

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.



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Project Investment

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



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COOMANDOOK – SPOKE SITE

SITE SUMMARY

The Coomandook field trial site was split across two sub-sites in the paddock to explore crop yield variation between the two sub-sites and differing soil types. The mid-slope site was situated on moderately to strongly alkaline soil, with approximately 50 cm of soil with variable rubble above a calcrete layer (Table 1). The shallow flat site was situated directly below the mid-slope site on the flat, with slightly acidic to strongly alkaline soil with a depth of 20 cm with variable rubble above a calcrete layer (Table 2). Both soils were low in salinity, nitrogen, phosphorus, zinc, and copper, with marginal to adequate levels of potassium and sulphur.

Opening season rainfall was average for the months of April and May, but rainfall significantly increased in June, with nearly double the monthly average providing ideal conditions for successful crop establishment and early crop growth (Figure 1). This was followed by below average rainfall in July, September and October, resulting in a higher frequency of frost events (nights below 0°C) in these months (Figure 2). No frost events occurred in June, coinciding with the higher rainfall in that month. Three frost events occurred in July, two in August, one in September and four in October, with the lowest temperature reaching -2.8°C in July, August and October. One frost event occurred in November, reaching 1.7°C. October and November frost events occurred during the months where daytime temperatures were getting warmer, with temperatures reaching nearly 40°C in November.

Trials were harvested in early November. Average grain yields for the trial site across both soil types is outlined in Table 3.

Table 1. Coomandook soil profile characterisation (brown loam/clay) of the mid-slope, 2023.

Depth (cm)	NH ₃ -N	NO ₃ -N	P (mg/kg)	K	S	OC (%)	EC (dS/m)	pH (CaCl ₂)	pH (H ₂ O)
0-10	1	31	56	287	8.7	1.10	0.156	7.3	7.6
10-30	2	8	15	177	8.1	0.39	0.180	7.8	8.6
30-50	1	3	4	100	21.0	0.33	0.273	7.9	8.8

Depth (cm)	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
	(mg/kg)					(meq/100g)				
0-10	0.26	11.3	2.56	1.22	1.01	8.89	1.06	0.64	0.18	0.019
10-30	0.08	8.8	0.41	0.37	0.91	11.81	1.22	0.42	0.36	0.035
30-50	0.09	11.7	0.72	0.18	1.29	14.18	2.93	0.29	0.88	0.033

Table 2. Coomandook soil profile characterisation (brown-grey loam/clay) of the shallow flat, 2023.

Depth (cm)	NH ₃ -N	NO ₃ -N	P (mg/kg)	K	S	OC (%)	EC (dS/m)	pH (CaCl ₂)	pH (H ₂ O)
0-10	1	22	39	226	5.5	0.87	0.098	7.0	6.8
10-25	1	4	29	179	4.4	0.36	0.133	7.8	8.8

Depth (cm)	Cu	Fe	Mn	Zn	B	Exc Ca	Exc Mg	Exc K	Exc Na	Exc Al
	(mg/kg)					(meq/100g)				
0-10	0.28	32.7	1.97	0.95	0.48	4.49	0.57	0.47	0.11	0.48
10-25	0.05	10.2	0.38	0.27	0.65	6.31	0.85	0.38	0.25	0.65

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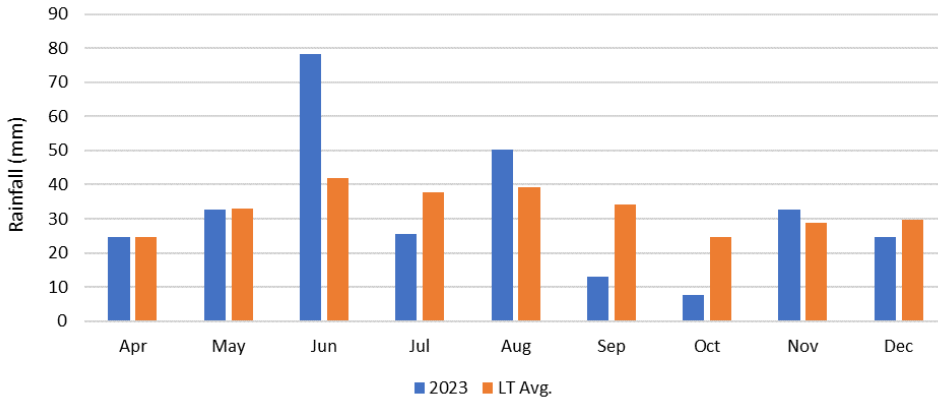


Figure 1. Monthly rainfall recorded at the Coomandook field trial site compared to the long-term average rainfall from the Nethererton BOM weather station (#25558).

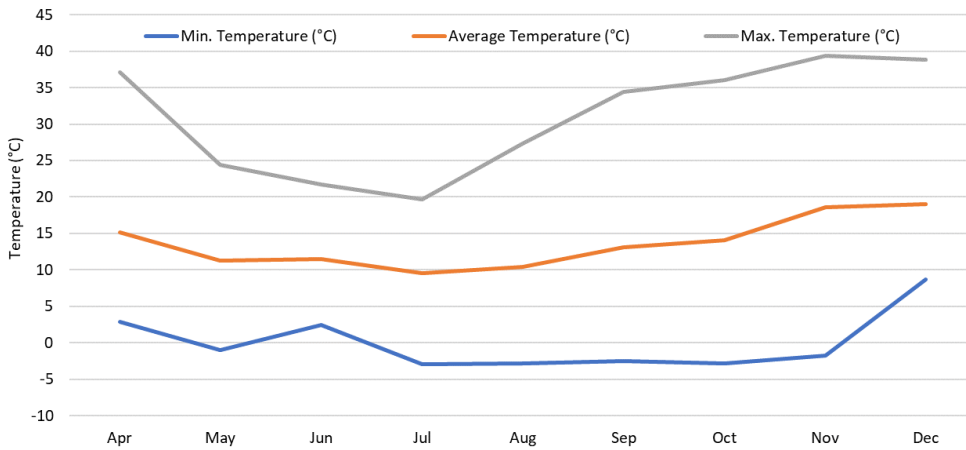


Figure 2. Minimum, average and maximum temperature (°C) recorded during the growing season at the Coomandook field trial site in 2023.

Table 3. Average grain yield (t/ha) for lentil, faba bean and vetch for each sub-site, near Coomandook, 2023.

Crop	Mid-slope	Shallow flat
Lentil	0.95	0.90
Faba bean	1.45	1.36
Vetch	0.88	0.90

TRACE ELEMENTS X SOIL TYPE

Authors: Sarah Day

Aim: This trial aims to assess the grain yield response of faba bean and lentil to trace elements cross variable soil types within a paddock.

Treatments:

Varieties: PBA Bendoc, PBA Highland XT

Treatments: See Table 4 - T1. Copper, T2. Zinc, T3. Moly, T4. Manganese, T5. Boron, and T6. Control (MAP only) Elements applied separately (not stacked) at a high rate 4-5 times over the growing period.

TIMINGS: 4 July, 2 August, 24 August

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Table 4. Nutrition treatments, products and associated nutrient analysis, and rate applied to lentil and faba bean at Coomandook, 2023.

Treatment No.	Treatment Name	Product Name (Stoller Product)	Nutrient Analysis (%W/V)	Rate (mL/ha)
T1	Untreated control (MAP only)	N/A	N/A	N/A
T2	Copper	WL Copper Chelate	Copper 5.0 Sulphur 4.0	1500
T3	Zinc	Cropping Zinc	Zinc 11.0 Sulphur 5.0	5000
T4	Molybdenum	CoMo	Cobalt 1.0 Molybdenum 6.0	800
T5	Manganese	WL Manganese Chelate	Manganese 10.0 Sulphur 4.0	2000
T6	Boron	Liquid Boron	Boron 13.0	4000

Table 5. Trial site details, Coomandook 2023.

Trial design	RCBD
Replicates	3
Data Analysis	Statistically analysed using ANOVA and Fisher's least significance test in Genstat 23 rd Edition
Sowing date	24 May 2023
Plant density	Lentil: 120 plants/m ² Faba bean: 24 plants/m ²
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	7 November 2023 (shallow flat), 8 November 2023 (mid slope)

Key messages

- Lentil yield was not influenced by soil type or nutrition application at Coomandook in 2023.
- Faba bean yield was improved by 0.2 t/ha on the mid slope compared to the shallow flat, but not by any nutrition treatment at Coomandook in 2023.

Results and Discussion:

Lentil grain yield was not influenced by soil type or nutrition treatment, averaging 1.13 t/ha (Table 6).

Faba bean grain yield was influenced by soil type, but not nutrition treatment (Table 7). Faba bean grain yield was improved by 0.2 t/ha on the mid slope compared to the shallow flat.

Further understanding of crop yield response to applied nutrition in-crop is required. Although the soils were low in some elements applied (zinc and copper), there was still no response in the plants in terms of grain production. No plant tissue tests were taken to understand if the applied nutrition was being taken up by the plants.

Table 6. Lentil grain yield in response to nutrition treatment and soil type, Coomandook 2023.

Nutrition Treatment	Grain Yield (t/ha)		
	Shallow Flat	Mid Slope	Average
Untreated control	1.16	1.16	1.16
Copper	1.00	1.12	1.06
Zinc	1.03	1.15	1.09
Molybdenum	1.12	1.14	1.13
Manganese	1.07	1.30	1.19
Boron	1.19	1.09	1.14
Average	1.09	1.16	1.13

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Least Significant Difference (P<0.05)	
Soil type x Treatment	n.s.
Soil type	n.s.
Treatment	n.s.

Key: n.s = not significant (>0.05).

Table 7. Faba bean grain yield in response to nutrition treatment and soil type, Coomandook 2023.

Nutrition Treatment	Grain Yield (t/ha)		
	Shallow Flat	Mid Slope	Average
Untreated control	1.55	1.73	1.64
Copper	1.62	1.86	1.74
Zinc	1.48	1.78	1.63
Molybdenum	1.57	1.87	1.72
Manganese	1.60	1.68	1.64
Boron	1.70	1.86	1.78
Average	1.59*	1.80**	1.69
Least Significant Difference (P<0.05)			
Soil type x Treatment	n.s.		
Soil type	0.105		
Treatment	n.s.		

Key: n.s = not significant (>0.05), values marked * and ** indicate significant difference between soil type average yields (P<0.001).

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PRE-EMERGENT HERBICIDE DEMO X SOIL TYPE

Authors: Sarah Day

Aim: Demonstration of pre-emergent herbicide options on lentil and faba bean across variable soil types within a paddock.

Treatments:

Varieties: PBA Bendoc faba bean, PBA Highland XT lentil

Herbicides: As per

Herbicide choice, rate and application timing is important to reduce risk associated with pulse production, in particular lentil production as this crop is extremely sensitive to herbicide use in dry conditions. Herbicide choice will differ depending on product labels, an individual grower’s attitude towards risk and experience with products, soil type, target weed populations, environmental conditions, herbicide solubility and leaching rate. It is important to remember that product label rates, plant-back periods and directions for use must be adhered to. Please note that results shown are for one replicate per variety per soil type only and caution should be taken if using grain yield results for decision making.

Table 9 and Table 10.

Table 8. Trial site details, Coomandook 2023.

Trial design	Demonstration
Replicates	1 replication per variety per soil type
Sowing date	24 May 2023
Plant density	Lentil: 120 plants/m ² Faba bean: 24 plants/m ²
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	7 November 2023 (shallow flat), 8 November 2023 (mid slope)

Results and Discussion:

Herbicide choice, rate and application timing is important to reduce risk associated with pulse production, in particular lentil production as this crop is extremely sensitive to herbicide use in dry conditions. Herbicide choice will differ depending on product labels, an individual grower’s attitude towards risk and experience with products, soil type, target weed populations, environmental conditions, herbicide solubility and leaching rate. It is important to remember that product label rates, plant-back periods and directions for use must be adhered to. Please note that results shown are for one replicate per variety per soil type only and caution should be taken if using grain yield results for decision making.

Table 9. Lentil (PBA Highland XT) pre-emergent herbicide x soil type demonstration grain yield (t/ha) results, Coomandook 2023.

#	Herbicide Treatment	Active Ingredient (concentration)	Rate (g or mL/ha)	Timing	Grain Yield (t/ha)	
					Shallow Flat	Mid Slope
1	Untreated control	No pre-emergent herbicide			0.85	0.85
2	Diuron	Diuron (900 g/kg)	830	IBS	0.84	0.97
3	Diuron	Diuron (900 g/kg)	550	PSPE	1.00	0.67
4	Terbyne®	Terbuthylazine (875 g/kg)	860	IBS	1.04	0.91
5	Reflex®	Fomesafen (240 g/L)	500	IBS	0.98	1.12
6	Ultro®	Carbetamide (900 g/kg)	1000	IBS	0.79	0.56

Key: IBS = incorporated by sowing, PSPE = post-sowing pre-emergent.

Table 10. Faba bean (PBA Bendoc) pre-emergent herbicide x soil type demonstration grain yield (t/ha) results, Coomandook 2023.

#	Herbicide Treatment	Active Ingredient (concentration)	Rate (g or mL/ha)	Timing	Grain Yield (t/ha)	
					Shallow Flat	Mid Slope

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1	Untreated control	No pre-emergent herbicide			1.27	1.09
2	Diuron	Diuron (900 g/kg)	830	IBS	1.09	1.25
3	Terbyne®	Terbutylazine (875 g/kg)	860	IBS	1.28	0.37
4	Ultro®	Carbetamide (900 g/kg)	1000	IBS	1.31	0.94
5	Overwatch®	Bixlozone (400 g/L)	1250	IBS	1.68	1.20
6	Reflex®	Fomesafen (240 g/L)	500	IBS	1.29	0.93
7	Reflex®	Fomesafen (240 g/L)	500	PSPE	1.33	1.32
8	Simazine	Simazine (900 g/kg)	1000	IBS	1.30	1.38
9	Simazine	Simazine (900 g/kg)	1000	PSPE	1.24	1.42

Key: IBS = incorporated by sowing, PSPE = post-sowing pre-emergent.

VARIETY X SOIL TYPE DEMONSTRATION

Authors: Sarah Day

Aim: Demonstration of lentil and vetch varieties.

Varieties: As per Table 12.

Table 11. Trial site details, Coomandook 2023.

Trial design	Demonstration
Replicates	1 replication per variety per soil type
Sowing date	24 May 2023
Plant density	Lentil: 120 plants/m ² Vetch: 60 plants/m ²
Row spacing	23 cm
Fertiliser	80 kg/ha MAP + Zn
Harvest date	7 November 2023 (shallow flat), 8 November 2023 (mid slope)

Results and Discussion:

Several lentil and vetch varieties are commercially available to growers. Each variety has a distinctive set of characteristics and a fit in the farming system. A range of phenology, growth habits and herbicide tolerance traits allow growers to select a variety to suit their needs. It is important to keep in mind that some varieties with herbicide tolerance trait have a yield penalty, however they have a unique fit in the farming system. Please note that results shown are for one replicate per variety per soil type only and caution should be taken if using grain yield results for decision making.

Table 12. Variety x soil type demonstration grain yield (t/ha) results, Coomandook 2023.

Crop	Variety	Grain Yield (t/ha)	
		Shallow Flat	Mid Slope
Lentil	PBA Hallmark XT	0.80	0.77
	PBA Highland XT	1.17	0.98
	PBA Hurricane XT	0.67	0.85
	PBA Kelpie XT	1.06	0.97
	GIA Thunder	0.78	1.21
	GIA Lightning	*	0.84
	GIA Metro	0.33	0.49
	GIA Sire	0.38	*
Vetch	Rasina	*	0.59
	SA37107	0.97	0.82
	Studenica	0.97	0.91
	Timok	0.76	1.2

* Missing value due to harvest error