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Chickpea Desiccation Timing

Trial ID: LB2011

Location:

Dalby

Trial Year: 2020

Investigator:

Linda Bailey

This trial was one of a final series of trials focussed on generating an improved understanding of the impact of chickpea desiccation timing. Desiccation can provide benefits in reducing variability in uneven maturity crops, shortening the time to crop 'harvest readiness', reduce weed biomass and improve the efficiency of crop harvest.

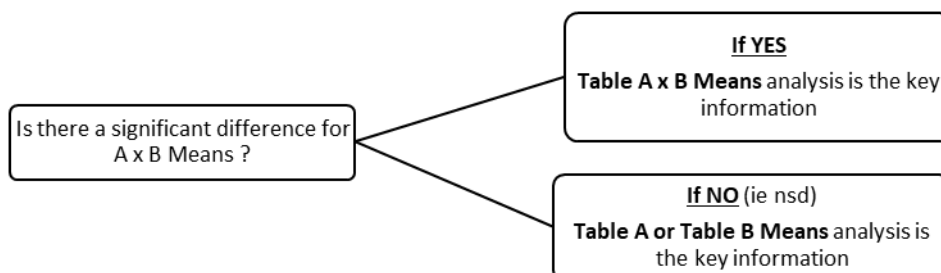
An additional focus of the work was to evaluate alternative desiccation options to glyphosate. Glyphosate or glyphosate + Ally have been the primary harvest aid options used in chickpeas. Glyphosate MRLs differ between many of our chickpea export markets and are frequently lower than the MRL applied in Australia. The loss of glyphosate as a harvest aid treatment in chickpeas is a real threat. This trial included unregistered options to evaluate potential glyphosate harvest aid replacements.

Objective:	To evaluate the impact of desiccation timing on chickpea yield and grain quality	
Crop & Variety:	Chickpeas cv. PBA Seamer	
Planting Date:	29/05/2020	
Planting Details:	Direct drilled with tyne on 60cm spacing	
Trial Design	Split plot with timing as main plot and desiccant as sub plots. Plot size 2 m x 12 m	
Desiccation Application:	A (Timing 1)	B (Timing 2)
Crop Maturity:	87% of pods physiologically mature	93% of pods physiologically mature
Application Date:	07/10/2020	12/10/2020
Harvest Date:	14/10/2020 (7 days after application)	21/10/2020 (9 days after application)
Keywords:	Desiccation, chickpea	

Trial designed and analysed as a Split Plot

	In Simple Terms
Table of A Means:	Mean of 'Timing' performance with ALL 'Desiccant' treatments
Table of B Means:	Mean of 'Desiccant' performance with ALL 'Timing' treatments
Table of A x B Means:	'Timing' performance with EACH 'Desiccant' treatment

How to interpret?



NB: Original plan was for 3 desiccation timings at 70, 80 and 90% pod maturity. Due to site relocation and rapid maturing of crop, only 2 timings were conducted – Timing 1 at 87% of pods physiologically mature and 5 days later, Timing 2 at 93% of pods physiologically mature.

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Table 1: Field assessments and grain moisture content

Crop Name Crop Variety Assessment Date Assessment Type Sample Size Assessment Unit ARM Action Codes				Chickpea PBA Seamer			
				A: 14/10/2020 B: 21/10/2020 DISCOLOUR Whole plot % AA	A: 14/10/2020 B: 21/10/2020 STEM SNAP 10 plants/ plot % AA	H1: 14/10/2020 H2: 21/10/2020 YIELD 1.6 m x 9 m t/ha	H1: 16/10/2020 H2: 23/10/2020 GRAIN MOISTURE 1.5 kg grain %
Trt No.	Treatment	Product Rate	Appln. Code				
TABLE OF A MEANS (Timing)							
1	Timing 1 (87% maturity)		A	98.3tb	58.4tb	2.69a	11.0b
2	Timing 2 (93% maturity)		B	100.0ta	95.4ta	1.70b	11.9a
TABLE OF B MEANS (Desiccant)							
1	Untreated	-		99.1t-	78.6t-	2.14-	11.4-
2	Crucial	1600ml/ha		99.9t-	73.1t-	2.27-	11.3-
3	Crucial Ally	1000ml/ha 5g/ha		99.7t-	85.9t-	2.14-	11.4-
4	Sharpen Hasten	34g/ha 1% v/v		99.1t-	85.6t-	2.27-	11.6-
5	Sharpen Ally Hasten	9g/ha 5g/ha 1% v/v		99.2t-	80.3t-	2.20-	11.6-
6	Sharpen Ally Hasten	34g/ha 5g/ha 1% v/v		99.9t-	77.7t-	2.16-	11.4-
TABLE OF A x B MEANS (Timing x Desiccant)							
1a	Untreated	-	A	96.3t-	56.7t-	2.51-	10.8-
2a	Crucial	1600ml/ha	A	99.5t-	46.1t-	2.91-	10.9-
3a	Crucial Ally	1000ml/ha 5g/ha	A	98.7t-	70.2t-	2.68-	10.8-
4a	Sharpen Hasten	34g/ha 1% v/v	A	97.7t-	63.0t-	2.79-	11.2-
5a	Sharpen Ally Hasten	9g/ha 5g/ha 1% v/v	A	96.7t-	62.3t-	2.63-	11.1-
6a	Sharpen Ally Hasten	34g/ha 5g/ha 1% v/v	A	99.5t-	51.6t-	2.65-	11.1-
1b	Untreated	-	B	100t-	94.2t-	1.77-	12.0-
2b	Crucial	1600ml/ha	B	100t-	93.1t-	1.63-	11.7-
3b	Crucial Ally	1000ml/ha 5g/ha	B	100t-	96.3t-	1.60-	12.0-
4b	Sharpen Hasten	34g/ha 1% v/v	B	99.9t-	98.5t-	1.75-	11.9-
5b	Sharpen Ally Hasten	9g/ha 5g/ha 1% v/v	B	100t-	93.5t-	1.77-	12.0-
6b	Sharpen Ally Hasten	34g/ha 5g/ha 1% v/v	B	100t-	95.4t-	1.66-	11.8-

Means followed by same letter do not significantly differ (P=.05, LSD)

t=Mean descriptions are reported in transformed data units, and are not de-transformed.

Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

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Table 2: Visual grain grading

Crop Name Crop Variety Description Assessment Type Assessment Unit Sample Size ARM Action Codes				Chickpea PBA Seamer			
				Mature Grain COUNT	Green Grain COUNT	Damaged Grain COUNT	Shrivelled Grain COUNT
				% 100 g grain AA	% 100 g grain	% 100 g grain AL	% 100 g grain AL
Trt No.	Treatment	Product Rate	Appln. Code				
TABLE OF A MEANS (Timing)							
1	Timing 1 (87% maturity)		A	98.0t b	0.14 -	0.47t-	1.37ta
2	Timing 2 (93% maturity)		B	98.8t a	0.00 -	0.26t-	0.88tb
TABLE OF B MEANS (Desiccant)							
1	Untreated	-		98.7t -	0.06 -	0.54t-	0.76t-
2	Crucial	1600ml/ha		98.4t -	0.04 -	0.30t-	1.20t-
3	Crucial	1000ml/ha		98.1t -	0.06 -	0.51t-	1.28t-
	Ally	5g/ha					
4	Sharpen	34g/ha		98.5t -	0.11 -	0.33t-	1.08t-
	Hasten	1% v/v					
5	Sharpen	9g/ha		98.3t -	0.05 -	0.30t-	1.33t-
	Ally	5g/ha					
	Hasten	1% v/v					
6	Sharpen	34g/ha		98.6t -	0.10 -	0.21t-	1.04t-
	Ally	5g/ha					
	Hasten	1% v/v					
TABLE OF A x B MEANS (Timing x Desiccant)							
1a	Untreated	-	A	98.2t-	0.13 -	0.74t-	1.09t-
2a	Crucial	1600ml/ha	A	98.1t-	0.08 -	0.32t-	1.50t-
3a	Crucial	1000ml/ha	A	97.6t-	0.13 -	0.74t-	1.53t-
	Ally	5g/ha					
4a	Sharpen	34g/ha	A	97.9t-	0.23 -	0.49t-	1.36t-
	Hasten	1% v/v					
5a	Sharpen	9g/ha	A	97.8t-	0.10 -	0.42t-	1.65t-
	Ally	5g/ha					
	Hasten	1% v/v					
6a	Sharpen	34g/ha	A	98.4t-	0.20 -	0.19t-	1.15t-
	Ally	5g/ha					
	Hasten	1% v/v					
1b	Untreated	-	B	99.2t-	0.00 -	0.35t-	0.49t-
2b	Crucial	1600ml/ha	B	98.8t-	0.00 -	0.29t-	0.94t-
3b	Crucial	1000ml/ha	B	98.6t-	0.00 -	0.30t-	1.06t-
	Ally	5g/ha					
4b	Sharpen	34g/ha	B	98.9t-	0.00 -	0.19t-	0.84t-
	Hasten	1% v/v					
5b	Sharpen	9g/ha	B	98.7t-	0.00 -	0.20t-	1.05t-
	Ally	5g/ha					
	Hasten	1% v/v					
6b	Sharpen	34g/ha	B	98.8t-	0.00 -	0.23t-	0.94t-
	Ally	5g/ha					
	Hasten	1% v/v					

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Table 3: Visual grain grading and seed germination

Crop Name Crop Variety Description Assessment Type Assessment Unit Sample Size ARM Action Codes				Chickpea PBA Seamer	
				Whole Intact Pods	Seed
				COUNT	GERMINATION
				% 100 g grain AL	% 100 seeds AA
Trt No.	Treatment	Product Rate	Appln. Code		
TABLE OF A MEANS (Timing)					
1	Timing 1 (87% maturity)		A	1.37t-	99t-
2	Timing 2 (93% maturity)		B	0.66t-	97t-
TABLE OF B MEANS (Desiccant)					
1	Untreated	-		1.25t-	97t-
2	Crucial	1600ml/ha		0.73t-	99t-
3	Crucial	1000ml/ha		1.08t-	99t-
	Ally	5g/ha			
4	Sharpen	34g/ha		0.70t-	98t-
	Hasten	1% v/v			
5	Sharpen	9g/ha		1.48t-	97t-
	Ally	5g/ha			
	Hasten	1% v/v			
6	Sharpen	34g/ha		0.77t-	98t-
	Ally	5g/ha			
	Hasten	1% v/v			
TABLE OF A x B MEANS (Timing x Desiccant)					
1a	Untreated	-	A	1.36t-	99t-
2a	Crucial	1600ml/ha	A	0.77t-	100t-
3a	Crucial	1000ml/ha	A	1.70t-	99t-
	Ally	5g/ha			
4a	Sharpen	34g/ha	A	1.29t-	99t-
	Hasten	1% v/v			
5a	Sharpen	9g/ha	A	2.19t-	94t-
	Ally	5g/ha			
	Hasten	1% v/v			
6a	Sharpen	34g/ha	A	1.14t-	98t-
	Ally	5g/ha			
	Hasten	1% v/v			
1b	Untreated	-	B	1.14t-	95t-
2b	Crucial	1600ml/ha	B	0.69t-	97t-
3b	Crucial	1000ml/ha	B	0.60t-	100t-
	Ally	5g/ha			
4b	Sharpen	34g/ha	B	0.26t-	95t-
	Hasten	1% v/v			
5b	Sharpen	9g/ha	B	0.92t-	99t-
	Ally	5g/ha			
	Hasten	1% v/v			
6b	Sharpen	34g/ha	B	0.47t-	97t-
	Ally	5g/ha			
	Hasten	1% v/v			

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COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer DISCOLOUR % AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	1543.347415				
R	3	35.821616	11.940539	0.543	0.6569	
A	1	611.372573	611.372573	60.512	0.0044	2.9
ERROR A	3	30.309752	10.103251			
B	5	112.511173	22.502235	1.022	0.4222	4.8
AB	5	93.043370	18.608674	0.845	0.5285	6.8
ERROR B	30	660.288931	22.009631			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer STEM SNAP % AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	15742.611346				
R	3	306.839921	102.279974	0.595	0.6232	
A	1	9230.580508	9230.580508	79.661	0.0030	9.9
ERROR A	3	347.620456	115.873485			
B	5	506.272734	101.254547	0.589	0.7083	13.4
AB	5	193.873686	38.774737	0.226	0.9485	18.9
ERROR B	30	5157.424040	171.914135			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Harvest 1: 14/10/2020; Harvest 2: 21/10/2020 YIELD t/ha						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	14.562733				
R	3	0.273279	0.091093	1.537	0.2253	
A	1	11.955599	11.955599	612.171	0.0001	0.13
ERROR A	3	0.058589	0.019530			
B	5	0.149682	0.029936	0.505	0.7701	0.25
AB	5	0.347245	0.069449	1.172	0.3461	0.35
ERROR B	30	1.778338	0.059278			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer GRAIN MOISTURE %						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	15.226667				
R	3	0.811667	0.270556	3.070	0.0428	
A	1	10.267500	10.267500	54.598	0.0051	0.4
ERROR A	3	0.564167	0.188056			
B	5	0.449167	0.089833	1.019	0.4239	0.3
AB	5	0.490000	0.098000	1.112	0.3750	0.4
ERROR B	30	2.644167	0.088139			

Chickpea Desiccation Timing

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COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Mature Grain COUNT % AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	178.507180				
R	3	11.661502	3.887167	1.170	0.3375	
A	1	46.734494	46.734494	20.283	0.0204	1.39
ERROR A	3	6.912487	2.304162			
B	5	9.558547	1.911709	0.576	0.7182	1.86
AB	5	3.988089	0.797618	0.240	0.9415	2.63
ERROR B	30	99.652061	3.321735			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Green Grain COUNT %						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	1.241778				
R	3	0.238216	0.079405	5.281	0.0048	
A	1	0.245599	0.245599	3.093	0.1769	0.26
ERROR A	3	0.238216	0.079405			
B	5	0.034333	0.006867	0.457	0.8051	0.13
AB	5	0.034333	0.006867	0.457	0.8051	0.18
ERROR B	30	0.451081	0.015036			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Damaged Grain COUNT % AL						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	0.543266				
R	3	0.010718	0.003573	0.303	0.8233	
A	1	0.054113	0.054113	5.890	0.0936	0.09
ERROR A	3	0.027562	0.009187			
B	5	0.064324	0.012865	1.089	0.3865	0.11
AB	5	0.032272	0.006454	0.547	0.7396	0.16
ERROR B	30	0.354277	0.011809			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Shrivelled Grain COUNT % AL						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	0.657940				
R	3	0.054709	0.018236	1.504	0.2337	
A	1	0.122655	0.122655	12.992	0.0366	0.09
ERROR A	3	0.028323	0.009441			
B	5	0.077297	0.015459	1.275	0.3006	0.11
AB	5	0.011141	0.002228	0.184	0.9666	0.16
ERROR B	30	0.363816	0.012127			

Chickpea Desiccation Timing

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COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer Whole Intact Pods COUNT % AL						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	1.814144				
R	3	0.166437	0.055479	1.992	0.1365	
A	1	0.290286	0.290286	3.733	0.1489	0.26
ERROR A	3	0.233312	0.077771			
B	5	0.185531	0.037106	1.332	0.2777	0.17
AB	5	0.102882	0.020576	0.739	0.6005	0.24
ERROR B	30	0.835696	0.027857			

COMPLETE SPLIT-PLOT AOV Chickpea cv. PBA Seamer GERMINATION % AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	2072.595061				
R	3	129.141623	43.047208	1.030	0.3931	
A	1	67.340973	67.340973	7.256	0.0742	3
ERROR A	3	27.842213	9.280738			
B	5	149.028466	29.805693	0.713	0.6182	7
AB	5	445.989121	89.197824	2.135	0.0884	9
ERROR B	30	1253.252665	41.775089			

ARM Action Codes

AA = Automatic arcsine square root % transformation

AL = Automatic log transformation of X+1

Assessment Type

DISCOLOUR = Phytotoxicity - % discoloration

STEM SNAP = Measurement of stem dry down as indicator of harvest readiness. 10 plants/plot were twisted and evaluated. Recorded the % of plants where all stems had snapped in 2 twists.

MOISTURE = % grain moisture analysed by NIR

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Conclusions:

This trial was designed to determine the impact of desiccant application timing whilst evaluating potential alternatives to glyphosate for chickpea desiccation. The objective was to evaluate application at ~70%, 80% and 90% pod maturity. Application timings were delayed with Timing 1 (T1) occurring at ~87% pod maturity (~label recommendation) and Timing 2 (T2) 5 days later at ~93%. A planned third application timing was not conducted due to the rapid rate of crop maturing. Harvest was conducted 7 days after T1 and 9 days after T2. Shortly prior to each harvest, visual ratings of crop discolouration and leaf drop were conducted and a physical measure of stem dry down (stem snapping) was performed. Grain quality was evaluated within 24 hours of both harvest timings.

Visual ratings of crop discolouration showed no significant difference between any treatment and the untreated at either timing. High levels of natural crop discolouration (96-100%) were apparent in untreated plots at both assessments as the crop was in a phase of rapid dry down. There was no significant difference in the % stem snapping between any treatment compared to the untreated. There was however a significantly greater % of stem snapping in all treatments from the T2 application due to natural crop ripening rather than any treatment effect.

There were no significant desiccation effects on yield from the treatments applied. However yields at the T2 harvest were reduced by ~1 t/ha. Explaining this reduced yield is difficult. Losses of ~1-4% in grain yield can often be attributed to a reduction in % grain moisture from delayed harvest. However, in this trial, 9 mm of rain was received two days prior to the 2nd harvest with grain moisture actually ~1% higher from the T2 harvest. An assessment of whole intact pods was conducted on the harvest grain samples. The % of intact pods was low at both harvests with no indication of increased un-thrashed pods at T2 harvest. Increases in cracked grain are also common from delayed harvests due to lower grain moisture. These cracked grains may be blown out of the header resulting in lower harvest yield. In this situation there was no indication of increased cracking of grain at T2 harvest, most likely due to the higher grain moisture. The most likely explanation is that a difference in header set-up combined with increasing crop maturity and harvest conditions resulted in the increased grain loss at harvest. These losses may have been at the front of the header due to pod shattering and loss, increased losses within the header due to harvest shortly after a rain event, or a combination of the two.

Visual grain grading was conducted on all samples with no significant differences between desiccation treatments and the untreated. Mature grain accounted for ~98-99% of the harvested weight from both harvest timings. The % of mature grain was significantly higher (by ~1%) at the 2nd harvest, most likely due to the extra 7 days of crop ripening. Grain from the second harvest timing had significantly less shrivelled grain (by ~0.5%).

Germination tests were conducted on seed from all treatments, with no significant differences apparent and mean germination of ~97-99% observed across all treatments.

Unfortunately, due to the rapid natural desiccation of the crop, no data was able to be generated to evaluate the benefits of alternate treatment options to glyphosate in this trial.

Crop Description	
Crop:	<i>Cicer arietinum</i> Chickpea
Variety:	Kyabra
Planting Date:	29/06/2020
Planting Rate:	60 kg/ha
Planting Method:	Direct Drilled
Planting Depth, Unit:	20cm
Planting Equipment:	Tyne Planter
Row Spacing, Unit:	43cm
Harvest Dates:	H1: 14/10/2020 H2: 21/10/2020
Harvested Width, Unit:	1.6m
Harvested Length, Unit:	9m

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Application Description		
	A	B
Application Date:	7/10/2020	12/10/2020
Application Start Time:	6:00 AM	6:00 AM
Application Stop Time:	7:30 AM	7:30 AM
Application Method:	SPRAY	
Application Timing:	PRE-HARVEST	
Application Placement:	FOLIAR	
Applied By:	Kalyx	
Air Temperature, Unit:	18 C	17 C
% Relative Humidity:	66	73
Wind Velocity, Unit:	3 km/h	8 km/h
Wind Direction:	NE	ENE
Dew Presence (Y/N):	No	
Soil Moisture:	Dry	
% Cloud Cover:	0	100
Next Moisture Occurred On:	13/10/2020	13/10/2020

Crop Stage at Each Application				
	A		B	
Crop:	<i>Cicer arietinum</i> Chickpea			
Stage Scale Used:	% pod maturity		% pod maturity	
Stage Majority, %:	100	33%	100	87%
Stage Minimum, %:	64	7%	67	7%
Stage Maximum, %:	100	33%	100	87%

Application Equipment		
	A	B
Application Equipment:	HBM032	HBM033
Equipment Type:	SPRBAC	
Operation Pressure, Unit:	250 kPa	
Nozzle Type:	AIRMIX	
Nozzle Size:	110015	
Boom Length, Unit:	2 m	
Boom Height, Unit:	50 cm	
Ground Speed, Unit:	4.8 km/h	
Spray Volume, Unit:	100 L/ha	