Albus lupin, faba bean, vetch, lentil and chickpea variety experiments – Rankins Springs 2021

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Key findings

Faba bean

- PBA Amberley$^{\Phi}$ was the highest yielding variety, while PBA Samira$^{\Phi}$, PBA Nanu$^{\Phi}$, PBA Marne$^{\Phi}$, PBA Bendoc$^{\Phi}$ and Nasma$^{\Phi}$ had similar grain yields.
- PBA Marne$^{\Phi}$ and PBA Nasma$^{\Phi}$ had the highest hundred seed weight.
- PBA Nanu$^{\Phi}$ and PBA Nasma$^{\Phi}$ were the earliest to flower and continued to flower for over 50 days. PBA Amberley$^{\Phi}$ and PBA Samira$^{\Phi}$ were last to begin flowering and had two of the three shortest flowering durations.

Albus lupin

- The early flowering Murringo$^{\Phi}$ was the highest yielding variety, while Luxor$^{\Phi}$ and Rosetta$^{\Phi}$ yielded similarly.
- Murringo$^{\Phi}$ was the earliest flowering, followed by Luxor$^{\Phi}$ then Rosetta$^{\Phi}$.
- Rosetta$^{\Phi}$ had the highest hundred seed weight, while Luxor$^{\Phi}$ had the lowest.

Vetch

- Timok$^{\Phi}$ and Volga$^{\Phi}$ were the highest yielding varieties. Studenica$^{\Phi}$ and Morava$^{\Phi}$ yielded the lowest and were not significantly different from each other.
- There were no significant differences in peak dry matter between varieties.
- Studenica$^{\Phi}$ was first to flower and had the longest flowering duration. Morava$^{\Phi}$ flowered last.
- Studenica$^{\Phi}$ was the earliest to mature, followed by Volga$^{\Phi}$, and Timok$^{\Phi}$. Morava$^{\Phi}$ matured significantly later.

Lentil

- The highest yielding variety was PBA Ace$^{\Phi}$. There was some loss of pod/seed due to weather conditions before harvest, but this did not influence grain yield values.
- PBA Blitz$^{\Phi}$ and PBA Kelpie XT$^{\Phi}$ were the earliest flowering varieties and had the longest flowering duration. Nipper$^{\Phi}$ and PBA Flash$^{\Phi}$ flowered last.
- PBA Kelpie XT$^{\Phi}$ and PBA Hallmark XT$^{\Phi}$ matured earliest, while Nipper$^{\Phi}$, PBA Ace$^{\Phi}$ and PBA Jumbo2$^{\Phi}$ matured significantly later.

Chickpea

- Average chickpea grain yield was significantly lower than all other pulse species at this site. This is attributed to the cooler than average mean daily temperatures affecting pod set during the critical reproductive window.
- While all varieties yielded above average for this environment, PBA Slasher$^{\Phi}$ was the best performing variety with a grain yield of 2.8 t/ha.

Keywords Rankins Springs, 2021, pulses, legumes, variety

Introduction

Variety experiments were conducted at Rankins Springs in 2021 to evaluate the phenology and grain yield responses of 6 faba bean, 3 albus lupin, 4 vetch and 11 lentil varieties. Data was collected to assess each variety's establishment (scores), flowering dates, maturity rating, grain yield and seed weight.

In addition, chickpea evaluation experiments were conducted at Rankins Springs in 2017, 2019, 2020 and 2021 to assess a range of commercially available chickpea varieties. The predicted mean yield values are presented.

Site details

Location	Rankins Springs
Soil type	Sandy loam
Soil pH_{Ca}	4.8 (0–5 cm), 4.4 (5–10 cm), 4.7 (10–15 cm), 5.3 (15–20 cm), 5.6 (20–25 cm), 5.9 (25–30 cm)
Previous crop	Wheat
Rainfall	• Fallow (November–March): 203 mm • Fallow long-term average (LTA): 170 mm • In-crop (April–October): 291 mm • In-crop LTA (April–October): 232 mm
Fertiliser	100 kg/ha, mono-ammonium phosphate (MAP) 50% and single super phosphate (SSP) 50% (blend) (nitrogen [N]: 5, phosphorus [P]: 15.4, potassium [K]: 0, sulfur [S]: 6.25)
Sowing date and harvest date	T Table 1 shows sowing and harvest dates for each species.
Site climate	Figure 1 presents the climate data for the site.

Table 1 Sowing and harvest dates for experiments conducted at Rankins Springs, 2021.

Species	Sowing date	Harvest date
Faba bean	18 May 2021	23 November 2021
Vetch	18 May 2021	23 November 2021
Lentil	18 May 2021	1 December 2021
Lupin	19 May 2021	17 December 2021

Treatments

Variety

Faba bean

PBA Amberley$^{\Phi}$, PBA Bendoc$^{\Phi}$, PBA Marne$^{\Phi}$, PBA Nanu$^{\Phi}$, PBA Nasma$^{\Phi}$ and PBA Samira$^{\Phi}$

Albus lupin

Luxor$^{\Phi}$, Murringo$^{\Phi}$, and Rosetta$^{\Phi}$

Vetch

Morava$^{\Phi}$, Studenica$^{\Phi}$, Timok$^{\Phi}$ and Volga$^{\Phi}$

Lentil

Nipper$^{\Phi}$, PBA Ace$^{\Phi}$, PBA Blitz$^{\Phi}$, PBA Bolt$^{\Phi}$, PBA Flash$^{\Phi}$, PBA Hallmark XT$^{\Phi}$, PBA Highland XT$^{\Phi}$, PBA Hurricane XT$^{\Phi}$, PBA Jumbo2$^{\Phi}$ and PBA Kelpie XT$^{\Phi}$ (red), and PBA Greenfield$^{\Phi}$ (green)

Chickpea

Year 2017: Neelam$^{\Phi}$, PBA Boundary$^{\Phi}$, PBA Slasher$^{\Phi}$ and PBA Striker$^{\Phi}$

Year 2019: CBA Captain$^{\Phi}$, Genesis™090, Neelam$^{\Phi}$, PBA Boundary$^{\Phi}$, PBA HatTrick$^{\Phi}$, PBA Maiden$^{\Phi}$, PBA Seamer$^{\Phi}$, PBA Slasher$^{\Phi}$ and PBA Striker$^{\Phi}$

Year 2020: CBA Captain$^{\Phi}$, Neelam$^{\Phi}$, PBA Maiden$^{\Phi}$, PBA Slasher$^{\Phi}$ and PBA Striker$^{\Phi}$

Year 2021: CBA Captain$^{\Phi}$, Neelam$^{\Phi}$, PBA Maiden$^{\Phi}$, PBA Slasher$^{\Phi}$ and PBA Striker$^{\Phi}$

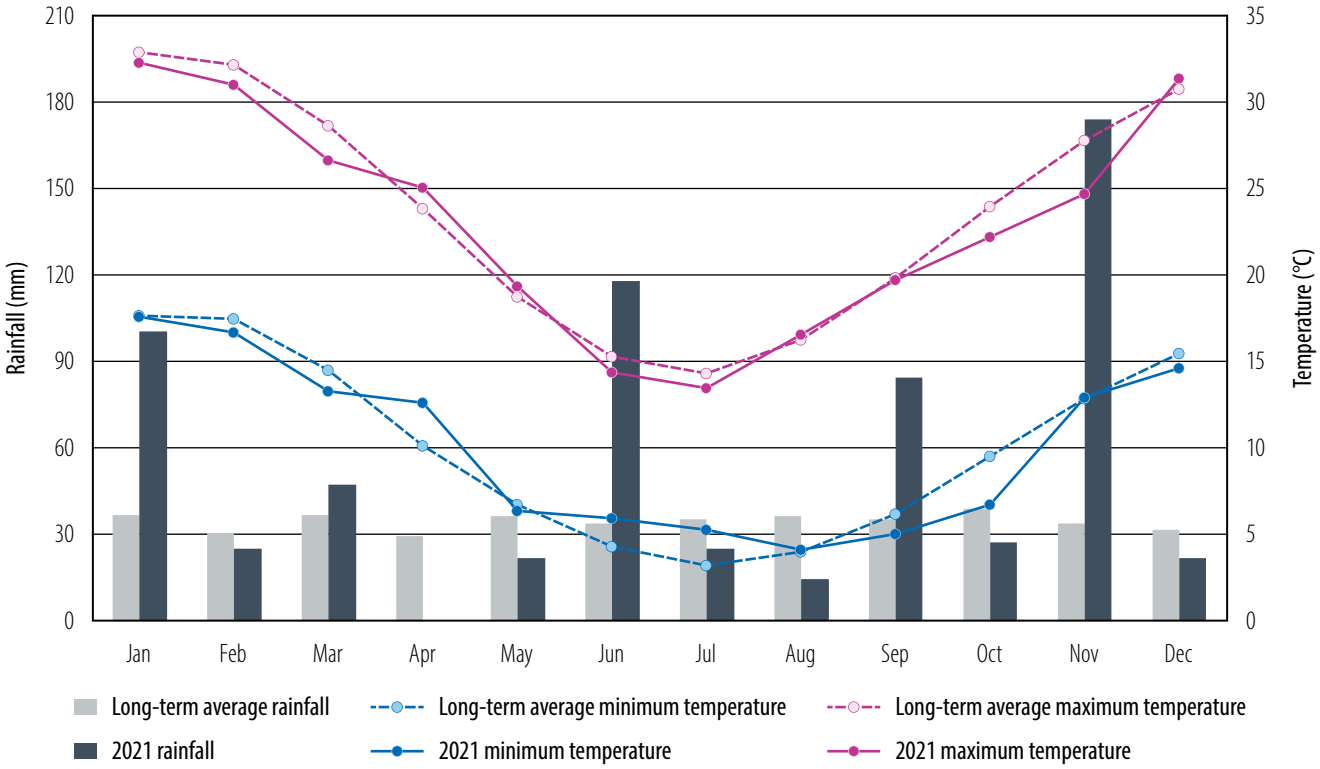

Figure 1 Monthly rainfall and monthly average minimum and maximum temperature for Hillview, Rankins Springs in 2021 and the long-term average.

Results

Seasonal conditions

The 2021 season at Rankins Springs was exceptional with above average rainfall in June, September and November. La Niña conditions resulted in cooler than average temperatures and wetter conditions throughout the growing season. The Rankins Springs site recorded 5 frosts (<0 °C) during flowering (August to September). There was a severe frost of –2 °C on 26 September that lasted 4 hours. Overall, the seasonal conditions were conducive to above average grain yields across all pulse species with a long, cool spring combined with negligible moisture, heat or disease stress.

Faba bean

PBA Amberley$^{\Phi}$ had the highest yield (3.9 t/ha), while PBA Samira$^{\Phi}$, PBA Nanu$^{\Phi}$, PBA Marne$^{\Phi}$, PBA Bendoc$^{\Phi}$ and Nasma$^{\Phi}$ had similar yields ranging from 3.18 t/ha to 3.43 t/ha (Table 2).

PBA Nanu$^{\Phi}$ and PBA Nasma$^{\Phi}$ were the earliest flowering varieties (87 days after sowing [DAS]) and had some of the longest flowering durations, with 51 and 50.7 days, respectively. PBA Amberley$^{\Phi}$ and PBA Samira$^{\Phi}$ were last to begin flowering (96 DAS) and had two of the three shortest flowering durations.

Table 2 Faba bean variety evaluation experiment results, Rankins Springs 2021.

Variety	Establishment (plants/m²)	Flowering (DAS)		Flowering duration (days)	Grain yield (t/ha)	Hundred seed weight (g)
		Start	End			
PBA Amberley	27.7	96.7	144.0	47.3	3.89	62.2
PBA Bendoc	35.0	93.3	146.3	53.0	3.29	57.8
PBA Marne	32.3	91.3	138.0	46.7	3.32	76.4
PBA Nanu	35.7	87.0	138.0	51.0	3.39	67.3
PBA Nasma	30.7	87.0	137.7	50.7	3.18	82.3
PBA Samira	34.0	96.0	145.7	49.7	3.43	67.6
Site mean	32.3	91.1	140.8	49.7	3.41	69.2
l.s.d. (P<0.05)	n.s.	1.7	2.9	3.3	0.25	3.9

l.s.d. = least significant difference; n.s. = not significant, DAS = days after sowing.

Albus lupin

There were significant differences in time to flowering, grain yield and hundred seed weight in the albus lupin experiment (Table 3). Murringo$^{\Phi}$ was the earliest flowering variety (94.5 DAS), with Luxor$^{\Phi}$ and Rosetta$^{\Phi}$ flowering later (100 and 108 DAS, respectively). The early flowering Murringo$^{\Phi}$ was the highest yielding variety (3.7 t/ha), while Luxor$^{\Phi}$ and Rosetta$^{\Phi}$ yielded 3.4 t/ha, similar to the site mean at 3.5 t/ha. Rosetta$^{\Phi}$ had the highest hundred seed weight (34.5 g), while Luxor$^{\Phi}$ had the lowest at 31.8 g.

Table 3 Lupin variety evaluation experiment results, Rankins Springs 2021.

Variety	Establishment (plants/m²)	Vigour score*	Flowering (DAS)		Flowering duration (days)	Grain yield (t/ha)	Hundred seed weight (g)
			Start	End			
Luxor	41.3	6.5	100.3	151.7	51.3	3.42	31.76
Murringo	43.3	7.7	94.5	146.8	52.3	3.69	33.16
Rosetta	46.8	7.5	108.3	148.8	40.5	3.38	34.53
Site mean	43.8	7.2	101.1	149.1	48.1	3.50	33.15
l.s.d. (P<0.05)	n.s.	0.9	0.8	1.2	1.2	0.19	1.07

l.s.d. = least significant difference; n.s. = not significant; *Vigour score: 1 = poor, 9 = excellent.

Vetch

Timok$^{\Phi}$ (3.82 t/ha) and Volga$^{\Phi}$ (3.67 t/ha) yielded significantly more than Studenica$^{\Phi}$ or Morava$^{\Phi}$, both 3.22 t/ha (Table 4). Studenica$^{\Phi}$ was first variety to flower (98 DAS) and had the longest flowering duration, Morava$^{\Phi}$ was the last to start flowering (122 DAS). Morava$^{\Phi}$ was the last variety to finish flowering (151 DAS), nearly 2 weeks after the other 3 varieties had finished (approximately 138 DAS), around 4 October 2021. This was reflected in the visual maturity score where Studenica$^{\Phi}$ started to mature before Timok$^{\Phi}$ and Volga$^{\Phi}$, with Morava$^{\Phi}$ having only started to mature at the time that the score was taken.

There were also significant differences in maturity. Studenica$^{\Phi}$ was the earliest maturing variety, followed by Volga$^{\Phi}$ and Timok$^{\Phi}$. Morava$^{\Phi}$ was significantly later maturing.

Table 4 Vetch variety evaluation experiment results, Rankins Springs 2021.

Variety	Flowering (DAS)		Flowering duration (days)	Dry matter (t/ha) 27 Sep 2021	Maturity score** 18 Nov 2021	Grain yield (t/ha)
	Start	End				
Timok	110.7	138.0	27.3	6.24	4.3	3.82
Volga	109.3	137.7	28.3	5.25	3.3	3.67
Studenica	98.0	137.3	39.3	5.92	1.0	3.22
Morava	121.7	151.3	29.7	5.75	8.7	3.22
Site mean	109.9	141.1	31.2	5.79	4.3	3.48
l.s.d. (P<0.05)	1.8	1.4	1.8	n.s.	1.6	0.46

l.s.d. = least significant difference; n.s. = not significant; **Maturity score: 1 = early, 9 = late.

Lentil

The highest yielding variety was PBA Ace$^{\Phi}$ (4.01 t/ha), while the lowest yielding were PBA Flash$^{\Phi}$ and Nipper$^{\Phi}$ (2.85 and 2.91 t/ha, respectively) (Table 5). The site mean for grain yield was 3.26 t/ha. There was some loss of pod/seed due to weather conditions before harvest, which would have slightly affected grain yield values.

PBA Blitz$^{\Phi}$ and PBA Kelpie XT$^{\Phi}$ were the earliest flowering varieties (98.5 and 101 DAS, respectively) and had the longest flowering duration (61.5 and 65 days, respectively). In contrast, Nipper$^{\Phi}$ and PBA Flash$^{\Phi}$ flowered the latest (114 and 112 DAS, respectively) and had the 2 shortest flowering durations (47 and 47.5 days, respectively).

There were significant differences in maturity with PBA Kelpie XT$^{\Phi}$ and PBA Hallmark XT$^{\Phi}$ maturing early, while Nipper$^{\Phi}$, PBA Ace$^{\Phi}$ and PBA Jumbo2$^{\Phi}$ matured last.

Table 5 Lentil variety evaluation experiment results, Rankins Springs 2021.

Variety	Vigour score*	Days to flower (DAS)	Flower duration (days)	Maturity score**	Grain yield (t/ha)
Nipper	7.0	114.0	47.0	6.0	2.91
PBA Ace	8.0	108.0	53.5	6.0	4.01
PBA Blitz	8.5	98.5	61.5	5.0	3.19
PBA Bolt	8.5	103.5	59.5	4.0	3.40
PBA Flash	8.0	112.0	47.5	5.0	2.85
PBA Greenfield	7.5	108.0	52.5	5.0	3.58
PBA Hallmark XT	8.0	105.5	57.5	3.0	3.33
PBA Highland XT	8.5	102.0	61.0	4.0	3.28
PBA Hurricane XT	7.5	108.0	56.0	4.0	3.49
PBA Jumbo2	8.0	106.0	56.0	6.0	3.19
PBA Kelpie XT	8.5	101.0	65.0	3.0	3.25
Site mean	8.0	105.6	56.4	4.8	3.26
l.s.d. (P<0.05)	n.s.	2.5	4.0	2.0	0.71

l.s.d. = least significant difference; n.s. = not significant; *Vigour score: 1 = poor, 9 = excellent; **Maturity score: 1 = early, 9 = late.

Chickpea

The 2021 season produced high grain yields across all varieties at Rankins Springs with a site mean of 2.60 t/ha (Table 6). The best performing variety was PBA Slasher$^{\Phi}$ yielding 108% (2.82 t/ha) of site predicted mean yield. CBA Captain$^{\Phi}$ had the lowest yield in 2021 (2.44 t/ha) which was 94% of the site predicted mean yield.

Grain yield analysis for commercial varieties over the 2017 to 2021 growing seasons showed variation, with 2017 having the lowest grain yield with a site mean of 1.16 t/ha. On average, varieties yielded more than 1.44 t/ha lower compared with 2021. Three varieties (Neelam$^{\Phi}$, PBA Slasher$^{\Phi}$ and PBA Striker$^{\Phi}$) were included in all 4 experimental years. In 2017, the highest yielding varieties were PBA Boundary$^{\Phi}$ and PBA Slasher$^{\Phi}$ (both 1.29 t/ha).

Chickpea evaluation experiments conducted at Rankins Springs across 4 years highlight the exceptional 2021 season with high yields for all varieties and a site mean of 2.60 t/ha. In comparison, the less favourable 2017 and 2019 seasons produced site mean yields of 1.16 t/ha and 1.38 t/ha, respectively.

Table 6 Grain yield (t/ha) of chickpea variety experiments conducted at Rankin Springs from 2017 to 2021.

Variety	Grain yield (t/ha) (%SMY)			
	Experiment year			
	2017	2019	2020	2021
CBA Captain	*	1.38 (100)	2.59 (109)	2.44 (94)
Genesis090	*	1.41 (102)	*	*
Neelam	1.27 (109)	1.47 (107)	2.68 (113)	2.67 (102)
PBA Boundary	1.29 (111)	1.36 (99)	*	*
PBA HatTrick	*	1.36 (98)	*	*
PBA Maiden	*	1.28 (93)	2.61 (110)	2.59 (99)
PBA Seamer	*	1.29 (93)	*	*
PBA Slasher	1.29 (111)	1.48 (107)	2.74 (115)	2.82 (108)
PBA Striker	1.27 (109)	1.50 (108)	2.66 (112)	2.74 (105)
Site mean	1.16 (100)	1.38 (100)	2.37 (100)	2.60 (100)
Sowing date	17 May	9 May	18 May	19 May
Harvest date	12 Dec	22 Nov	10 Dec	14 Dec

%SMY = Percentage of grain yield compared with site mean yield; * = variety not included in experiments that year.

Summary

The combination of mild winter temperatures, minimal frosts and adequate soil moisture during spring and early summer resulted in all pulse and legume species producing high yields when compared with previous years. Due to minimal biotic and abiotic stress during the growing season, there was no relationship between flowering dates and yield for any of the species tested, however, there were significant differences in the yields between varieties within individual species.

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