

L4 Sowing Time, MRZ Mid North (Pinery), South Australia

L5 Sowing Time, MRZ Yorke Peninsula (Melton), South Australia

Aim

To examine the effects of varying sowing dates on yield of lentil varieties with the aim of identifying appropriate sowing times across different environments.

Variety and site details are presented in Table 1 and 2.

Table 1: Lentil commercial varieties (including new varieties) and advanced breeding lines sown at two different sowing times at Pinery and Melton 2016.

Seed type	Variety
Small red	Nipper
	PBA Hurricane XT
Medium red	PBA Bolt
	PBA Flash
	PBA Ace
	Nugget
	PBA Blitz
Large red	PBA Jumbo 2
Medium and large green	PBA Greenfield
	PBA Giant
	Boomer
Advanced breeding lines	CIPAL1422
	CIPAL1301
	CIPAL1601
	CIPAL1602
	CIPAL1621

Table 2: Site details

		Trial site	
		Pinery	Melton
Sowing date		6 May (Early); 31 May (Late)	12 May (Early); 7 June (Late)
Soil type		Sandy loam/limestone clay	Sandy clay loam over light clay
Similar site details			
Inoculant	Nil		
Seed dressing	P-Pickel T (200 ml/100 kg seed)		
Row spacing	22.5 cm		
Plot size	10 m x 1.75 m		
Plant density	120 plants/m ²		
Fertiliser	MAP + Zn (2%) @ 90 kg/ha at sowing		
Foliar fungicides	Canopy closure-Carbendazim @500 ml/ha & Chlorothalonil @ 2L/ha Mid flowering to Early podding - Carbendazim @500 ml/ha& Chlorothalonil @ 2L/ha		

Effect of sowing date on flowering

- Commencement in flowering was assessed as the calendar date when at least one open floret was observed on 50 % or more plants.
- The date of first flower and time taken from sowing to reach this date was influenced by sowing date and varied between varieties sown within similar and different sowing dates across the two sites. Varietal differences in temperature and photoperiod responsiveness may explain the differences observed in commencement in flowering within and between sowing dates across the sites.
- Early sown lentils commenced flowering earlier, mainly towards the end of winter, while flowering was delayed to early and mid-spring, as sowing date was delayed at the two sites. Earlier flowering has the advantage of increasing the number of nodes during the growing season resulting in more potential pods and yield benefits particularly in longer growing seasons as was the case in 2016.

- On the other hand, earlier flowering put lentils at risk to environmental stresses of excessive rain and waterlogging conditions that occurred during the season. Further, earlier sown lentils had developed dense crop canopies from early crop establishment and good rainfall during growing and this increased their susceptibility to the development of Botrytis Grey Mould (BGM) in less resistant varieties.
- The period from sowing to first flower was generally reduced under delayed sowing indicating that the vegetative period before flowering was reduced as sowing was delayed (Table 3, parenthesis).
- PBA Blitz flowered earlier than all varieties across sowing times and sites. This variety flowered on average 22 days earlier than Nipper which was the latest flowering variety across the two sowing times and sites.

Table 3: Commencement of flowering date (Number of days from sowing to flowering in parenthesis) of 16 lentil varieties sown at two different sowing dates at Pinery and Melton, 2016

		Sowing dates			
		Pinery		Melton	
Variety type	Variety	6-May	31-May	12-May	7-Jun
Small reds	Nipper	5 Sep (122)	25-Sep (117)	7 Sep (118)	25-Sep (110)
	PBA Hurricane XT	23 Aug (109)	7 Sep (99)	2 Sep (113)	17 Sep (102)
Medium reds	PBA Bolt	18 Aug (104)	5 Sep (97)	25 Aug (105)	15 Sep (100)
	PBA Flash	26 Aug (112)	6 Sep (98)	2 Sep (113)	19 Sep (104)
	PBA Ace	23 Aug (109)	6 Sep (98)	25 Aug (105)	18 Sep (103)
	Nugget	25 Aug (111)	6 Sep (98)	2 Sep (113)	22 Sep (107)
	PBA Blitz	10 Aug (96)	1 Sep (93)	19 Aug (99)	6 Sep (91)
Large red	PBA Jumbo 2	18 Aug (104)	5 Sep (97)	25 Aug (105)	15 Sep (100)
Medium and large green	PBA Greenfield	23 Aug (109)	6 Sep (98)	27 Aug (107)	19 Sep (104)
	PBA Giant	16 Aug (102)	1 Sep (93)	25 Aug (105)	15 Sep (100)
	Boomer	18 Aug (104)	5 Sep (97)	21 Aug (101)	17 Sep (102)
Advanced breeding lines	CIPAL1422	23 Aug (109)	5 Sep (97)	27 Aug (107)	15 Sep (100)
	CIPAL1301	23 Aug (109)	5 Sep (97)	28 Aug (108)	15 Sep (100)
	CIPAL1601	23 Aug (109)	5 Sep (97)	25 Aug (105)	25 Aug (110)
	CIPAL1602	18 Aug (104)	1 Sep (93)	20 Aug (100)	15 Sep (100)
	CIPAL1621	23 Aug (109)	5 Sep (97)	25 Aug (105)	15 Sep (100)

Lodging

- Varietal resistance to lodging was assessed on a 1-9 score where 1= flat and 9= erect. Favourable growing conditions of above average rainfall in winter followed by a prolonged cool spring in 2016, led to the development of dense crop canopies causing severe lodging.
- Although a sowing date by site interaction was found for resistance to lodging, the level of lodging was severe and ranged between 2 and 3 with no meaningful improvement to standing ability with sowing date and site.

Grain yield

- In 2016, the growing season was characterized by good winter rainfall conditions that allowed crops to develop dense canopies and increase their yield potential. Crops were also exposed to environmental stresses of waterlogging, frost, hail, BGM disease outbreak, lodging and shattering in more susceptible varieties. Strategic fungicide sprays were maintained during the reproductive stage of flowering and podding to minimize the spread of BGM. The factor that defined the season was the more favourable spring conditions with good moisture and cool temperatures that allowed additional crop growth, node production, flowering and increased the length of grain filling period which resulted in high and above average yields in the Southern Pulse Agronomy trials and lentil production areas.
- Grain yield was influenced by sowing date and also differed between varieties however the responses were dependent on site.
- Sowing lentils early in the first week of May increased grain yields by 8% compared to delaying sowing by three weeks at Pinery but not at Melton where yields remained similar across the two sowing dates (Figure 1). At Pinery, earlier flowering may have lengthened the reproductive (podding) and grain filling

phase which may have contributed to increased yields in the early sown lentils compared to delayed sowing.

- Varieties which were suited to high yielding conditions and longer growing seasons maximized their yield in 2016. Averaged across sowing dates, the large red-seeded PBA Jumbo 2 was the highest equal yielding variety at Pinery (3.78 t/ha) and Melton (3.22 t/ha) (Table 4). PBA Jumbo 2, a variety released in 2015 and has improved agronomic characteristics of early vigour, improved resistance to lodging, disease (including R-rating for BGM) was well suited to high rainfall and its late maturity was suited by the long finishing conditions in 2016.
- PBA Flash and advanced breeding line CIPAL1602 yielded equal to PBA Jumbo 2 across the two sites. Advanced breeding lines CIPAL1301, CIPAL1601 and CIPAL1422 were also similarly suited to the high yielding conditions in 2016 depending on site.
- The green-seeded lentil, PBA Greenfield, had a mid-range yield at Pinery and yielded higher than the other two green lentils, PBA Giant and Boomer which were among the lowest yielding varieties at this site. PBA Giant is susceptible to BGM while Boomer produces large amounts of biomass making it prone to lodging under favourable conditions and is also susceptible to shattering, agronomic traits which may have contributed to low yields in these varieties.
- PBA Blitz which was the earliest flowering variety across the two sowing dates and sites had a mid-range yield. The duration taken to date of first flower in PBA Blitz was shorter compared to most varieties, therefore reducing its vegetative phase and yield potential. This variety is also early maturing and mainly suited to shorter seasons and hence may not have been favoured by the long season.

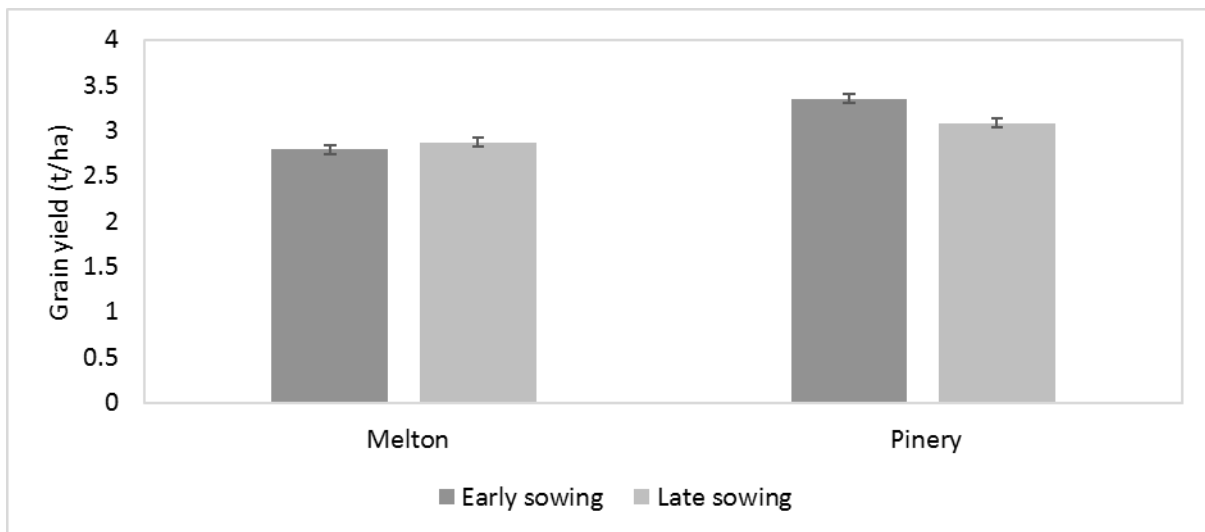


Figure 1: Grain yield (t/ha) averaged across 16 lentil varieties sown at two different sowing times at Melton and Pinery, SA, 2016.

Table 4: Grain yield (t/ha) of 16 lentil varieties averaged across two different sowing dates at Pinery and Melton, SA 2016.

Variety	Pinery Grain yield (t/ha)	Melton Grain yield (t/ha)
PBA Jumbo2	3.78	3.22
CIPAL1602	3.68	3.06
CIPAL1301	3.67	2.8
PBA Flash	3.63	3.22
CIPAL1601	3.54	2.82
CIPAL1621	3.30	2.68
Nugget	3.28	3.07
PBA Ace	3.23	2.68
PBA Hurricane XT	3.23	2.65
PBA Greenfield	3.18	2.91
PBA Blitz	3.17	2.74
Nipper	3.04	2.52
CIPAL1422	2.92	2.84
PBA Bolt	2.81	2.80
Boomer	2.56	2.63
PBA Giant	2.45	2.64
LSD (P<0.05)	0.4	

Conclusion

- The 2016 season was characterized by favourable growing conditions that enabled crops to establish early, develop bulk canopies and increase their yield potential. Crops were also exposed to environmental and biotic stresses however adequate moisture and cool temperature conditions during the reproductive phase led to a longer grain filling period resulting in above average yields.
- The benefit from early sowing may be less beneficial under favourable growing conditions where moisture and temperatures are non-limiting factors as was shown at Melton
- Grain yield was maximized in varieties with agronomic traits of early vigour, large canopies with improved lodging, shattering and disease resistance together with a late maturity profile such as PBA Jumbo 2 among others.
- Varieties with an early flowering and maturity profile such as PBA Blitz are best suited to shorter seasons and did not benefit from the long season.