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

KULPARA

SITE SUMMARY

Above average rainfall in March and April resulting in adequate levels of soil moisture at seeding in 2023. Apart from June, growing season rainfall was well below average for most of winter and spring (Figure 1). Growing season (April – October) rainfall for 2023 was below average at 216 mm compared to the long-term average of 289 mm. The 2023 annual rainfall was also below average at 354 mm compared to 385 mm long-term average.

During July and early September there were several occasions where the temperature dropped below 0°C (Figure 2). The lentil trial would have been in vegetative growth stages in July and August but would have been flowering during the September frost event. Despite this there were no physical signs of frost damage. Spring temperatures were generally mild across the northern Yorke area (Figure 2). The trial was harvested on November 13 following >40°C in early November.

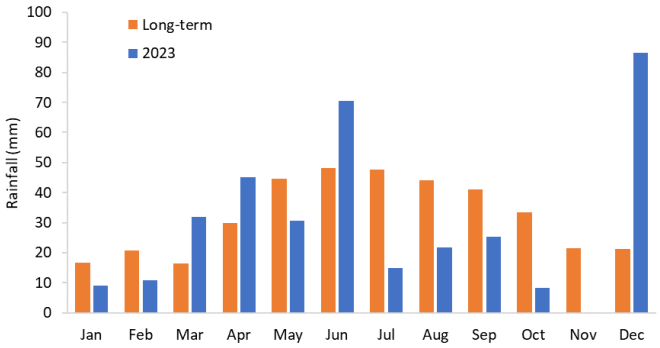

Figure 1. Monthly rainfall recorded at Paskeville BOM weather station (#022012) in 2023 compared to the long-term average.

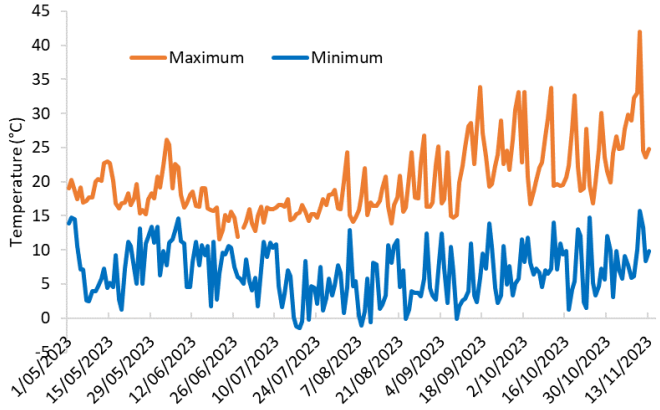

Figure 2. Daily minimum and maximum temperature (°C) recorded during the trial growing season at Kadina BOM station (#022050), 2023.

Table 1. Soil characterisation for Kulpara (0-10 cm) trial site, 2023.

Depth	Texture	pH	pH	Organic Carbon	Colwell P	PBI	DGTP	Sulfur	
cm		$CaCl_2$	H_2O	%	mg/kg		ug/L	mg/kg	
0-10	Loam	7.5	7.8	1.89	68	113	109	11	

Depth	Conductivity		Exchangeable Cations (CEC)						
cm	EC1:5 dS/m	ECe	Exc Al	Exc Ca	Exc Mg	Exc K	Exc Na	ECEC	ESP
0-10	0.23	2.2	<0.02	28.7	3.00	2.28	0.29	34.3	0.8

LENTIL POD DROP MANAGEMENT

Authors: Sam Trengove, Stuart Sherriff, Jordan Bruce and Declan Anderson - Trengove Consulting

Aim: To investigate strategies to alter canopy structure and the use of a pod seal product to improve pod retention in lentil.

Methodology:

Measurements throughout the season included plant establishment counts, GreenSeeker NDVI and grain yield. Pod drop counts were conducted immediately prior to harvest. The method for the counts included three counts at different locations in plots for 0.5m of row for two adjacent rows.

The trial was desiccated by the grower on October 13 when the surrounding paddock was sprayed. The trial was then left for a month to increase exposure to pod drop events from the weather and was harvested on November 13.

Treatments:

Table 2. Treatment descriptions and the respective management category for the pod drop management trial at Kulpara, SA 2023. PBA Highland XT was the variety used in all treatments unless specified.

Treatment	Description	Pod drop management method
1	Control (120 plants/m^2)	Nil
2	Double seeding rate (240 plants/m^2)	Plant/canopy structure
3	Zero row spacing – 50% sown, 50% pre-spread	
4	High P rate: 30 kg P/ha – 15 kg/ha deep banded & 15 kg/ha with seed (applied as MAP)	
5	GIA Thunder	
6	GIA Thunder/PBA Highland XT – 50/50 seed mix	
7	GIA Lightning	
8	EnviroShield# 1.0L/ha at desiccation	Pod seal product
9	EnviroShield# 2.0L/ha at desiccation	
10	EnviroShield# 3.0L/ha at desiccation	
11	PBA Highland XT + Canola	Intercropping/canopy structure
12	EnviroShield 1.0L/ha 7 days prior to desiccation	Pod seal product

EnviroShield# is a product that is not regulated and does not require evaluation by the APVMA. The current label rate is 1.0 L/ha and it is advised that you contact the supplier prior to using any rates above the current label rate.

Table 3. Trial details for the lentil pod drop management trial at Kulpara, SA 2023.

Trial design	RCBD
Data analysis	Data was analysed using ANOVA in R statistical package.
Plot size	10 m x 1.5 m
Replicates	3
Sowing date	11/05/2023
Plant density	120 plants/m^2 PBA Highland lentil XT (control, refer to treatment list above for variations)
Row spacing	250 mm
Fertiliser	68 kg/ha MAP + 1% Zn (except treatment 4 – higher rate)
Harvest date	13/11/2023

Key messages

- GIA Lightning had the highest amount of pod loss (pod drop count) at 328 kg/ha. The pod loss for varieties GIA Thunder and PBA Highland XT averaged 162 kg/ha.
- The only grain yield difference to the control (PBA Highland XT), was GIA Lightning yielding 560 kg/ha less.
- Applying EnviroShield 7 days prior to or at desiccation did not reduce pod drop when compared to the control.

Results and Discussion:

Plant establishment:
Target plant densities for the control, zero row spacing and high P rate was 120 plants/m^2. There were no plant establishment differences among these treatments averaging of 90 plants/m^2 (Table 4). The double seeding rate achieved a higher plant establishment of 191 plants/m^2.

The canola in treatment 11 failed to establish at the site. Therefore, the treatment is similar to the control treatment as it was PBA Highland XT sown at a target of 120 plants/m^2.

Table 4. Plant establishment counts for selected treatments in the pod drop management trial at Kulpara, SA 2023. Data labelled with the same letters within a column are not significantly different.

Description	Plants/m^2	
Control	78	b
Double seeding rate	191	a
Zero row spacing	92	b
High P rate	101	b
Pr(>F)	0.043	

GreenSeeker NDVI, pod drop and grain yield:
Despite selecting a flat and uniform site there were variations across the trial that affected crop growth (Table 5Table 1). Treatments 1, 8, 9, 10 and 12 had been managed the same at this point in time of the GreenSeeker NDVI recording. However, there were unexpected differences among these treatments (Table 5).

The trial was left exposed to weather events for one month following desiccation, however the amount of pod drop that occurred would be considered low-moderate in comparison to recent years. Pod drop counts were conducted immediately prior to harvest. The only difference in pod drop count compared to the control was GIA Lightning (Table 5). The pod drop for variety GIA Lightning was 328 kg/ha compared to the Highland XT control of 166 kg/ha. This was approximately double the amount of pod drop between these two lentil varieties.

Grain yield across the trial ranged from 1.08 t/ha to 1.80 t/ha (Table 5). Some of the differences in grain yield between treatments can be attributed to the site variation. Figure 3 shows the relationship between NDVI and grain yield. Treatment 10 and 12 (Enviroshield applications) both recorded a lower NDVI compared to the control despite also being untreated at the time of measurement. It is unlikely that the application of Enviroshield would have caused a grain yield loss. The variety GIA Lightning was the only treatment to yield less than the control at 1.08 t/ha (560 kg/ha less). This difference is likely to be driven by varietal characteristics (e.g. higher pod drop) rather than site variation alone.

Table 5. GreenSeeker NDVI, pod drop data and grain yield at the pod drop management trial at Kulpara in 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Treatment	Description	NDVI 29 August		Pod drop count* (kg/ha)		Grain yield (t/ha)	
1	Control	0.707	bcd	166	bcd	1.64	ab
2	Double seeding rate	0.740	ab	238	abc	1.80	a
3	Zero row spacing	0.716	abcd	221	abcd	1.55	bc

4	High P rate	0.732	abc	149	cd	1.68	ab
5	GIA Thunder	0.755	a	158	bcd	1.75	a
6	GIA Thunder/PBA Highland XT mix	0.652	ef	187	bcd	1.51	bc
7	GIA Lightning	0.725	abcd	328	a	1.08	d
8	Enviroshield# 1.0 L/ha at desiccation	0.711	bcd	113	d	1.70	ab
9	Enviroshield# 2.0 L/ha at desiccation	0.692	cde	236	abc	1.61	ab
10	Enviroshield# 3.0 L/ha at desiccation	0.638	f	185	bcd	1.39	c
11	PBA Highland XT + Canola**	0.689	de	229	abcd	1.55	bc
12	Enviroshield 1.0 L/ha before desiccation	0.661	ef	277	ab	1.39	c
	Pr(>F)	<0.001		0.045		<0.001	
	LSD (0.05)	0.042		120.6		0.20	

*Pod drop count was converted to kg/ha by assuming an average of 1.5 seeds per pod and an average seed weight of 35.9 mg/seed.
**Canola failed to establish and therefore this treatment is equivalent to the control.
EnviroShield# is a product that is not regulated and does not require evaluation by the APVMA. The current label rate is 1.0 L/ha and it is advised that you contact the supplier prior to using any rates above the current label rate.

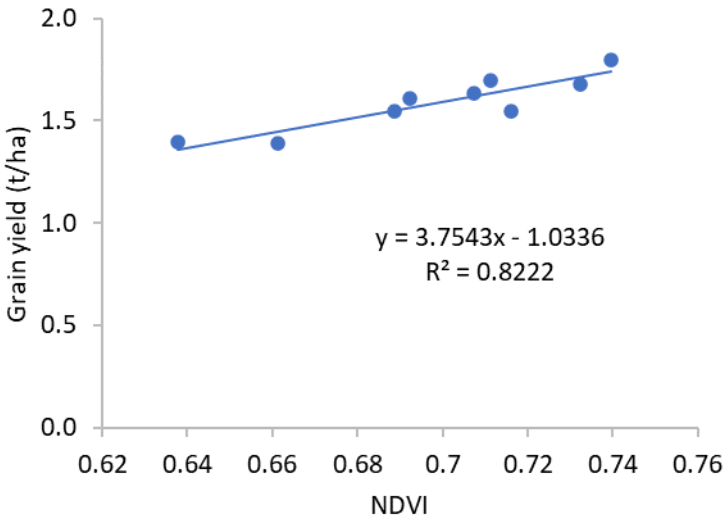

Figure 3. Positive linear relationship between NDVI (measured 29 August) and grain yield (t/ha) for treatments sown to PBA Highland XT.

THOMAS PLAINS

SITE SUMMARY

Above average rainfall in March and April resulted in adequate levels of soil moisture at seeding (Figure 4). Apart from June growing season rainfall was below to well below average for most of winter and spring. Growing season (April – October) rainfall for 2023 was below average at 216 mm compared to the long-term average of 289 mm. The 2023 annual rainfall was also below average at 354 mm compared to 385 mm long-term average.

During July and early September there were several occasions where the minimum temperature dropped below 0°C (Figure 5Figure 4). The lentil trial would have been in vegetative growth or early flowering stages at these times, keeping frost damage to a minimum. Spring temperatures were generally mild across the northern Yorke area (Figure 5) and the trial was harvested on November 7.

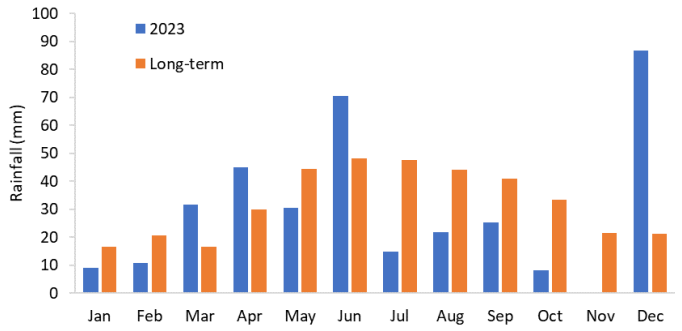

Figure 4. Monthly rainfall recorded at Paskeville BOM weather station (#022012) in 2023 compared to the long-term average.

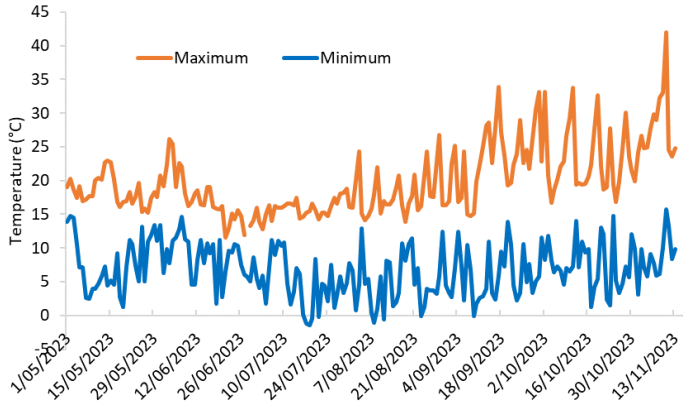

Figure 5. Daily minimum and maximum temperature (°C) recorded during the trial growing season at Kadina BOM station (#022050), 2023.

Table 6. Soil characterisation for Thomas Plains (0-10 cm) trial site, 2023.

Depth	Texture	pH	pH	Organic Carbon	Colwell P	PBI	DGTP	Sulfur	
cm		$CaCl_2$	H_2O	%	mg/kg		ug/L	mg/kg	
0-10	Clay loam	7.5	7.8	2.17	48	114	28	7.7	

Depth	Conductivity		Exchangeable Cations (CEC)						
cm	EC1:5 dS/m	ECe	Exc Al	Exc Ca	Exc Mg	Exc K	Exc Na	ECEC	ESP
0-10	0.23	2.0	<0.02	32.9	3.93	2.93	0.66	40.4	1.6

LENTIL POD DROP AND STUBBLE HEIGHT

Authors: Sam Trengove, Stuart Sherriff, Jordan Bruce and Declan Anderson - Trengove Consulting

Aim: This trial aims to investigate the effect of previous stubble height on lentil growth habits and how this can alter canopy structure and ultimately influence pod drop.

Methodology:
The plots and different stubble height treatments were established on June 2 after the grower had sown the paddock to lentils on May 27. A brush cutter was used to cut the stubble to the desired height for the treatments, whilst the standing stubble was not altered. The stubble removed plots (Treatment 1) had the stubble removed by a rake after being cut close to ground level by the brush cutter. The trial was a randomised complete block design consisting of four treatments with four replicates. Plots ran perpendicular to the crop rows.

Measurements included in-season plant height, GreenSeeker NDVI, maturity score (October 20), canopy score (October 20), harvest plant height (i.e. vine length), harvest canopy height, harvest lowest pod height, grain yield and pod drop counts.

Treatments:

Table 7. Stubble treatments implemented in the lentil pod drop by stubble height trial at Thomas Plains, SA 2023.

	Treatment name	Approximate stubble height
1.	Stubble removed	4 cm height
2.	Slashed and retained	4 cm height
3.	Half height stubble	20-25 cm height (i.e., draper front height)
4.	Standing stubble	50 cm height (i.e., stripper front height)

Table 8. Trial details for the lentil pod drop by stubble height trial at Thomas Plains, SA 2023.

Trial design	RCBD
Plot size	8 m x 3 m
Replicates	4
Sowing date	27/05/2023
Plant density	53 kg/ha GIA Leader
Row spacing	12-inch row (farmer - disc seeder)
Fertiliser	60 kg/ha MAP
Harvest date	7/11/2023

Key messages

- Stubble height impacted lentil pod drop. The higher the stubble, the less pod drop that occurred.
- Full height stubble (50 cm of stripper stubble) reduced pod drop from 258 kg/ha to 56 kg/ha (78% reduction) when compared to the stubble removed treatment.
- The effect of stubble changed the plant structure and growth habits in terms of plant height, maturity, canopy structure and lowest pod height.

Results and Discussion:

Similar lentil growth responses were measured (Table 9) compared to a similar trial in 2022. Lentil plant height in-season was in order of stubble height and retention. With increasing stubble height, the lentils appear to elongate more, potentially in response to light availability and interception. In addition, the lentils were able to use the stubble as a trellis to grow upwards. This is in contrast to the stubble removed and slashed treatments, where the lentil growth habit was restricted into a bushy structure with much less height.

GreenSeeker NDVI in mid-August did not show any differences between treatments despite their plant height differences. Therefore, the plant health and vegetation density of the lentils were equal despite the difference in plant structure.

Scores recorded on October 20 showed differences between treatments for maturity and canopy structure. The percent (%) maturity score refers to the percentage of the plot that had naturally browned off and matured. The stubble removed treatment had the greatest maturity at this timing with 80%. Full height stubble was the least mature at only 16.3%, with the remainder of the plot still green or yellowing (senescing).

The percent (%) open canopy score refers to the percent of the plot where the plants had not achieved canopy closure with rows of plants not touching adjacent rows. It is suggested that more open canopies (such as the stubble removed treatment with 95% open canopy) will be more susceptible to pod drop due to greater movement of plants in wind events. In contrast, the full height treatment reached canopy closure for most of the plots and should be less susceptible to pod drop from wind. Any remaining standing stubble may also offer some protection of plants from wind.

Table 9. Data for in-season measurements recorded at the pod drop and stubble height trial at Thomas Plains in 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Description	Plant height (cm)		Plant height (cm)		NDVI		% mature		% open canopy	
	July 14		August 16				October 20			
Stubble Removed	7.9	d	18.5	c	0.416	b	80	a	95	a
Slashed and retained	9.8	c	20.6	bc	0.432	ab	58	b	55	b
Half Height	11.2	b	22.9	b	0.463	a	54	b	30	c
Full height	14.9	a	27.6	a	0.442	ab	16	c	23	c
Pr(>F)	<0.001		<0.001		0.058		<0.001		<0.001	
LSD (0.05)	1.3		2.4		ns		16		17	

Similar to the in-season results, all plant measurements recorded at harvest were affected by the different stubble treatments (Table 10). Pod drop scores recorded immediately prior to harvest showed pod drop was highest in the stubble removed treatment at 258 kg/ha. This may be related to the shorter plant height, open canopy structure and lack of protection from residual stubble. The full stubble height dropped the lowest number of pods totalling 56 kg/ha which is a reduction of 78% compared to stubble removed. This is most likely due to the knitted canopy between plants and stubble resulting in less plant movement and less pod drop.

Despite the changes in the lentil canopy and pod drop from stubble treatments, there were no differences in grain yield (Table 10). Lentil grain yields averaged 1.67 t/ha.

Table 10. Data for measurements at immediately prior to harvest and grain yield data at the pod drop and stubble height trial at Thomas Plains in 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Treat.	Description	Lowest pod height (cm)		Canopy height (cm)		Vine length (cm)		Pod drop (kg/ha)*		Grain yield (t/ha)
1	Stubble Removed	15.9	b	27.1	c	36.3	c	258	a	1.59
2	Slashed and retained	15.3	b	28.6	bc	39.4	b	127	b	1.69
3	Half Height	17.3	b	30.4	b	41.3	b	98	bc	1.73
4	Full height	22.1	a	41.1	a	49.3	a	56	c	1.68
	Pr(>F)	<0.001		<0.001		<0.001		<0.001		0.104
	LSD (0.05)	2.8		3.1		3.0		48		ns

*Pod drop weight assumes 1.5 seeds per pod and grain weight of 42.5mg/seed.

BUTE

SITE SUMMARY

Above average rainfall in March and April resulted in adequate levels of soil moisture at seeding (Figure 6). Early in the growing season Bute received close to average rainfall for May and June. However, July and spring months were dry, with well below average rainfall recorded in September and October. In 2023, Bute received below average growing season rainfall at 225 mm compared to the long-term average rainfall 290 mm (Figure 6). This is a decile 3 for Bute growing season rainfall. The site annual rainfall was 362 mm compared to 391 mm long-term average.

During July, August and early September there were several occasions where the temperature dropped below 0°C (Figure 7). The lentil trial would have been in vegetative growth stages in July and August but would have been flowering during the September frost event. Despite this there were no physical signs of frost damage. Spring temperatures were generally mild across the northern Yorke area (Figure 7) and the trial was harvested in late October.

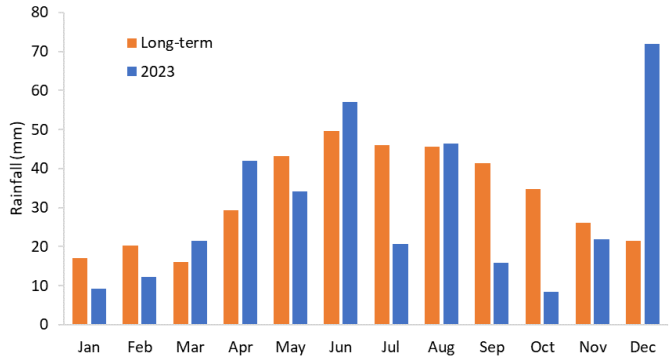

Figure 6. Monthly rainfall recorded at Bute BOM weather station (#21012) in 2023 compared to the long-term average.

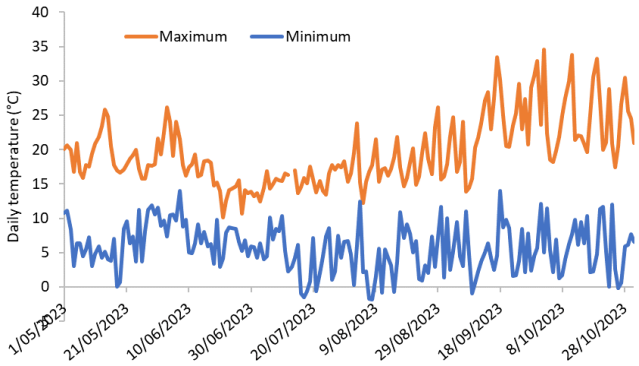

Figure 7. Daily minimum and maximum temperature (°C) recorded during the trial growing season at Snowtown BOM station (#021133), 2023.

Table 11. Soil characterisation for Bute (0-10 cm) trial site, 2023.

Depth	Texture	pH	pH	Organic Carbon	Colwell P	PBI	DGTP	Sulphur	Avail. Nitrogen
cm		$CaCl_2$	H2O	%	mg/kg		ug/L	mg/kg	kg/ha
0-10	Sand*	7.5	7.9	1.0	57	25	230	39	54.6

Depth	Conductivity		Exchangeable Cations (CEC)						
cm	EC1:5 dS/m	ECe	Exc Al	Exc Ca	Exc Mg	Exc K	Exc Na	ECEC	ESP
0-10	0.22	3.1	<0.02	15.9	1.25	0.63	0.09	17.9	0.5

*MIR – Aus Soil Texture not measured at Bute site. Estimated to be a sand.

LENTIL IBS HERBICIDES BY TIME OF ROLLING TRIAL ON SANDY SOILS

Authors: Sam Trengove, Stuart Sherriff, Jordan Bruce and Declan Anderson - Trengove Consulting

Aim: Improve crop safety of rolling and pre-emergent herbicide applications in lentil.

Methodology:
The trial was a randomized complete block design consisting of 15 treatments with three replicates located on an alkaline sandy soil. The treatments were a combination of rolling (nil rolling, PSPE rolling and post-emergent rolling) combined with five herbicide treatments. All pre-emergent herbicide treatments were applied immediately prior to sowing. A hollow steel trial plot roller was used for all rolling.

Measurements for this trial included plant establishment counts on June 9, herbicide damage scores on July 3 and August 2, GreenSeeker NDVI on July 28 and September 1. All plots were harvested for grain yield.

Treatments:

Table 12. Herbicide and rolling treatments applied to GIA Lightning lentil at Bute, SA 2023. PSPE = post-sowing pre-emergent

Treatment	Herbicide(s) product	Active constituent	Rolling timing
1	Nil	-	Nil
2	Diuron 623 g/ha	900 g/kg Diuron	Nil
3	Reflex® 500 mL/ha	240 g/L Fomesafen	Nil
4	Reflex® 1000mL/ha	240 g/L Fomesafen	Nil
5	Diuron 623 g/ha + Reflex® 1000 mL/ha	900 g/kg Diuron 240 g/L Fomesafen	Nil
6	Nil	-	PSPE
7	Diuron 623 g/ha	900 g/kg Diuron	PSPE
8	Reflex® 500 mL/ha	240 g/L Fomesafen	PSPE
9	Reflex® 1000 mL/ha	240 g/L Fomesafen	PSPE
10	Diuron 623 g/ha + Reflex® 1000 mL/ha	900 g/kg Diuron 240 g/L Fomesafen	PSPE
11	Nil	-	Post-em
12	Diuron 623 g/ha	900 g/kg Diuron	Post-em
13	Reflex® 500 mL/ha	240 g/L Fomesafen	Post-em
14	Reflex® 1000 mL/ha	240 g/L Fomesafen	Post-em
15	Diuron 623 g/ha + Reflex® 1000 mL/ha	900 g/kg Diuron 240 g/L Fomesafen	Post-em

Table 13. Trial details for the herbicides by time of rolling trial at Bute, SA 2023.

Trial design	RCBD
Plot size	10 m x 1.5 m (2.0 m centres)
Replicates	3
Sowing date	10/05/2023
Plant density	50 kg/ha GIA Lightning
Row spacing	250 mm
Fertiliser	100 kg/ha MAP
Harvest date	24/10/2023

Key messages

- Herbicide damage symptoms were generally low for the soil type and treatments tested compared to previous seasons.
- The only treatment to still have herbicide damage symptoms present in early August was diuron 623 g/ha + Reflex 1000 mL/ha. However, the symptoms observed (chlorosis and stunting) were present at low levels.
- No grain yield differences occurred from any herbicide treatment.
- Rolling (PSPE or post-em) had no impact on herbicide damage symptoms or grain yield this season.

Results and Discussion:

There was no measured interaction between herbicides and rolling for any of the plant assessment measured in the trial (P>0.05). Where differences among treatments were observed, they were generally for herbicide application alone. Therefore, data in Table 14-Table 16 show herbicide response only averaged across rolling treatments.

Plant establishment:

There were no differences in lentil plant establishment for any treatment (P>0.05, data not shown). The average plant density across the lentil trial was 124 plants/m2.

Herbicide damage scores and NDVI:

In general, herbicide damage symptoms were low (Table 14) compared to previous seasons when using diuron and Reflex at these rates on similar soil types.

The necrosis symptoms in the trial were generally very low (Table 14). Only diuron + Reflex® recorded more necrosis symptoms (score 2.7) than the control on July 3. However, this score indicated low levels of symptoms and by early August they were no longer present.

Symptoms associated with chlorosis can come from Reflex® in the form of yellowing or leaf speckling. Reflex applied at 500 mL/ha did not cause any chlorosis. When Reflex® was used at 1000 mL/ha symptoms were present at low levels in early July but were no longer present by August 2. However, when Reflex® 1000 mL/ha was mixed with diuron 623g/ha the chlorosis symptoms increased to a score of 3.9 in early July and were still present at low levels (1.7) in early August.

Herbicide damage may present in the form of crop stunting, including from Reflex® and diuron in lentils where crop effects occur. The only treatment to cause stunting symptoms in the trial was the mix of diuron with Reflex®. This caused low levels of stunting in early July with a score of 3.6 and these symptoms were still present in August with a score of 3.0.

The GreenSeeker NDVI recorded on July 28th shows (Table 15) that the mix of diuron with Reflex® reduced NDVI by 19% compared to the nil herbicide treatments. This aligns with the herbicide damage scoring.

Grain yield:

Lentil grain yield ranged from 2.04 t/ha to 2.23 t/ha across the trial. Due to the low levels of herbicide damage present in early spring, it was not surprising that there were no differences in lentil grain yield, compared to the Nil (Table 16). Despite the diuron + Reflex® treatment having the highest herbicide damage, it yielded the same as the nil (treatment 1).

Table 14. Herbicide damage scores including necrosis, stunting and chlorosis (1=nil symptoms, 5=moderate, 9=severe/plant death) scored on the 3rd of July and 2nd of August for the herbicide by time of rolling trial at Bute, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05). ns = not significant (P>0.05).

Treat.	Diuron	Reflex	Necrosis		Chlorosis		Stunting		Necrosis	Chlorosis		Stunting	
			July 3						August 2				
1	Nil	Nil	1.3	a	1.6	a	1.4	a	1.0	1.0	a	1.1	a
2	623	Nil	1.6	a	1.6	a	1.5	a	1.0	1.1	a	1.2	a
3	Nil	500	1.2	a	1.8	a	1.2	a	1.0	1.0	a	1.0	a
4	Nil	1000	1.8	ab	2.8	b	1.4	a	1.0	1.2	a	1.7	a

5	623	1000	2.7	b	3.9	c	3.6	b	1.0	1.7	b	3.0	b
	Pr (>F)		*<0.001*		*<0.001*		*<0.001*		*ns*	*<0.001*		*<0.001*	

Table 15. GreenSeeker NDVI recorded on the 28th July for the herbicides by time of rolling trial at Bute, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Treatment	Diuron	Reflex	NDVI July 28	
1	Nil	Nil	0.64	bc
2	623	Nil	0.63	bc
3	Nil	500	0.66	c
4	Nil	1000	0.59	b
5	623	1000	0.52	a
Pr (>F)			*<0.001*	

Table 16. Grain yield results for the herbicide by time of rolling trial at Bute, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Treat.	Diuron	Reflex	Grain yield (t/ha)	
1	Nil	Nil	2.09	ab
2	623	Nil	2.12	ab
3	Nil	500	2.23	b
4	Nil	1000	2.18	ab
5	623	1000	2.04	a
Pr (>F)			*0.003*	

MAITLAND

SITE SUMMARY

Average rainfall in March and April resulted in adequate levels of soil moisture at seeding. Both May and June were slightly below and above average for monthly rainfall, respectively (Figure 8). This was followed by well below average rainfall for the remainder of the season, in particularly for July, August and October. Growing season (April – October) rainfall for 2023 was below average at 280 mm compared to the long-term average of 390 mm. The 2023 annual rainfall was also below average at 456 mm compared to 503 mm long-term average.

During July, August and early September there were several occasions where the temperature dropped below 0°C (Figure 9). The lentil trial would have been in vegetative growth or early flowering stages at these times, keeping frost damage to a minimum. Spring temperatures were generally mild across the northern Yorke area (Figure 9) and both trials were harvested on November 8.

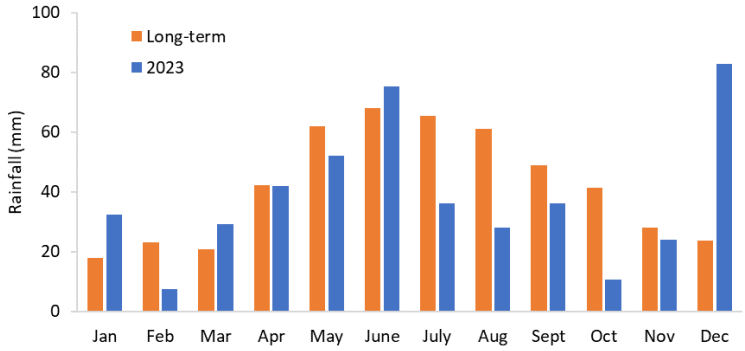

Figure 8. Monthly rainfall recorded at Maitland BOM weather station (#22008) in 2023 compared to the long-term average.

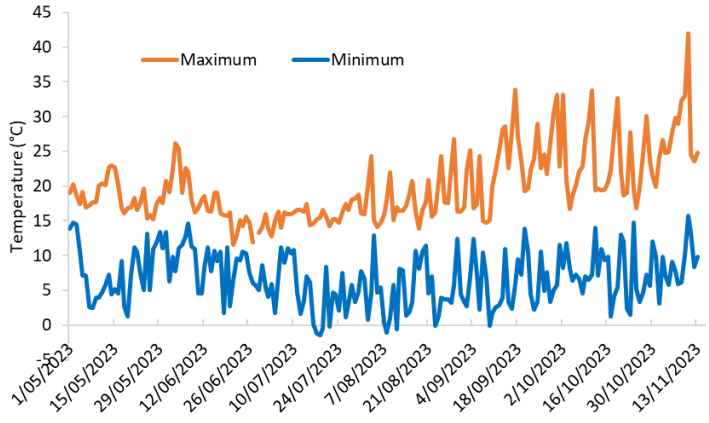

Figure 9. Daily minimum and maximum temperature (°C) recorded during the trial growing season at Kadina BOM station (#022050), 2023.

Table 17. Soil characterisation for the Maitland (0-10 cm) trial sites, 2023.

Depth	Texture	pH	pH	Organic Carbon	Colwell P	PBI	DGTP	Sulfur	
cm		$CaCl_2$	H_2O	%	mg/kg		ug/L	mg/kg	
0-10	Clay loam	7.2	7.6	2.61	44	117	30	8.8	

Depth	Conductivity		Exchangeable Cations (CEC)						
cm	EC1:5 dS/m	ECe	Exc Al	Exc Ca	Exc Mg	Exc K	Exc Na	ECEC	ESP

0-10	0.27	2.3	<0.02	34.5	3.43	2.02	0.35	40.3	0.9

COMPARISON OF LENTIL VARIETIES WITH NOVEL HERBICIDE TRAITS

Authors: Sam Trengove, Stuart Sherriff, Jordan Bruce and Declan Anderson - Trengove Consulting

Aim: To compare the performance of new herbicide tolerant lentil varieties alongside current industry standards.

Methodology:
Herbicide applications were applied as outlined in Table 18 below. All plots were hand-weeded when conducting weed counts on sow thistle on June 28 and September 12 to remove any weed competition with the lentils. At the time of these weed counts, turnip weed, medic and milk thistle plants were small and were unlikely to have resulted in crop competition and reduce crop growth or grain yield.

Data collection included weed counts for the species named above, herbicide damage scores (July 10) and lentil grain yield.

Treatments:

Table 18. List of lentil varieties and registered herbicides included in the trial at Maitland, SA 2023. Off-label experimental treatments have been removed from this report.

Treatment	Variety	Herbicides	Active constituent
1	GIA Thunder	Nil	-
2	GIA Thunder	Diuron 830g/ha (IBS) fb Intercept 600 ml/ha (POST)	900 g/kg Diuron 33 g/L Imazamox
3	GIA Thunder	Reflex® 1000 ml/ha (IBS) + Diuron 830g/ha (IBS) fb Intercept® 600 ml/ha (POST)	240 g/L Fomesafen 900 g/kg Diuron 33 g/L Imazamox
4	GIA Thunder	Reflex® 1000 ml/ha (IBS) + Diuron 830g/ha (IBS) fb diflufenican 200 ml/ha fb Intercept® 600 ml/ha (POST)	240 g/L Fomesafen 900 g/kg Diuron 500 g/L diflufenican 33 g/L Imazamox
7	GIA Metro	Nil	-
8	GIA Metro	Metribuzin 380g/ha (POST)	750 g/kg Metribuzin
13	GIA Sire	Nil	-

Key: fb = followed by, IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, POST = post-emergent

Table 19. Trial details for the novel herbicide traits trial at Maitland, SA 2023.

Trial design	RCBD
Data analysis	Data was analysed using ANOVA or ASREML in R statistical package
Plot size	10 m x 1.5 m (2.0 m centres)
Replicates	3
Sowing date	23/05/2023
Plant density	120 plants/m^2 (target)
Row spacing	250 mm
Fertiliser	100 kg/ha MAP
Harvest date	8/11/2023

Key messages

- No herbicide treatments resulted in any grain yield loss compared to the untreated controls.
- GIA Thunder was the highest yielding variety (3.12 t/ha), followed by GIA Sire (3.00 t/ha) and GIA Metro (2.35 t/ha).

Herbicide damage was generally low across the treatments, with a score of 1 indicating no damage. The treatment of Reflex + diuron fb diflufenican fb Intercept resulted in a herbicide damage score of 4.5 (Table 20). This indicates there was moderate bleaching and/or stunting following these applications.

All herbicide treatments provided full control of turnip weed, medic and milk thistle in GIA Thunder (Table 20). The background weed population was moderate at the site, averaging 1-2 plants/m2 in the nil treatments for all three weed species. The single application of metribuzin post emergent resulted in lower control, averaging 72% for turnip weed, medic and milk thistle in GIA Metro.

Table 20. Herbicide damage (July 10), turnip weed, medic and milk thistle control for the novel herbicide trait trial at Maitland, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Variety	Herbicides	Herbicide Damage 10 July		Turnip weed (% control)		Medic (% control)		Milk Thistle (% control)	
GIA Thunder	Nil	1.0	c	0	a	0	a	0	a
GIA Thunder	Diuron 830g/ha (IBS) fb Intercept 600 ml/ha (POST)	2.25	b	100	c	100	b	100	c
GIA Thunder	Reflex® 1000 ml/ha (IBS) + Diuron 830g/ha (IBS) fb Intercept® 600 ml/ha (POST)	1.0	c	100	c	100	b	100	c
GIA Thunder	Reflex® 1000 ml/ha (IBS) + Diuron 830g/ha (IBS) fb diflufenican 200 ml/ha fb Intercept® 600 ml/ha (POST)	4.5	a	100	c	100	b	100	c
GIA Metro	Nil	1.0	c	0	a	0	a	0	a
GIA Metro	Metribuzin 380g/ha (POST)	1.0	c	72	abc	71	ab	72	bc
GIA Sire	Nil	1.0	c	0	a	0	a	0	a
P-Value		*<0.001*		*<0.001*		*0.0139*		*<0.001*	

Average grain yields across the trial ranged from 2.35 t/ha to 3.12 t/ha for the three varieties (Table 21). All plots were hand weeded (at the time of weed counts) and crop competition did not influence crop growth or grain yield. Any earlier concerns of crop safety issues were no longer present later in the season and no grain yield differences were present within herbicide treatments for each variety. GIA Thunder was the highest yielding variety, followed by GIA Sire and then GIA Metro.

Table 21. Lentil grain yield (t/ha) for varieties in the novel herbicide trait trial at Maitland, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Variety	Grain yield (t/ha)	
GIA Thunder	3.12	a
GIA Metro	2.35	c
GIA Sire	3.00	b
Pr(>F)	<0.001	
LSD (0.05)	0.08	

LENTIL HERBICIDE TOLERANCE

Authors: Sam Trengove, Stuart Sherriff, Jordan Bruce and Declan Anderson - Trengove Consulting

Aim: To determine the effect of herbicide products, rates and application timings on GIA Thunder lentil crop safety on a clay loam soil.

Methodology: Herbicide applications were applied as outlined in Table 6 below. Herbicide damage was scored on July 10 and weed counts (milk thistle, medic and turnip weed) were conducted on September 12. All plots were harvested for grain yield.

Treatments:

Table 22. Herbicide treatments in the herbicide tolerance trial at Maitland, SA 2023.

Treatment	Herbicides	Active constituent
1	Nil	-
2	Diuron 830 g/ha (IBS)	900 g/kg Diuron
3	Reflex® 1000 ml/ha (IBS)	240 g/L Fomesafen
4	Diflufenican 200 ml/ha (POST)	500 g/L diflufenican
5	Intercept® 600 ml/ha (POST)	33 g/L Imazamox
6	Diuron 830 g/ha (IBS) fb Intercept 600 ml/ha (POST)	900 g/kg Diuron 33 g/L Imazamox
7	Diuron 830 g/ha (IBS) fb Diflufenican 200 ml/ha (POST) fb Intercept® 600 ml/ha (POST)	900 g/kg Diuron 500 g/L diflufenican 33 g/L Imazamox
8	Reflex 1000 ml/ha (IBS) + Diuron 830 g/ha (IBS) fb Intercept® 600 ml/ha (POST)	240 g/L Fomesafen 900 g/kg Diuron 33 g/L Imazamox
9	Reflex® 1000 ml/ha (IBS) + Diuron 830 g/ha (IBS) fb Diflufenican 200 ml/ha (POST) fb Intercept® 600 ml/ha (POST)	240 g/L Fomesafen 900 g/kg Diuron 500 g/L diflufenican 33 g/L Imazamox

Key: fb = followed by, IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, POST = post-emergent

Table 23. Trial details for the lentil herbicide tolerance trial at Maitland, SA 2023.

Trial design	RCBD
Data analysis	Data was analysed using ANOVA in R statistical package
Plot size	10 m x 1.5 m (2.0 m centres)
Replicates	3
Sowing date	23/05/2023
Plant density	55kg/ha GIA Thunder
Row spacing	250 mm
Fertiliser	100 kg/ha MAP
Harvest date	8/11/2023

Key messages:

- Lentil herbicide damage from the various treatments was low across the trial.
- A number of herbicide treatments provided high levels of milk thistle control.
- There were no differences in grain yield for any of the herbicide treatments trialled, averaging 3.4 t/ha.

Results and Discussion:

Crop damage as a result of herbicide applications was generally low across the trial, with a score of 1 indicating no damage (Table 24). Post-emergent diflufenican (200 ml/ha) applied alone or in combination with other herbicides post-emergent, was the only herbicide to result in an increased level of crop damage. These treatments on average scored 4.3, indicting there was moderate bleaching and/or stunting.

Despite a range of control levels among the herbicide treatments trialled, there were no differences in turnip weed control (Table 24). This is due to the variable background levels of turnip weed across the site making it challenging to demonstrate weed control strategies. However, there were a number of herbicide treatments which provided moderate-high levels of milk thistle control (Table 24).

There were no differences in lentil grain yield (P>0.05, data not shown) for any of the herbicide treatments trialled, averaging 3.4 t/ha.

Table 24. Herbicide damage (July 10), turnip weed and milk thistle control for the lentil herbicide tolerance trial at Maitland, SA 2023. Data labelled with the same letters within a column are not significantly different (P<0.05).

Herbicides	Herbicide damage	Turnip weed (% control)	Milk thistle (% control)
Nil	1.0 b	0 abc	0 a
Diuron 830 g/ha (IBS)	1.0 b	0 a	80 c
Reflex 1000 ml/ha (IBS)	1.0 b	82 bc	80 c
Difflufenican500 200 ml/ha (POST)	4.2 a	100 c	100 c
Intercept 600 ml/ha (POST)	1.0 b	100 c	80 c
Diuron 830 g/ha (IBS) fb Intercept 600 ml/ha (POST)	1.0 b	100 c	100 c
Diuron 830 g/ha (IBS) fb Diflufenican 200 ml/ha (POST) fb Intercept® 600 ml/ha (POST)	4.0 a	100 c	100 c
Reflex 1000 ml/ha (IBS) + Diuron 830 g/ha (IBS) fb Intercept® 600 ml/ha (POST)	1.0 b	100 c	100 c
Reflex® 1000 ml/ha (IBS) + Diuron 830 g/ha (IBS) fb Diflufenican 200 ml/ha (POST) fb Intercept® 600 ml/ha (POST)	4.7 a	100 c	100 c
Pr(>F)	<0.001	<0.001	0.013
LSD (0.05)	0.72		