

TRIAL SUMMARIES

1. Lentils

L1 Sowing Time x Stubble Management, MRZ Mid North (Mallala), South Australia

Aim

To investigate the interaction between genotype, sowing date and stubble management on grain yield, disease and agronomic characteristics of lentil in low rainfall modern farming systems of southern Australia.

Treatments

Varieties:	Boomer, Nipper, Nugget, PBA Blitz, PBA Bounty, PBA Flash, PBA Jumbo and CIPAL0803
Sowing dates:	6 May (Early), 27 May (Mid), 24 June (Late)
Stubble:	2.2t/ha Barley stubble (30cm high)
Treatments:	Removed (cut at ground height and raked bare just prior to sowing) Slashed (cut at ground height to straw on soil surface) Standing (30cm high) All treatments sown inter-row on 9inch (22.5cm) spacings
Fertiliser:	MAP + Zn @ 75kg/ha

Results and Interpretation

- **Herbicide Damage** – Generally low but variable levels of metribuzin damage were observed in lentils due to a combination of dry soil at application and a significant first rainfall event after treatment. Consideration of this factor is required when interpreting results.
Late season plant mortality scores showed a significant interaction between sowing date and stubble management, and sowing date and variety. Plant mortality was highest at the early sowing date, due to the conditions around the time of application, but was also noted to a lesser extent at the late sowing date (Tables L1.1 and L1.2). At the early sowing date, there was less plant mortality in the Standing stubble than in Removed or Slashed stubble treatments (Table L1.1). There was no significant difference in metribuzin damage between stubble treatments at the mid or late sowing dates.
Genotypic variation in herbicide damage was also noted, and is presented as a two-way interaction (Sowing Date x Variety) in Table L1.2. Nipper showed greater plant mortality than all other varieties, which showed similar and low levels of mortality. Nipper was the only variety to incur plant mortality at the late sowing date. This variety response is in line with our current understanding of variety sensitivity to metribuzin.
- **Disease** – winter and spring conditions were not conducive for disease, and there was no disease observed at this site in 2011.
- **Lodging** – lodging scores taken at maturity showed significant one-way interactions only with sowing date and variety. There was no effect of stubble management on lodging in 2011. Lodging resistance of lentil was improved by delayed sowing (Table L1.3), as is generally noted in previous seasons. Boomer, PBA Jumbo and the advanced breeding line CIPAL0803, followed by PBA Bounty had the highest levels of lodging (Table L1.4). These three varieties have more prostrate growth habits, which make them prone to lodging. Earlier maturing varieties PBA Blitz and PBA Flash had the lowest lodging scores followed by Nipper and Nugget.
- **Maturity** – maturity scores, taken three weeks prior to harvest, showed a significant interaction between variety and stubble management. Nipper, Nugget and CIPAL0803 showed delayed maturity in retained (Slashed and Standing) stubble treatments compared with Removed stubble (Table L1.5). There was no difference in maturity between Slashed and Standing stubbles in any variety.
- **Grain Yield** – A complex three way interaction between genotype, sowing date and stubble management occurred for grain yield. Late sown lentils were generally lower yielding than early and mid sown lentils (Figure L1.1).

Standing stubble improved grain yield by an average of 14% compared to the Removed stubble treatment, and up to 36% depending on variety and sowing date (Table L1.6). Grain yield was improved by an average of 8% in Slashed stubble treatments compared to Removed stubble, and up to 34% between varieties.

All varieties except PBA Jumbo and Nipper showed a variable yield response from retained stubble. In some varieties both Standing and Slashed stubble out-performed Removed stubble (eg Late sown PBA Blitz, Late CIPAL803 and Mid PBA Flash) (Figure L1.1). In others only the Standing stubble treatment outyielded the Removed treatment (Late sown Boomer, Early PBA Flash, Mid Nugget). In four further treatments the Standing stubble treatment outyielded both Slashed and Removed stubble plots (Early sown PBA Blitz, Early and Mid PBA Bounty, and Mid CIPAL803, denoted by bold figures in Table L1.6).

CIPAL803, which is an early-mid flowering and mid-late maturing lentil with high early vigour, showed lower grain yield from sowing into standing stubble compared to slashed stubble at the Early sowing date (Figure L1.1).

The early maturing PBA Blitz showed the highest yield advantage from sowing into standing stubble, yielding 28-36% higher at the Late and Early sowing dates, respectively. PBA Blitz also showed a prominent yield advantage from sowing early into Standing stubble in the 2010 trial. There was no effect of stubble on performance of PBA Blitz at the Mid sowing date in 2011.

PBA Flash showed the highest yield response from sowing into slashed stubble, with a 34% yield increase compared to the Removed treatment at the Mid sowing date. PBA Flash also showed high yield increases from sowing into standing stubbles at the Early and Mid sowing dates.

PBA Bounty showed a 19-20% yield advantage from sowing into standing stubbles compared to slashed and removed stubbles at the Early and Mid sowing dates. PBA Bounty is a mid flowering and maturing variety, with a prostrate growth habit. The same trend was seen by PBA Bounty across all sowing dates in 2010.

Nugget showed a varied response to stubble management. There was no effect of stubble management sown early, however Standing stubble showed a significant yield improvement over Removed stubbles at the Mid sowing date. At the Late sowing date Slashed stubble significantly improved yield compared to the Removed treatment, while yield in Standing stubble plots was not quite improved to significant level.

Table L1.1. Effect of stubble management on plant mortality score (% thinning) of lentils due to post sowing pre-emergent metribuzin herbicide damage, Pinery 2011.

Sowing Date	Removed	Slashed	Standing
6-May	5.4 ^b	7.5 ^b	2.1 ^a
27-May	0 ^a	0 ^a	0 ^a
24-Jun	1.7 ^a	0 ^a	0 ^a

lsd (P<0.05) SDxStubble = 2.8 (1.9 same SD)

Table L1.2. Effect of sowing date on plant mortality score (% thinning) of lentils due to post sowing pre-emergent metribuzin herbicide damage, Pinery 2011.

Sowing Date	PBA Blitz	Boomer	PBA Bounty	CIPAL803	PBA Flash	PBA Jumbo	Nipper	Nugget
6-May	4.4	0	3.3	3.3	0	5.6	22.2	1.1
27-May	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	4.4	0

lsd (P<0.05) SDxVariety = 5.5

Shading denotes significant differences.

Table L1.3. Effect of sowing date on lodging (1-9 score) of lentils, Pinery 2011.

1= prostrate, 9= erect.

Sowing Date	6 May	27 May	24 Jun
Lodging (1-9)	4.53 ^c	5.61 ^b	6.06 ^a

lsd (P<0.05)SD= 0.35

Table L1.4. Mean lodging (1-9 score) of 8 lentil varieties, Pinery 2011. 1= prostrate, 9= erect.

Variety	PBA Blitz	Boomer	PBA Bounty	CIPAL803	PBA Flash	PBA Jumbo	Nipper	Nugget
Lodging (1-9)	6.70 ^a	4.07 ^g	4.89 ^d	4.04 ^g	6.85 ^a	3.85 ^g	6.63 ^{ab}	6.15 ^b

lsd (P<0.05)Variety = 0.5

Table L1.5. Effect of stubble treatment on maturity (1-9 score) of 8 lentil varieties, Pinery 2011.

1= complete senescence, 9= reproductive.

Variety	PBA Blitz	Boomer	PBA Bounty	CIPAL803	PBA Flash	PBA Jumbo	Nipper	Nugget
Removed	3 ^a	4 ^b	3 ^a	3 ^a	3 ^a	3 ^a	4 ^b	3 ^a
Slashed	3 ^a	4 ^b	3 ^a	4 ^b	3 ^a	4 ^b	5 ^c	4 ^b
Standing	3 ^a	4 ^b	3 ^a	4 ^b	3 ^a	4 ^b	5 ^c	4 ^b

lsd (P<0.05)Variety x Stubble = 0.5

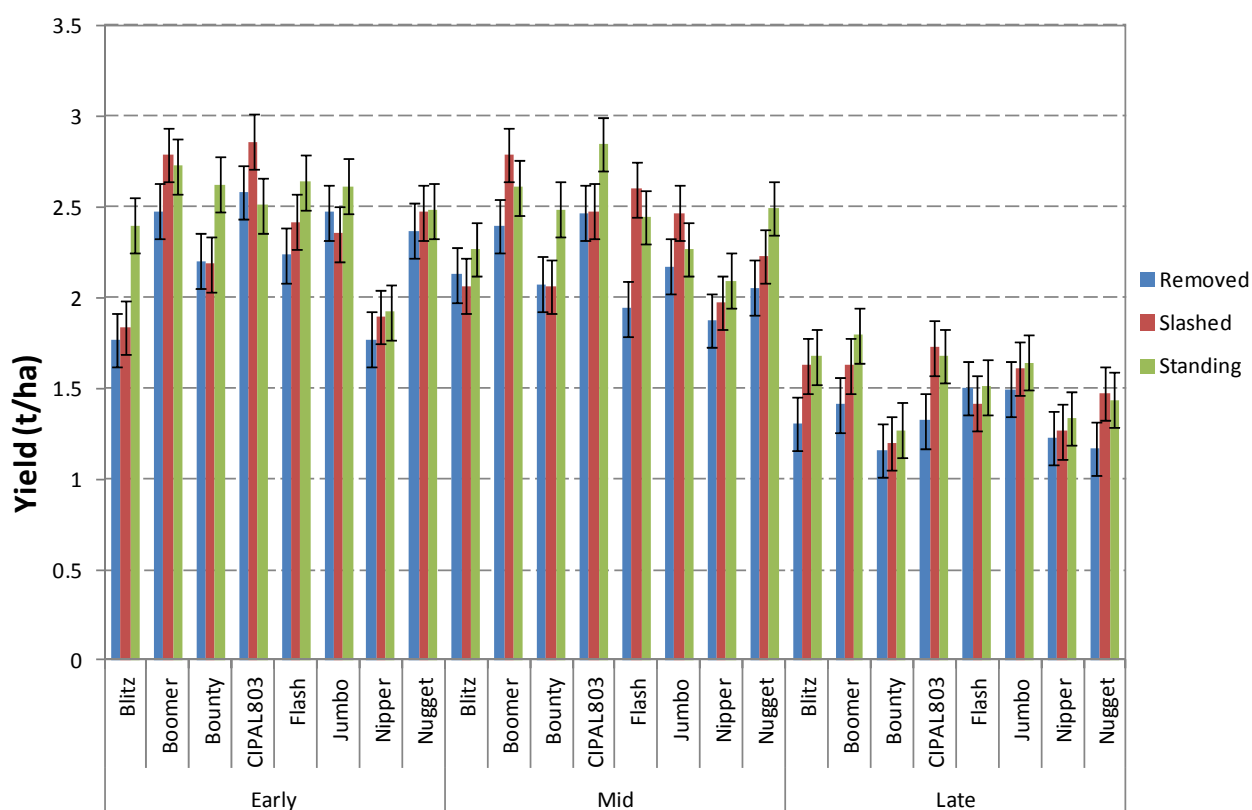
**Figure L1.1.** Effect of sowing date and stubble treatment on grain yield (t/ha) of 8 lentil varieties, Pinery 2011

Table L1.6. Effect of sowing date and stubble treatment on grain yield (% of Removed stubble treatment) of 8 lentil varieties, Pinery 2011

Variety	Sowing Date	Yield	Yield (% of Removed)	
			Slashed	Standing
PBA Blitz	Early	1.77	104	136
	Mid	2.13	97	107
	Late	1.31	124	128
Boomer	Early	2.48	112	110
	Mid	2.40	116	109
	Late	1.41	115	127
PBA Bounty	Early	2.20	99	119
	Mid	2.08	99	120
	Late	1.16	103	110
CIPAL803	Early	2.58	111	97
	Mid	2.47	100	115
	Late	1.32	131	127
PBA Flash	Early	2.23	108	118
	Mid	1.94	134	126
	Late	1.50	94	100
PBA Jumbo	Early	2.47	95	106
	Mid	2.17	114	104
	Late	1.49	108	110
Nipper	Early	1.77	107	108
	Mid	1.88	105	112
	Late	1.23	103	109
Nugget	Early	2.37	104	105
	Mid	2.06	108	121
	Late	1.17	126	123

lsd (P<0.05) SD x Variety x Stubble = 0.34 (0.30 same SD x Variety)

Shaded figures denote significant difference to the Recommended stubble treatment

Figures in bold denote significant difference to the Slashed stubble treatment

Key Findings and Comments

Results must be interpreted with caution due to metribuzin damage in this trial. Damage scores showed varieties performed in line with our current understanding of relative tolerance, and may complicate the interpretation of Nipper (the most sensitive variety to metribuzin) to the imposed treatments.

PBA Jumbo and Nipper showed no response to stubble management, while CIPAL0803 showed a varied response to stubble management at the early sowing date. This is the first season with PBA Jumbo and CIPAL0803 in this trial, and further work is required to understand these findings. It is difficult to confidently describe differences between stubble treatments however, results show that yields in retained stubble treatments (Standing and Slashed) were equal or higher than the Removed stubble treatment, however genotypes varied in their response.

Retaining stubble (Standing or Slashed) delayed maturity compared to removing stubble, particularly in some later maturing varieties. This is likely due to increased soil moisture retention, as was measured in the 2010 trial. The mulching effect is likely a result of either the stubble itself slowing down evaporation, or the increased biomass (and resulting earlier canopy closure) protecting bare soil from water loss. Although only later maturing varieties showed delayed maturity in 2011 trials, earlier maturing varieties are more likely to benefit most from this delayed maturity by enabling them to capitalise better on late rains.

These results from 2011 provide support to 2010 trial results, where retained stubble increased yield and delayed maturity. Stubble retention improved yields at all sowing dates in 2010, although standing stubble was most important for grain yield at the later sowing date. Boomer showed no difference in grain yield in 2010 but did in 2011, while PBA Blitz was the most responsive variety to stubble retention systems in both 2010 and 2011. This may be due to the stubble conserving soil

moisture, and potentially delaying maturity. Blitz has a very erect plant type and is generally late to canopy closure, however upon reaching the reproductive phase it tends to limit vegetative growth and may never reach canopy closure. In this scenario retaining standing stubble in the inter-row may protect bare soil from water loss. Alternatively, this response may be due to delayed maturity in standing stubble plots, enabling better use of late rains.

The mid season, prostrate variety PBA Bounty showed a significant yield response from sowing into standing stubble in both seasons of field testing. Although it was not measured in 2011, PBA Bounty had the greatest increase in plant height from sowing into standing stubble of all varieties tested in 2010. Further work is required to understand why this response is generated.