SA Grain Legume Development and Extension Project

UOA2105-013RTX

2022 Field Trial Results

Acknowledgements

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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

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Cover image: Hart Field Day Site pulse varieties demonstration, 20 September 2022.

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KULPARA

SITE SUMMARY

Below average rainfall in February, March and April resulted in dry sowing across most parts of the northern Yorke Peninsula. This was followed by a dry start to May, until 34 mm was received at Kulpara in the last week of the month (Figure 1). The trial was sown on 26th May into marginal moisture and followed by 29 mm in the 7 days post seeding resulting in optimal germination and establishment. Rainfall received during June was above the long-term average, followed by a dry July. Kulpara experienced above average spring rainfall with the growing season extending into November (62 mm received). Growing season (April – October) rainfall for 2022 and the long-term average were both around 290 mm. The 2022 annual rainfall was well above average at 461 mm compared to 385 mm long-term average.

During July and early September there were four occasions where the temperature dropped below 0°C (Figure 2). The lentil trial would have been in vegetative growth stages at these times, keeping frost damage to a minimum. Spring temperatures were generally mild across the northern Yorke Peninsula (Figure 2) allowing for a long, wet, and cool finish to the season.

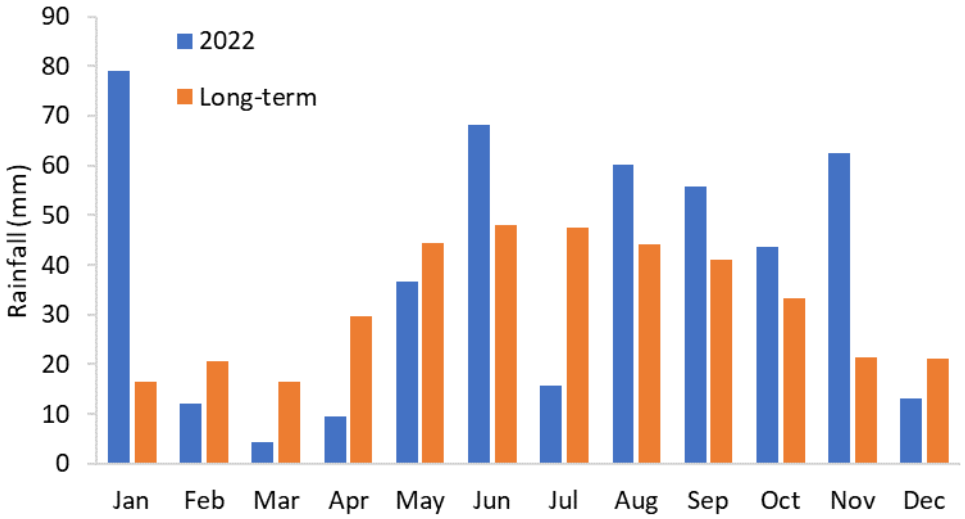

Figure 1. Monthly rainfall recorded at Paskeville BOM weather station (#022012) in 2022 compared to the long-term average.

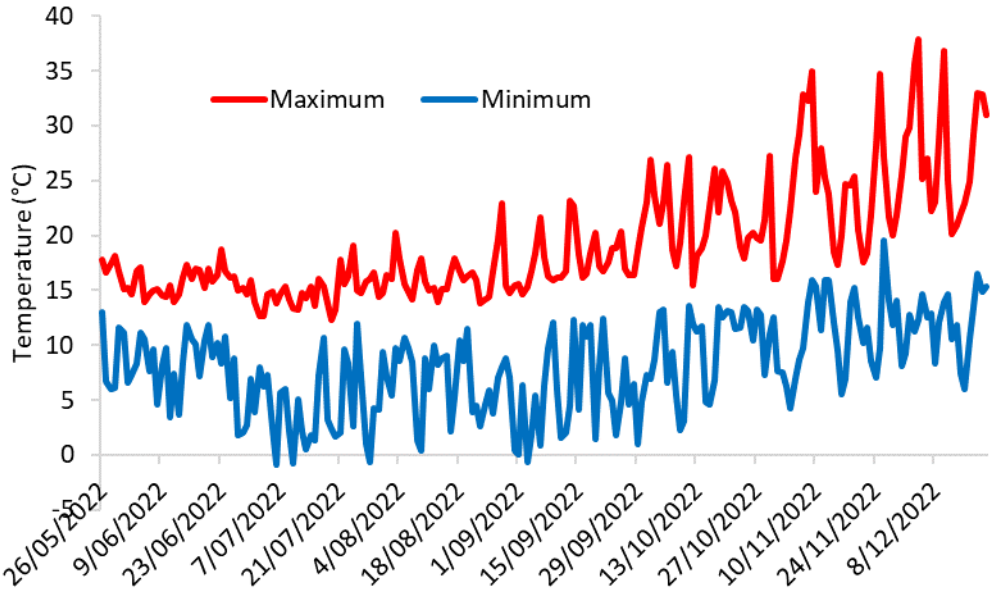

Figure 2. Daily minimum and maximum temperature (°C) recorded during the trial growing season at Kadina BOM weather station (#022050), 2022.

Table 1. Soil characterisation for Kulpara (0-10 cm) trial site, 2022.

Depth (cm)	PBI	DG TP ug/L	P (mg/kg)	S (mg/kg)	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-10	119	28	39	16	2.13	0.32	7.8	8.2

Depth (cm)	Texture	ECEC	ESP	Exc Al	Exc Ca (meq/100g)	Exc Mg	Exc K	Exc Na
0-10	Loam	32.8	1.5	<0.02	28.3	2.51	1.49	0.49

LENTIL POD DROP MANAGEMENT

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

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

Methodology:
Measurements throughout the season included plant establishment counts, GreenSeeker NDVI, grain yield, pod drop score and pod drop weight (collected with catch trays). Data was analysed using ANOVA in R statistical package.

Treatments (Table 2**):**
The control treatment of PBA Highland XT (120 plants/m^2, which equated to 50 kg/ha) was selected as an upright variety which may be more susceptible to plant movement during strong wind events compared to other commonly grown varieties. Treatments 2, 3, 4, 5 and 14 looked at different strategies that can be employed during seeding in order to change the structure of the lentil canopy. Treatments 5 and 14, being PBA Hurricane XT and GIA Thunder respectively, investigate the influence of different lentil variety plant structure on pod drop. The zero-row spacing treatment was sown to PBA Highland XT with 50% of the seed sown with the seeder and 50% spread on the soil surface prior to sowing with the total rate coming to 50 kg/ha. The high P fertiliser treatment was included to investigate if the lentils would respond to additional P fertiliser on a calcareous soil and how the increased growth would impact canopy structure and pod drop. The 0-10 cm soil test (Table 1) indicates a highly responsive soil with a high PBI of 119 and a low DGT-P value of 28 µg/L.

Treatments 6-10 utilise plant growth regulator (PGR) products to either stimulate or inhibit cell division and elongation. PGR Product #1 was used as a growth stimulant. In contrast, PGR Product #2 was used as a growth inhibitor, decreasing rates of cell division and elongation. The length between nodes on the lentil plant will be affected by this application and the peduncle length can be affected too. The peduncle is the short stalk that joins the lentil flowers/pods to the lentil branches.

Treatments 11-13 trialled EnviroShield (polymer of cyclohexane), a product used to seal the pods of plants to prevent moisture intrusion. The intended outcome is to prevent pod splitting and shattering as a result of weather damage. Therefore, it is not expected to prevent pod drop as a result of breaking of the peduncles.

Treatment 15 investigates the strategy of a very late rolling timing with the aim of lowering the plant and canopy height in order to protect the plants and pods from wind exposure.

Table 2. Treatment descriptions and their respective management category for the pod drop management trial at Kulpara in 2022.

Treatment	Description	Pod drop management method
1	Control – PBA Highland XT*	Nil
2	PBA Highland XT/PBA Hurricane XT – 50/50 seed mix	Plant/canopy structure
3	Zero row spacing – 50% sown, 50% pre-spread	
4	High P 30 kg P/ha – 15 kg/ha deep banded & 15 kg/ha with seed	
5	PBA Hurricane XT	
6	PGR Product #1 at first flower	Plant/canopy structure & peduncle length
7	PGR Product #2 half rate at first flower	
8	PGR Product #2 full rate at first flower	
9	PGR Product #2 half rate at mid flower	
10	PGR Product #2 full rate at mid flower	
11	EnviroShield 1.0 L/ha at 10 days prior to desiccation	Pod seal product
12	EnviroShield 1.0 L/ha at desiccation	
13	EnviroShield 1.0 L/ha 10 days prior and at desiccation	
14	GIA Thunder	Plant/canopy structure
15	Rolling during pod set	Late canopy structure change

**Variety used for all treatments unless specified.*

Enviroshield®(Agspec): Active Constituent – Polymer of cyclohexane, 1-methyl-4-(1-methylethyl)

Table 3. Agronomic trial details, Kulpara 2022.

Trial design	RCBD
Plot size	10 m x 1.5 m
Replicates	3
Sowing date	26/05/2023
Plant density	120 plants/m^2 PBA Highland XT lentil (control refer to treatment list above for variations)
Row spacing	250 mm
Fertiliser	68 kg/ha MAP + 1% Zn (except treatment 4)
Harvest date	20/12/2022

Key messages

- No significant pod drop occurred in this trial, which was due to seasonal conditions leading to crop lodging and lack of strong wind events when the crop was mature.
- GIA Thunder was the highest yielding treatment/variety in this trial increasing grain yield by 680 kg/ha (18%) over the PBA Highland XT control treatment.
- Treatments that yielded less than the control included PGR Product #1, PGR Product #2 full rate at mid flower and rolling during pod set.

Results and Discussion:

Lentil plant establishment was not affected by any of the pod drop management strategies, averaging 120 plants/m^2 across the site (Table 4). When utilising zero-row spacing seeding it is important to be mindful of pre-emergent herbicide use, as the pre-spread lentils are incorporated by soil that has been sprayed with the herbicide. The only pre-emergent used in the trial was a low rate of diuron at 150 g/ha and was found to be

safe in this situation. For the high P fertiliser treatment, no negative impacts on plant establishment were found when placing an additional 68 kg/ha MAP + 1% Zn with the seed. Therefore, no fertiliser toxicity symptoms were present in this treatment.

Table 4. Plant establishment counts for selected treatments in the pod drop management trial at Kulpara in 2022. ns = not significant (P>0.05).

Description	Plants/m^2
Control – PBA Highland XT	116
Zero row spacing	138
High P 30 Pkg/ha	112
Pr (>F)	*0.236*
LSD(0.05)	*n.s.*

The two best performing treatments with higher NDVI than the control on the 5th of September were the zero-row spacing followed by PBA Hurricane XT treatments (Table 5Table 5). There were no treatments that reduced NDVI compared to the control.

The only treatment to yield higher than the control (PBA Highland XT) was GIA Thunder, by 680 kg/ha (18%). PBA Hurricane XT yielded similar to the control but was higher than all PGR treatments and rolling during pod set. Treatments that yielded less than the control included PGR Product #1, PGR Product #2 full rate at mid flower and rolling during pod set.

There was no difference for pod drop collected in catch trays from this trial (Table 5). This may be due to the seasonal conditions (above average rainfall and extended growing season) favouring high growth and biomass in lentil crops. This resulted in large crop canopies and lodging of plants occurring. Lodging lowers the overall canopy height, which can protect the plants and pods from wind. This lines up well with pod drop results from 2021, where pod drop increased with increasing plant/canopy height. Secondly, there were no significant wind events that caused any widespread pod loss when the lentil crop was mature in 2022. This lines up with grower reports of minimal pod drop in 2022, compared to high rates of pod loss in 2021 with lower biomass, upright lentil canopies and at least one significant strong wind event when lentil crops were mature.

Table 5. GreenSeeker NDVI, grain yield and pod drop data (selected treatments) at the pod drop management trial at Kulpara in 2022. Different letters within the same column indicate a significant difference (P<0.05). ns = not significant (P>0.05).

Description	Greenseeker 5th September		Grain yield (t/ha)		Pod drop (kg/ha)
Control – PBA Highland XT	0.508	cd	3.73	bcde	209
PBA Highland XT/PBA Hurricane XT – 50/50 seed mix	0.521	cd	3.86	bc	-
Zero row spacing – 50% sown, 50% pre-spread	0.623	a	3.81	bcd	-
High P 30 kg P /ha	0.510	cd	3.80	bcde	151
PBA Hurricane XT	0.570	b	3.90	b	167
PGR Product #1 at first flower	0.542	bc	3.33	gh	308
PGR Product #2 half rate at first flower	0.505	cd	3.64	cdef	223
PGR Product #2 full rate at first flower	0.517	cd	3.56	efg	231

PGR Product #2 half rate at mid flower	0.519	cd	3.56	efg	303
PGR Product #2 full rate at mid flower	0.516	cd	3.41	fg	328
Enviroshield 1.0 L/ha at 10 days prior to desiccation	0.513	cd	3.58	def	233
Enviroshield 1.0 L/ha at desiccation	0.498	d	3.71	bcde	262
Enviroshield 1.0 L/ha 10 days prior and at desiccation	0.525	cd	3.72	bcde	171
GIA Thunder	0.535	bcd	4.41	a	160
Rolling during pod set	0.506	cd	3.14	h	-
Pr(>F)	*<0.001*		*<0.001*		*0.151*
LSD(0.05)	*0.038*		*0.241*		*ns*

MAITLAND

SITE SUMMARY

Below average rainfall for February, March, April, and the beginning of May resulted in dry sowing across most parts of central Yorke Peninsula. The three lentil trials reported here were sown into marginal soil moisture on the 23rd of May. Optimal germination and establishment occurred at the site following 60 mm of rainfall in the last week of May (Figure 3). Rainfall received during June to October was similar to the long-term average, with the exception of July. Growing season (April – October) rainfall totalled 358 mm in 2022 compared to the long-term average 390 mm. Maitland received well above average rainfall (94 mm) in November, extending the growing season, and delaying harvest until mid-December. Maitland annual rainfall was 569 mm compared to 503 mm long-term average.

Temperatures during the 2022 trial growing season (Figure 4) were generally mild and consistent with average years for Maitland. During winter there were 11 occasions where the temperature dropped below 5°C (minimum 3.6°C). Spring was similarly mild with only 12 days having temperatures over 30°C (maximum 36.2°C). The trials experienced a long, wet, and cool finish to the season.

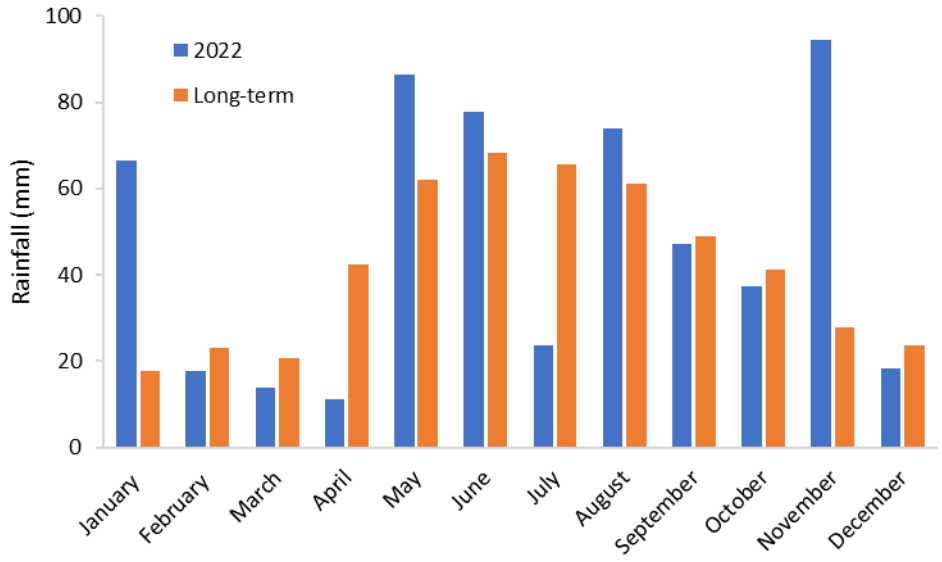

Figure 3. Monthly rainfall recorded at Maitland in 2022 compared to the long-term average rainfall from the Maitland BOM weather station (#22008).

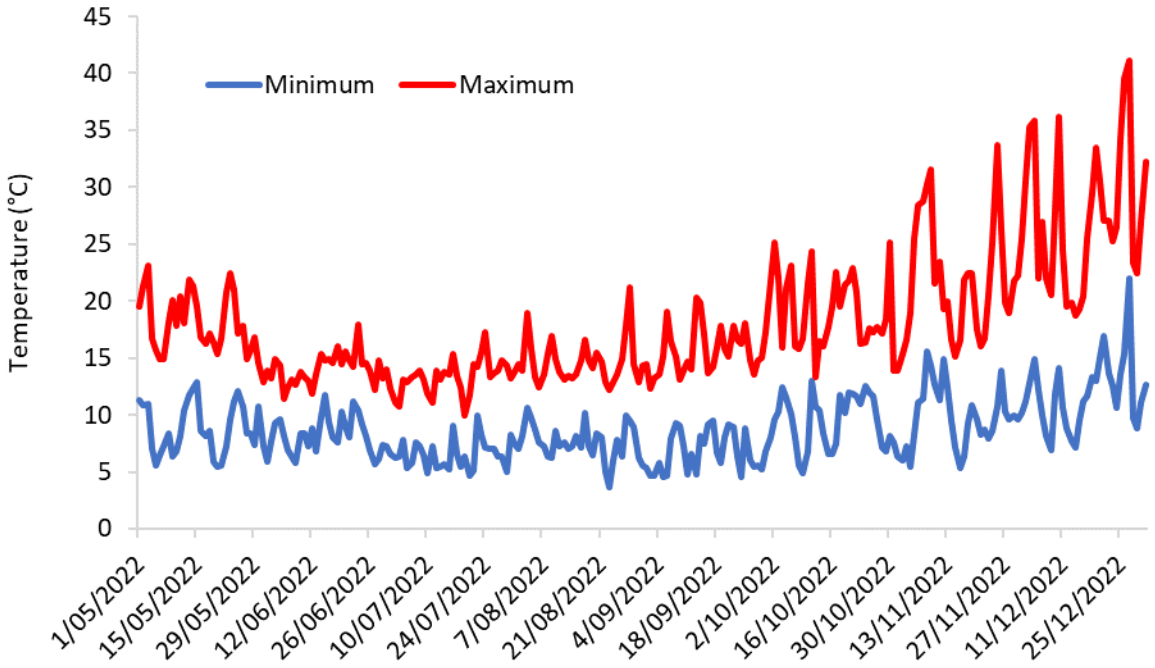

Figure 4. Daily minimum and maximum temperature (°C) recorded from 1st May to 31st December at the Maitland trial site, 2022 (source: grower weather station).

Table 6. Soil characterisation for the Maitland trial site, 2022.

Depth (cm)	PBI	DG TP ug/L	P (mg/kg)	S	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-10	97	54	50	20	2.29	0.31	7.1	7.4

Depth (cm)	Texture	ECEC	ESP	Exc Al	Exc Ca (meq/100g)	Exc Mg	Exc K	Exc Na
0-10	Loam	27.3	1.0	<0.02	23.2	2.39	1.38	0.27

COMPARISON OF LENTIL VARIETIES WITH NOVEL HERBICIDE TRAITS

Authors: Sam Trengove, Stuart Sherriff, and Jordan Bruce - ***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 7 below. All plots were hand-weeded when conducting sow thistle counts on the 25th August and the 5th October to remove any weed competition with the lentils. At the time of these weed counts, sow 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 common sow thistle (*Sonchus oleraceus*) and lentil grain yield. Data was analysed using ANOVA in R statistical package.

Treatments: See Table 7.

Table 7. List of lentil varieties and herbicides included in the trial at Maitland, 2022.

Treatment	Variety	Herbicides
1	PBA Hurricane XT	Nil
2	PBA Hurricane XT	Intercept® 600 mL/ha (POST)
3	PBA Hurricane XT	Brodal® 150 mL/ha (POST) fb Intercept® 600 mL/ha (POST)
4	PBA Hurricane XT	Reflex® 1000 mL/ha (IBS) fb Intercept® 600 mL/ha (POST)
5	GIA Metro	Nil
6	GIA Sire	Nil

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

Table 8. Agronomic trial details, Maitland 2022.

Trial design	RCBD
Plot size	7.8 m x 1.5 m
Replicates	3
Sowing date	23/05/2022
Plant density	120 plants/m^2
Row spacing	250 mm
Fertiliser	100 kg/ha MAP + 1% Zn
Harvest date	14/12/2022

Key messages

- PBA Hurricane XT, GIA Metro and GIA Sire all yielded similarly averaging at 4.68 t/ha across the trial.
- No herbicide treatments resulted in any yield loss compared to the untreated controls.

Results and Discussion:

All herbicide treatments provided some level of common sow thistle control. The background sow thistle population was moderate at the site, averaging 4 plants/m^2 in the nil treatments. The herbicide strategies used on PBA Hurricane XT provided 52-68% control of common sow thistle. This level of control is considered low, as the amount of common sow thistle escaping the herbicide and setting seed will lead to further

increases in the seed bank. It was surprising that Reflex at 1000 mL/ha IBS did not provide higher levels of control.

Grain yields across the trial were high with no differences for any treatment (Table 9). All plots were hand weeded (at the time of weed counts) and crop competition did not influence crop growth or grain yield. This was also useful to understand any crop safety concerns with using these herbicides and any differences between varieties in terms of grain yield. In this trial, all varieties yielded equally, and no herbicide treatment resulted in any crop safety issues.

Table 9. Results including percent common sow thistle control and grain yield for the Maitland novel herbicide traits trial in 2022. Different letters within the same column indicate a significant difference (P<0.05). ns = not significant (P>0.05).

Variety	Herbicides	Common sow thistle control (%)		Grain yield (t/ha)
PBA Hurricane XT	Nil	0	a	4.76
PBA Hurricane XT	Intercept 600mL/ha (POST)	52	b	4.64
PBA Hurricane XT	Brodal 150mL/ha (POST) fb Intercept 600mL/ha (POST)	68	bc	4.63
PBA Hurricane XT	Reflex 1000mL/ha (IBS) fb Intercept 600mL/ha (POST)	59	b	4.77
GIA Metro	Nil	0	a	4.52
GIA Sire	Nil	0	a	4.95
	Pr(>F)	*<0.001*		*0.07*
	LSD(0.05)	*28.2*		*ns*

LENTIL FUNGICIDE EVALUATION FOR ASCOCHYTA BLIGHT

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

Aim: To evaluate the efficacy of registered and permitted products for the control of ascochyta blight in lentil.

Methodology:

Ascochyta blight was allowed to naturally infect the trial (no additional infected stubble was spread across the trial). Ascochyta blight infection was assessed as a severity score (reported from 0 = no infection to 10 = entire plot infected) recorded on the 7th of November for all plots. Grain yield was assessed at harvest. Data was analysed using ANOVA in R statistical package.

Treatments: See Table 10.

Table 10. Fungicide treatments included in the Ascochyta blight trial at Maitland, 2022.

Treatment	Product	Active ingredients	Fungicide group	Rate used	Registered rates
1	Nil	-	-	-	-
2	Dithane Rainshield	750 g/kg mancozeb	M3	2.2 kg/ha	1.0 – 2.2 kg/ha
3	Bravo	720 g/L chlorothalonil	M5	1.0 L/ha	1.0 – 2.0 L/ha
4	Bravo	720 g/L chlorothalonil	M5	2.0 L/ha	1.0 – 2.0 L/ha
5	Veritas Opti	370 g/L tebuconazole 222 g/L azoxystrobin	3 11	540 mL/ha	400 – 500 mL/ha
6	Amistar Xtra	80 g/L cyproconazole 200 g/L azoxystrobin	3 11	600 mL/ha	400 – 600 mL/ha
7	Aviator Xpro	150 g/L prothioconazole 75 g/L bixafen	3 7	600 mL/ha	400 – 600 mL/ha
8	Polyram DF	700 g/kg metiram	M3	2.2 kg/ha	1.0 – 2.2 kg/ha
9	Captan*	900 g/kg captan	M4	1.1 kg/ha	1.1 kg/ha^{P}
10	Filan*	500 g/kg boscalid	7	600 g/ha	600 g/ha^{P}
11	Miravis Star	100 g/L pydiflumetofen 150 g/L fludioxonil	7 12	500 mL/ha	250-500 mL/ha

*Captan and Filan are currently permitted for use in lentil with permits PER81406 and PER82476, respectively.

Table 11. Agronomic trial details, Maitland 2022.

Trial design	RCBD
Plot size	10 m x 1.5 m
Replicates	3
Sowing date	23/05/2022
Plant density	59 kg/ha PBA Hallmark XT
Row spacing	250 mm
Fertiliser	100 kg/ha MAP + 1% Zn
Harvest date	14/12/2022

Key messages

- Ascochyta blight was only present at low levels in the trial and did not impact grain yield.
- The products Dithane Rainshield (group M3), Veritas Opti (group 3 + 11), Polyram DF (group M3) and Captan (group M4) did not provide any ascochyta blight control compared to the untreated control.
- Products containing an SDHI active ingredient provided the greatest level of ascochyta blight control, including Filan, Miravis Star, and Aviator Xpro.

Results and Discussion:

The trial experienced low levels of ascochyta blight infection throughout the growing season. The lowest score of 0.3 indicated the disease was sparsely present at very low levels, whereas, the highest score of 2.3 indicated the disease was easily identifiable but still at low levels. For context, a score of 9.0 would indicate the disease was present at very high levels.

Despite low levels of ascochyta blight infection there were still differences among the fungicides trialled. Products such as Dithane Rainshield, Veritas Opti, Polyram DF and Captan did not provide any level of ascochyta blight control compared to the nil.

Whilst Veritas Opti did not provide any ascochyta blight control, the product Amistar Xtra did provide ascochyta blight control when compared to the untreated control. Veritas Opti and Amistar Xtra contain the same loading of azoxystrobin at 120 g a.i./ha. However, azoxystrobin did not have any activity on ascochyta blight in this trial. The results suggest the other DMI (fungicide group 3) component of Amistar Xtra (cyproconazole) had greater activity on ascochyta blight than the DMI in Veritas Opti (tebuconazole).

Products that provided the highest levels of control included Filan, Miravis Star and Aviator Xpro. All these products contain an SDHI (fungicide group 7) active ingredient. Therefore, selecting a fungicide product containing an SDHI should provide the best chance of ascochyta blight control. Following these products, Bravo used at either 1.0 L/ha or 2.0 L/ha also provided some control of ascochyta blight (

Table 12) when compared to the nil.

Analysis of lentil grain yield showed no differences between the fungicide treatments (

Table 12). This is not surprising given the low level of ascochyta blight infection was not expected to reduce grain yield. Despite having fungicides applied to control botrytis grey mould (BGM) and the RMR rating of PBA Hallmark XT, BGM was present throughout the trial and may have impacted grain yields.

Table 12. Ascochyta blight score from the 7th of November and grain yield for the ascochyta blight disease trial at Maitland in 2022. Different letters within the same column indicate a significant difference (P<0.05). ns = not significant (P>0.05).

Fungicide	Ascochyta score 7th Nov 2022		Grain yield (t/ha)
Nil	2.3	a	3.81
Dithane Rainshield	1.4	abcd	4.00
Bravo 1.0 L/ha	1.0	bcde	3.76
Bravo 2.0 L/ha	1.0	bcde	4.02
Veritas Opti	1.6	abc	4.29
Amistar Xtra	0.8	cde	4.02
Aviator Xpro	0.5	de	4.11

Polyram DF	1.4	abcd	4.03
Captan	1.8	ab	3.89
Filan	0.3	e	4.13
Miravis Star	0.4	e	4.31
Pr(>F)	*0.004*		*0.100*
LSD (0.05)	*1.0*		*ns*

LENTIL FUNGICIDE EVALUATION FOR BOTRYTIS GREY MOULD

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

Aim: to evaluate the efficacy of registered and permitted products for the control of botrytis grey mould (BGM) in lentil.

Methodology:

Assessments included BGM scores at three timings. A BGM score on the 5th of October recorded the percent of plants in a plot infected with BGM. Scores on the 3rd and 22nd of November recorded the percent of death in a plot as a result of BGM. All plots were assessed for grain yield. Data was analysed using ANOVA in R statistical package.

Treatments:

All fungicides were applied at their maximum label rate, except for Captan and Boscalid that are on permit for lentil. Captan (PER81406) and Filan (PER82476) were applied at the rate stated on the permit. However, Miravis Star was applied at 500 mL/ha, the highest label rate for ascochyta blight, whereas the label rate range for BGM control is 750–1000 mL/ha.

Multiple applications of each treatment were applied with the treatments receiving the same product each time. The first spray at canopy closure was on the 16th of August with subsequent sprays occurring approximately 4 weeks between them (13th September, 10th October and 7th November). Consecutive sprays of the same modes of action were used for research purposes. However, using consecutive sprays of the same fungicide modes of action on a broadacre scale can lead to increased incidences of fungicide resistance. Rotating fungicide modes of action within the same season is important. Fungicide residues from multiple applications may also be a potential issue.

Table 13. Fungicide treatments included in BGM trial at Maitland, 2022.

Treatment	Product	Active ingredients	Fungicide group	Rate used	Registered/ permitted rates
1	Nil	-	-	-	-
2	Dithane Rainshield	750 g/kg mancozeb	M3	2.2 kg/ha	1.0 - 2.2 kg/ha
3	Spinflo	500 g/L carbendazim	1	500 mL/ha	500 mL/ha
4	Bravo Weather Stik	720 g/L chlorothalonil	M5	2.0 L/ha	1.0 - 2.0 L/ha
5	Sumisclex	500 g/L procymidone	2	500 mL/ha	500 mL/ha
6	Veritas Opti	370 g/L tebuconazole 222 g/L azoxystrobin	3 11	540 mL/ha	400 - 500 mL/ha
7	Amistar Xtra	80 g/L cyproconazole 200 g/L azoxystrobin	3 11	600 mL/ha	400 - 600 mL/ha
8	Aviator Xpro	150 g/L prothioconazole 75 g/L bixafen	3 7	600 mL/ha	400 - 600 mL/ha
9	Polyram DF	700 g/kg metiram	M3	2.2 kg/ha	1.0 - 2.2 kg/ha
10	Captan	900 g/kg captan	M4	1.1 kg/ha	1.1 kg/ha^{P}
11	Filan	500 g/kg boscalid	7	600 g/ha	600 g/ha^{P}
12	Miravis Star	100 g/L pydiflumetofen 150 g/L fludioxonil	7 12	500 mL/ha*	750-1000 mL/ha

*Rate applied was below the registered label rates for BGM control. Rate applied was maximum label rate for ascochyta blight control.

[P] Captan and Filan are currently permitted for use in lentil with permits PER81406 and PER82476, respectively.

Table 14. Agronomic trial details, Maitland 2022.

Trial design	RCBD
Plot size	10 m x 1.5 m
Replicates	3
Sowing date	23/05/2022
Plant density	66 kg/ha
Row spacing	250 mm
Fertiliser	100 kg/ha MAP + 1% Zn
Harvest date	14/12/2022

Key messages

- Botrytis grey mould resulted in 68% plant death in the untreated control plots on the 22nd of November.
- Products containing Group 7 (SDHI) fungicides including Filan, Miravis Star and Aviator Xpro were highly effective at controlling BGM.
- The product Filan provided both the highest level of BGM control and grain yield.
- The group 2 fungicide Sumisclex and combination products of group 3 + 11 fungicides, which were Veritas Opti and Amistar Xtra, also provided high levels of BGM control.

Results and Discussion:

A high level of BGM was present in the trial, which progressed through spring all the way up until crop desiccation. The high infection levels were driven by a combination of wet weather and a large crop canopy. Plant canopies remained wet due to above average rainfall in October and November and mild temperatures created ideal conditions for BGM to infect and continually reproduce. In early October, 57% of the plot in the untreated was infected by BGM and this resulted in 68% plant death by the 22nd of November (Table 15).

Several fungicides provided high levels of BGM control until late November (Table 15, Figure 5). Filan was highly effective at controlling BGM (5% plot infection on 22nd of November) and produced the highest grain yield at 4.18 t/ha. Filan contains one active ingredient from the SDHI fungicide group 7.

Other products containing group 7 SDHI fungicides (in combination with group 3 or 12), such as Miravis Star and Aviator Xpro, were also highly effective at controlling BGM (Table 15). However, in general these products were lower yielding, approximately 15% compared to Filan in this trial. Similarly, the group 2 fungicide Sumisclex and combination products (group 3 + 11) Veritas Opti and Amistar Xtra, also provided high levels of BGM control but were approximately 15% lower yielding compared to Filan.

Bravo Weather Stik and Spin Flo kept BGM infection to 44% on average on the 22nd of November. For these products, lentil grain yield was reduced by 40% on average when compared to the Filan.

Dithane Rainshield, Captan and Polyram DF yielded similarly to the untreated control (1.53 t/ha) and approximately 61% less than Filan. While Captan did provide some level of BGM suppression (53%) until late November it was unable to prevent any grain yield loss.

Table 15. Botrytis grey mould scores for three timings in fungicide evaluation trial at Maitland SA, 2022. Scores in October indicate the percent of plants in a plot infected with BGM. Scores in November indicate the percent of plant death in a plot as a result of BGM. Different letters within the same column indicate a significant difference (P<0.05).

Treatment	BGM plot infection (%) Oct 5th	BGM plot death (%) Nov 3rd	BGM plot death (%) Nov 22nd	Grain yield (t/ha) Dec 14th
Nil	56.7 a	63.3 a	68.3 a	1.53 d
Dithane Rainshield	36.7 bc	53.3 a	68.3 a	1.75 d
Spinflo	17.7 de	28.3 c	43.3 b	2.44 c
Bravo Weather Stik	21.7 cd	30.0 bc	45.0 b	2.57 c
Sumisclex	5.0 de	0.7 d	5.0 c	3.68 b
Veritas Opti	14.0 de	6.0 d	15.0 c	3.35 b
Amistar Xtra	7.7 de	6.7 d	13.3 c	3.44 b
Aviator Xpro	6.7 de	2.3 d	10.0 c	3.58 b
Polyram DF	53.3 ab	56.7 a	71.7 a	1.56 d
Captan	56.7 a	48.3 ab	53.3 b	1.72 d
Filan	2.7 e	0.0 d	5.0 c	4.18 a
Miravis Star	8.7 de	11.7 cd	18.3 c	3.74 b
Pr(>F)	*<0.001*	*<0.001*	*<0.001*	*<0.001*
LSD (0.05)	*18.5*	*19.02*	*13.6*	*0.419*

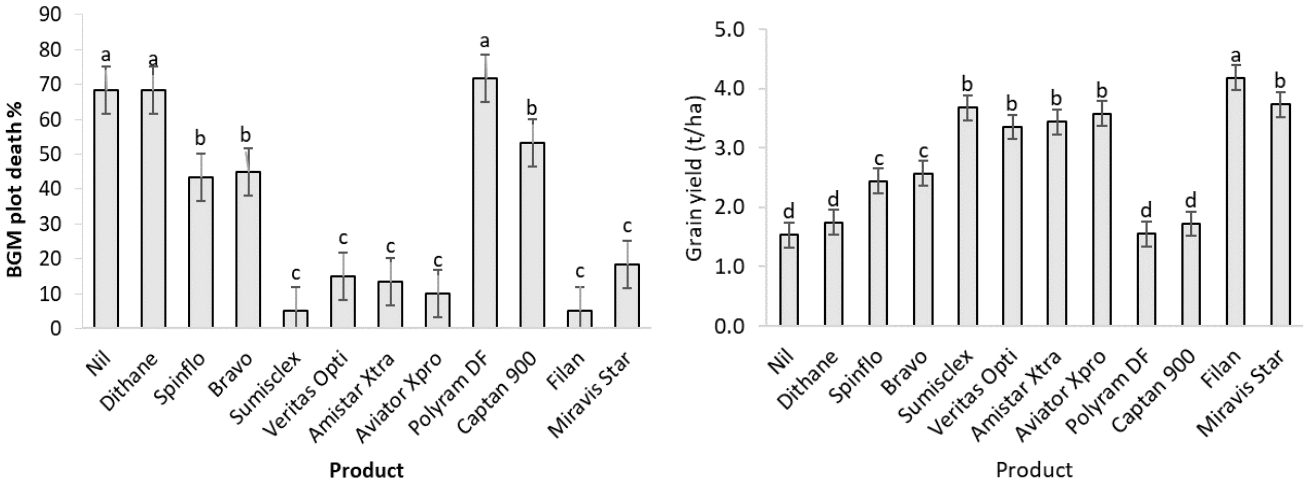

Figure 5. Botrytis fungicide evaluation trial at Maitland SA, 2022 (left) BGM plot death (%) score on the 22nd of November. The error bars represent LSD (0.05) with a value of 13.6%. (right) Lentil grain yield (t/ha). The error bars represent the LSD (0.05) with a value of 0.21t/ha.

TICKERA

SITE SUMMARY

Below average rainfall in April resulted in dry sowing across most parts of the northern Yorke Peninsula. The start of May was also dry and the lentil trial was dry sown on the 11th of May. Optimal germination and establishment occurred at the site following 28 mm of rain in the last week of May. Rainfall received during June to was similar to the long-term average, followed by a dry July (Figure 6). Tickera experienced above average spring rainfall with the growing season extending into November (59 mm received). Growing season (April – October) rainfall for 2022 and the long-term average were both 250 mm. The Tickera annual rainfall was 412 mm compared to 347 mm long-term average.

During July and early September there were four occasions where the temperature dropped below 0°C (Figure 7). The lentil trial would have been in vegetative growth stages at these times, keeping frost damage to a minimum. Spring temperatures were generally mild across the northern Yorke area (Figure 7) allowing for a long, wet, and cool finish to the season.

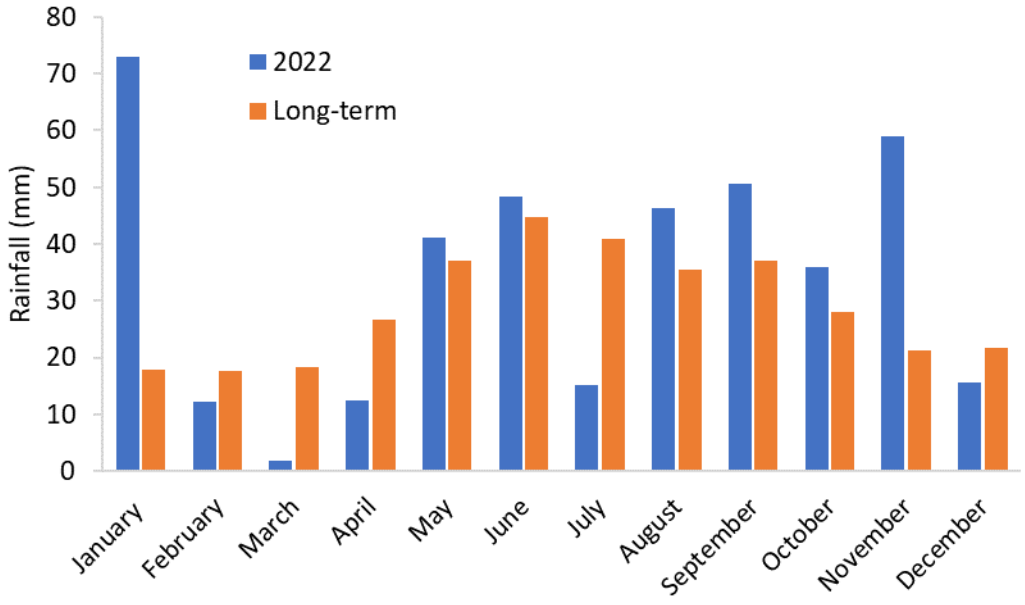

Figure 6. Monthly rainfall recorded at Tickera in 2022 compared to the long-term average rainfall from the BOM weather station (#021110).

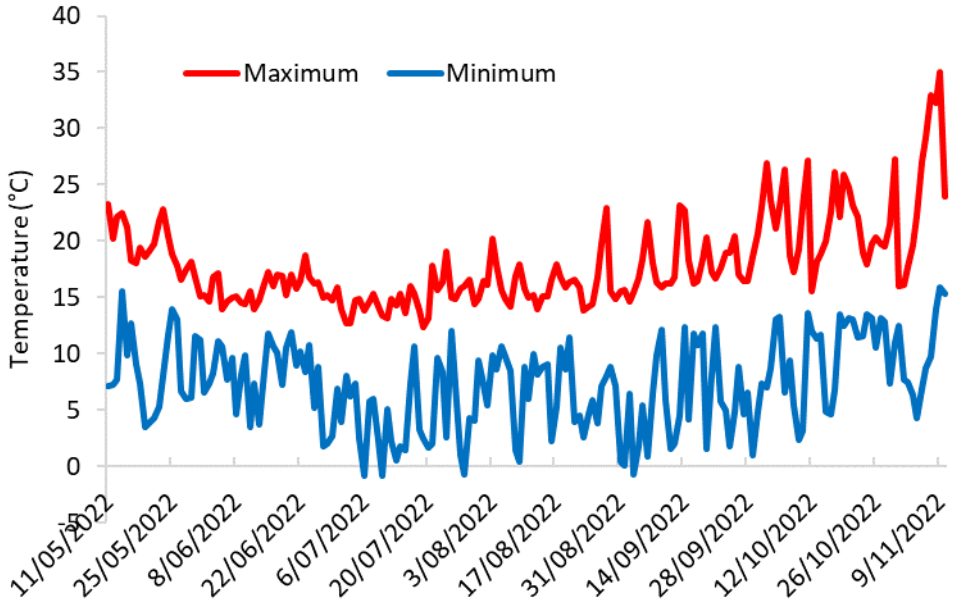

Figure 7. Daily minimum and maximum temperature (°C) recorded during the trial growing season at the Kadina BOM station (#022050), 2022.

LENTIL POD DROP AND STUBBLE HEIGHT

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

Aim: This trial investigates the effect of previous stubble height on lentil growth, canopy structure and pod drop.

Methodology:

Measurements included in-season plant height, GreenSeeker NDVI, harvest plant height, harvest canopy height, harvest lowest pod height, grain yield and pod drop counts. Data was analysed using ANOVA in R statistical package.

Treatments:

The plots and different barley stubble height treatments were established after the grower had sown the paddock to lentils on the 27th of May 2022. A brush cutter was used to cut the stubble to the desired height for the treatments, whilst the standing stubble was not altered.

Table 16. Stubble treatments in lentil pod drop trial at Tickera, SA.

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

Table 17. Agronomic trial details, Tickera 2022.

Trial design	RCBD
Plot size	8.0 m x 3.0 m
Replicates	4
Sowing date	11/05/2022
Plant density	50 kg/ha PBA Highland XT
Row spacing	7.5 inch (sown with grower's John Deere disc seeder)
Fertiliser	70 kg/ha DAP
Harvest date	10/11/2022

Key messages

- Increasing the height of retained stubble resulted in increased lentil plant growth and height.
- Changing the stubble height did not have any effect on lentil pod drop or grain yield in 2022.

Results and Discussion:

An early difference in lentil plant height was measured on the 12th of July. The standing stubble (50 cm) had greater lentil plant height compared to all other treatments (Table 18). The half-height stubble and the stubble cut and retained treatments both had greater lentil plant height than the stubble removed, which was lowest overall. This plant height effect followed through to plant height at harvest, with the standing stubble > half height stubble > stubble cut and retained > stubble removed treatment. However, lentil plant height did not fully reflect the height of the lentil crop canopy. Plant height was measured by standing the lentil plants up and recording the stretched-out height of the plants. Whereas the canopy height was measured by recording the height of the lentil canopy as it stood. Once again, the standing stubble treatment had the

greatest canopy height, greater than the stubble cut and retained and the stubble removed treatment. However, the half-height stubble treatment did not differ from the standing stubble treatment. This indicates utilising a stripper front to keep standing stubble did not result in any differences compared to using a draper front in this season. This was also reflected in the lowest pod measurement, with the standing stubble and half-height stubble treatments being equal and both greater than the remaining two treatments.

GreenSeeker NDVI recorded in September did not show any differences between treatments. There is a chance that any standing stubble still remaining above the canopy height may have interfered with the NDVI readings. There were no differences between stubble treatments for both pod drop and grain yield. This may be due to the seasonal conditions, which were favourable for high rates of lentil growth resulting in larger canopies for all treatments. In an average or drier season, it is possible that the effects of stubble on plant height may be more pronounced in terms of pod drop and overall grain yield. In addition to this there were no significant wind events that caused any widespread pod loss when the crop was mature.

Table 18. Data for all measurements recorded at the pod drop and stubble height trial at Tickera in 2022. Different letters within the same column indicate a significant difference (P<0.05). ns = not significant (P>0.05).

Description	NDVI 19th Sept	Plant height 12th July (cm)	Plant height at harvest (cm)	Canopy height at harvest (cm)	Lowest pod at harvest (cm)	Pod drop (kg/ha)	Grain yield (t/ha)
Standing stubble (50 cm)	0.753	11.6 a	45 a	37 a	16.1 a	415	2.37
Half-height stubble (25 cm)	0.748	9.0 b	43 b	35 ab	16.1 a	370	2.37
Stubble cut (4 cm) and retained	0.728	8.7 b	40 c	33 bc	13.3 b	357	2.32
Stubble cut (4 cm) and removed	0.716	6.5 c	37 d	31 c	12.3 b	337	2.28
Pr(>F)	*0.098*	*<0.001*	*<0.001*	*0.013*	*<0.001*	*0.568*	*0.144*
LSD (0.05)	*ns*	*1.22*	*1.81*	*3.26*	*2.07*	*ns*	*ns*

WARD HILL

SITE SUMMARY

Below average rainfall in February, March and April resulted in dry sowing across most parts of the northern Yorke Peninsula. This was followed by a dry start to May, until 33 mm was received at Ward Hill in the last week of the month. The trial was sown into moist soil following these rains on the 1st of June. Optimal germination and establishment occurred at the site due to moist and cool conditions post seeding. Rainfall received during June to was similar to the long-term average, followed by a dry July. Ward Hill experienced above average spring rainfall with the growing season extending into November (31 mm received early in the month prior to harvest). Growing season (April – October) rainfall for 2022 was 219 mm and below the long-term average of 249 mm. The annual rainfall was 333 mm compared to 344 mm long-term average.

During July and early September there were four occasions where the temperature dropped below 0°C (Figure 2). The lentil trial would have been in vegetative growth stages at these times, keeping frost damage to a minimum. Spring temperatures were generally mild across the northern Yorke area (Figure 2) allowing for a long, wet, and cool finish to the season.

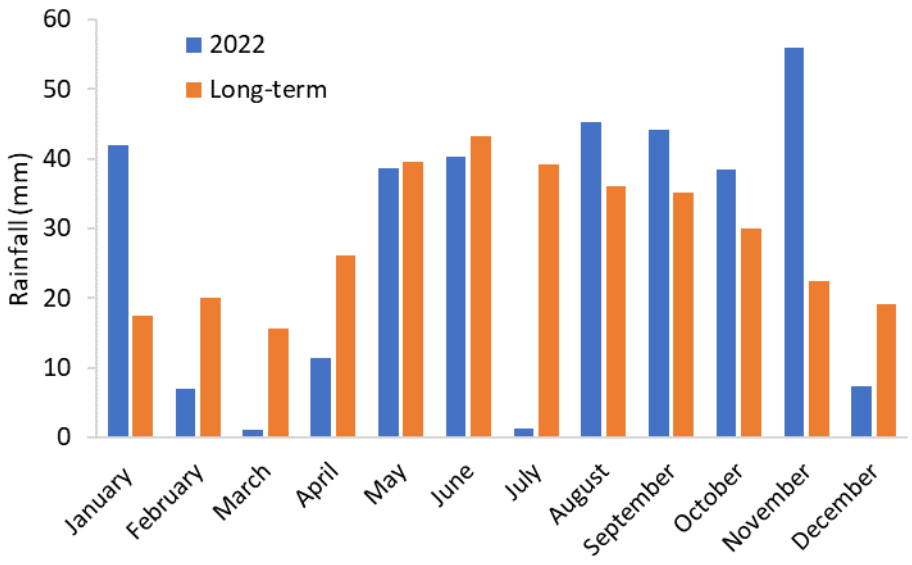

Figure 8. Monthly rainfall recorded at Pt Broughton BOM weather station (#021042) in 2022 and long-term average rainfall.

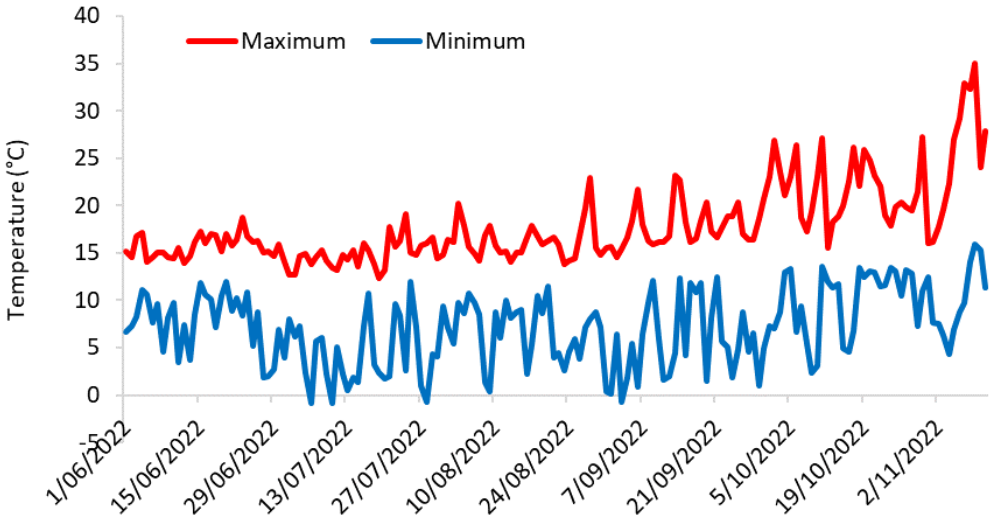

Figure 9. Daily minimum and maximum temperatures (°C) recorded during the 2022 trial growing season at Kadina BOM weather station (#022050).

Table 19. Soil characterisation for Ward Hill trial site, 2022.

Depth (cm)	PBI	DG TP ug/L	P (mg/kg)	S	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)
0-10	33	81	27	5.8	0.84	0.14	7.9	8.3

Depth (cm)	Texture	ECEC	ESP	Exc Al	Exc Ca (meq/100g)	Exc Mg	Exc K	Exc Na
0-10	Loamy sand	19.6	0.4	<0.02	18.0	1.10	0.42	0.08

LENTIL IBS HERBICIDES BY TIME OF ROLLING

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

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

Methodology:

Measurements throughout the season included plant establishment counts, herbicide damage scores, GreenSeeker NDVI and grain yield. Data was analysed using ANOVA in R statistical package.

Treatments:

The trial was a randomised complete block design consisting of 15 treatments. Agronomic treatments consisted of a rolling and herbicide factor. Within the rolling treatments there was:

1. Nil rolling
2. PSPE rolling immediately after seeding on 01/06/2022
3. Post-emergent rolling on 01/07/2022

A hollow steel trial plot roller was used for all rolling treatments.

Five herbicide treatments were also selected consisting of:

1. Nil
2. Diuron 623 g/ha
3. Reflex 500 mL/ha
4. Reflex 1000 mL/ha
5. Diuron 623 g/ha + Reflex 1000 mL/ha

All pre-emergent herbicide treatments were applied immediately prior to sowing.

Table 20. Agronomic details, Ward Hill 2022.

Trial design	RCBD
Plot size	10 m x 1.5 m
Replicates	3
Sowing date	01/06/2022
Plant density	50 kg/ha PBA Hallmark XT
Row spacing	250 mm
Fertiliser	100 kg/ha MAP + 1% Zn
Harvest date	11/11/22

Key messages

- Rolling timing (nil, PSPE and post-emergent) did not consistently impact lentil herbicide damage, NDVI or grain yield in this trial in 2022.
- The use of diuron at 623 g/ha (IBS) or Reflex at 500 mL/ha (IBS) did not reduce grain yield compared to the nil herbicide treatments.
- The application of Reflex at 1000 mL/ha (IBS) caused moderate stunting symptoms and decreased grain yield when compared to the untreated control for all times of rolling.

Results and Discussion:

There was no plant necrosis damage present in the trial, which is generally a symptom of group 5 (previously group C) herbicide damage. The use of diuron (group 5) alone did not cause any herbicide damage symptoms for any rolling times trialled (Table 21).

When Reflex 500 mL/ha was used with nil rolling, this was equal with the nil for stunting and had lower stunting symptoms than PSPE and post-emergent rolling. In general, increasing the rate of Reflex (1000 mL/ha) increased stunting symptoms for all rolling timings. There was no difference between stunting symptoms for any rolling timing when Reflex 1000 mL/ha was used.

Chlorosis symptoms for Reflex 500 mL/ha were consistently greater than nil herbicide but there was no effect of rolling timing. In general, the chlorosis symptoms increased for all rolling timings when the rate of Reflex increased from 500 mL/ha to 1000 mL/ha. The biggest increase in chlorosis for the Reflex rates was in the nil rolling, which had greater symptoms than PSPE and post-emergent rolling.

When Reflex and diuron were used in combination, the stunting symptoms increased for nil and post-emergent rolling but did not increase the severity of PSPE rolling timing compared to Reflex 1000 mL/ha used alone. This combination also increased chlorosis symptoms for the post-emergent rolling timing.

Table 21. Herbicide damage scores including necrosis, stunting and chlorosis (1=nil symptoms, 5=moderate, 9=severe/plant death) scored on the 15th of August for the lentil time of rolling trial in 2022. Different letters within the same column indicate a significant difference (P<0.05). ns = not significant (P>0.05).

Herbicide/s	Rolling	Necrosis	Stunting		Chlorosis	
			August 15th			
Nil	Nil	1.0	1.3	fg	1.0	d
Diuron 623 g/ha	Nil	1.7	1.5	fg	1.0	d
Reflex 500 mL/ha	Nil	1.0	2.2	ef	2.5	c
Reflex 100 0mL/ha	Nil	1.2	5.2	b	4.8	a
Diuron 623 g/ha + Reflex 1000 mL/ha	Nil	1.2	6.5	a	4.8	a
Nil	PSPE	1.0	1.0	g	1.0	d
Diuron 623 g/ha	PSPE	1.2	1.3	fg	1.2	d
Reflex 500 mL/ha	PSPE	1.3	3.3	cd	2.3	c
Reflex 1000 mL/ha	PSPE	1.0	5.0	b	3.8	b
Diuron 623 g/ha + Reflex 1000 mL/ha	PSPE	1.0	5.0	b	3.7	b
Nil	Post-em	1.0	1.0	g	1.0	d
Diuron 623 g/ha	Post-em	1.0	1.0	g	1.0	d
Reflex 500 mL/ha	Post-em	1.2	2.5	de	2.3	c
Reflex 1000 mL/ha	Post-em	1.2	3.8	c	3.5	b
Diuron 623 g/ha + Reflex 1000 mL/ha	Post-em	1.0	5.3	b	4.5	a
Pr(>F)		*0.615*	*<0.001*		*<0.001*	
LSD(0.05)		*ns*	*0.9*		*0.5*	

In general, the NDVI values for all treatments correspond with the herbicide damage scores (

Figure 10.). A strong negative relationship between stunting score and NDVI (

Figure 10.) indicated that herbicide damage symptoms were still influencing the crops biomass in September.

The relationship between stunting score and chlorosis score has an R^2 value of 0.95 (data not presented) indicating stunting and chlorosis symptoms were strongly related (i.e. one symptom not present without the other). Therefore, any yield loss is a combination of both symptoms.

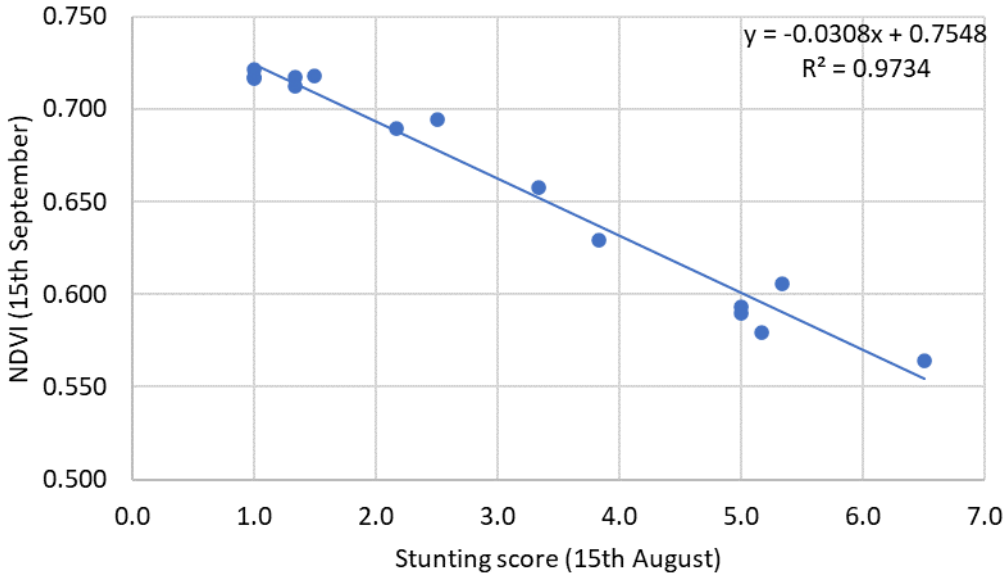

Figure 10. Scatter plot for stunting score (15th August) and Greenseeker NDVI (15th September) showing a strong linear relationship.

Lentil grain yield performance on sandy soils is often related to the amount of spring biomass present within the crop as found in previous trial work. This holds true for this trial, with a linear relationship for NDVI (15th September) and grain yield having an R^2 value of 0.93 (data not presented). However, the effect of rolling on herbicide damage symptoms did not follow expectations.

There was no grain yield reduction from using either diuron 623 g/ha or Reflex 500 mL/ha for any rolling timing compared to the nil herbicide treatments (Table 22). When Reflex 1000 mL/ha was used, the grain yield was reduced for all rolling timings (i.e. crop safety was not improved with post-em rolling). The combination of diuron and Reflex did not further decrease yields compared to Reflex 1000 mL/ha alone.

Table 22. GreenSeeker NDVI data recorded on the 15th of September and grain yield data for the lentil time of rolling trial in 2022. Different letters within the same column indicate a significant difference (P<0.05).

Herbicide	Rolling	NDVI 15th Sep		Grain yield (t/ha)	
Nil	Nil	0.713	a	2.29	a
Diuron 623 g/ha	Nil	0.718	a	2.23	ab
Reflex 500 mL/ha	Nil	0.689	ab	2.23	ab
Reflex 1000 mL/ha	Nil	0.580	ef	1.58	d
Diuron 623 g/ha + Reflex 1000 mL/ha	Nil	0.564	f	1.52	d
Nil	PSPE	0.717	a	2.19	ab
Diuron 623 g/ha	PSPE	0.717	a	2.32	a
Reflex 500 mL/ha	PSPE	0.658	bc	2.15	ab
Reflex 1000 mL/ha	PSPE	0.593	def	1.62	cd
Diuron 623 g/ha + Reflex 1000 mL/ha	PSPE	0.590	ef	1.74	cd
Nil	Post-em	0.721	a	2.23	ab
Diuron 623 g/ha	Post-em	0.716	a	2.33	a
Reflex 500 mL/ha	Post-em	0.694	ab	2.35	a
Reflex 1000 mL/ha	Post-em	0.629	cd	1.93	bc
Diuron 623 g/ha + Reflex 1000 mL/ha	Post-em	0.606	de	1.79	cd
Pr(>F)		*<0.001*		*<0.001*	
LSD(0.05)		*0.038*		*0.311*	