Variety specific agronomy for irrigated soybean crops in south-eastern Australia

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Crop	Soybean – row cropping with furrow irrigation
Irrigation area	Murrumbidgee Valley
Location	Leeton
Seasons	2013–14 to 2017–18

Key findings

- Grain yield was maximised when crops were sown from early November to early December and at plant densities between 30 and 60 plants/m^2.
- Delaying sowing into mid and late December, as well as the reduction of plant density to 15 plants/m^2 resulted in grain yield reductions.
- Varieties Burrinjuck$^{\Phi}$ and Djakal consistently achieved the highest grain yields.
- Variety Burrinjuck$^{\Phi}$ consistently achieved the highest seed protein levels.
- Both variety choice and the application of fungicides proved to be effective techniques for reducing the severity of powdery mildew, however, control of the disease is not always warranted.

Introduction

Soybean is a versatile crop that can provide many benefits to farming systems in the irrigated areas of southern NSW and northern Victoria. Suitability to a late sowing window, along with low input costs, nitrogen fixation and the disease break benefits that soybean crops provide, all improve farming system flexibility, particularly in double cropping situations.

Variety selection and agronomic management are essential aspects in the production of high yielding, high quality soybean crops. Ensuring that management decisions are matched to the geographical region and irrigation method maximises the potential to achieve high yielding, high quality soybean crops. This has been highlighted by previous soybean research and is confirmed with the outcomes of the 'Southern NSW Soybean Agronomy' project (DAN00192), which was a co-investment by NSW DPI and GRDC. The overall aim of this project was to increase the current average grain yield for irrigated soybean in southern NSW and northern Victoria regions from 2.8 t/ha to greater than 3.25 t/ha.

Field experiments were conducted at Leeton in the Murrumbidgee Valley, for five consecutive seasons, 2013–2018. These experiments aimed to develop management packages to maximise soybean yield and quality on a raised bed irrigation layout. A number of key agronomic factors

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including target plant density, sowing date and powdery mildew management were examined and will be discussed in this report.

The soybean varieties examined included the current industry standards Djakal, Snowy[PBR] and Bidgee[PBR] and the recently released variety Burrinjuck[PBR]. Burrinjuck[PBR], Snowy[PBR] and Bidgee[PBR] are clear hilum varieties with seed quality characteristics targeted for the higher value human consumption markets. Djakal is a dark hilum variety with low levels of protein.

Experiment site

The same experiment site was used throughout the five years of experimentation. Figure 1 shows one of the field experiments. Site details are described in Table 1.

Table 1: Site details for the furrow irrigated soybean experiments at Leeton NSW from 2013–14 to 2017–18.

Site detail	Description
Location	Leeton Field Station (LFS), Yanco NSW
Soil type	Grey, self-mulching clay (vertosol)
Fertiliser	125 kg/ha legume starter (N = 13.3%, P = 13.3%, S = 9%, Zn = 0.81%)
Inoculation method	Peat slurry in-furrow injection
Paddock layout	Raised beds (1.83 m centres) with furrow irrigation
Irrigation management	Soil moisture status was tracked using evapotranspiration calculations and gypsum blocks to schedule irrigations to ensure that water stress did not occur.

Figure 1: Soybean agronomy field experiment at Leeton Field Station (LFS), 24 January 2018.

Variety × plant density experiments

Treatments

The response of three soybean varieties under four target plant densities was examined in five consecutive seasons from 2013–14 to 2017–18 (Table 2).

Table 2: Soybean varieties and plant densities evaluated at LFS from 2013–14 to 2017–18.

Season	Varieties	Target plant densities
2013–14	Djakal, Snowy$^{\phi}$, Burrinjuck$^{\phi}$	15, 30, 45, 60 plants/m^2
2014–15	Djakal, Snowy$^{\phi}$, Burrinjuck$^{\phi}$	15, 30, 45, 60 plants/m^2
2015–16	Djakal, Snowy$^{\phi}$, Burrinjuck$^{\phi}$	15, 30, 45, 60 plants/m^2
2016–17	Djakal, Snowy$^{\phi}$, Burrinjuck$^{\phi}$	15, 30, 45, 60 plants/m^2
2017–18	Djakal, Snowy$^{\phi}$, Burrinjuck$^{\phi}$	15, 30, 45, 60 plants/m^2

Results and discussion

A multi-season META analyses was completed on the results of the five seasons of data using the REML liner mixed model procedure (Payne et al. 2015).

In each season, the varieties were sown at rates to establish four target plant densities. The sowing rates were determined using an industry standard calculation, taking into account seed size, germination percentage and estimated establishment percentage. When analysed over the multiple seasons, there were variety, target plant density and interaction effects on plant density established. Established plant densities were consistently lower than the target, with this effect more pronounced at higher target planting densities (Figure 2).

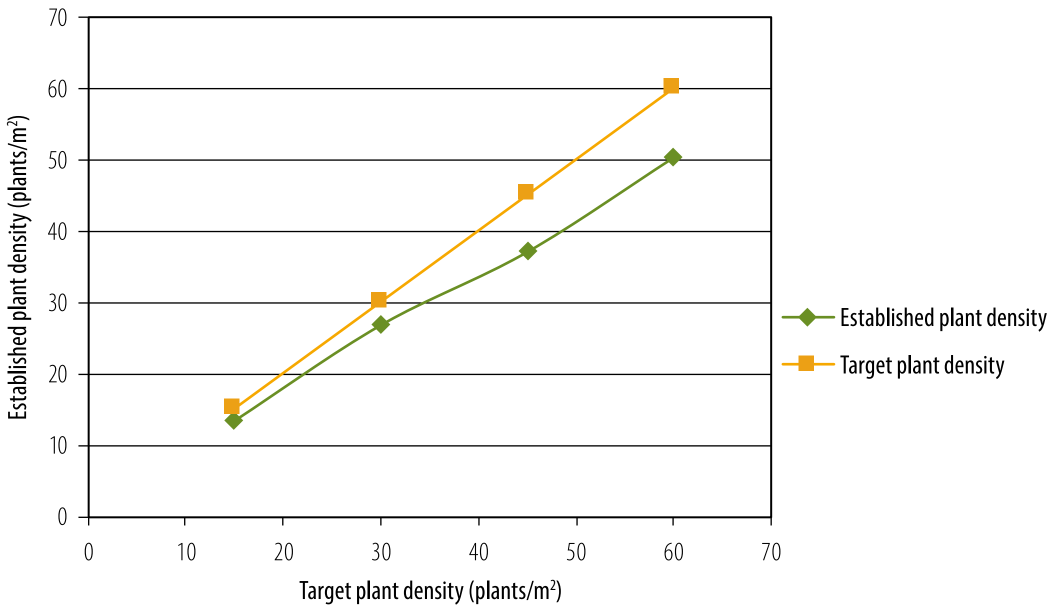

Figure 2: Relationship between target plant density and established plant density at Leeton over multiple seasons (2013–14 to 2017–18).

Multi-season analysis revealed that both variety and target plant density had an effect on grain yield, however, no statistically significant interaction was detected. Target plant densities of 30, 45 and 60 plants/m^2 resulted in the highest grain yield with statistically no difference between them (Table 3). The lowest target plant density of 15 plants/m^2 resulted in the lowest grain yield. These results indicate that maximum grain yields can be achieved over a large range of plant densities, however, planting densities below 30 plants/m^2 should be avoided as they can contribute to a reduction in grain yield.

Grain yields also varied between varieties (Table 3). Varieties Djakal and Burrinjuck$^{\phi}$ produced the highest grain yields, while Snowy$^{\phi}$ achieved significantly lower yields.

The seed protein concentration and seed size varied significantly between plant density and variety treatments, with no interactions detected for either (Table 3). Higher target plant densities resulted in a slightly higher seed protein concentration of 1% between the lowest and highest target plant density. A similar trend with seed size was found with higher target plant densities resulting in slightly larger seed sizes, although the effect was only small.

Seed protein concentration and seed size varied largely between varieties (Table 3). Both seed protein concentration and seed size were highest for Burrinjuck$^{\phi}$, followed by Snowy$^{\phi}$ and then Djakal. Seed protein concentration and size are important grain quality traits for human consumption soybean markets. These findings emphasise the importance of both variety selection and target plant density in meeting market requirements and obtaining price premiums.

Soybean crop maturity was measured as the number of days after sowing (DAS) until 95% of pods reached physiological maturity (P95). The number of days to reach maturity varied between both target plant density and variety, however, no interaction was detected (Table 3). As plant density increased, the days to reach maturity also increased, with a difference of 4.3 days between the lowest (15 plants/m^2) and highest (60 plants/m^2) plant densities. Djakal was the quickest maturing variety, followed by Burrinjuck$^{\phi}$ and then Snowy$^{\phi}$, with a difference of 4.2 days between the maturity of Djakal and Snowy$^{\phi}$.

Soybean lodging was assessed using a visual scoring system ranging from zero to five, where zero indicated erect plants with no lodging and five indicated severe lodging. Lodging varied both between plant density and variety with a significant interaction between them (Table 4). As plant density increased, lodging also increased for all three varieties. Similar levels of lodging occurred for both Djakal and Snowy$^{\phi}$, while in comparison Burrinjuck$^{\phi}$ had lower levels of lodging across all plant densities.

Table 3: Grain yield, seed protein concentration, seed size and maturity length responses for the variety × plant density experiments. Only the main effect results are displayed as interactions were not statistically significant ($P = 0.05$). Treatments with the same letter are not significantly different ($P = 0.05$).

		Grain yield (t/ha)	Seed protein concentration (%)	Seed size (g/100 seeds)	Maturity length (DAS to P95)
Variety	**Djakal**	3.80^{a}	40.0^{c}	21.9^{c}	123.8^{b}
	Snowy	3.16^{b}	42.5^{b}	23.4^{b}	128.0^{a}
	Burrinjuck	3.78^{a}	43.7^{a}	24.7^{a}	126.7^{a}
	l.s.d. ($P = 0.05$)	0.16	0.50	0.40	2.80
Target plant density (plants/m^2)	**15**	3.38^{b}	41.0^{c}	21.1^{b}	119.2^{c}
	30	3.69^{a}	41.3^{bc}	21.8^{a}	120.8^{bc}
	45	3.74^{a}	41.6^{b}	22.0^{a}	122.2^{ab}
	60	3.66^{a}	42.0^{a}	22.1^{a}	123.5^{a}
	l.s.d. ($P = 0.05$)	0.13	0.37	0.33	1.82

Table 4: Lodging score response for the variety × plant density experiments. Treatments with the same letter are not significantly different ($P = 0.05$).

Variety × target plant density		Lodging score (0–5)
Djakal	15	1.9[d]
	30	2.3[cd]
	45	3b[c]
	60	3.8[a]
Snowy	15	1.8[d]
	30	2.7[c]
	45	3.7[ab]
	60	3.9[a]
Burrinjuck	15	0.7[f]
	30	0.9[ef]
	45	1.6[de]
	60	2.3[cd]
	l.s.d. ($P = 0.05$)	0.76

Figure 3: Soybean field experiments at Leeton Field Station, 10 March 2017.

Variety × sowing date experiments

Treatments

The response of four soybean varieties to three sowing dates were examined in four consecutive seasons from 2014–15 to 2017–18 (Table 5).

Table 5: Soybean varieties and sowing dates evaluated at LFS from 2014–15 to 2017–18.

Season	Varieties	Early sowing date	Middle sowing date	Late sowing date
2014–15	Djakal, Snowy⊕, Burrinjuck⊕, Bidgee⊕	20 Nov	5 Dec	22 Dec
2015–16	Djakal, Snowy⊕, Burrinjuck⊕, Bidgee⊕	11 Nov	4 Dec	23 Dec
2016–17	Djakal, Snowy⊕, Burrinjuck⊕, Bidgee⊕	16 Nov	1 Dec	15 Dec
2017–18	Djakal, Snowy⊕, Burrinjuck⊕, Bidgee⊕	13 Nov	30 Nov	18 Dec

Results and discussion

In order to examine the results over the four seasons a multi-season META analyses was completed using the REML liner mixed model procedure (Payne et al. 2015).

As sowing dates varied slightly between seasons, each sowing date was allocated into either 'early', 'mid' or 'late' sowing date grouping to allow for analysis. The early group represents sowing dates early in the soybean sowing window, the mid group in the middle of the sowing window and the late group late in the sowing window.

The multi-season analysis revealed that both variety and sowing date had an effect on grain yield, however, no interaction was detected (Table 6). The mid sowing date resulted in the highest average yields, although not statistically different to the early sowing date. The late sowing date resulted in a significantly lower grain yield compared with the early and mid sowing dates. These results indicate that maximum grain yields can be achieved over a range of sowing dates from early November to early December, however, delaying sowing towards the end of the sowing window can result in a reduction in grain yield.

Grain yields also varied significantly between varieties (Table 6). Variety Djakal was the highest yielding variety with an average grain yield of 3.55 t/ha, although statistically the same as Burrinjuck⊕ with an average grain yield of 3.49 t/ha. Variety Bidgee⊕ was the lowest yielding variety with an average grain yield of 2.32 t/ha, significantly lower than all other varieties.

Seed protein concentration varied between variety and sowing date, however, no interaction was observed. Later sowing dates resulted in a slight decrease in seed protein concentration, although this effect was small, with only a 0.5% protein decrease between the early and late sowing dates. Varieties differed in their protein concentration to a much larger extent. Variety Burrinjuck⊕ achieved the highest seed protein concentration of 44.3%, significantly higher than all the other varieties (Table 6). Djakal achieved the lowest seed protein concentration of 40.5%, significantly lower than the other varieties.

Seed size varied between sowing date and variety with a significant interaction between them (Table 7). The early and mid sowing dates resulted in very similar seed sizes. However, when sowing was delayed until the late sowing date, a significant decrease in seed size occurred for every variety. The seed size decrease was particularly large for Djakal and Burrinjuck⊕.

Maturity length varied both between sowing date and variety, with an interaction between them also detected (Table 7). As expected, due to the strong photo-thermal sensitivity of soybean, sowing date had a large effect on days to reach maturity, with late sowing dates resulting in significantly shorter maturity lengths. Variety Bidgee⊕ was the quickest maturing variety at all sowing dates, followed by Djakal, Burrinjuck⊕ and then Snowy⊕.

Lodging varied between both sowing date and variety with a significant interaction detected (Table 7). Earlier sowing dates resulted in an increase in lodging for all four varieties. For all sowing dates, the highest level of lodging occurred for Snowy$^{\Phi}$, followed by Djakal, Burrinjuck$^{\Phi}$ and Bidgee$^{\Phi}$.

Table 6: Grain yield and seed protein concentration responses for the variety × sowing date experiments. Only main effect results displayed as interactions were not statistically significant (*P* = 0.05). Treatments with the same letter are not significantly different (*P* = 0.05).

		Grain yield (t/ha)	Seed protein concentration (%)
Variety	**Djakal**	3.55^{a}	40.5^{c}
	Snowy	2.85^{b}	42.9^{b}
	Burrinjuck	3.49^{a}	44.3^{a}
	Bidgee	2.32^{c}	42.8^{b}
	l.s.d. (*P* = 0.05)	0.31	0.42
Sowing date	**Early**	3.36^{a}	42.2^{a}
	Mid	3.58^{a}	42.0^{ab}
	Late	3.06^{b}	41.7^{b}
	l.s.d. (*P* = 0.05)	0.23	0.38

Table 7: Lodging score, seed size and maturity length response for the variety × sowing date experiments. Treatments with the same letter are not significantly different (*P* = 0.05).

Variety × sowing date		Lodging score (0–5)	Seed size (g/100 seeds)	Maturity length (DAS to P95)
Djakal	**Early**	3.4^{b}	23.0^{b}	131.0^{b}
	Mid	2.5^{c}	23.1^{b}	123.4^{d}
	Late	2.1^{d}	19.4^{d}	106.0^{g}
Snowy	**Early**	4.1^{a}	23.3^{b}	133.5^{a}
	Mid	3.3^{b}	23.6^{b}	126.4^{c}
	Late	3.2^{b}	21.2^{c}	108.8^{f}
Burrinjuck	**Early**	1.6^{e}	25.2^{a}	131.2^{b}
	Mid	1.3^{ef}	25.4^{a}	125.5^{c}
	Late	0.9^{g}	21.1^{c}	107.2^{fg}
Bidgee	**Early**	1.1^{fg}	18.3^{de}	123.3^{d}
	Mid	1.0^{fg}	18.8^{e}	112.4^{e}
	Late	0.8^{g}	16.5^{f}	97.1^{h}
	l.s.d. (*P* = 0.05)	0.37	0.69	2.05

Powdery mildew management experiments

Treatments

The response of three soybean varieties (Djakal, Snowy[PBR] and Burrinjuck[PBR]) to four or five fungicide treatments was examined in four consecutive seasons. The fungicide treatments are displayed in Table 8.

Table 8: Fungicide treatments and application regimes for each season of field experiments.

Treatments	Application regime	At R2 growth stage		Two weeks after R2	
		Rate	Adjuvant	Rate	Adjuvant
2013–14:					
Untreated control	–	–	–	–	–
Tebuconazole	Single	150 mL/ha	1 %	–	–
Tebuconazole + prothioconazole	Single	400 mL/ha	1 %	–	–
Tebuconazole + prothioconazole	Split	200 mL/ha	1 %	200 mL/ha	1 %
2014–15, 2015–16 and 2016–17:					
Untreated control	–	–	–	–	–
Tebuconazole	Single	240 mL/ha	1 %	–	–
Tebuconazole	Split	200 mL/ha	1 %	200 mL/ha	1 %
Tebuconazole + prothioconazole	Single	400 mL/ha	1 %	–	–
Tebuconazole + prothioconazole	Split	200 mL/ha	1 %	200 mL/ha	1 %

Results and discussion

In recent years powdery mildew (*Erisyphe diffusa* (syn. *Microsphaera diffusa*)) has been observed more regularly in the soybean growing regions of southern NSW. This research aimed to assess its affect on soybean production in southern NSW and examine the effectiveness of a range of fungicide treatments. Fungicides containing tebuconazole and tebuconazole + prothioconazole are discussed throughout this report, however, it should be noted that currently only tebuconazole has a permit for use on soybean crops in Australia (PER82518).

As the treatments were not identical across years, each year/experiment was analysed independently.

Powdery mildew infection severity varied significantly between variety and fungicide treatment and the interaction between them was significant (Table 9). No infection symptoms were observed for Djakal in any of the treatments or seasons, demonstrating its known genetic resistance to powdery mildew. For both susceptible varieties (Snowy[PBR] and Burrinjuck[PBR]), all fungicide treatments resulted in a lower level of powdery mildew symptoms than the untreated control.

Both the split application tebuconazole and the single and split applications of tebuconazole + prothioconazole reduced powdery mildew symptoms of both susceptible cultivars (Snowy[PBR] and Burrinjuck[PBR]) by an average 91%, 95% and 92% respectively (Table 9). In comparison, the single application of tebuconazole only reduced powdery mildew symptoms of Snowy[PBR] and Burrinjuck[PBR] by an average of 60% across the four seasons.

The severity of powdery mildew symptoms was much higher in the 2013–14 and 2014–15 seasons than the 2015–16 and 2016–17 seasons (Table 9). It is hypothesised that this is partially attributed to weather conditions being more conducive to development of the disease. The literature indicates that powdery mildew development is largely influenced by temperature with hastened development under cool temperatures (24 °C), and slowed development under warm temperatures above 30 °C. As shown in Figure 4, the 2013–14 and 2014–15 seasons were exposed to lower than average maximum temperatures in March and April than in the 2015–16 and 2016–17 seasons during the same period. This theory in part may help account for the large variability in severity of powdery mildew symptoms between seasons.

Although significant powdery mildew symptoms were detected on the susceptible varieties in all four seasons, few significant grain yield increases were identified as a result of fungicide application (Table 10). No significant grain yield differences between treatments were detected in the 2013–14, 2015–16 and 2016–17 seasons. However, in the 2014–15 season, the single and split application of tebuconazole + prothioconazole resulted in a 18% and 20% higher grain yield respectively compared with the untreated control. These two grain yield increases were the only statistically significant grain yield variations from the untreated control treatment detected.

Based on current literature, it is hypothesised that the presence of few statistically significant grain yield improvements, even when a high level of powdery mildew control was achieved, is likely a result of the late onset of powdery mildew in the southern NSW region. In all three seasons of this study powdery mildew development was not detected until the R6 and R7 growth stages. By these late growth stages soybean plants had largely set the major components of yield and therefore powdery mildew infection was unlikely to have affected yield.

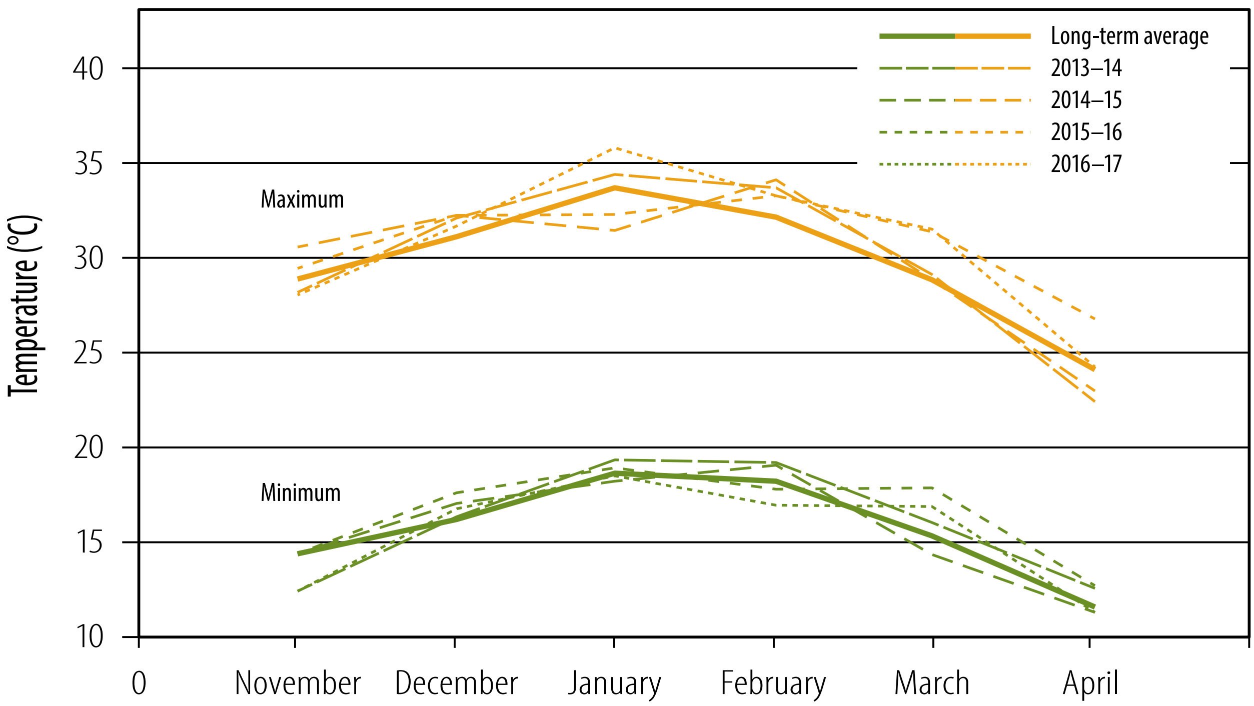

Figure 4: Average monthly minimum and maximum temperatures for each growing season and the long-term average for Yanco Agricultural Institute (Bureau of Meteorology).

Table 9: Fungicide treatment effects on powdery mildew symptom severity (%) during growth stage R7 for three varieties of soybean in four seasons of field experiments. Treatments with the same letter are not significantly different ($P = 0.05$).

Fungicide	Djakal				Snowy				Burrinjuck			
	2013–14	2014–15	2015–16	2016–17	2013–14	2014–15	2015–16	2016–17	2013–14	2014–15	2015–16	2016–17
Untreated	0^{a}	0^{a}	0^{a}	0^{a}	98^{a}	98^{a}	58^{a}	45^{a}	76^{a}	99^{a}	55^{a}	16^{a}
Tebuconazole (single application)	0^{a}	0^{a}	0^{a}	0^{a}	62^{b}	74^{b}	16^{b}	4^{b}	54^{b}	54^{b}	10^{b}	0^{b}
Tebuconazole (split application)	–	0^{a}	0^{a}	0^{a}	–	6^{d}	1^{c}	1^{b}	–	30^{c}	1^{bc}	1^{b}
Tebuconazole + prothioconazole (single application)	0^{a}	0^{a}	0^{a}	0^{a}	15^{c}	0^{d}	0^{c}	0^{b}	6^{c}	5^{d}	3^{bc}	1^{b}
Tebuconazole + prothioconazole (split application)	0^{a}	0^{a}	0^{a}	0^{a}	1^{c}	28^{c}	0^{c}	0^{b}	0^{c}	34^{c}	0^{c}	0^{b}
l.s.d. ($P = 0.05$)	n.s.	n.s.	n.s.	n.s.	16	14	9	7	16	14	9	7

Table 10: Fungicide treatment effects on soybean grain yield (t/ha) for three cultivars in four seasons of field experiments. Treatments with the same letter are not significantly different ($P = 0.05$).

Fungicide	Djakal				Snowy				Burrinjuck			
	2013–14	2014–15	2015–16	2016–17	2013–14	2014–15	2015–16	2016–17	2013–14	2014–15	2015–16	2016–17
Untreated	3.46^{a}	3.56^{a}	3.20^{a}	3.60^{a}	3.37^{a}	3.23^{b}	2.82^{a}	3.08^{a}	3.25^{a}	3.83^{a}	3.63^{a}	3.52^{a}
Tebuconazole (single application)	3.45^{a}	3.81^{a}	3.38^{a}	3.54^{a}	3.26^{a}	3.54^{ab}	2.94^{a}	3.05^{a}	3.59^{a}	4.28^{a}	3.69^{a}	3.49^{a}
Tebuconazole (split application)	–	3.92^{a}	3.22^{a}	3.42^{a}	–	3.69^{ab}	3.22^{a}	2.91^{a}	–	4.20^{a}	3.77^{a}	3.73^{a}
Tebuconazole + prothioconazole (single application)	3.54^{a}	3.33^{a}	3.39^{a}	3.59^{a}	3.40^{a}	3.73^{a}	3.06^{a}	3.05^{a}	3.25^{a}	4.29^{a}	3.61^{a}	3.73^{a}
Tebuconazole + prothioconazole (split application)	3.13^{a}	3.55^{a}	3.30^{a}	3.77^{a}	3.70^{a}	2.77^{a}	2.96^{a}	3.34^{a}	3.55^{a}	4.05^{a}	3.56^{a}	3.75^{a}
l.s.d. ($P = 0.05$)	n.s.	n.s.	n.s.	n.s.	n.s.	0.46	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Figure 5: Soybean rows in a field experiment at Leeton Field Station, 29 January 2016.

Summary

Results from the multi-season experiments demonstrate the importance of variety selection and agronomic management in the production of high yielding, high quality soybean crops. Both plant density and sowing date, in combination with variety selection, are key management decisions which can influence the performance of irrigated soybean production systems.

Established plant density was found to have significant effects on the grain yield, seed protein concentration, seed size, maturity length and lodging of soybean varieties. Grain yields were maximised at plant densities between 30 and 60 plants/m^2. There were slight increases in seed protein concentration, seed size and the days taken to reach maturity as plant density increased. In the variety × plant density experiments, all three varieties suffered from increased lodging as plant density increased. However, Burrinjuck$^{\phi}$ demonstrated strong resistance to lodging, with significantly lower levels of lodging across all target planting densities in comparison to Djakal and Snowy$^{\phi}$.

Sowing date also had significant effects on the measured soybean qualities. In the variety × sowing date experiments, grain yield was maximised at the early and mid sowing dates, indicating an optimal sowing window ranging from mid November to early December for this production region. Slight decreases in seed protein concentration occurred at later sowing dates. Seed size was maximised at the early and mid sowing dates with a large decrease in seed size when sowing was delayed until the late sowing date. As expected, later sowing dates resulted in large decreases in maturity length. Varieties Bidgee$^{\phi}$ and Burrinjuck$^{\phi}$ demonstrated resistance to lodging. Lodging severity decreased in all varieties as the sowing dates were delayed.

Variety choice is a key aspect of maximising the productivity and profitability of soybean production. Variety Burrinjuck$^{\phi}$ performed well over both the plant density and sowing date field experiments achieving equal highest yields. The high seed protein concentration, large seed size and clear hilum of Burrinjuck$^{\phi}$ allow access to human consumption markets, often attracting price premiums. Variety Djakal also achieved the highest yields in both plant density and sowing date field experiments. This, combined with powdery mildew resistance, makes it a popular variety with some growers, however, its low protein and brown hilum restrict its use in many human consumption markets. Variety Snowy$^{\phi}$ consistently achieved lower grain yields than either Burrinjuck$^{\phi}$ and Djakal, however, its moderate protein level, seed size and a clear hilum would be suitable for human consumption markets.

Over the four seasons of field experiments all fungicide treatments were found to be effective at reducing the symptoms of powdery mildew. Both the split application tebuconazole and the single and split applications of tebuconazole + prothioconazole proved to be the most effective fungicide treatments. Variety Djakal demonstrated its known resistance to powdery mildew, while Snowy$^{\phi}$ and Burrinjuck$^{\phi}$ developed a degree of powdery mildew infection symptoms in every season. Few grain yield benefits from the application of fungicide treatments were found, even under high levels of powdery mildew severity.

Reference

Payne, R, Welham, S & Harding, S 2015, A guide to REML in GenStat®, 18th edn, VSN International Ltd, UK.

The project

This variety specific agronomy package (VSAP) is an output of the 'Southern NSW Soybean Agronomy' project (DAN00192; 2014–2018). It summarises the research outcomes for experiments that were conducted in this location on this crop type.

The project focuses on profitable soybean production in modern irrigation farming systems. The project outcomes aim to assist growers to increase the productivity, stability and profitability of irrigated soybean crops in south-eastern Australia. The overall aim is to reach a stable yield average of 3.25 t/ha or greater across the entire growing area. Currently the soybean yield average in this region is 2.8 t/ha. This target will be achieved by developing management packages underpinned by sound scientific principles to increase the reliability and profitability of each soybean variety.

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