

Break crop species by variety, MRZ Mid North (Eudunda), South Australia
Break crop species by variety, MRZ Mid North (Warnertown), South Australia
Break crop species by variety, MRZ South East (Mundulla), South Australia
Break crop species by variety, MRZ South East (Coomandook), South Australia

Authors

Sarah Day, Penny Roberts, Amanda Pearce

Aim

To evaluate the suitability of different pulse species as break crops for different climatic, soil and biotic stress conditions.

Treatments

Six break crop species (and their varieties)

Break crop species	Varieties	Sowing density (plants/m ²)
Chickpea	Genesis 090, PBA Monarch, PBA Striker	50 (Desi variety: PBA Slasher) 35 (Kabuli varieties: PBA Monarch and Genesis 090)
Faba bean	PBA Marne, PBA Bendoc, PBA Samira	24
Field pea	Kaspa, PBA Butler, PBA Coogee, PBA Percy, PBA Gunyah, PBA Wharton	45 (conventional) 55 (semi leafless)
Lentil	PBA Blitz, PBA Bolt, PBA Flash, PBA Hallmark XT, PBA Hurricane XT, PBA Jumbo2	120
Lupin	PBA Bateman, PBA Jurien, Mandelup	55
Vetch	Rasina, Timok, Volga	60

Table 1. Trial site details

	Eudunda	Warnertown	Mundulla	Coomandook
Sowing Date	19 May	17 May	22 May	22 May
Row Spacing (cm)	23	23	21	21
Fertiliser (kg/ha)¹	80	80	80	80

¹MAP (9.2, 20.2, 01 2.7) + Zn (2.5)

Results and Interpretation

- Key messages: Biomass and grain yield performance of varieties differed between environments, particularly when there were major differences in soil characteristics and rainfall.
- Normalised difference vegetation index: Normalised difference vegetation index (NDVI) was measured multiple times during the growing season to identify differences in their early vigour (Table 2). Certain varieties demonstrated better early vigour (NDVI) than the others. For example, in vetch Rasina and Volga had better vigour than Timok (Table 2). Conventional field pea varieties PBA Percy and PBA Coogee had higher NDVI readings than semi-leafless field pea varieties, indicating their better early vigour.

Table 2. Normalised difference vegetation index (NDVI) measured on three different occasions, at Warnertown 2019. Varieties with the same letters in the same column are not significantly different ($P < 0.05$).

Species	Variety	Warnertown					
		17-Jul		26-Jul		16-Aug	
Chickpea	Genesis 090	0.3197	fgh	0.4085	cdefg	0.5518	cdefg
	PBA Monarch	0.3337	efgh	0.4018	cdefg	0.5509	cdefg
	PBA Striker	0.3832	bc	0.4351	bcde	0.6171	bc
Faba bean	PBA Bendoc	0.3307	efgh	0.3862	defgh	0.6018	bcd
	PBA Marne	0.3651	bcde	0.4396	bcde	0.5578	cdef
	PBA Samira	0.3407	defg	0.4196	cdef	0.5602	cdef
Field pea	Kaspa	0.3084	gh	0.3962	defg	0.4759	hi
	PBA Butler	0.2981	hi	0.3562	fgh	0.5302	fgh
	PBA Coogee	0.4067	b	0.4929	ab	0.711	a
	PBA Gunyah	0.3411	defg	0.3796	efgh	0.5557	cdef
	PBA Percy	0.4572	a	0.5396	a	0.7214	a
	PBA Wharton	0.2615	i	0.3262	h	0.4452	i
Lentil	PBA Blitz	0.3537	cdef	0.3918	defgh	0.5337	efgh
	PBA Bolt	0.3283	efgh	0.4518	bcd	0.5305	fgh
	PBA Flash	0.3563	cdef	0.4251	bcde	0.5548	cdef
	PBA Hallmark XT	0.3207	fgh	0.3718	efgh	0.5766	bcdef
	PBA Hurricane XT	0.3288	efgh	0.4118	cdefg	0.6129	bc
	PBA Jumbo2	0.3853	bc	0.4385	bcde	0.6309	b
Lupin	Mandelup	0.3522	cdef	0.4218	cdef	0.5975	bcde
	PBA Bateman	0.3265	efgh	0.3985	defg	0.5361	defgh
	PBA Jurien	0.3578	cdef	0.4251	bcde	0.5861	bcdef
Vetch	Rasina	0.3604	cdef	0.4274	bcde	0.599	bcde
	Timok	0.2972	hi	0.3507	gh	0.4873	ghi
	Volga	0.3789	bcd	0.4674	bc	0.6334	b
LSD ($P < 0.05$)		0.0418		0.0688		0.0664	

- Biomass: Differences in biomass production (DM t/ha) were observed between break crop species at all four sites in 2019. However, there were no differences observed between varieties of each break crop species at any site.

Of the pulses grown, vetch produced the highest amount of biomass at all sites except at Warnertown (Figure 1). This shows the versatility of vetch as a break crop over a wide range of soils and climatic conditions. Further, faba beans, lentils and field pea too produced considerable level of biomass in Mundulla and Coomandook indicating their suitability as break crop for these regions. Chickpea did not perform well in any of the sites and the biomass was significantly lower at all sites (Figure 1).

In contrast, field pea had the highest biomass production (5.09 DM t/ha) at Warnertown, 2019. Biomass production of lentil and faba bean was 26% and 29% lower than field pea, respectively. Vetch, lupin and chickpea had the lowest biomass production, 38-47% lower biomass than field pea. Faba bean (2.85 DM t/ha), field pea (2.99 DM t/ha) and vetch (3.13 DM t/ha) had the highest biomass production at Eudunda, 2019. Lentil biomass production was 29% lower than field pea. Chickpea produced the lowest quantity of biomass and was 52% lower than field pea.

At Warnertown field pea and lentils produced greater quantities of biomass than vetch (Figure 1). Lentil are the most grown pulse crop in the region with a grain yield 33% lower than field pea (Figure 1). However, the relative price difference between the two is the deciding factor for choosing either crop in the region. Faba bean and lupin had the lowest biomass production at this site as they are least adapted to the environment conditions and soil type.

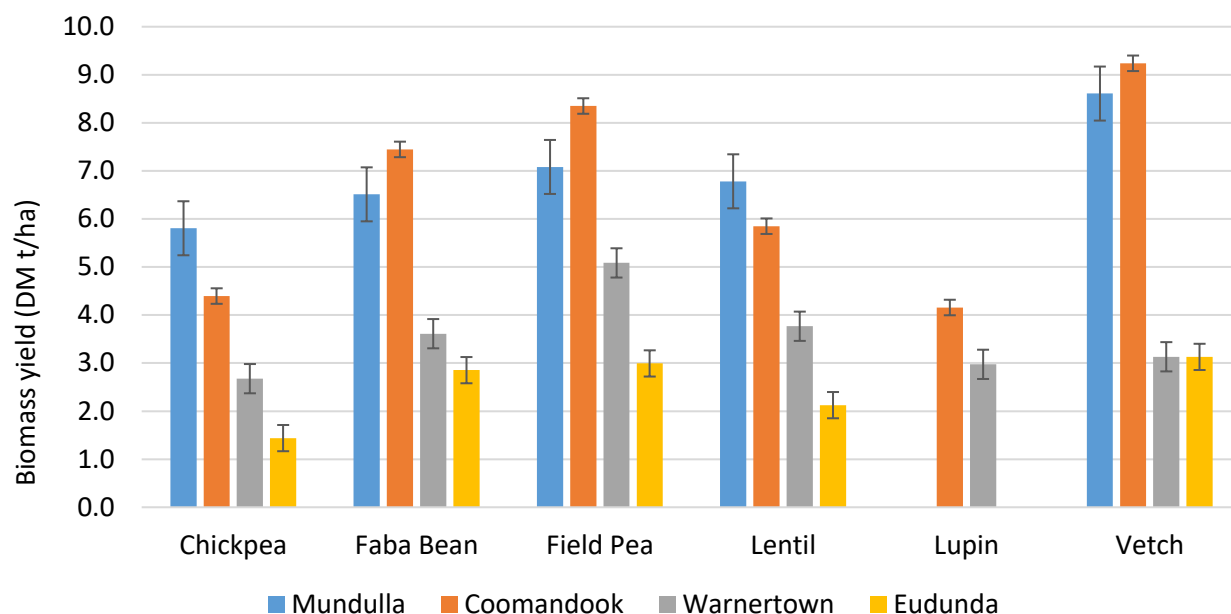


Figure 1. Biomass yield of break crop species at four trial sites in 2019. Error bars represent least significant difference ($P<0.05$).

- Degree of lodging: Conventional field pea varieties lodged more than semi-leafless field pea varieties (Figure 2). Semi-leafless field pea variety Kaspera had the lowest level of lodging for all the field pea and vetch varieties. Increased lodging makes harvesting difficult. Conventional field pea types, such as PBA Percy, are known for increased lodging compared to semi-leafless field pea varieties. Hence conventional field pea types, which are more susceptible to lodging are better suited for biomass production, grazing or hay, than for grain production.

Vetch is also prone to lodging and is commonly grown for grazing or hay production rather than grain production.

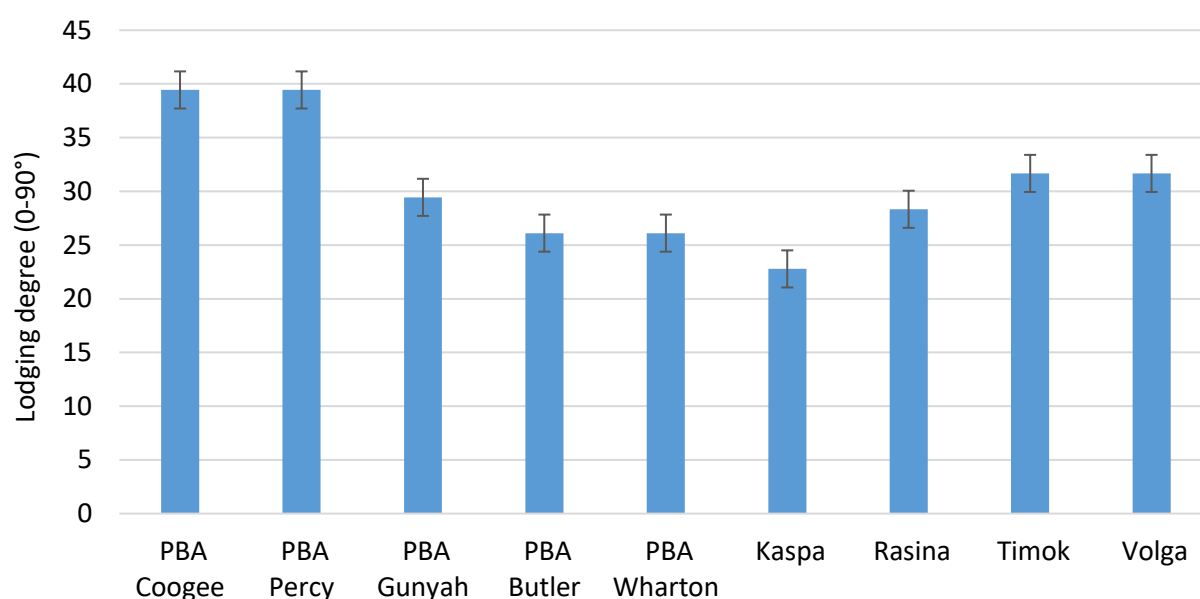


Figure 2. Lodging degree of field pea and vetch varieties scored prior to harvest from 0 – 90°, 0°: plants did not lodge and 90°: plants lodged completely flat, at Coomandook 2019. Error bars represent least significant difference ($P<0.05$).

- Grain yield: All the pulses except chickpea were well adapted for grain production at Mundulla and Coomandook (Figure 3). The above average rainfall received in these sites earlier or later into the season resulted in better yields compared to Warnertown and Eudunda. None of the crops produced adequate grain yields in Warnertown and Eudunda. This is because the rainfalls received were lower than the long-term average recorded for the areas especially during August to September. Light frost events in Eudunda may have further decreased yields. Faba bean produced considerable grain yields in Mundulla, Coomandook and Eudunda, which experienced significant number of frost events (Figure 3). For instance, Mundulla had 24 frost events and six in Eudunda. Therefore, faba beans is ideal for areas that experiences frost compared to the other species. The grain yields of chickpeas were lower than the average yields reported at all sites (Figure 3). These sites experienced a significant number of frost events and subzero night temperatures, which coincided with the flowering and pod filling of chickpea. Flowering and duration of grain filling in chickpea is negatively influenced by frost and lower temperatures, which explains the lower yield of the crop at these sites. Lupin produced greater grain yields in Coomandook than Warnertown (Figure 3 and 4). This is because lupin is well adapted to sandy soil types in Coomandook than heavier soil types at Warnertown. Thus, lupin is a good break crop option for sites where soil is light textured and acidic. Of the crops grown, vetch produces comparatively lower grain yields (Figure 3). However, vetch is a popular crop in these regions due to their lower risk, higher return to investment and many alternative end-use options. Field pea are often the highest yielding in environments with a low incidence of frost during the growing season. On the other hand, chickpea is the least adapted break crop species across the environments studied and had the lowest production.

Varietal performance differed between environments, particularly due to the differences in soil characteristics and rainfall (Figure 4). Top performing varieties on the heavier soil type at Warnertown are not the same top performing varieties on the sandier soil at Coomandook (Figure 4). Chickpea performance was similar between varieties at Warnertown. However, PBA Monarch was at least 340 kg/ha lower yielding than other chickpea varieties at Coomandook. For faba bean, PBA Samira was higher yielding than PBA Bendoc at Coomandook while the opposite occurred at Warnertown, where PBA Samira was lower yielding. Similarly, for field pea varieties, at Warnertown, PBA Coogee was the lowest yielding variety, whilst at Coomandook this variety was one of the highest yielding. PBA Percy was the lowest yielding field pea variety at the latter site. Lupin varieties performed similarly at both sites, while vetch varieties had similar production to one another at Coomandook. Differences in vetch variety performance was observed at Warnertown, with Volga having higher grain yield than Rasina and Timok. PBA Jumbo2 was the highest yielding lentil variety at Warnertown and equal highest yielding to PBA Flash at Coomandook. PBA Jumbo2 is the currently the highest yielding red lentil available for the southern region.

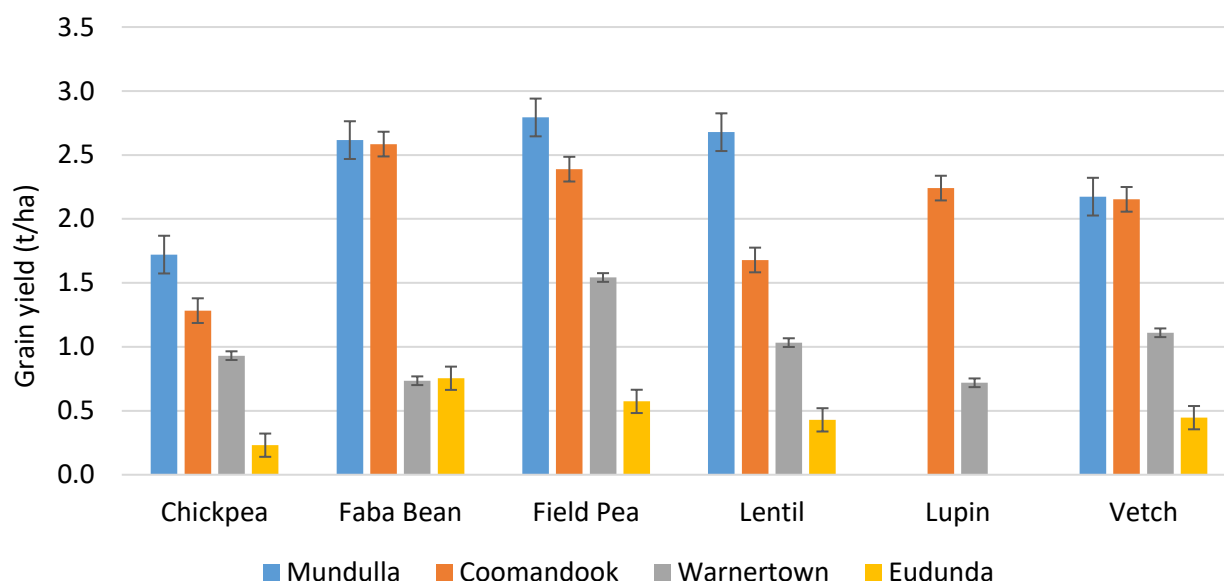


Figure 3. Grain yield of break crop species at four trial sites in 2019. Error bars represent least significant difference ($P < 0.05$).

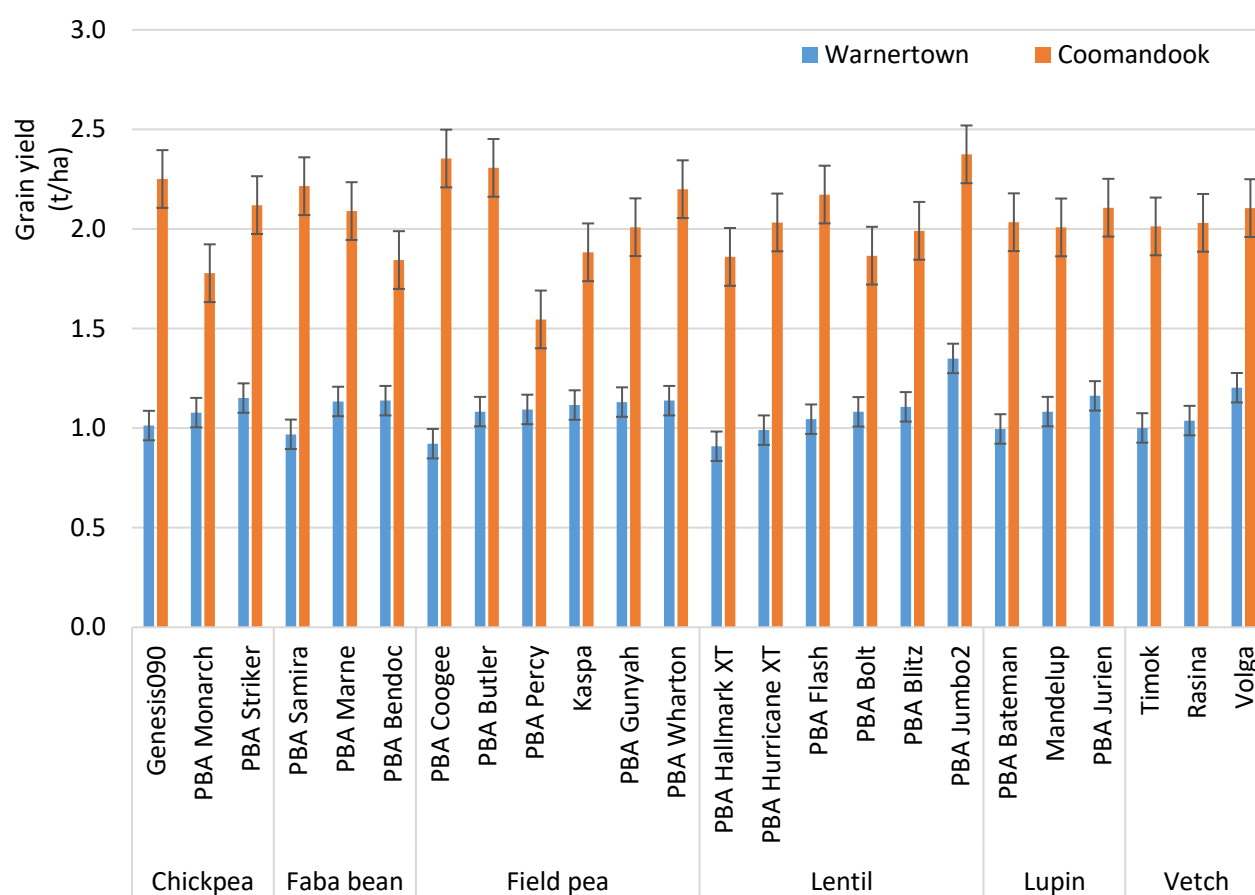


Figure 4. Grain yield of break crop varieties at Warnertown and Coomandook, 2019. Error bars represent least significant difference ($P < 0.05$).

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