L12 Sowing Time and Plant Density, HRZ Wagga Wagga, New South Wales

Aim

1. To establish agronomic guidelines for lentil time of sowing and seeding rate for current commercial lentil varieties alongside promising advanced breeding lines on an acidic, red-brown earth at Wagga Wagga, NSW. This information will be used to confirm and update current agronomic recommendations for lentil in this region.
2. To determine if optimum plant density and sowing time remains constant across varieties in this environment.

Key Findings

- PBA Ace and PBA Jumbo2 performed very well across a range of agronomic characters, compared to the other varieties tested in this experiment.
- Sowing time was a critical management factor in the 2015 season.
- Sow lentil early to late May in the eastern cropping region of southern NSW.
- Target establishment densities of 120 plants m^2 in this environment.

Treatments

Varieties (6)	Six, small to medium seeded red lentils: PBA Ace, PBA Blitz, BPA Bolt, Herald XT, Nugget, CIPAL0901
Time of sowing TOS (2) Harvest	TOS1–1 May, 2015 TOS2– 10 June, 2015 TOS 1 – 9th Nov

Site details

Site	Paddock 18, Wagga Wagga Agricultural Institute
Soil type	Red sandy loam, pH ($CaCl_2$) (0–10 cm) 5.4
Trial Design	Randomised complete block design with sowing date the main blocks and varieties the sub-plots; three replications.
Sowing	Direct –drilled using a six row cone seeder with 300mm row spacings and GPS auto-steer
Inoculation	Group F peat inoculant was mixed directly into an on board 100L water tank then pumped though micro-tubes into each sowing furrow
Stubble management	Stubble burnt and the paddock worked up
Fertiliser	80 kg/ha grain legume super (N:P:K:S 0:13.8:0:6.1) placed 30–40 mm below the seed
Plant population	Target 120 plants/m^2, 30 cm row spacing
Weed management	Commercial practices used with aim of weed-free trials, eliminating both weed competition and weed seed set. Fallow weed control: 2 L/ha glyphosate (450 g/L) and 1 L/ha 2,4-D LV ester (680 g/L) Incorporated by sowing: 2 L/ha glyphosate (450 g/L), 2 L/ha Stomp® (440 g/L pendimethalin), 2 L/ha Avadex® (400 g/L tri-allate) and 1 kg/ha Terbyne® (750 g/kg terbuthylazine) Post sowing: 330 ml/ha Select® (240 g/L clethodim), 100 ml/ha Verdict® (520 g/L haloxyfop) and 500 ml/100 L Uptake spraying oil
Insect management	Targeting *Helicoverpa* sp.: 400 ml/ha Fastac Duo ® (100 g/L alpha-cypermethrin) at late pod fill

Soil analysis

Table 1. Site soil chemical characteristics for 0–10 cm and 10–20 cm depth at Yenda, 2013.

Depth	pH (1:5 $CaCl_2$)	Al Sat %	Nitrate N (NO_3) mg/kg	Ammonium N mg/kg	P (Colwell) mg/kg	CEC cmol(+)kg
0–10 cm	5.4	1.6	3.5	1.2	21	6.31
10–20 cm	6.4	0	3.3	1.1	9	8.06

Rainfall

The 2015 growing season at Wagga Wagga was almost ideal for pulses except for a disastrous September/October. Growing season rainfall (April to October) was close to long-term average (333mm), with 56mm of this falling in early April ensuring timely sowing. Rainfall in June, July and August was 55% above long-term average and this contributed to valuable sub-soil moisture.

However, the flowering and grain filling period of September-October was extreme with eight continuous weeks of no effective rainfall and wide temperature fluctuations (5 September to 31 October). Three consecutive days in late September (23rd-25th) received below zero temperatures and damaging frosts, only to be followed by an exceptionally hot dry October. Average daily maximum temperature for the month exceeded the long-term average by 8.3°C, and the first week experienced unseasonal temperatures in the mid-30's.

Results and discussion

Establishment

A significant variety by density interaction at P<0.05 was observed for this experiment, however all varieties followed the main trend for target plant density There was a trend for lower density to be achieved at the high target densities, which often occurs in plant density experiments.

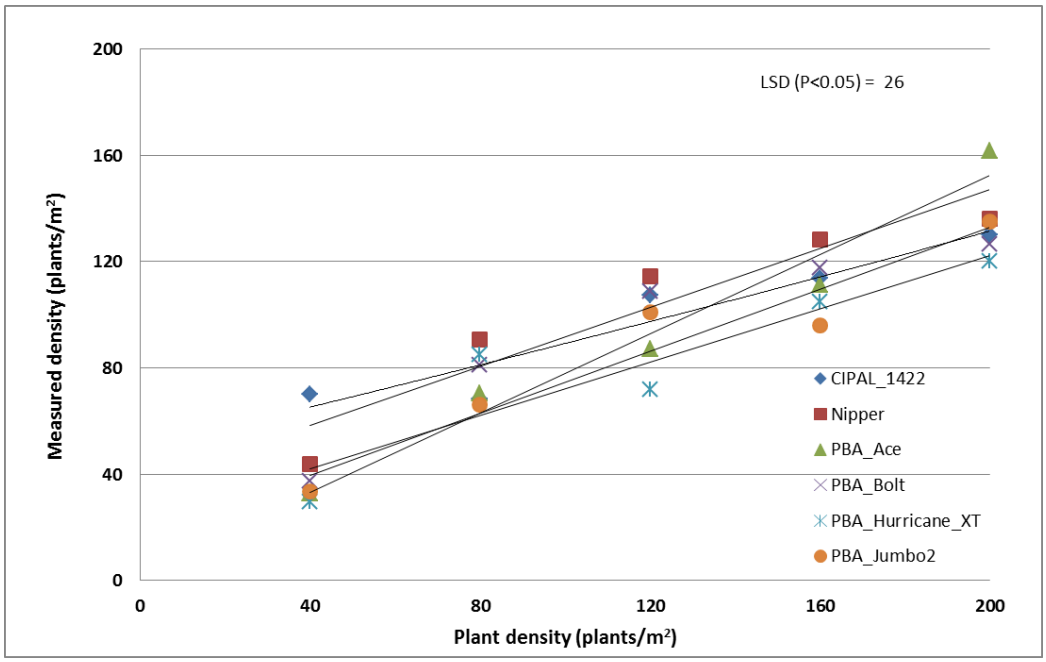


Figure1. Measured plant densities closely followed targeted plant densities at Yenda, 2015

Time of sowing, density, variety and grain yield

Grain yield of lentil was significantly reduced with a delay in sowing time from 1 May to 10 June, falling by 60% on average (Figure 2). It is not surprising the second sowing (10 June) performed so poorly given the quick dry finish. Like other pulses in southern NSW, sowing date of lentil is one of the most critical management factors and determinants of growth, production and profit.

It must be noted that this trial suffered significant shattering from a hail storm just prior to harvest on the 1st of November. Yield loss measurements were taken and a significant variety and sowing date interaction was observed at P<0.05. There was 38% more grain loss at TOS 1 (247 kg/ha) compared to TOS 2 (150 kg/ha). This was due to Nipper, PBA Bolt and CIPAL 1422 not being fully mature at TOS 2 and hence being more resistant to hail shattering losses.

Above ground dry matter ranged from 2.55 t/ha for Nipper which was significantly less than all other varieties at P<0.001 which ranged from 3.72to 4.41 t/ha.

Plant height and position of the lowest pod are critical attributes of lentil, particularly since lentil is a very short-growing winter pulse, making it difficult to harvest. TOS 1 with a mean height to bottom pod of 31.45 cm was 38% higher than TOS 2 at 19.5 cm. PBA Ace and PBA Jumbo2 were the tallest and most vigorous varieties, giving significant benefits to harvest height and weed competition. They also had the additional benefit of positioning bottom pods highest off the ground, again assisting harvest (Figure 3). In comparison, Nipper and PBA Hurricane XT were disadvantaged by being too short.

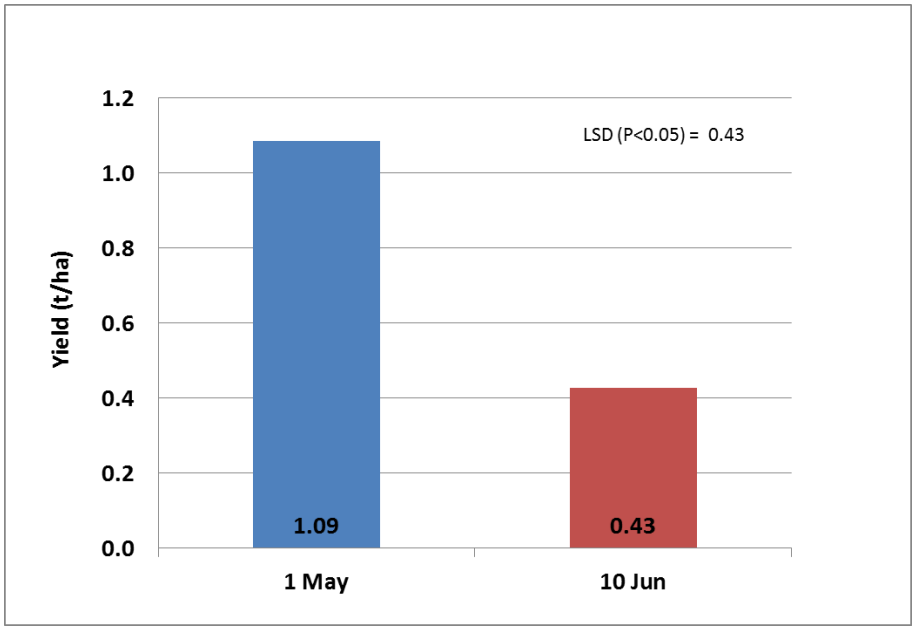


Figure 2. Time of sowing effect on grain yield at Wagga Wagga, 2015.

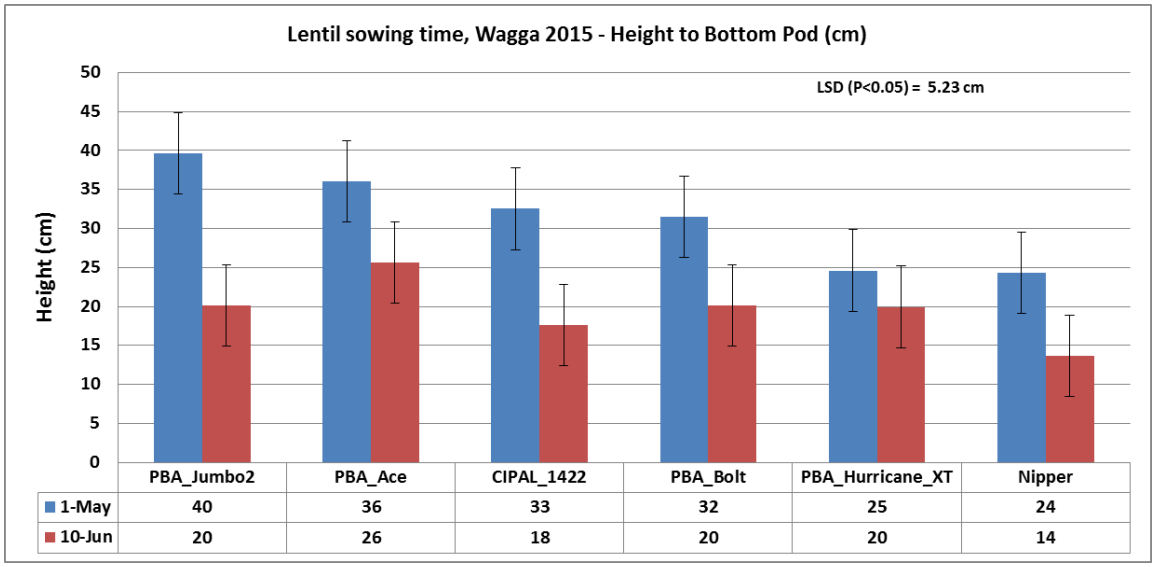


Figure 3. Variety and sowing time height to bottom pod at Wagga Wagga, 2015.

A significant yield increase with increasing density was observed as expected with 135 plants/m^2 yielding 20% higher than the 77 to 112 plants/m^2 (Figure 3).

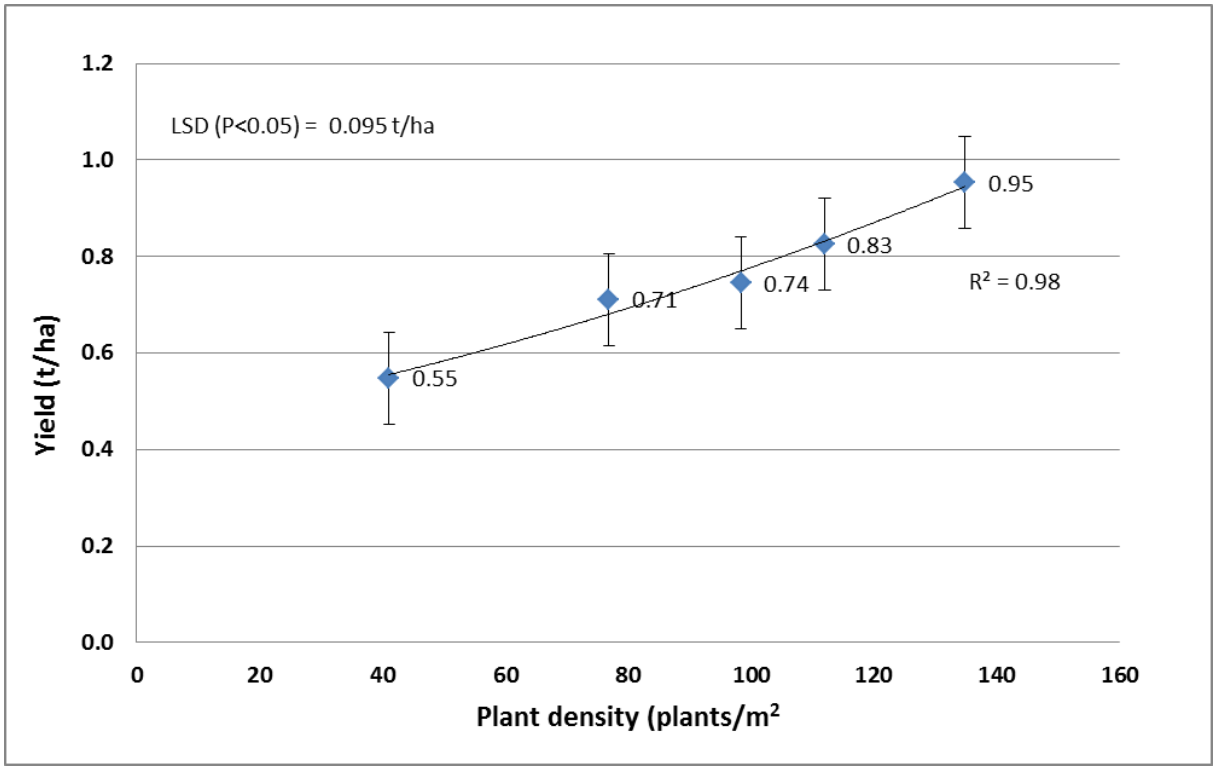
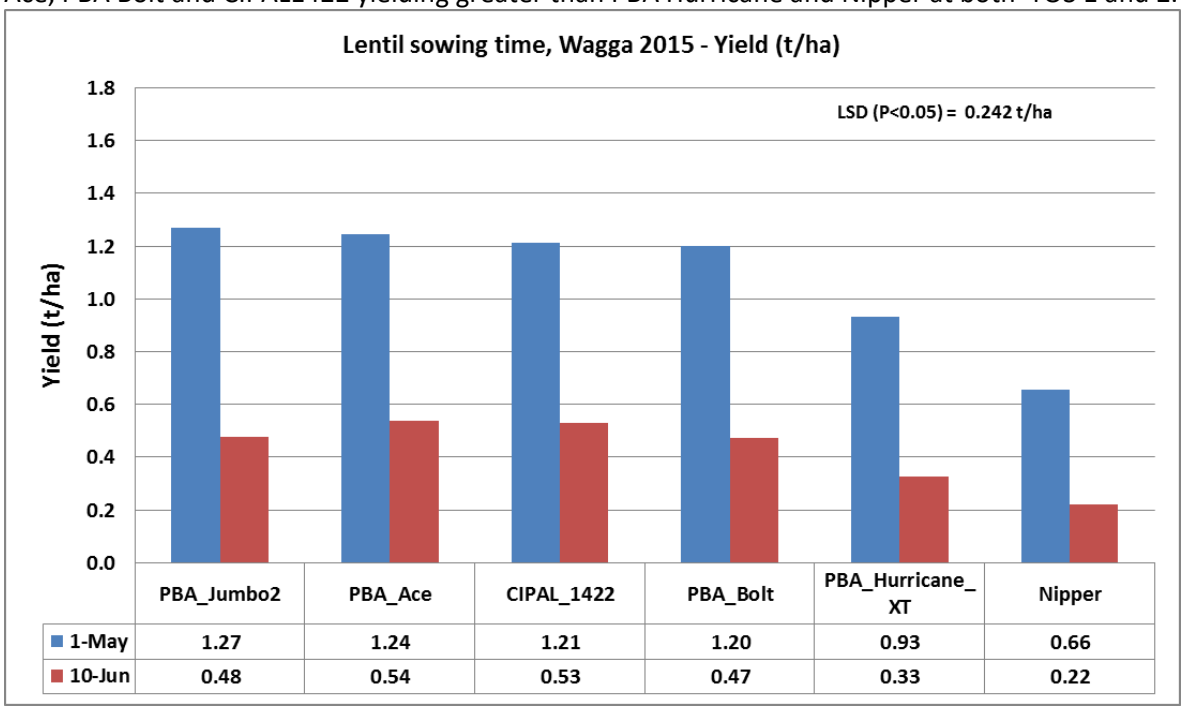


Figure3. Grain yield response to plant density at Wagga Wagga, 2015.

A significant interaction between variety and sowing time was observed at P<0.009 with PBA Jumbo2, PBA Ace, PBA Bolt and CIPAL1422 yielding greater than PBA Hurricane and Nipper at both TOS 1 and 2.



	PBA_Jumbo2	PBA_Ace	CIPAL_1422	PBA_Bolt	PBA_Hurricane_XT	Nipper
1-May	1.27	1.24	1.21	1.20	0.93	0.66
10-Jun	0.48	0.54	0.53	0.47	0.33	0.22