C4. Chickpea Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

Aim

Chickpea are generally considered to be unsuited to the agronomic practice of crop-topping due to their late maturity timing, and are the least of the four winter pulse crop types commonly grown in South Australia. This work aims to identify lines with improved adaptation (through earlier maturity) to this practice.

Treatments

Varieties: Table 2 (details of some breeding lines have been withheld).
Sowing date: 6 June.
Treatments: see tables for dates.

Nil	- no desiccant applied
Early	- applied 13 days pre ryegrass milky dough stage (12 Oct)
Recommended	- applied at ryegrass milky dough stage (25 Oct)
Late	- applied 12 days post ryegrass milky dough stage

Fertiliser: MAP + Zn @ 90kg/ha

Results and Interpretation

- There was no significant interaction between variety and crop-top timing for grain yield in 2012, which means that all varieties behaved similarly at each crop-top timing. This is the first instance (out of five trials) where this result has occurred and may have been due to a combination of moderate weed (bedstraw) competition and low levels of bird damage in this trial. These results should be interpreted with caution.
- Grain Yield – site mean yield was 1.13t/ha. Crop-top timing had a significant effect on grain yield of chickpea in 2012 (Table 1). All treatment timings incurred a significant yield loss, which decreased as the treatment timing was delayed. This result was more severe in 2012 than in previous seasons where only a few incidences of yield loss from crop-topping at the Late timing have occurred.

  Crop-topping at the Recommended timing for ryegrass control (milky dough stage) caused a 21% yield loss compared to the Nil, while crop-topping 2 weeks before and after the Recommended timing caused 40% and 5% yield losses, respectively.

  CICA0717 was the highest yielding variety (Table 2), but was not significantly higher yielding than Sonali, Genesis079, PBA Striker, PBA Slasher and the breeding line Chickpea 4. The latest maturing line Genesis114 was the equal lowest yielding variety in this trial, yielding similarly to Genesis509, PBA HatTrick, Genesis090 and Chickpea 3, but higher than the remaining 9 varieties in this trial.

  Long term grain yield responses to crop-topping (Table 4) shows a clear link between cultivar maturity and response to crop-topping. The earliest maturing varieties have shown the lowest incidence of yield loss and the lowest average yield loss percentages at the Early and Recommended crop-top timing, and have therefore been better suited to crop-topping than later maturing varieties. However high average yield losses at the Recommended timing still confirm that chickpea are poorly suited to this practice.
- Grain weight – all varieties showed reduced grain weight at the Early timing (Table 2), and ten of the 14 cultivars showed reduced grain weight at the Recommended timing. The varieties which showed no reduction in grain weight at the Recommended timing were generally earlier maturing cultivars (breeder's lines Chickpea 1 and Chickpea 3, and the commercial cultivars Sonali and Genesis509). No varieties showed reduced grain weight at the Late treatment timing.

  Long term summary of crop-topping on grain weight (Table 4) shows a link between cultivar maturity and grain weight following crop-topping. The later maturing kabuli varieties

Genesis090 and Genesis114 show increased sensitivity to reduced grain weight from crop-topping, particularly at the Late timings. Lower sensitivity in these varieties compared to others at the earlier timings may be due to the abortion of later developing flower and pods, greatly limiting grain yield by reducing total number of seeds per plant but with limited effect on grain weight.

Table 1. Effect of crop-top timing on grain yield (t/ha) of chickpeas, Melton 2012.

Treatment	Early 12-Oct	Recommended 25-Oct	Late 6-Nov	Nil	LSD (P<0.05)
Yield (t/ha)	0.81 [a]	1.08 [b]	1.29 [c]	1.36 [d]	0.066

Table 2. Grain yield (t/ha) of chickpea varieties, Melton 2012. Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late).

Variety	Flowering time	Maturity time	Grain Yield (t/ha)
Chickpea 1	VE	VE	1.08
Sonali	E	E	1.21
PBA Striker	E	E	1.25
Chickpea 2	E	E	1.11
Genesis079	E	E	1.28
Chickpea 3	E	E-M	1.03
Genesis509	E-M	E-M	0.99
CICA0717	M	M	1.3
Chickpea 4	E-M	M	1.24
CICA1252	E-M	M	1.12
PBA HatTrick	M	M	1.06
PBA Slasher	M	M	1.21
Genesis090	M	M	1.06
Genesis114	M-L	M-L	0.94
LSD (P<0.05)			**0.124**

* Lodging (1-9 score): 1 = prostrate, 9 = erect.

Table 3. Effect of crop-top timing on grain weight of chickpea varieties, Melton 2012.
Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late).

Variety	Grain Wt. (g/100)	Grain Weight (% of Nil)		
	Nil	Early 12-Oct	Recommended 25-Oct	Late 6-Nov
Chickpea 1	19.5	80	95	96
Sonali	18.0	88	96	100
PBA Striker	22.9	83	93	102
Chickpea 2	20.6	84	93	100
Genesis079	24.3	78	89	98
Chickpea 3	15.0	83	94	100
Genesis509	15.9	88	97	102
CICA0717	24.3	86	93	101
Chickpea 4	19.7	86	90	99
CICA1252	37.7	88	90	102
PBA HatTrick	20.2	85	86	98
PBA Slasher	19.5	83	87	95
Genesis090	29.7	90	83	97
Genesis114	36.5	83	86	100

lsd (P<0.05)timing.var = 1.214

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to Recommended timing

[b] = 2 weeks after Recommended timing

Table 4: Long term summary (2008-2012) of grain yield and grain weight responses of selected chickpea cultivars to crop-topping. Varieties are ranked according to their visual maturity rating from earliest to latest.

Variety	Incidence of significant yield losses (# trials)		Average Yield [Range] (% of Control)		Incidence of significant grain weight loss (# trials)			Average Grain Weight [Range] (% of Control)		
	Early	Rec.	Early	Rec.	Early	Rec.	Late	Early	Rec.	Late
PBA Striker	5 (5)	3 (5)	51 [31-68]	81 [74-93]	3 (5)	3 (5)	0 (5)	82 [60-97]	88 [80-99]	98 [93-99]
Genesis079	5 (5)	4 (5)	51 [25-81]	82 [71-96]	4 (5)	3 (5)	0 (5)	82 [72-95]	94 [86-104]	100 [99-104]
PBA Slasher	5 (5)	4 (5)	48 [30-64]	79 [65-91]	3 (5)	3 (5)	0 (5)	83 [73-92]	86 [78-96]	97 [94-101]
Genesis090	5 (5)	5 (5)	44 [25-61]	77 [64-84]	4 (5)	3 (5)	3 (5)	88 [79-96]	87 [83-93]	94 [91-97]
Genesis114	5 (5)	4 (5)	42 [17-60]	80 [65-94]	4 (5)	4 (5)	1 (5)	89 [83-96]	92 [85-102]	97 [90-104]

Key Findings and Comments

- A combination of weed competition and bird damage likely accounts for the absence of interaction between variety and crop-top application timing for grain yield in this trial. However significant treatment and variety responses were generated for grain yield, as well as a significant interaction for grain weight.
- Earlier maturing cultivars generally showed higher grain yield, favoured by the dry (but mild) finish to the season. The latest maturing cultivar Genesis114 showed the equal lowest average yield with other later maturing cultivars Genesis090, PBA HatTrick and Chickpea 3.
- Long term grain yield summary showed less yield loss from crop-topping in earlier maturing cultivars compared to later maturing cultivars. However all chickpea varieties are still poorly suited to this practice due to their unacceptably high yield losses compared to other pulse crops at the Recommended timing for ryegrass control.

- Grain weight does not generally influence profitability of pulses, however premiums are paid on seed size of kabuli chickpea. A close link exists between seed size and grain weight, and therefore grain weight was measured in this study to extrapolate the potential effect of crop-topping on seed size of chickpea.
- Earlier maturing varieties generally showed a lower reduction in grain weight at the Recommended timing, while later maturing varieties incurred a higher grain weight loss. Long term grain weight analyses also support these results. The common commercial cultivar Genesis090 showed greater sensitivity of grain weight to crop-topping applications than most other cultivars, particularly at the Late treatment timing, indicating that it may be subject to price penalties if this agronomic practice is used.