2023 Trial Reports

UOA2105-013RTX – Development and extension to close the economic yield gap and maximise farming system benefits from grain legume production in South Australia.

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

THE UNIVERSITY of ADELAIDE

Government of South Australia
Department of Primary Industries and Regions

SARDI SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

Acknowledgements

The research undertaken as part of the GRDC-funded 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

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 farming systems benefits from grain legume production in South Australia

Contributions and Trial Management

Melrose, Coomandook, Riverton/Tarlee, Hart/Condowie: Sarah Day, **SARDI Agronomy Clare** sarah.day@sa.gov.au

Kimba and Tooligie: Amy Keeley, **SARDI Agronomy Port Lincoln** amy.keeley@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: Aaron Vague, **FAR Australia** aaron.vague@faraustralia.com.au

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

Extension Hosts

Loxton, Pinnaroo and Lameroo: Paige Cross, **Mallee Sustainable Farming** paige@msfp.org.au

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

Millicent: Aaron Vague, **FAR Australia** aaron.vague@faraustralia.com.au

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

Melrose: Jade Rose **Upper North Farming Systems** jade@unfs.com.au

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

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

Cover image: Sunset over a lentil crop, north of Brinkworth, 2023. Photo credit: Sarah Day

CONTENTS

KIMBA – SPOKE SITE

SITE SUMMARY

In 2023, there was below average rainfall recorded in all months except April at Kimba on the Upper Eyre Peninsula (Figure 1). All trials were situated at the primary site on a loam/clay over clay soil (Table 1). The sub-site was situated on a loam over sand/loam (Table 2) to compare variability of growing lupin and lentil on dissimilar soil types. The Kimba site was sown on the 3rd of May 2023 with little moisture present. Approximately 23 mm of rainfall occurred 22 days later between the 25th and the 29th of May. Germination and establishment were not affected by low rainfall in autumn and winter. Minimum temperatures were recorded at Kimba during winter and only three below zero (<0°C) events were noted (Figure 3). No frost damage was visible at the site. A dry finish to the season allowed for a timely harvest on the 2nd of November.

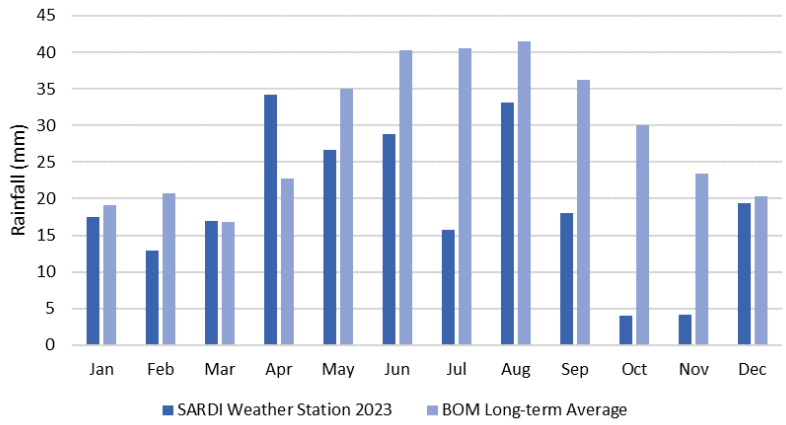

Figure 1. Rainfall at Kimba trial site in 2023 compared to the long-term average rainfall at Kimba BOM weather station (18040).

Figure 2. Satellite image of the Kimba trial site paddock showing the locations and soil type of the primary and sub site, 2023.

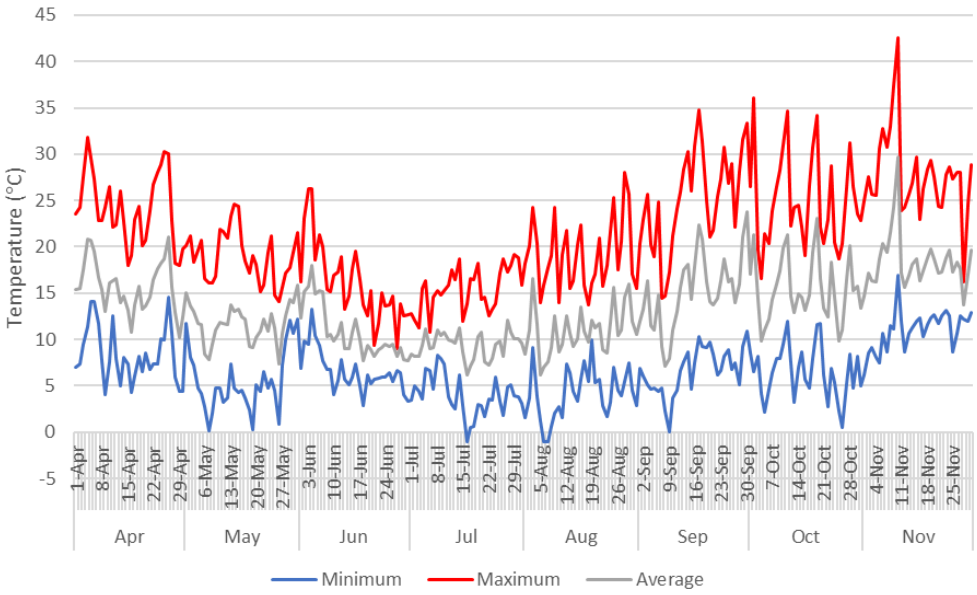

Figure 3. Minimum, maximum and average temperature (°C) recorded during the growing season at Kimba trial site in 2023.

Table 1. Soil characterisation (loam/clay) for Kimba primary trial site, 2023.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)
0-10	<1	19	33	277	3.6	0.65	0.109	7.1	7.7
10-30	<1	15	11	320	7.9	0.24	0.204	8.2	9.5
30-60	<1	2	5	486	4.6	0.16	0.364	8.3	10.0

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
(cm)			(mg/kg)					(meq/100g)		
0-10	0.41	18.60	3.55	1.33	1.00	5.61	1.37	0.73	0.21	0.024
10-30	0.67	12.10	1.50	0.21	5.03	7.56	4.68	0.90	1.72	0.053
30-60	1.03	11.70	1.05	0.15	17.36	8.64	8.86	1.43	4.21	0.078

Table 2. Soil characterisation (sand/loam) for Kimba trial sub-site, 2023.

Depth	NH_3-N	NO_3-N	P	K	S	OC	EC	pH	pH
(cm)			(mg/kg)			(%)	(dS/m)	($CaCl_2$)	(H_20)
0-10	< 1	8	31	118	1.4	0.40	0.066	8.0	9.1
10-30	< 1	5	11	28	1.4	0.10	0.049	8.2	9.5
30-60	< 1	3	7	237	3.4	0.07	0.225	8.7	10.1

Depth	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
(cm)			(mg/kg)					(meq/100g)		
0-10	0.33	3.00	0.92	0.81	0.64	5.79	0.74	0.26	0.04	0.089
10-30	0.19	4.00	0.27	0.24	0.27	2.35	0.27	0.08	0.03	0.064
30-60	0.34	6.70	0.28	0.19	5.43	6.16	4.04	0.64	1.63	0.098

LENTIL VARIETY TRIAL, KIMBA

Authors: *Sarah Day, Amy Keeley*

Key messages

- Developments in lentil variety agronomic characteristics and herbicide tolerance traits will assist expansion of lentil production into low rainfall zones.

How was it done?

A lentil variety field trial was sown near Kimba on 10 May 2023. The field trial tested nine varieties of lentil with varying agronomic traits (including new herbicide tolerance traits), sown in a randomised complete block design with three replicates per variety (Table 3). All varieties received the same agronomic management, as per local best standard practice. The field trial was harvested on 2 November 2023. Data was statistically analysed using ANOVA and Fisher's least significant difference test in Genstat 23rd Edition.

Table 3. Agronomic characteristics of lentil varieties at Kimba, 2023. Source: 2024 South Australian Crop Sowing Guide.

Variety	Market category	Vigour	Plant height	Flowering time	Maturity time	Lodging resistance	Pod drop	Shattering
Imidazolinone Tolerant								
GIA Leader	MRS	Moderate	Medium	Mid/late	Mid/late	MR	MR	MR
GIA Lightning	SRP	Moderate	Medium	Mid/late	Mid	MR	MR	RMR
GIA Thunder	SRP	Moderate	Medium	Mid	Mid	MRMS	MR	RMR
PBA Hallmark XT	MRS	Mod/good	Medium	Mid	Mid	MR	MR	R
PBA Highland XT	MRS	Mod/good	Medium	Early	Early/mid	MR	MR	MR
PBA Hurricane XT	SRP	Moderate	Medium	Mid	Mid	MR	MR	R
PBA Kelpie XT	LRS	Mod/good	Medium	Early/mid	Early/mid	MRMS	MR	R
Dual-Herbicide Tolerant								
GIA Metro	LRS	Mod/poor	Short/med	Late	Mid/late	MR	MR	RMR
GIA Sire	SRP	Poor	Short	Mid/late	Mid	MR	MR	RMR

Key: R = resistant, RMR = resistant to moderately resistant, MRMS = moderately resistant to moderately susceptible, MS = moderately susceptible, S = susceptible. Market category: MRS = medium red split, SRP = small red premium round (football), SR = small red round (football), LRS = large red split

What happened?

Grain yield differences between lentil varieties was observed at Kimba in 2023 (Figure 4). GIA Thunder, PBA Highland XT, PBA Hallmark XT, GIA Lightning and PBA Hurricane XT were the highest yielding varieties, yielding more than GIA Leader, PBA Kelpie XT, GIA Metro and GIA Sire (Figure 4Figure 4). The high yielding varieties are popular among growers in low to medium rainfall zones in South Australia due to their high yield potential and imidazolinone (IMI) tolerance. Lentil varieties with improved IMI tolerance provides growers with the opportunity to expand weed control options with a post-emergent IMI application.

GIA Metro and GIA Sire have dual herbicide tolerance, and although they are lower yielding than the other varieties tested in this study, these varieties have a unique fit in the farming system. GIA Metro is the first lentil variety with combined IMI tolerance and metribuzin tolerance. This unique combination of herbicide tolerances has the potential to expand lentil production and weed control options, particularly on lighter textured soils that are prone to Group 5 herbicide damage. Grain yield of this variety is lower than existing lentil varieties in the absence of weed pressure, or where weeds are controlled effectively without crop damage from metribuzin. Therefore, GIA Metro is more likely to

be best suited to lighter soil types where Group 5 herbicide damage is more likely an issue, paddocks with high density weed populations, or paddocks with populations of Group 2 resistant weeds.

GIA Sire is the first lentil variety with combined IMI tolerance and improved tolerance to clopyralid soil residues from a prior crop applied according to product label directions. GIA Sire is not well suited to low fertility sandy soils and low rainfall frost prone environments. GIA Sire is best suited to agronomic practices that maximise growth, harvest height and grain yield, as this variety is slow growing and has a short plant height. GIA Sire has a unique fit and is likely to produce higher yields over existing lentil varieties where significant levels of clopyralid soil residues are present.

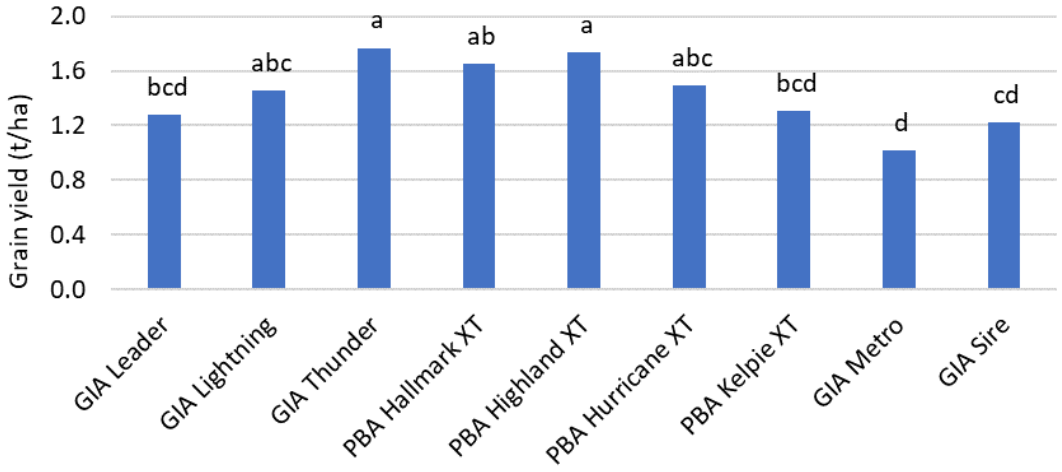

Figure 4. Lentil variety grain yield production at Kimba, 2023. Bars labelled with the same letters are not significantly different (P=0.009).

LENTIL PRE-EMERGENT HERBICIDE MANAGEMENT +/- ROLLING, KIMBA (EYRE PENINSULA)

Authors: *Sarah Day, Amy Keeley*

Aim: The trials aim to assess the impact of time of rolling on pre-emergent herbicide safety.

Treatments:

Variety: PBA Highland XT.

Herbicides: Please see Table 4 for a list of herbicide treatments, active ingredients and rates.

Rolling treatments: Nil, pre-emergent (roll immediately post-sowing), post-emergent (6 weeks post sowing, 4 node).

Table 4. Treatments and respective active ingredients and rates applied to lentil at Kimba, 2023.

Treatment No.	Treatment	Active Ingredient (concentration)	Rate (mL or g/ha)
1	Intercept POST* only	Imazamox (33 g/L) + Imazapyr (15 g/L)	750
2	Diuron PSPE fb Intercept POST	Diuron (900 g/kg) Imazamox (33 g/L) + Imazapyr (15 g/L)	550 750
3	Metribuzin PSPE fb Intercept POST	Metribuzin (750 g/kg) Imazamox (33 g/L) + Imazapyr (15 g/L)	180 750
4	Reflex® IBS fb Intercept POST	Fomesafen (240 g/L) Imazamox (33 g/L) + Imazapyr (15 g/L)	500 750

*Applied at 4-6 node growth stage, fb = followed by

Table 5. Trial site details, Kimba 2023.

	Kimba
Trial design	Split plot
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significant difference test in Genstat 23rd Edition
Sowing date	10 May 2023
Plant density	120 plants/m^2
Row spacing	25 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	2 November 2023

Key messages

- The timing of rolling lentils (nil, pre- or post-emergent) did not influence herbicide damage or grain production at either site.

Results and Discussion:

Lentil grain yield can be influenced by herbicide use, depending on soil type, seasonal conditions and how the herbicides interact. Rolling timing did not influence grain yield at Kimba in 2023 (Table 6). This is consistent with findings from previous studies, suggesting that timing of rolling does not generally increase herbicide damage or reduce grain yield for the soil types in this location and the rainfall received in 2023.

Table 6. Grain yield of lentil in response to herbicide and rolling treatments, at Kimba 2023. NS = not significant (P>0.05).

HERBICIDE	Grain yield (t/ha)			
	Nil rolling	Pre-emergent rolling	Post-emergent rolling	*Avg.*
Intercept POST only	1.35	1.29	1.41	1.35
Diuron PSPE fb Intercept POST	1.36	1.38	1.34	1.36
Metribuzin PSPE fb Intercept POST	1.52	1.38	1.12	1.34
Reflex® IBS fb Intercept POST	1.24	1.48	1.24	1.32
Experimental Herbicide Rate 1 PSPE fb Intercept POST	1.49	1.70	1.28	1.49
Experimental Herbicide Rate 2 PSPE fb Intercept POST	1.70	1.45	1.28	1.48
Avg.	1.44	1.28	1.45	1.39
LSD (P<0.05)				
Rolling x Herbicide		NS		
Rolling		NS		
Herbicide		NS		

TOOLIGIE

SITE SUMMARY

The hub trial site was located on an alkaline clay soil type at Tooligie on the Eyre Peninsula in 2023 (**Error! Reference source not found.**). Below average rainfall was recorded in all months except March and April (Figure 5). The site was sown on the 24th of May, 2023. All trials germinated well, and the site did not encounter any frost events during the growing season (Figure 6). Lower rainfall throughout the season resulted in low weed populations establishing. The site was harvested on the 23rd – 24th of November.

Table 7. Soil characterisation (clay) for Tooligie trial site in 2023. Soil samples analysed by CSBP.

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	6	17	52	417	5.8	1.49	0.183	7.7	8.7	
10-30	< 1	4	7	164	5.4	0.85	0.148	7.9	9.0	
30-60	< 1	4	9	154	6.2	0.41	0.270	8.2	9.7	
Depth	**Cu**	**Fe**	**Mn**	**Zn**	**B**	**Exc Ca**	**Exc Mg**	**Exc K**	**Exc Na**	**Exc Al**
(cm)			(mg/kg)					(meq/100g)		
0-10	0.52	7.40	2.27	1.89	4.67	24.57	4.09	1.23	0.35	0.022
10-30	0.86	8.10	1.00	0.72	5.08	20.97	6.20	0.59	0.60	0.055
30-60	0.52	6.20	0.77	0.26	9.98	12.68	9.64	0.52	2.36	0.050

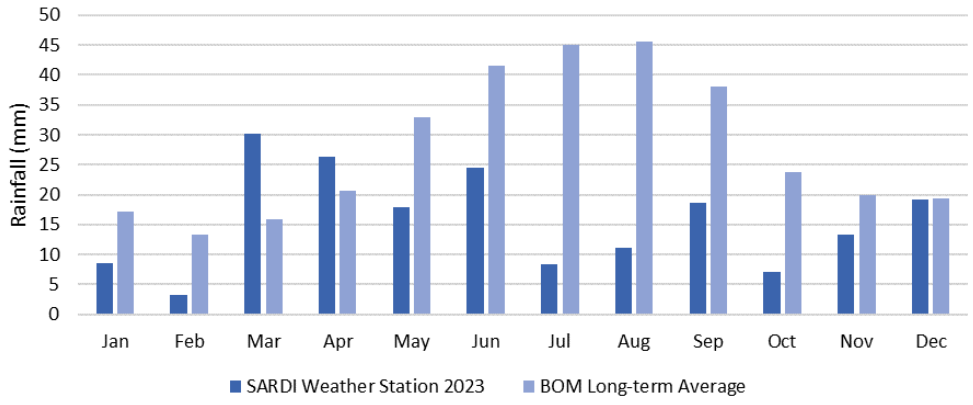

Figure 5. Rainfall at Tooligie trial site in 2023 compared to the long-term average rainfall at Murdinga BOM station 18164.

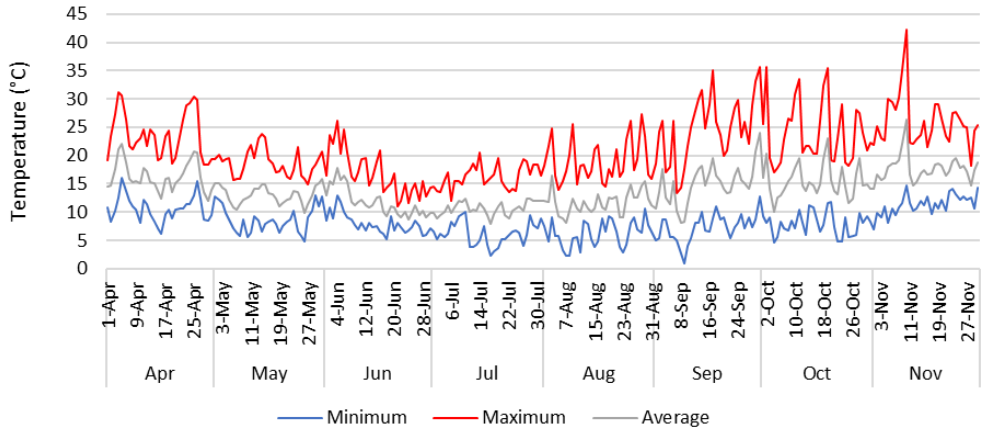

Figure 6. Minimum, maximum and average temperature (°C) recorded from an automatic weather station during the growing season at Tooligie trial site in 2023.

GROUND COVER AND LEGACY OF PULSES

Authors: Sarah Day, Amy Keeley

Aim: To assess the ground cover and legacies of pulses in rotation with wheat and canola.

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

Phase 1: Pulses in 2021, wheat in 2022 and wheat in 2023.
Phase 2: Wheat in 2021, pulses in 2022 and wheat in 2023.
Phase 3: Canola in 2021, wheat in 2022 and pulses in 2023.

Results and Discussion:

Wheat produced the highest levels of total crop biomass and grain yield at Tooligie, 2023 followed by faba bean, lentil + faba bean, lentil and lentil + canola and then canola (Table 8). Canola yield was low due to damage from galahs during flowering and seed development. The combination of lentil + faba bean (0.79 t/ha) produced more yield than lentil + canola (0.26 t/ha).

Legacy effects and full data analysis to be completed and results published in 2025.

Table 8. Biomass yield (t/ha) and grain yield (t/ha) of crops sown in rotation at Tooligie, 2023. Different letters within the same column indicate a significant difference (P<0.001).

Treatment	Total Biomass Yield (t/ha)	Total Grain Yield (t/ha)
Lentil	1.05 cd	0.62 c
Faba bean	1.66 b	0.86 b
Canola^	0.74 d	0.05 e
Wheat	2.41 a	1.95 a
Lentil + canola	0.85 cd	0.26 d
Lentil + faba bean	1.27 bc	0.79 b
Average	*1.33*	*0.76*
LSD (P<0.05)	0.49	0.11

^Canola had damage and seed loss from galahs.