

Impact of row spacing, inter-row sowing and sowing time on lentils and chickpeas

Crop Agronomy



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Aim

To investigate the adaptability of a range of lentil and chickpea varieties and breeding lines to inter-row sowing in wider row spacings than conventional cropping systems. Results from this trial will be used to provide best management practices for growers and advice to breeders on the characteristics required for modern inter-row and wider row cropping systems.

Take home messages

- Grain yields and lowest pod height of chickpeas were generally higher in no-till wider row systems sown inter-row (30 and 60cm) compared with conventional system (20cm).
- Herbicide damage in both lentils and chickpeas were significantly more severe in conventional systems where herbicides were applied post sowing pre-emergent.
- In lentils, despite showing significant early growth and good biomass production, yields were generally less than 0.2t/ha.

Method

| | |
|--------------------|---|
| Location: | Curyo |
| Replicates: | 3 |
| Varieties: | See Tables 1 and 2 |
| Row Spacing: | 1. Inter-row, 30cm row spacing, standing stubble 2. Inter-row, 60cm row spacing, standing stubble (chickpeas only) 3. 20cm row spacing, slashed stubble |
| Sowing date: | 21-22 May, 23-24 June |
| Seeding density: | Chickpeas 30 plants/m ² , lentils 110 plants/m ² |
| Seeding equipment: | Trials were sown inter-row (30cm) into standing barley stubble using narrow points and press wheels. |

Please note: These trials are a comparison of systems, not just row space. In the wider row spacings, plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing (seed at 2-5cm depth). In the narrow row spacings, plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent (seed at 5-8cm depth).

Table 1. Disease and agronomic characteristics of lentil varieties and advanced breeding lines used in 2008 trials.

| Name | Vigour # | Lodging resistance# | Pod drop # | Shattering # | Flowering time # | Maturity | Comments |
|--------------------|----------|---------------------|------------|--------------|------------------|-----------|---------------------------|
| Aldinga | Mod | S | MR | MR | Mid | Mid | tall, primary branches |
| Northfield | Poor/mod | MS | MR | MS | Mid/late | Mid | short |
| Nugget | Mod | MS/MR | MR | MS | Mid | Mid/late | semi-erect-branching |
| Nipper | Poor/mod | MR | MR | MR | Mid/late | Mid | short/erect |
| Boomer | Good | MS | S | MS | Mid | Late | tall/bulky |
| CIPAL411 | Mod | MR | MR | MR | Mid | Early/mid | erect/high pods |
| CIPAL415 | Mod | MS | MR | MR | Mid/late | Mid | prostrate/many branches |
| CIPAL501 | Mod | MS | MS | MR | Mid | Mid/late | Nugget type |
| CIPAL607 | Poor/mod | MS | MR | MR | Mid/late | Mid/late | |
| CIPAL611 | Mod | MR | MR | MR | Mid/late | Mid | |
| CIPAL801 | Mod | R | MR | MR | Mid | Mid | erect/tall |
| CIPAL802 | Mod | R | MR | MR | Mid | Mid | erect/tall |
| CIPAL803 | Mod | MR | MR | MR | Mid | Mid | prostrate/bulky/branching |
| 99-088L *02H051 | Mod | R | | MS | Mid/early | Mid | |

R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible

Ratings relative to Nugget

Table 2. Disease and agronomic characteristics of chickpea varieties and advanced breeding lines used in 2008 trials.

| Variety | Ave 100 seed wt (g) | Seed size (mm) | Vigour | Flowering | Maturity | Botrytis grey mould | Ascochyta blight | Growth habit |
|---------------------------|---------------------|----------------|---------|-----------|-----------|---------------------|------------------|----------------|
| Desi | | | | | | | | |
| Sonali18 (16-20) | | Good | Early | Early | S | MS | stick-like | |
| Genesis TM 509 | 16 (15-17) | | Average | Mid | Early/Mid | MS | R | erect |
| CICA 0503 | 18 (17-19) | | Average | Mid | Early/Mid | S | R | vase shape |
| CICA 0613 | | | | | Late | | R* | very high pods |
| CICA 0721 | | | | | Mid | | R* | erect |
| 99-4447G*02H015 | | | | | Mid | | | vase shape |
| 01040-1057 | | | | | Late | | | tall, showy |
| 03-024C*04HS003 | | | | | Mid/late | | | bunched pods |
| 99226*02HS001 | | | | | Mid/early | | | short/low pods |
| Kabuli | | | | | | | | |
| Genesis TM 090 | 30 (26-35) | 7-8 | Good | Mid | Mid/late | S | R | bushy |
| Almaz42 (40-45) | 9 | Average | Late | Late | S | MR | branching | |
| Genesis TM 079 | 26 (24-28) | 6-7 | Good | Early | Early | S | R | prostrate |

R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible

Results

Chickpeas

Establishment and early growth was generally good although there was significant herbicide damage (simazine + isoxaflutole) in the conventionally sown plots (19cm row spacing). In some plots the herbicide damage resulted in up to 80 percent plant death (data not shown).

Height to lowest pod was measured at maturity to give an indication of potential harvesting height for the crop. Generally lowest pod height was reduced at the later sowing date (Table 3). Significant differences were observed between varieties, with 01040-1057 producing pods at approximately double the height of Genesis079. In most cases, pod height was reduced in the narrow row (20cm) plots, however for some varieties, such as Almaz and CICA0613, little difference was observed (Table 3).

Table 3. Height to lowest pod (t/ha) of chickpea varieties grown at Curyo sown 21 May and 23 June 2008 at 3 row spacings (20cm, 30cm and 60cm).

| Sowing date | Row space | Genesis 079 | Genesis 090 | Genesis 509 | Almaz | 01040-1057 | 03-024C*04 HS003 | |
|-------------|-----------|-----------------|----------------|-------------|-----------|------------|------------------|------|
| 21 May | 20cm | 10.4 | 20.3 | 18.0 | 29.3 | 29.3 | 19.3 | |
| | 30cm | 18.0 | 25.0 | 23.3 | 29.3 | 33.3 | 19.7 | |
| | 60cm | 18.0 | 26.7 | 24.7 | 30.7 | 34.3 | 23.7 | |
| | Mean | 15.5 | 24.0 | 22.0 | 29.8 | 32.3 | 20.9 | |
| 23 June | 20cm | 9.0 | 14.0 | 14.7 | 21.7 | 23.3 | 12.0 | |
| | 30cm | 12.7 | 17.0 | 18.7 | 19.0 | 21.7 | 18.0 | |
| | 60cm | 12.0 | 17.3 | 17.7 | 21.7 | 21.0 | 16.3 | |
| | Mean | 11.2 | 16.1 | 17.0 | 20.8 | 22.0 | 15.4 | |
| Sowing date | Row space | 99-447G*02 H015 | 99226*02 HS001 | CICA 0503 | CICA 0613 | CICA 0721 | Sonali | Mean |
| 21 May | 20cm | 18.0 | 14.9 | 17.3 | 28.7 | 24.3 | 18.7 | 20.7 |
| | 30cm | 23.3 | 17.0 | 15.7 | 29.0 | 22.3 | 18.7 | 22.9 |
| | 60cm | 25.3 | 17.0 | 20.3 | 28.3 | 24.3 | 21.3 | 24.6 |
| | Mean | 22.2 | 16.3 | 17.8 | 28.7 | 23.7 | 19.6 | 22.7 |
| 23 June | 20cm | 18.0 | 11.0 | 14.3 | 19.0 | 15.7 | 13.7 | 15.5 |
| | 30cm | 17.0 | 12.0 | 15.0 | 22.3 | 16.3 | 15.3 | 17.1 |
| | 60cm | 16.7 | 14.7 | 16.0 | 19.0 | 19.0 | 15.3 | 17.2 |
| | Mean | 17.2 | 12.6 | 15.1 | 20.1 | 17.0 | 14.8 | 16.6 |

$LSD(sowing\ date \times variety)(P<0.05) = 2.7$ except when comparison within a variety = 2.3

$LSD(row\ spacing \times variety)(P<0.10) = 3.1$ except when comparison within a row space = 2.8

Grain yields ranged between 0.1 and 0.6t/ha. Similar to pod heights, grain yield was reduced at the later sowing date (Table 4). Reductions in yield from delayed sowing ranged from 15 percent for CICA613 to 50 percent for Genesis 079. Varieties with the highest yields were Genesis 079 (sow early only), Genesis 090, 99226*02HS001 and CICA0503. Grain yield was reduced in the narrow row (20cm) plots by 25-70 percent compared with 30cm row spacing (Table 4).

Table 4. Grain yield (t/ha) of chickpea varieties grown at Curyo sown 21 May and 23 June 2008 at 3 row spacings (20cm, 30cm and 60cm).

| Sowing date | Row space | Genesis 079 | Genesis 090 | Genesis 509 | Almaz | 01040-1057 | 03-024C*04 HS003 | |
|-------------|-----------|-----------------|----------------|-------------|-----------|------------|------------------|------|
| 21 May | 20cm | 0.19 | 0.43 | 0.24 | 0.18 | 0.31 | 0.16 | |
| | 30cm | 0.50 | 0.54 | 0.61 | 0.39 | 0.40 | 0.41 | |
| | 60cm | 0.56 | 0.53 | 0.50 | 0.29 | 0.38 | 0.37 | |
| | Mean | 0.42 | 0.50 | 0.45 | 0.29 | 0.36 | 0.31 | |
| 23 June | 20cm | 0.09 | 0.15 | 0.09 | 0.16 | 0.16 | 0.14 | |
| | 30cm | 0.32 | 0.31 | 0.35 | 0.12 | 0.31 | 0.29 | |
| | 60cm | 0.25 | 0.38 | 0.34 | 0.19 | 0.31 | 0.34 | |
| | Mean | 0.22 | 0.28 | 0.26 | 0.16 | 0.26 | 0.26 | |
| Sowing date | Row space | 99-447G*02 H015 | 99226*02 HS001 | CICA 0503 | CICA 0613 | CICA 0721 | Sonali | Mean |
| 21 May | 20cm | 0.23 | 0.50 | 0.46 | 0.34 | 0.26 | 0.30 | 0.30 |
| | 30cm | 0.46 | 0.60 | 0.60 | 0.43 | 0.43 | 0.44 | 0.48 |
| | 60cm | 0.46 | 0.59 | 0.53 | 0.36 | 0.45 | 0.42 | 0.45 |
| | Mean | 0.39 | 0.56 | 0.53 | 0.38 | 0.38 | 0.38 | 0.41 |
| 23 June | 20cm | 0.21 | 0.13 | 0.25 | 0.25 | 0.22 | 0.08 | 0.16 |
| | 30cm | 0.38 | 0.38 | 0.46 | 0.35 | 0.33 | 0.30 | 0.33 |
| | 60cm | 0.33 | 0.41 | 0.40 | 0.35 | 0.31 | 0.25 | 0.32 |
| | Mean | 0.31 | 0.31 | 0.37 | 0.32 | 0.29 | 0.21 | 0.27 |

LSD(sowing date × variety) (P<0.05) = 0.12 except when comparison within a variety = 0.07

LSD(row spacing × variety) (P<0.10) = 0.10 except when comparison within a row space = 0.09

Lentils

Establishment and early growth was excellent in no-till wider row plots (30cm and 60cm), however significant herbicide damage (simazine) occurred in the conventionally sown plots (19cm row spacing). In some plots the herbicide damage resulted in up to 80 percent plant death. Despite good biomass production, grain yields were extremely low, generally less than 0.2t/ha for 21 May sown plots and less than 0.1t/ha for 23 June sown plots (not shown). Most of the conventionally sown plots (19.5cm row spacing) sown 21 May and 23 June and all plots sown 23 June were not harvested. There appeared to be a trend with the newer lines, such as CIPAL 801, 802 and 803, having higher grain yields than traditional varieties, but due to high variability and low yields no significant differences were not seen. Harvestability of the inter-row sown plots was much better than the conventional narrow plots.

Interpretation

Chickpeas – Grain yields of chickpea were generally good considering the extremely dry finish to the season. A key driver of yield differences observed between treatments in this trial was the herbicide damage. It is difficult to ascertain the proportion of the yield differences that could be attributed to the herbicide damage. When comparing varieties, there appeared to be a relationship between herbicide damage and grain yield, in that the varieties with higher herbicide damage scores had the greatest yield reduction in the narrow rows (data not shown). In addition, this trial highlighted the benefits of earlier sowing in chickpeas. Firstly it maximised harvesting height (as indicated by height to lowest pod) and secondly grain yields were up to 50 percent greater for some varieties. From a

breeding perspective, it is important to note that some varieties had relatively stable yields across sowing dates (eg. CICA0613).

Application

In dry seasons like 2008, earlier sowing is likely to maximise potential yield and maximise crop height for harvesting. In addition, no-till and wider rows (30cm in lentils and 30cm and 60cm in chickpeas) appear to maximise yield potential. Further work is required over coming seasons to confirm these findings in a range of environments.

This research has shown some varieties of chickpeas that are more responsive to sowing date than others, ie. Genesis 079 which benefits from early sowing. In addition, some varieties appear to show a greater reduction in the narrow row spacing than others. Further work is needed to confirm these findings in the absence of herbicide damage.

Further details of these trials is available in a full report encompassing all other measurements including emergence, anthesis, herbicide damage, biomass production, branching patterns, grain yield etc. Please contact Jason Brand (jason.brand@dpi.vic.gov.au or 0409 357 076) if you would like a copy of this report. It also includes all other Pulse Agronomy trials conducted at Curyo and Horsham in 2008.

