C2 Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

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Aim

To identify optimum maturity profiles for improved suitability to crop-topping of chickpea.

Treatments

Varieties: see Table C2.1
Sowing date: 27 June
Treatments: see tables for dates
Nil - no desiccant applied
Early Crop-top - applied 7-14 days pre ryegrass milky dough stage
Mid Crop-top - applied at ryegrass milky dough stage ("Recommended")
Late Crop-top - applied 7-14 days post ryegrass milky dough stage
Chemical: Paraquat at 800ml/ha
Fertiliser: MAP + Zn @ 90kg/ha

Table C2.1. Chickpea flowering and maturity ratings, Melton crop-top trial 2011.

Variety	Type	Flower	Maturity
Genesis 079	Kabuli	E	E-M
Genesis 090	Kabuli	M	M
Genesis 114	Kabuli	M-L	M-L
Genesis 509	Desi	E-M	E-M
PBA HatTrick	Desi	M	M
PBA Slasher	Desi	M	M
Sonali	Desi	E	E
CICA0603	Desi	E-M	E-M
CICA0717	Desi	M	M
CICA1123	Desi	M	M
01-481*03HS010	Desi	VE	E
01-482*03HS009	Desi	VE	E
02-150C*04HS003	Desi	E-M	M
03-028C*04HS004	Desi	E-M	M

E = Early, M = Mid, L = Late

Results and Interpretation

- Due to varying soil depth, and a relatively rapid finish in 2011, variable growth was observed over the trial in 2011. This carried through to variable grain yield across the trial, despite an acceptable cv value (9.9%). This can be seen from the low relative yield of untreated PBA HatTrick (all three Nil treatments were randomly located in poor areas) and the high percentage yield at the Recommended and Late crop-top timings (Table C2.2).
- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table 2).
- Grain Yield – All cultivars showed yield loss from crop-topping at the Early timing (Table C2.2). Seven of the 14 varieties in this trial also showed significant yield loss from crop-topping at the Recommended timing. These included Sonali, Genesis 079, Genesis 090, Genesis 114, CICA0717, CICA1123, and the breeding line 02-150C*04HS003. Sonali also showed yield loss from crop-topping at the Late timing.
  There was no clear effect of maturity on crop-topping response in this trial in 2011, most likely due to the variable plant growth which occurred across the trial site. However the latest maturing varieties did show the highest yield losses at the Early timing, and the three earliest maturing cultivars showed no yield loss from crop-topping at the Recommended timing.
  Long term grain yield responses to crop-topping (Table C2.3) show a clear link between cultivar maturity and response to crop-topping. The earliest maturing varieties showed the lowest incidence of yield loss and the lowest average yield loss percentages at the Early and Recommended crop-top timing, and are therefore 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 – 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 effect of crop-topping on seed size of chickpeas.
  All varieties showed reduced grain weight at the Early timing (Table C2.2), and ten of the 14 cultivars showed reduced grain weight at the Recommended timing. These were generally earlier maturing cultivars (breeders lines 01-482*03HS009, 01-481*03HS010 and the commercial cultivar Sonali), while the mid maturing breeders line 02-150C*04HS003 also showed no effect on grain weight from this treatment. The late maturing variety Genesis 090 was the only variety to show yield loss at the Late crop-top timing.
  Long term summary of crop-topping on grain weight (Table C2.3) shows a link between cultivar maturity and grain weight following crop-topping. Later maturing varieties Genesis 090 and Genesis 114 show more sensitivity to reduced grain weight from crop-topping, particularly at the Late timings. Decreased sensitivity in these varieties 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.
- Grain Mould – The effect of crop-topping on occurrence of mould in grain samples was also investigated in the 2011 trials. Assessments of a number of varieties detected high levels of mould in the Early crop-top treatment (Table C2.4). Recommended and Late treatment timings had similar mould levels to the Nil. This data shows that maturity at timing of crop-topping is likely to be important in determining the incidence of mould in crop-topped chickpea crops.

Table C2.2. Effect of crop-top timing on grain yield and grain weight of chickpeas, Melton 2011
Varieties are ranked according to their visual maturity rating from earliest to latest.

Treatment	Yield (t/ha)	Yield (% of Nil)			Grain Wt. (g/100)	Grain Weight (% of Nil)		
Variety	Nil	- 2 wks[a] (25/10)	Recommended (2/11)	+ 2 wks[b] (10/11)	Nil	- 2 wks[a] (25/10)	Recommended (2/11)	+ 2 wks[b] (10/11)
01-482*03HS009	2.1	58	96	97	20.0	60	90	100
01-481*03HS010	2.6	52	89	99	27.6	64	93	96
CICA0603	2.7	55	93	94	21.7	60	85	98
Sonali	2.9	43	69	78	18.1	68	92	102
Genesis 079	2.8	44	80	94	23.2	72	90	101
Genesis 509	2.5	44	87	97	16.6	57	81	98
CICA0717	2.9	47	84	87	24.3	62	87	99
02-150C*04HS003	2.5	50	85	99	19.4	54	93	103
03-028C*04HS004	2.6	51	93	104	22.2	61	83	91
CICA1123	2.6	43	81	89	35.4	51	88	102
PBA Hatrick	1.8	55	114	137	20.5	60	83	93
PBA Slasher	2.2	50	91	118	18.6	73	82	97
Genesis 090	2.2	40	77	100	32.3	83	83	91
Genesis 114	2.1	38	65	99	38.3	95	85	93
Mean	**2.46**	**1.18**	**2.09**	**2.42**	**24.1**	**16.2**	**21.0**	**23.4**

lsd (P<0.05)timing.var = 0.33, (Grain Yield), 2.0 (Grain Weight)
NB: Shading denotes significant difference from the Nil treatment.
[a] = 2 weeks prior to Recommended timing
[b] = 2 weeks after Recommended timing

Table C2.3. Long term summary (2008-2011) of grain yield response 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
CICA0603	4 (4)	2 (4)	49 [31-68]	81 [74-93]	2 (4)	2 (4)	0	82 [60-97]	87 [80-99]	97 [93-99]
Genesis 079	4 (4)	3 (4)	48 [25-81]	82 [71-96]	3 (4)	2 (4)	0	83 [72-95]	95 [86-104]	101 [99-104]
PBA Slasher	4 (4)	3 (4)	45 [30-64]	78 [65-91]	2 (4)	2 (4)	0	83 [73-92]	85 [78-96]	98 [94-101]
Genesis 090	4 (4)	4 (4)	40 [25-61]	77 [64-84]	3 (4)	2 (4)	3	87 [79-96]	88 [83-93]	94 [91-97]
Genesis 114	4 (4)	3 (4)	38 [17-57]	81 [65-94]	3 (4)	3 (4)	1	90 [83-96]	94 [85-102]	96 [90-104]

Table C2.4. Effect of crop-topping timing on incidence of mould on chickpea seed (# infected seeds/sample) at Melton, SA 2011.

Treatment Timing	**Early**	**Recommended**	**Late**	**Nil**	**LSD (0.05)**
No. Infected seeds/sample	25.8	4.4	2	7.1	7.9

Key Findings and Comments

Chickpea are generally considered to be unsuited to crop-topping due to their high yield losses, and are the least suited of the four pulse crops commonly grown in South Australia. This work aims to identify plant types and maturity profiles which may be better suited to this practice.

Variable early season growth arising from variable soil depth resulted in variable grain yield across the trial, and may have resulted in a lower correlation between variety maturity and yield losses from crop-topping than in previous seasons. In previous seasons yield losses have been observed in all varieties at the Early treatment timing and Recommended timings. Some varieties in 2011 did not show yield loss from crop-topping at the Recommended timing, although a similar trend was observed to previous seasons where earliest maturities generally showed less yield loss, and latest maturities generally showed the highest yield losses. Long term grain yield summary showed less yield loss in earlier maturing cultivars. However chickpea are still poorly suited to this practice due to their unacceptably high yield losses compared to other pulse crops at the ideal timing for ryegrass control and this practice is not recommended.

Grain weight response from crop-topping in 2011 aligned much more closely with cultivar maturity. Earliest maturities showed no reductions in grain weight at the Recommended timing, while latest maturities showed highest weight loss at all timings. Long term grain weight analysis also support these results. The common commercial cultivar Genesis 090 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 where this agronomic practice is used.

Incidence of field mould in grain samples has become an important issue for growers, and appears to be highly season dependent. However, preliminary results from the 2011 trials have shown that mould in chickpea samples may be associated with crop-topping while plants are still immature. This finding may have implications when crop-topping paddocks which may have varying levels of crop maturity due to variable soil types. Work is ongoing in this area.

The Pulse Breeding Australia Chickpea breeding program is committed to producing chickpea varieties with improvements in varietal performance and better suitability to common agronomic practices such as crop-topping. A recent focus has been on the development of varieties with earlier maturity, which will be better suited to this practice. These varieties will be evaluated over the coming years.