

Sowing flexibility of chickpea and lentil in the Western Australian farming system

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Key messages

- Chickpea and lentil can be successfully grown on sands outside their traditional growing areas.
- Chickpea and lentil can be sown to depths of up to 200mm, with no delay to emergence and no impact on establishment, phenology and yield.
- In the low to medium rainfall areas earlier sowing produces higher yields in chickpea and lentil
- Sowing position (edge/inter-row) on ameliorated sand makes no difference to plant establishment and yield, however, continued seasons of edge row sowing could offer a benefit.

Aims

At present, few break crop choices are available to Western Australian growers. To address this, we are evaluating novel planting strategies for high-value pulses in the medium- and low-rainfall areas. The goal is to develop easily implemented sowing options that enable growers to consider incorporating high-value pulses into their rotations.

Introduction

Chickpea and lentil offer considerable potential across WA as alternate break crops to the more commonly used options of canola and lupin. In addition to providing good gross margins, incorporating high-value pulses into rotation can improve soil nitrogen and provide a disease break for cereal crops. Over the past 20 years chickpea and lentil use has declined substantially in WA, however, recent good prices and new cultivars with improved resistance to ascochyta blight and/or with herbicide resistance has renewed interest in these crops. The increasing occurrence of liming as part of farming practice has also broadened the potential growing area in WA for these acid intolerant crops. Agronomic packages for the newer varieties are still being developed within WA. Here we focus on the impact of sowing time, depth and position on lentil and chickpea plant emergence, establishment and yield in the low- to medium- rainfall areas.

Sowing time is a key factor in crop yield, with sowing times relating to both crop phenology and site x season variation. Work done by the Department of Primary Industries and Regional Development (DPIRD) and the University of Western Australia (UWA) in the late 1990s suggested lentil yield declines in WA as sowing time is delayed. Across the grain growing areas of WA a late April or early May sowing allows for the longest period for biomass production and yield. In chickpea, optimum sowing times depend on region, likely due to the temperature dependant nature of pod set in this crop (critical daily temperature of 15-16°C for pod to set). In the drier areas higher chickpea yields were generated with earlier sowing times. Late April/early May performed the best with a significant drop in yield if sown later than mid-May (Regan et al 2006; Siddique et al 1998).

Declining autumn rainfall and a more variable break of season can result in insufficient moisture near the soil surface for early-sown crops. However, adequate moisture can be

found at depth, especially if there has been summer rainfall or a fallow. Deep sowing can also reduce seed predation and avoid phytotoxicity of pre-emergent herbicides. In wheat, deep sowing can result in a slower, reduced emergence and lower early leaf area (leading to lower weed competition and more soil evaporation), which usually results in lower yields. However, in both lentil and chickpea this does not appear to be the case with several studies from overseas and a WA study (Siddique and Loss, 1999) showing that sowing depths up to 10cm had no significant effect on plant emergence time, establishment, phenology, nodulation and dry matter production. Yield/depth interactions varied, although generally there was little impact on yield from deep sowing.

In our 2019 field trials we investigated whether deep, early sowing of pulses before the main sowing program could capitalise on stored soil water or early false breaks. We wanted to determine how deep the pulses could be sown and assess an early vs mid-season sowing time with a current variety.

Method

Trials for sowing date and depth of pulses were sown at Merredin and Dandaragan in April and May (see Table 1). Trials were fully replicated ($n = 4$) with split plot designs. At Dandaragan a sowing position trial (edge- vs inter-row) was also established with chickpea and lentil sown into plots near or between rows of standing wheat stubble on April 15. These plots were all ripped in 2018 and half had also been spaded. The 2018 wheat stubble had been sown as 25cm (10") paired rows and the 2019 near-row sowing successfully sowed inter-row (mean 12.4cm from centre of standing pair-row stubble) vs sowing through one of the stubble paired-rows (edge-row; mean 6.8cm from remaining standing stubble row).

Table 1: Field experimental conditions with sowing depths and dates for PBA Striker chickpea and PBA Bolt lentils in 2019.

Site	Sowing date	crop	Sowing depth			Soil moisture at sowing (%)		GSR (mm)	soil pH	
			50 mm	120 mm	200 mm	0 - 100 mm	100 - 200 mm		50 mm	200 mm
Dandaragan (deep sand)	April 15/16	Chickpea	✓		✓	4.46 ± 0.2	3.32 ± 0.3	242	6.5 ± 0.2	6.1 ± 0.5
		Lentil	✓		✓					
	May 27	Chickpea	✓		✓	1.56 ± 0.2	1.78 ± 0.3	221.3		
		Lentil	✓		✓					
Merredin (sandy loam)	April 9	Chickpea	✓	✓		5.84 ± 0.3	7.50 ± 0.4	176.4	4.7 ± 0.2	4.6 ± 0.3
		Lentil								
	May 9	Chickpea	✓		✓	4.14 ± 1.2	8.05 ± 0.5	172.6		
		Lentil	✓		✓					

Plant emergence time and number were counted by hand and establishment monitored as canopy cover increased over time. Time to 50% of plot flowering was recorded, and biomass cuts taken at full anthesis and maturity.

Hand harvest cuts were completed on October 29 (Merredin) and November 5 (Dandaragan) with machine harvesting by contractors on November 26/27. November was very hot and dry and both crops experienced pod-shedding before machine harvest, which along with header issues resulted in significantly lower machine yields than hand cuts. In Dandaragan, machine-harvested chickpea yields were 30% lower and lentil 36% lower while in Merredin machine-harvested chickpeas were 48% lower and lentil 29% lower than hand harvests.

Results

There was no significant difference in emergence time or number between the different sowing times, depths or positions of any crop. Plots sown at 120mm emerged no later than those sown at 50mm and the 'extreme depth' plots (200mm) emerged with only a few days delay (3 – 6 days). These 'extreme depth' plots showed slightly slower development (canopy cover) but phenology was not affected and biomass cuts at harvest showed no difference between sowing depths. Sowing depth had no significant impact on yield in any trial, although sowing at 50mm tended to give slightly higher yields than at 200mm. Sowing time, however, did affect yield with higher yields being achieved by both crops sown earlier at both Dandaragan and Merredin (see Table 2). There was no significant difference in yield between sowing position for either lentil or chickpea, nor was there a yield difference in spaded or un-spaded treatments. Machine harvested yield of this trial was $0.86 \pm 0.03\text{t/ha}$ for chickpea and $0.72 \pm 0.04\text{t/ha}$ for lentil.

Table 2. Hand harvested yields (with SD) from depth trials in 2019; sowing depths were pooled as no significant difference was found. Yields at t/ha \pm SD

SITE	SOWN	Chickpea (Striker)	Lentil (Bolt)
Merredin	April 9	1.06 \pm 0.27	na
Merredin	May 9	0.93 \pm 0.23	1.12 \pm 0.41
Dandaragan	April 16	2.22 \pm 0.47	1.50 \pm 0.39
Dandaragan	May 27	1.30 \pm 0.39	0.87 \pm 0.30

Conclusion

The results of this research support and extended the findings of the work done in the late 1990s. In all trials, depth of sowing did not significantly impact on plant emergence time, establishment, phenology, dry matter production and yield, even at depths as extreme as 200mm. With only one year of data under current conditions this finding needs further validation and we intend to continue to use both modelling and field trials to determine the relationship between depth of sowing and variety, season and soil and how these relationships impact growth parameters.

While we found no impact of sowing position on chickpea and lentil growth and yield, we will continue this trial on the same site to see if there is an affect after two or three years of edge-row sowing of these crops.

Our finding that early sowing is beneficial to yield in the low- to medium-rainfall offers options to growers wanting the try these high-value pulses without interfering with their main sowing program. Early sowing and deep sowing can also be stacked in the right season to offer added benefits of stored soil moisture capture.

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