ha) of faba bean (cv. PBA Amberley) with different nutrition treatments (see Table 2) sown 8 May and harvested by hand 21 December. P-value = 0.024, LSD (P = 0.05) = 1.6.

The 2021 nutrition management trial showed little advantage of additional nitrogen at this site in 2021. There were significant differences across treatments for harvest biomass in PBA Amberley. While N content has yet to be calculated, based on our estimates (and using 20kg N fixed per tonne of dry matter) this equates to between 160 – 220kg N fixed between the lowest and highest treatment, and shows the importance of crop nutrition for N fixation. This is not factoring in how much N would be exported in the grain. Grain yield, harvest index, and nitrogen removal results have not been processed at the time of publication.

The same nutrition treatments had no significant difference on the grain yield in Aquadulce broad bean. This may have been due to the high organic carbon and organic matter at the site. This experiment will be repeated in 2022.