Barellan

Barellan site attributes
2023

Focus

Pulse species and variety comparison

- Evaluation of pulse species including lentils, lupins, field peas, vetch, and faba beans
- Determine which pulse species maintains nitrogen fixation at high base soil nitrogen levels.

Rainfall

Table 22: *Monthly rainfall for 2022, 2023 and long-term average (LTA, 1878–2023) at Barellan Post Office (BOM Number 74005) and total annual and growing season (GSR, April–October) rainfall.*

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	GSR
2022	163.4	9.2	83.2	63.5	79.0	22.2	27.9	80.7	76.3	107.0	81.3	14.0	807.7	456.6
2023	43.6	0	79.1	44.6	17.0	50.3	22.8	19.3	4.3	10.0	97.7	40.4	429.1	168.3
LTA	38.3	33.9	38.2	34.7	37.5	40.3	36.5	38.0	34.9	42.7	35.1	31.6	441.7	264.6

Crop sequence and key management dates

Crop sequence		
Year	Crop	Cultivar
2022	Wheat	Scepter$^{\phi}$
2021	Canola	Pioneer® 43Y92CL
2020	Barley	Spartacus CL$^{\phi}$

Site management 2023		
Activity	Date	Comments
Sowing	9 May	All species and varieties
Establishment	20 June	Establishment scores
Sampling	21 September	Vetch hay cut – early podding
Harvest	13 November	All species and varieties

Pulse species and variety evaluation, Barellan 2023

Soil characteristics

Sampled February 2023		Soil depth (cm)	
Characteristic	Unit	0–10	10–60
NO_3 N (ppm)	ppm	18	4
NH_4 N (ppm)	ppm	0	0
Phosphorus [Colwell]	ppm	39	
Potassium [Am. Acet.]	meq/100 g	1.19	
Magnesium [Am. Acet.]	meq/100 g	0.84	
Calcium [Am. Acet.]	meq/100 g	4.57	
Sulphur [MCP]	ppm	9	
Manganese [DTPA]	ppm	41.8	
Boron [$CaCl_2$]	ppm	0.4	
Copper [DTPA]	ppm	0.4	
Iron [DTPA]	ppm	16	
Zinc [DTPA]	ppm	0.2	
Organic matter	%	2.2	
CEC	meq/100 g	6.66	
Ca:Mg ratio		5.44	
K base saturation	%	17.9	
Mg base saturation	%	12.6	
Ca base saturation	%	68.6	
Na base saturation	%	0.1	
pH [1:5 $CaCl_2$]		4.9	
EC [1:5 H_2O]	dS/m	0.06	
Aluminium [KCl]	meq/100 g	0.05	
Chloride	ppm	31	
Sodium [Am. Acet.]	meq/100 g	-0.08	
Organic carbon	%		
Soil N	kg N/ha	21.6	26
Total N (0–60 cm)	kg N/ha	47.6	

Chickpeas (L), field peas (R), 22 August 2023

Barellan field day, 26 September 2023

Field pea harvest, 13 November 2023

Pulse species and variety comparison

Barellan 2023

Key findings

- **Faba bean** grain yield averaged 1.53 t/ha and peak biomass 4.01 t/ha with no difference between varieties or PBA Samira +N treatment. FBA Ayla[Φ] produced the smallest seed (49.33 g/100 seeds) of all varieties, while PBA Amberley[Φ] produced the largest (63.11 g/100 seeds).
- **Field pea** highest yielding variety was APB Bondi[Φ] (1.88 t/ha) and the lowest was Sturt[Φ] (1.42 t/ha). The addition of N to PBA Butler[Φ] made no difference to peak biomass but reduced grain yield by 0.17 t/ha. Of all varieties PBA Taylor[Φ] produced the largest seed (18.89 g/100 seeds), while Sturt[Φ] produced the smallest (16.01 g/100 seeds).
- **Lentil** variety GIA Thunder[Φ] was the highest yielding (1.25 t/ha) and GIA Leader[Φ] the lowest (0.83 t/ha). GIA Thunder[Φ] also produced the largest seed (5.08 g/100 seeds). There was no difference in grain yield or peak biomass by the addition of N to PBA Hallmark XT[Φ].
- **Lupin** yield of the albus variety Luxor[Φ] (1.14 t/ha) was lower than all other varieties in the trial including the albus variety Murringo[Φ] (1.63 t/ha). Luxor[Φ] also produced lower peak biomass (3.7 t/ha) than both PBA Bateman[Φ] (5.92 t/ha) and PBA Bateman[Φ] +N (7.53 t/ha). The average seed size of narrow leaf lupin varieties was 16.44 g/100 seeds, compared to 33.93 g/100 seeds for albus lupin varieties.
- **Vetch** variety Timok[Φ] (1.38 t/ha) and Timok[Φ] +N (1.52 t/ha) were the highest yielding treatments in the trial, while Volga[Φ] (0.81 t/ha) and Studenica[Φ] (0.95 t/ha) were the lowest. Volga[Φ] produced larger seed (8.6 g/100 seeds) than all other varieties. The addition of N to Timok[Φ] made no difference to peak biomass. A hay cut completed at early podding (21 September) resulted in average biomass (above ground) of ~5 t/ha for Studenica[Φ], Timok[Φ] and Volga[Φ], with no effect from the addition of nitrogen on the biomass of Timok[Φ]. Rasina[Φ] had lower biomass than the three other varieties (3.9 t/ha).

Trial details

The pulse species and variety comparison trial in 2023 was set up to:

1. evaluate and compare the performance of major pulse crops (faba beans, field peas, lentils, lupins, vetch) in the northern Riverina region; and
2. measure the nitrogen balance (nitrogen fixed minus nitrogen removed) of the pulse species and how that is affected by elevated soil mineral N (using nitrogen fertiliser).

Seasonal conditions

The 2022 season was generally wet, so coming into the 2023 season there was a full profile of water. The trial was sown 9 May, with the topsoil starting to dry, as there was little rain during the second half of April and most of May. These drier conditions led to slow early crop growth.

Good rain followed in June and early July, which promoted crop growth, which then tapped into subsoil moisture reserves. Late winter and early spring were dry with extreme heat and some frost experienced in September. Rain in early October was timely, following the warm weather in late September, as conditions were starting to dry. The season finished with hot dry conditions.

Trial set up

Five separate pulse variety trials were sown at the site, therefore statistical comparisons between species (faba beans, field peas, lentils, lupins and vetch) cannot be made. Each pulse species included four varieties (Table 1) and for one variety of each species 100 kg N/ha was applied pre-sowing as urea.

Measurements included peak biomass (related to nitrogen fixation and measured on selected varieties), grain yield, and seed size. Peak biomass and seed from one variety from each species will be further analysed to determine total N fixation and N removal.

Table 23: *Trial management and the pulse species and varieties evaluated at Barellan in 2023.*

Management	2023				
Pre-sow herbicides	2 May: Nufarm Crucial® @ 1.1 L/ha + Terbyne® Xtreme® @ 1 kg/ha + TriflurX® @ 1.2 L/ha				
Sowing date	9 May				
Starter fertiliser	SuPerfect® (8.8% phosphorus, 11% sulphate sulphur, 19% calcium) @ 80 kg/ha				
Nitrogen fertiliser	9 May: 100 kg N/ha IBS (as urea) to appropriate species +N plots				
Sowing rate	Calculated from seed size for target population (see below)				
Post-emergent herbicides	30 June: Nufarm Factor® @ 80 g/ha + Status® @ 0.5 L/ha + Hasten @ 1%				
Fungicide	19 August: Miravis® Star @ 1.0 L/ha				
Insecticide	28 September: Trojan @ 30 mL/ha + BS1000 @ 0.2%				
Harvest	13 November				
Species	**Target plant population (plant/m²)**	**Variety**			**Variety +N**
Lentils	100	PBA Hallmark XT$^{\phi}$	CIPAL2122	PBA Kelpie XT$^{\phi}$	GIA Leader$^{\phi}$	PBA Hallmark XT$^{\phi}$ +N
Vetch	40	Timok$^{\phi}$	Rasina$^{\phi}$	Volga$^{\phi}$	Studenica$^{\phi}$	Timok$^{\phi}$ +N
Field Pea	40	PBA Butler$^{\phi}$	PBA Taylor$^{\phi}$	Sturt$^{\phi}$	APB Bondi$^{\phi}$	PBA Butler$^{\phi}$ +N
Lupin	30–40	PBA Bateman$^{\phi}$	Luxor$^{\phi}$	Mandelup$^{\phi}$	Murringo$^{\phi}$	PBA Bateman$^{\phi}$ +N
Faba bean	20	FBA Ayla$^{\phi}$	PBA Nasma$^{\phi}$	PBA Samira$^{\phi}$	PBA Amberley$^{\phi}$	PBA Samira$^{\phi}$ +N

Pulse species and variety comparison trials at Barellan, 22 August 2023

Results

Vetch hay

Table 24: *Vetch biomass at early podding stage or hay cut time (21 September) at Barellan in 2023.*

Vetch variety	Hay dry matter* (t/ha)
Rasina	3.91[b]
Studenica	5.03[a]
Timok	4.88[a]
Timok +N	4.88[a]
Volga	5.34[a]
Mean	4.81
l.s.d. (*P* = 0.05)	0.795

Note: Means followed by same letter do not significantly differ
* Samples cut at ground level and may not be completely reflective of a commercial hay cut yield.

Vetch samples cut at early podding to simulate a hay cut, 21 September 2023

Peak biomass

Representative varieties from each species and the +N treatment were sampled for peak biomass (*Table 25*).

Table 25: *Peak biomass of representative varieties of each pulse species at Barellan in 2023.*

Variety	Dry matter (t/ha)
Field peas	
PBA Butler	5.86
PBA Butler +N	5.56
Mean	5.71
l.s.d. (*P* = 0.05)	n.s.
Faba beans	
PBA Nasma	4.46
PBA Samira	3.58
PBA Samira +N	3.99
Mean	4.01
l.s.d. (*P* = 0.05)	n.s.

Variety	Dry matter (t/ha)
Lentils	
PBA Hallmark XT	3.82
PBA Hallmark XT +N	4.00
Mean	4.13
l.s.d. (*P* = 0.05)	n.s.
Lupins	
Luxor	3.70
PBA Bateman	5.92
PBA Bateman +N	7.53
Mean	5.72
l.s.d. (*P* = 0.05)	2.185

Variety	Dry matter (t/ha)
Vetch	
Timok	6.52
Timok +N	6.85
Mean	6.68
l.s.d. (*P* = 0.05)	n.s.

n.s. = not significant

Grain yield

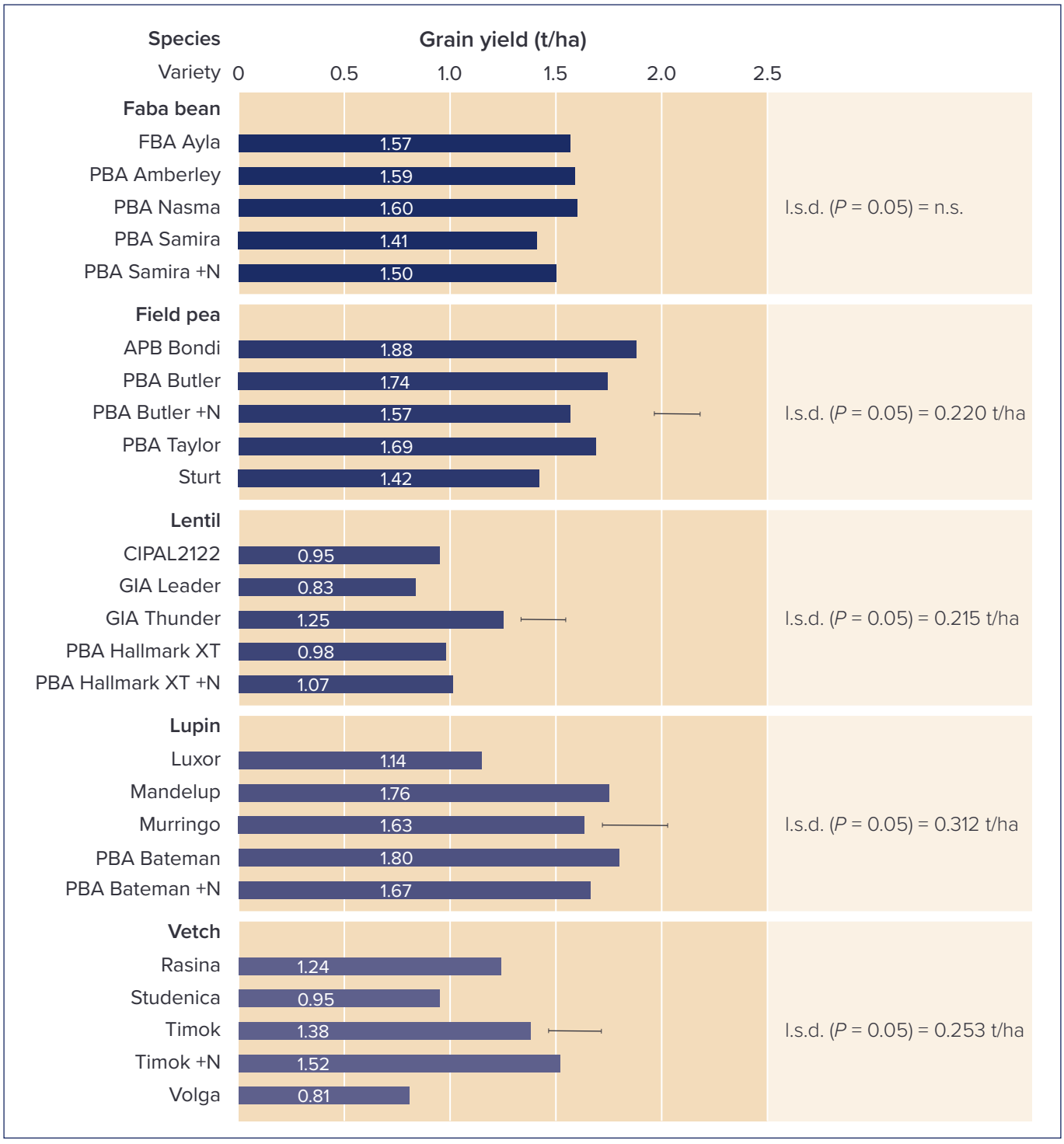

Figure 5: *Grain yield of each variety of five pulse species at Barellan in 2023.*

Faba bean varieties PBA Nasma & FBA Ayla recommended for northern NSW maturing earlier than southern varieties PBA Nasma & PBA Amberley at Barellan on 3 October 2023

Seed size

Table 26: *Seed size of each variety of five pulse species at Barellan in 2023.*

Variety	Seed size (g/100 seeds)
Faba beans	
FBA Ayla	49.33[d]
PBA Amberley	63.11[a]
PBA Nasma	53.56[c]
PBA Samira	59.34[b]
PBA Samira +N	60.60[b]
Mean	57.19
l.s.d. (*P* = 0.05)	1.944
Lupins	
Luxor	33.37[a]
Mandelup	16.43[b]
Murringo	34.49[a]
PBA Bateman	16.39[b]
PBA Bateman +N	16.51[b]
Mean	23.44
l.s.d. (*P* = 0.05)	1.78

Variety	Seed size (g/100 seeds)
Field peas	
APB Bondi	18.24[b]
PBA Butler	18.46[ab]
PBA Butler	18.43[ab]
PBA Taylor	18.99[a]
Sturt	16.01[c]
Mean	18.02
l.s.d. (*P* = 0.05)	0.660
Vetch	
Rasina	6.75[c]
Studenica	7.24[b]
Timok	6.91[c]
Timok +N	6.98[bc]
Volga	8.60[a]
Mean	7.29
l.s.d. (*P* = 0.05)	0.294

Variety	Seed size (g/100 seeds)
Lentils	
CIPAL2122	4.02[c]
GIA Leader	4.36[b]
GIA Thunder	5.08[a]
PBA Hallmark XT	4.13[c]
PBA Hallmark XT +N	4.12[c]
Mean	4.34
l.s.d. (*P* = 0.05)	0.133

Means followed by the same letter do not significantly differ

Vetch (L) and field pea (R) at Barellan, 22 August 2023