Commercial harvest loss assessments in chickpeas

Ed Offner, Jess Mickelborough, Edward Britten, Agronomist, MCA Agronomy Pty Ltd

Key words

chickpea, harvest, losses

Take home message

- Australian chickpea growers are potentially leaving hundreds of dollars per hectare behind at harvest due to header setup
- Header set up and modifications may have a dramatic impact on harvest losses
- As farm scale has increased over time, harvest efficiency has become more crucial. However, have harvest losses increased to achieve this efficiency? Is there potential to achieve both an efficient harvest and reduce grain losses at harvest?
- Can we produce guidelines to educate growers on what can be achieved by improving harvest setups or using header adaptions in chickpeas?

Introduction

Producing a chickpea crop is a large investment so there is nothing more frustrating than watching a fair percentage of that crop being left on the ground through harvest losses.

Harvest losses are not a new issue to pulse production. Harvest evaluations in mungbeans in CQ in 1985-1987 seasons, found harvest losses to be on average 30% of harvestable yield. This equated to approximately 230kg/ha (Cumming 2010).

Since that time, industry has been extremely fortunate to have had plant breeders working hard to achieve huge advancements in the harvestability of modern pulse varieties including chickpeas. There have also been significant engineering improvements to header fronts: drapers, self-levelling, flex platforms and others.

Air reels were commonly used in the past for harvesting pulses to improve harvestability. Improvements to modern fronts has meant the majority of growers are no longer using air reels as a preferred option. Even with all of these engineering improvements, are we still incurring unacceptable harvest losses?

In recent years growers have been reporting particularly high levels of harvest losses in chickpeas, predominantly at the header front near the knife. Growers were reporting that pod losses were occurring when the knife hit the plant and when pods were rolling off the front over the knife. After observing this happening on many of our clients' farms, MCA undertook some basic pod counts to better understand how much was being left behind. Assessments were undertaken on three farms in the Meandarra district with varying header front set ups. Our data collection and analysis would not stand up to any scrutiny by a biometrician, however the extent of the losses and the potential impact on profitability was extreme in some cases. Refer to Figure 1. (Please note these were multiple fields and in some cases had multiple machines working).

Method 1

Twelve random samples were assessed per field to look at the yield and dollars per hectare lost at harvest. Each sample was 1/10th of a square metre. Whole unsplit pods were counted, and we assumed an average of 1 seed per pod with a seed size of 5000 seeds/kg and an on-farm price $800/t. Refer to Table 1 and Figure 1.

Table 1. 2018 Pod loss at the header front

	Conventional header set up	Conventional header set up	Conventional header set up	Conventional header set up	Flex front	Flex front	Flex front
Seed counts/0.1m^2	17	10	0	5	12	3	21
	12	81	16	34	2	6	14
	9	47	19	0	6	12	5
	8	12	8	8	15	7	9
	5	4	6	28	17	27	5
	47	2	8	6	52	6	1
	56	14	12	44	2	16	7
	20	8	7	17	1	45	14
	41	27	46	12	1	8	6
	22	2	13	8	3	31	16
	14	17	7	7	24	15	5
	7	31	22	3	2	9	8
Total	258	255	164	172	137	185	111
Average	21.5	21.2	13.7	14.3	11.4	15.4	9.2
Seeds/m^2	217	214	138	145	115	155	93
Seeds/ha	2167339	2142137	1378024	1444557	1150877	1554103	932460
	GROWER 1	**GROWER 1**	**GROWER 1**	**GROWER 2**	**GROWER 3**	**GROWER 3**	**GROWER 3**
Variety	**HatTrick**(b)	**HatTrick**(b)	**HatTrick**(b)	**HatTrick**(b)	**Seamer**(b)	**Seamer**(b)	**Kyabra**(b)
Rigid/Flex front	**Rigid Front**	**Rigid Front**	**Rigid Front**	**Rigid Front**	**Flex Front**	**Flex Front**	**Flex Front**
Kg/ha assuming 5,000 seeds	433	428	276	289	230	311	186
$/ha on the ground assuming $800/t	$347	$343	$220	$231	$184	$249	$149

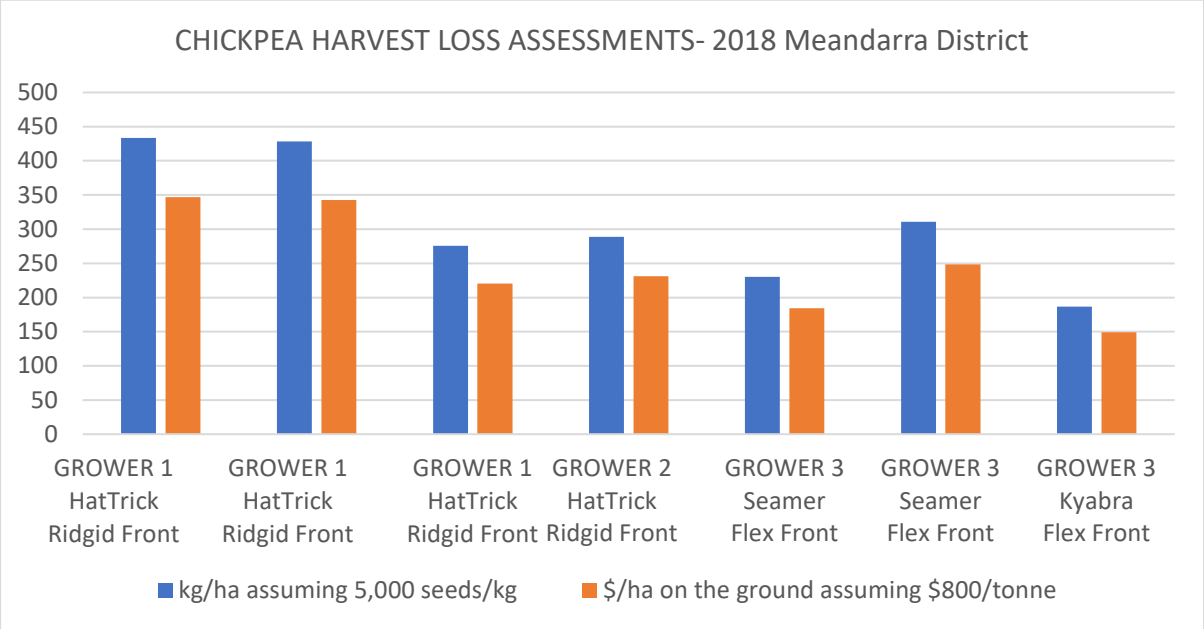

Figure 1. 2018 Pod loss at the header front
(HatTrick, Seamer and Kyabra are varieties protected under the Plant Breeders Rights Act 1994)

Of note: Grower 1 for example, had variations from field to field and there were multiple headers working in these fields. The variation may have been operator, ground conditions and/or set up. It appeared that the flex fronts were an improvement, however in one of grower 3's fields, there was still significant losses.

After being quite shocked by what the pod counts were suggesting, we started asking the question, "Can we reduce losses by modifying the header front?".

Multiple clients tried different modifications, including adding paddles to the reel, fixing different light crop fingers, adding bristles behind the knife sections and a combination of these attachments. They achieved varying results. Some clients also purchased flex fronts, again achieving varying results depending on the design of the front, and crop and field conditions.

After observing a well-regarded pulse grower utilise an AWS Airbar® attachment mounted in front of the reel of a John Deere® flex front harvesting mungbeans, and achieving a large reduction in losses, MCA became interested in the concept and started discussing it with clients.

In 2018 and 2019 four of our clients invested in the Airbar systems. We then decided to do some more basic pod counts to try and measure a reduction in losses. The average improvement in losses was 180 kg/ha with one very short low yielding crop showing an extreme improvement of 297 kg/ha.

Method 2

We asked header operators to do strips with the Airbar operating and then set up without the Airbar operating. In these strips we assessed 20 x 625 cm^2 samples and assumed 1.5 seeds/pod and a seed size of 5000 seeds/kg. Please note our data collection and analysis is not to be seen as statistically valid. Refer to Table 2 and Figure 2.

Table 2. 2019 Airbar pod counts (4 comparison sites)

Site 1: HatTrick(1), yield 0.4t/ha, 50cm rows 2018								
Regular header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average/m^2	Average/ha
1	5	18	5	5	6	7.8	125	
2	13	14	3	1	9	8	128	
3	13	12	10	22	5	12.4	198	
4	33	4	4	7	10	11.6	186	
					Total Av.	**9.95**	**159**	1,592,000
							Av peas/ha (assuming 1.5 peas/pod)	2,388,000
							Kg/ha (assuming 5000 peas/kg)	478
							t/ha	0.48
Air header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average/m^2	Average/ha
1	4	0	9	0	0	2.6	42	
2	2	8	12	5	11	7.6	122	
3	1	6	1	6	0	2.8	45	
4	0	0	2	0	8	2	32	
					Total Av.	**3.7**	**60**	600,000
							Av peas/ha (assuming 1.5 peas/pod)	900,000
							Kg/ha (assuming 5000 peas/kg)	180
							t/ha	0.18
							Difference (kg/ha)	298
							t/ha	0.30
							Cost/ha (assuming $800/t)	$238
							Area (ha)	350
							Paddock benefit of airfront	**$83,328**

Site 2: Kyabra(1), yield 0.6 t/ha 50cm rows 2019								
Regular header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average /m^2	Average/ha
1	3	0	7	3	3	3.2	51	
2	2	6	2	5	3	3.6	58	
3	5	1	0	6	1	2.6	42	
4	0	5	12	6	6	5.8	93	
					Total Av.	**3.8**	**61**	608,000
							Av peas/ha (assuming 1.5 peas/pod)	912,000
							Kg/ha (assuming 5000 peas/kg)	182
							t/ha	0.18
Air header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average /m^2	Average/ha
1	2	1	5	1	0	1.8	29	
2	1	2	2	4	0	1.8	29	
3	5	2	0	1	1	1.8	29	
4	1	0	2	0	0	0.6	10	
					Total Av.	**1.5**	**24**	240,000
							Av peas/ha (assuming 1.5 peas/pod)	360,000
							Kg/ha (assuming 5000 peas/kg)	72
							t/ha	0.07

Difference (kg/ha)	110
t/ha	0.11
Cost/ha (assuming $800/t)	$88
Area (ha)	292
Paddock benefit of airfront	**$25,789**

Site 3: Seamer, 1.5 t/ha, 75cm rows								
Regular header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average/m^2	Average/ha
1	5	2	10	7	10	6.8	109	
2	2	2	6	2	2	2.8	45	
3	0	12	0	1	3	3.2	51	
4	6	6	0	3	4	3.8	61	
					Total Av.	**4.15**	**66**	664,000
						Av peas/ha (assuming 1.5 peas/pod)		996,000
						Kg/ha (assuming 5000 peas/kg)		199
						t/ha		0.20
Air header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average /m^2	Average/ha
1	1	1	8	3	1	2.8	45	
2	1	1	2	0	1	1	16	
3	2	1	1	1	1	1.2	19	
4	1	2	0	4	2	1.8	29	
					Total Av.	**1.7**	**27**	272,000
						Av peas/ha (assuming 1.5 peas/pod)		480,000
						Kg/ha (assuming 5000 peas/kg)		82
						t/ha		0.08
						Difference (kg/ha)		118
						t/ha		0.12
						Cost/ha (assuming $800/t)		$94
						Area (ha)		150
						Paddock benefit of airfront		**$14,112**

Site 4: Seamer, 0.5 t/ha, 37cm rows								
Regular header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average/m^2	Average/ha
1	11	3	5	0	10	5.8	93	
2	4	1	4	8	9	5.2	83	
3	11	7	4	1	13	7.2	115	
4	10	2	13	8	2	7	112	
					Total Av.	**6.3**	**101**	1,008,000
						Av peas/ha (assuming 1.5 peas/pod)		1,512,000
						Kg/ha (assuming 5000 peas/kg)		304
						t/ha		0.30
Air header front								
Counts/25cm^2						Average/625cm^2 (25x25cm)	Average /m^2	Average/ha
1	0	4	4	6	1	3	48	

2	2	5	0	0	3	2	32	
3	1	3	2	2	5	2.6	42	
4	0	0	1	1	1	0.6	10	
					Total Av.	**2.05**	**33**	328,000
							Av peas/ha (assuming 1.5 peas/pod)	492,000
							Kg/ha (assuming 5000 peas/kg)	98
							t/ha	0.10
							Difference (kg/ha)	204
							t/ha	0.20
							Cost/ha (assuming $800/t)	$163
							Area (ha)	463
							Paddock benefit of airfront	**$75,562**

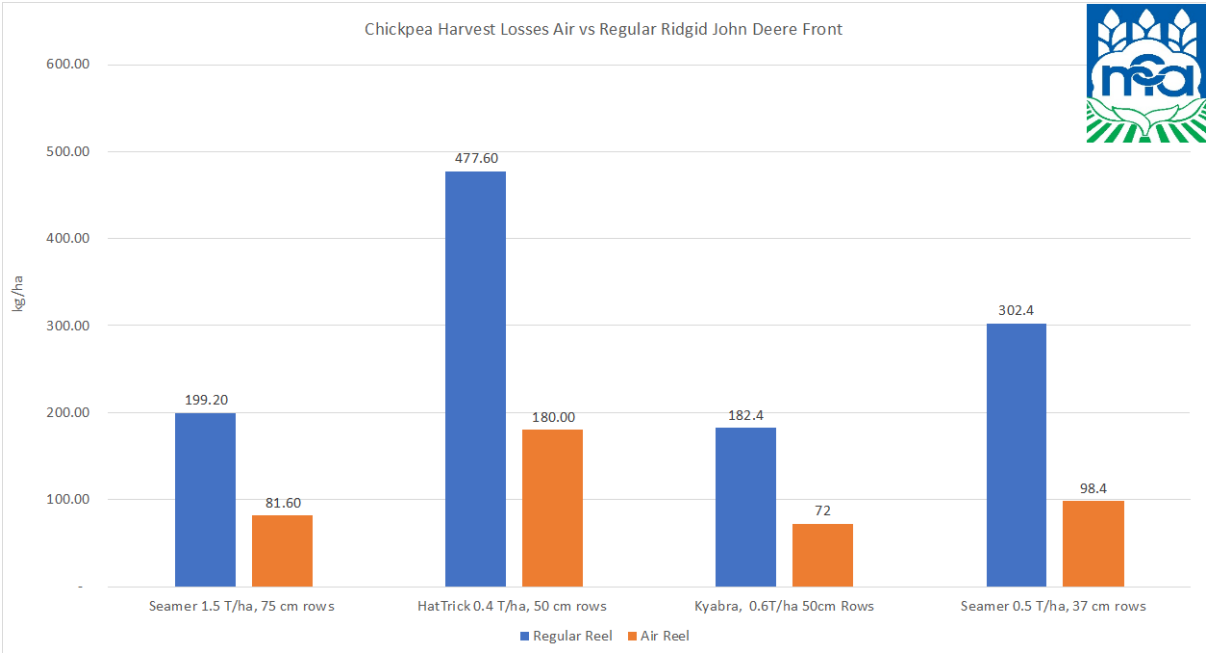

Figure 2. 2019 Harvest losses in chickpeas based on pod counts left on the ground after harvesting with a regular and an air assisted reel
(HatTrick, Seamer and Kyabra are varieties protected under the Plant Breeders Rights Act 1994)

Please note: These were all rigid John Deere draper fronts with AWS Airbar attachments. These results may not be replicated with other machines or in different harvesting conditions.

Discussion

From the limited data we collected which was anecdotally supported by machinery operators, header front adjustments and modifications may provide improvements to chickpea harvest losses. Our sampling occurred in varying varieties in a range of crop yields. Of note these years were particularly low yielding. The results may not be replicated in more favourable seasons with taller crop canopies improving feeding over the knife. In fact, in higher yielding years it may be possible that these modifications may have a negative impact on losses. Replicated, statistically significant sampling needs to be collected over multiple years to answer these questions.

Conclusion

Harvest is arguably the most important aspect of chickpea crop management. Very large improvements in profitability may be achieved by adapting harvester set ups in some situations. Growers should invest the time to monitor losses and attempt to reduce these losses as the improvements to profits may be significant.

Acknowledgements

I would like to acknowledge Jess Mickelborough and Edward Britten for conducting the pod counts and tabling the information.

References

Cumming G. (editor) (2010). Northern mungbean best management practice training course, module 8 – desiccation harvest and storage.

Contact details

Ed Offner
Director/Consultant
MCA Agronomy Pty Ltd
PO Box 1034, GOONDIWINDI QLD 4390
Mb: 0409 712 011
Email: EdOffner@mcagoondi.com.au