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

FAR

EPAG RESEARCH

Trengove Consulting

agcommunicators.

Mallee Sustainable Farming

UNFS Upper North Farming Systems

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

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

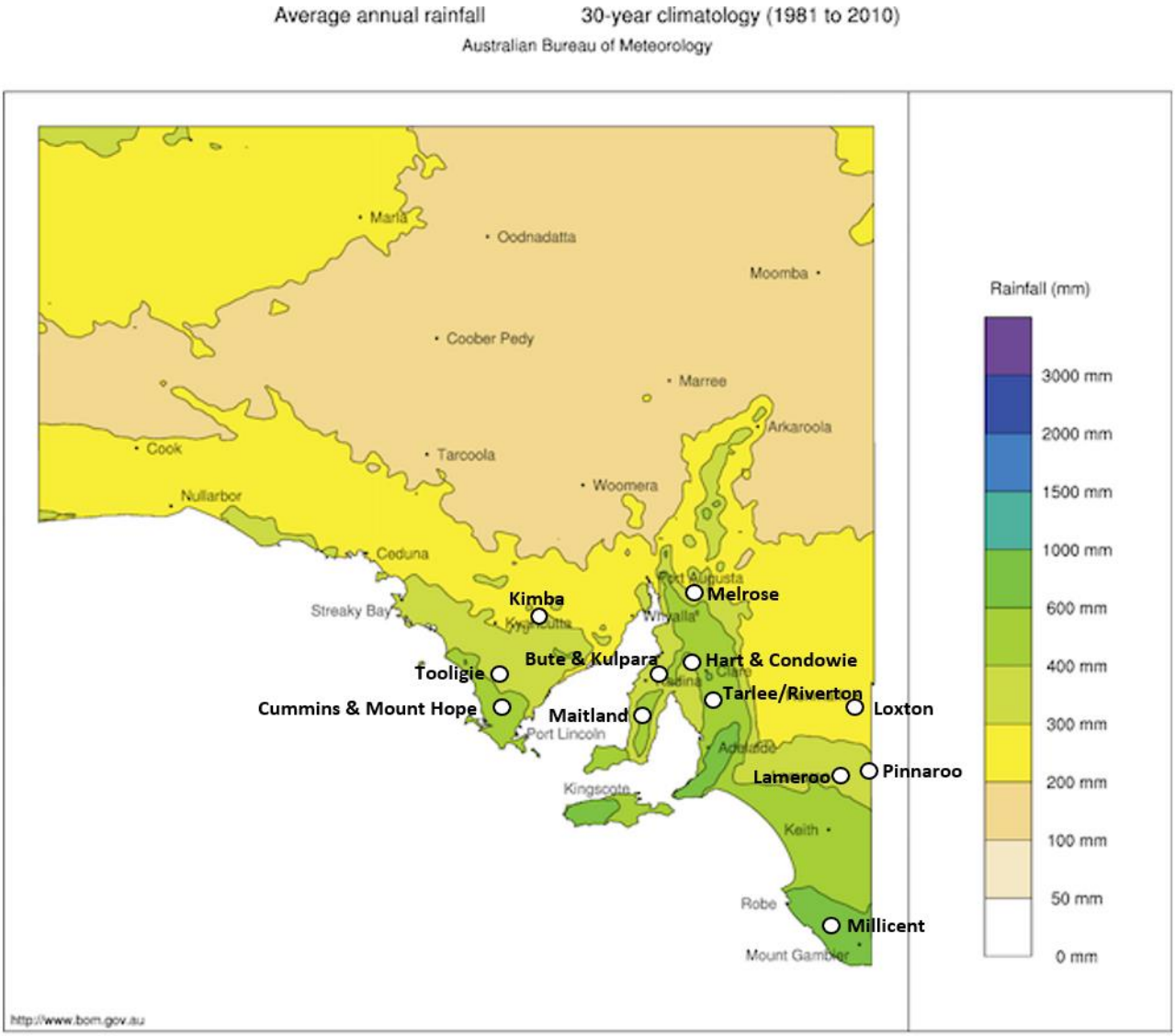

Figure 1. Trial locations for SA Grain Legume hub and spoke sites in 2021, selected by collaborators to represent the range of environments and soil types across the state's legume cropping regions.

TOOLIGIE

SITE SUMMARY

Following above average rainfall in the pre-season, April rainfall was well below-average at Tooligie in 2021 (Figure 2). While May rainfall was above average, of the 34 mm received, 23 mm of this did not fall until late in the month. As a result, trial sowing was delayed until 10th June. Fortunately, germination was not affected by the delay, and June and July rainfall were above average (57 mm and 62 mm respectively) and sufficient for crops to survive on throughout winter. Temperatures did not reach 0°C at any stage during the growing season (Figure 3) and no frosts were recorded; however, crops had poor vigour and canopy closure was not achieved. In the second half of the growing season, August and September rainfall were below average (Figure 2) resulting in moisture stress. Substantial October and November rainfall did not improve the crop condition, and delayed harvest until the 25th of November. No grain cracking was recorded following delayed harvest at Tooligie.

The site soil is a clayey loam interspersed with a sandy loam layer from 10-30 cm, with a neutral-alkaline pH and moderate soil nitrogen and Colwell phosphorus (Table 1). No obvious production constraints were identified from the soil profile analysis.

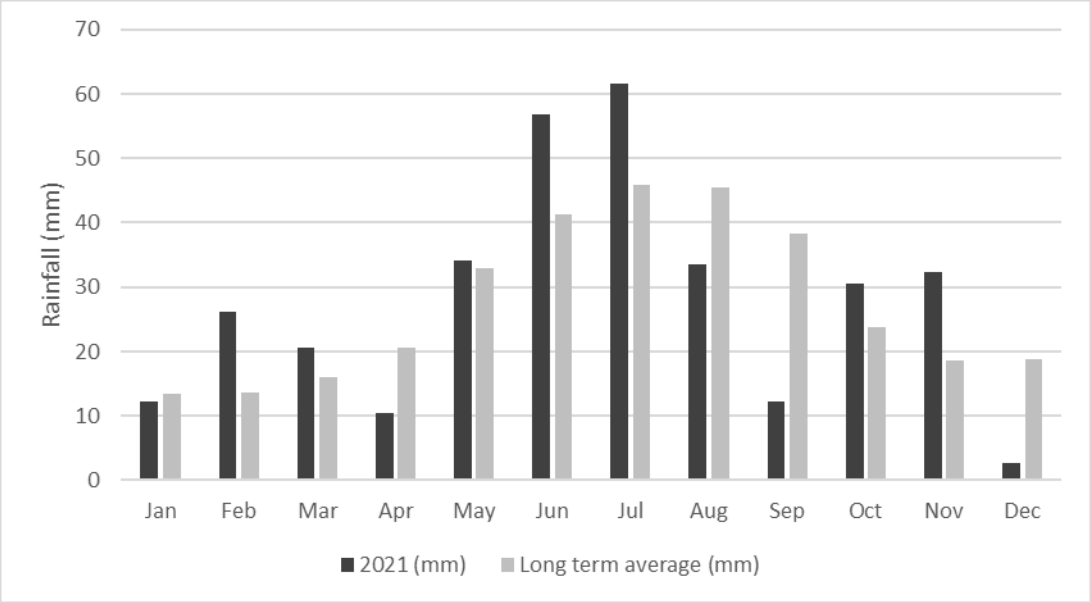

Figure 2. Monthly rainfall at Tooligie in 2021 compared to the long-term average recorded at Murdinga BOM weather station (#018164).

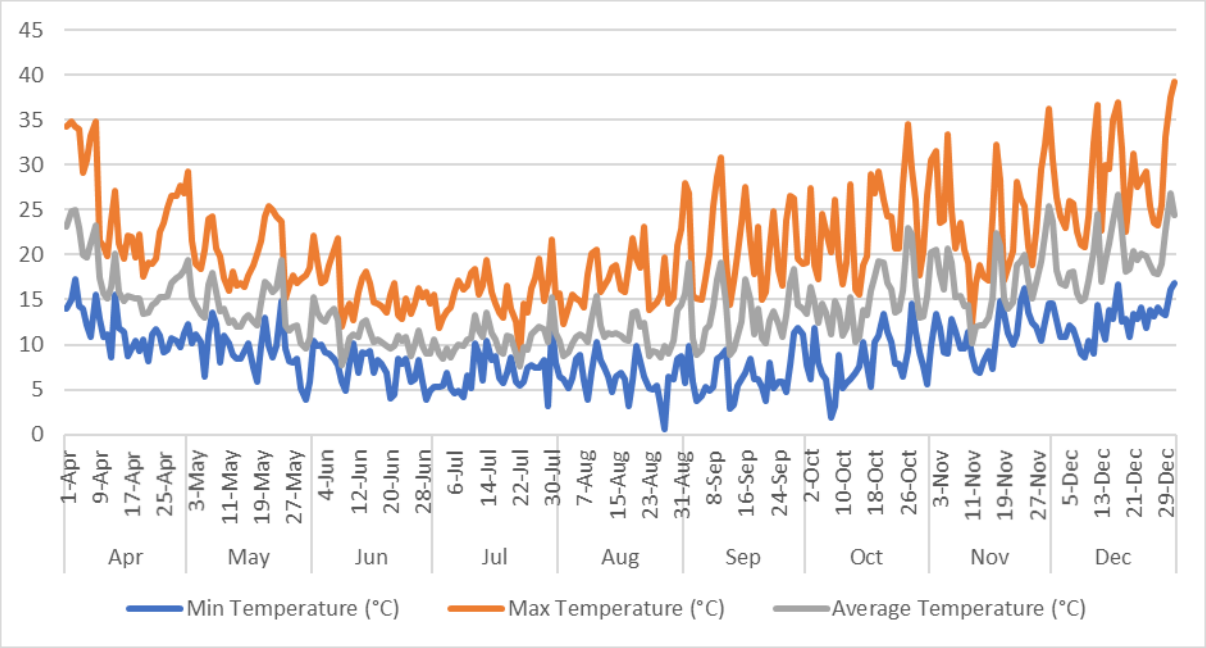

Figure 3. Minimum, maximum and average daily temperatures recorded at Tooligie, 2021.

Table 1. Soil characterisation (clay loam/sandy loam) at Tooligie trial site, 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	1	20	30	571	10.3	1.62	0.235	7.3	7.8
10-30	1	11	8	363	33.7	0.78	0.462	8.0	9.1
30-60	<1	8	9	454	57.6	0.54	0.827	8.4	9.8
60-90	<1	5	3	464	80.7	0.33	1.146	8.6	10.1

Depth (cm)	Cu	Fe	Mn (mg/kg)	Zn	B	Exc Ca	Exc Mg	Exc K (meq/100g)	Exc Na	Exc Al
0-10	0.63	13.00	3.08	0.76	4.24	21.75	3.83	1.57	0.76	0.050
10-30	0.49	14.60	1.57	0.31	13.11	15.53	6.67	0.97	2.92	0.060
30-60	0.59	15.30	1.58	0.38	24.18	9.41	9.81	1.17	6.27	0.040
60-90	0.62	12.70	0.93	0.22	27.11	6.60	7.57	1.26	10.65	0.040

GROUND COVER AND LEGAICES OF PULSES

Sarah Day, Amy Keeley, Brianna Guidera, Penny Roberts. ***SARDI***

Aim: This trial aims to assess the ground cover and legacies of pulses in rotation.

Methodology:

Three trial phases were established in 2021, to assess the legacies of pulses in rotation:

Phase 1: Pulses (as per treatments) in 2021, wheat in 2022 and wheat in 2023
Phase 2: Wheat in 2021, pulses (as per treatments) in 2022, and wheat in 2023
Phase 3: Canola in 2021, wheat in 2022, and pulses (as per treatments) in 2023

Varieties sown in the canola and wheat phases of the rotation are as per treatments listed below (Table 2). Each crop was managed as per best practice for that crop.

Ground cover was measured in February and April in 2022 to assess the remaining crop residue ground cover from the prior pulse rotation. Photos were captured from above each plot, then analysed using Canopeo to convert the photo to a percentage (%) of ground cover.

Biomass was measuring at the mid-flowering growth stage by cutting the 4 middle rows by 1m of each plot.

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

Ground cover was measured 6-8 weeks post-sowing of the pulse phase to assess early crop growth and ground cover. Photos were captured at a consistent height from the top of the canopy, then analysed using Canopeo to convert the photo to a percentage (%) of ground cover.

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

Treatments: See Table 2.

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

Trial design	RCBD
Replicates	4
Sowing date	27 May
Plant density (sole plots)	Faba bean: 24 plants/m2 Lentil: 120 plants/m2 Wheat: 150 plants/m2 Canola: 2 kg/ha
Row spacing	25 cm
Fertiliser	80 kg/ha MAP + Zn
Treatments (varieties):	1. Sole lentil (PBA Highland XT) 2. Sole faba bean (PBA Bendoc) 3. Sole canola (Pioneer 43Y92 CL) 4. Sole wheat (Sheriff CL) 5. Lentil + canola 6. Lentil + faba bean

Key messages

- Legacy effects of pulse crops will be evaluated in 2022 and 2023.

Results and Discussion:

Wheat, alongside faba bean, lentil + faba bean and lentil + canola, had the most ground cover in late winter at Tooligie, 2021 (Table 3). Aside from wheat, the latter treatments all had similar ground cover to canola. Lentil had the lowest winter ground cover, but not lower than canola. Ground cover is important during the growing season to out-compete weeds for resources. Additionally, obtaining adequate ground cover during the growing season is important in ensuring ground cover residue remains following harvest to reduce to the risk of soil erosion.

Canola, wheat and lentil + canola crops produced the highest quantity of biomass by mid flowering (Table 3). Lentil biomass production had the lowest biomass production, but not lower than faba bean and lentil + faba bean. Intercropping lentil and canola improved the total biomass compared to lentil alone. However, this was not the case for lentil + faba bean, where the intercropped and sole treatments produced equal biomass.

Wheat produced the highest grain yield at 1.4 t/ha at Tooligie, 2021 (Table 3). Faba bean and lentil + faba bean had equal grain yield (0.86-0.94 t/ha) below wheat, and both higher than lentil, canola and lentil + canola (0.62-0.71 t/ha).

Ground cover following the rotation phase varied between crops and differed from the in-season ground cover assessments (Table 3). Wheat had the lowest level of ground cover by February, but equal to faba bean (1.7-3.6 %). Lentil + canola and lentil + faba bean crops retained the highest levels of ground cover (6.3-7.7 %), but only higher than faba bean and wheat crops.

Plots will be sown to wheat in 2022 and 2023 to determine the legacy effects.

Table 3. Biomass yield (t/ha), grain yield (t/ha) and ground cover (%) of crops sown in rotation at Tooligie, 2021.

Treatment	Total Biomass Yield (t/ha)	Total Grain Yield (t/ha)	Ground Cover (%) August 2021	Ground Cover (%) February 2022
Lentil	0.58	0.71	6.3	5.12
Faba bean	1.09	0.86	13.6	3.61
Canola	2.88	0.65	8.9	4.22
Wheat	1.95	1.40	18.6	1.72
Lentil + canola	1.85	0.62	14.1	7.66
Lentil + faba bean	1.14	0.94	14.2	6.25
Average	*1.58*	*0.87*	*12.6*	*4.77*
LSD (P<0.05)	1.08	0.14	5.7	2.28