

Trial 5. Influence of chickpea stubble cultivation on durum yield and profitability

Protocol objective: To evaluate the influence of top work cultivation (speed till) on chickpea stubbles vs. direct drilling prior to a durum wheat (effect on yield and profitability).

Location: Kerang, Victoria

FAR Code: FAR D21-06-2

Sown: 24th May 2021

Cultivar: DBA Vittaroi

Harvested: 8th Dec 2021

Rotation position: Faba Beans (2020), Dryland vetch/brown manure (2019), Oaten hay (2018)

Soil Type: Neutral medium grey clay

Irrigation: Surface, 4 applications total of 410mm (4.1 ML/ha)

GSR: April-October 160mm. Total water available 570mm

Key Messages:

- Neither previous chickpea sowing rate or pre-sowing stubble management had any significant effect on the following durum wheat yields or grain protein.
- Calculated stubble residues showed no difference as a result of variable chickpea seeding rates.
- NDVI measurements demonstrated that there was little influence on canopy development from either previous seeding rate or pre-sowing preparation.
- Durum wheat has a considerable requirement for N to achieve DR1 quality and so the contribution from the chickpea stubble is a relatively small part of the total N budget.
- Water use efficiency was 17.8 kg/mm.

Table 1. Influence of pre-sowing preparation and chickpea stubble incorporation on durum wheat grain yield (t/ha) with two different varieties grown under flood irrigation.

		Yield			Protein		
Chickpea Seeding Rate		Direct Drill	Speed till	Mean Yield	Direct Drill	Speed till	Mean
2020							
Seeds/m²	Plants/m²	t/ha	t/ha	t/ha	%	%	%
15	9	7.7 - 1	8.19 -	7.95 -	13.6 -	12.9 -	13.2 -
25	15	7.8 -	8.15 -	7.99 -	13.3 -	13.5 -	13.4 -
35	22	8.0 -	7.96 -	8.02 -	13.4 -	13.4 -	13.4 -
45	27	7.9 -	8.21 -	8.08 -	13.4 -	13.3 -	13.4 -
Mean		7.8 -	8.13 -		13.4 -	13.3 -	
LSD Preparation p=0.05			ns		ns		
P val			0.103		0.317		
LSD Seed Rate p=0.05			ns		ns		
P val			0.927		0.834		
LSD Seed Rate x Soil prep. p=0.05			ns		ns		
P val			0.497		0.279		

Neither pre-sowing preparation nor previous chickpea plant population had any influence on grain yield or protein.

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Soil N level at sowing was 71.4 kg N/ha taken from random samples across the site. A nitrogen budget for the trial assumed an 8 t/ha target and an N requirement of 50 kg N/t to achieve durum specification meant considerable amount of N (260 kg N/ha) had to be applied on top of what was present as a result of the chickpea residues.

The average yield for the trial was 8.01 t/ha. This represents a WUE of 17.8 kg/mm and a nitrogen use efficiency of 49 kg N/t.

Table 2. Influence of pre-sowing preparation on pre-season residues, harvest biomass, N content and heads/m² at harvest (8 Dec).

Treatment	Canopy composition			
	Residues Pre-sowing Yield t/ha	GS89 biomass t/ha	GS89 N content Kg N/ha	Heads/m ²
Direct Drill				
15 seeds/m ²	5.62 -	16.96 -	286.6 -	383 -
25 seeds/m ²	6.97 -	19.17 -	295.2 -	388 -
35 seeds/m ²	7.79 -	18.93 -	301.5 -	405 -
45 seeds/m ²	7.09 -	18.02 -	281.0 -	453 -
Speedtill				
15 seeds/m ²	6.38 -	17.90 -	261.3 -	378 -
25 seeds/m ²	6.34 -	17.08 -	255.3 -	365 -
35 seeds/m ²	6.68 -	18.20 -	286.4 -	365 -
45 seeds/m ²	7.95 -	18.91 -	310.5 -	410 -
Mean	6.85	18.14	284.7	393
LSD Seed Rate x soil				
Prep. P=0.05	ns	ns	ns	ns
P val Seed Rate x Prep	0.321	0.364	0.293	0.870
P=0.05				
P val Seed Rate P=0.05	0.104	0.652	0.507	0.143
P val Soil Prep P=0.05	0.953	0.763	0.341	0.137

There were no differences between any of the treatments. Residues from the previous chickpea plots was calculated from 2020 harvest dry matter and grain yield results. While grain yield did increase in the 2020 chickpea trial, it is interesting to note the lack of difference in the calculated residues across the 4 seeding rates. Making some assumptions about N demand by durum wheat, it could be estimated the chickpea stubble contributed 40 kg N/ha in-crop, as well as the mineralisation prior to sowing.

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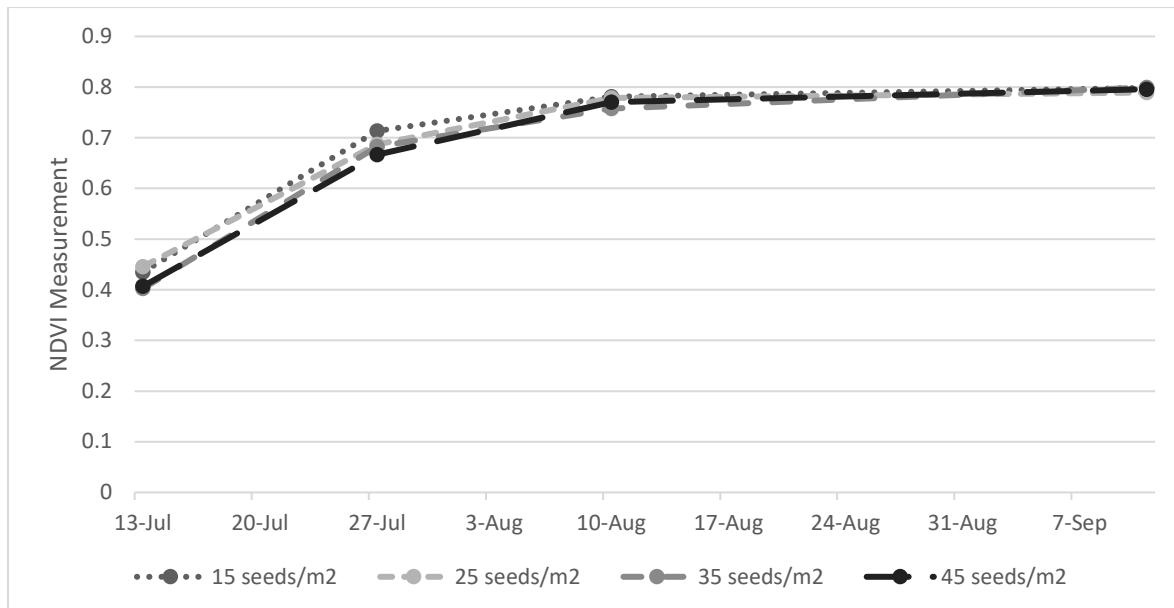


Figure 1. NDVI assessments at GS30 (6 August), GS69 (12 October) and GS89 (8December).

At most assessments, neither pre-sowing preparation nor previous seeding rate had any influence on the NDVI measured. Only the assessment on 27 July saw any significant difference – the 15 seed/m² plots had a higher NDVI measurement than the 45 seed/m² seeding rate treatment ($p=0.016$) but this was only 0.71 versus 0.67 (LSD = 0.039)

SAGI statistical analysis (Predicted values for Yield, Harvest dry matter, test weight, screenings and grain protein)

The following statistical analysis of key harvest assessments has been carried out by SAGI. This analysis uses spatial statistical analysis to refine predicted values for key assessment values.

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Table 26: Harvest Traits for the Yield, Dry Matter and Test Weight

Cultivation	Seeding Rate	Yield (t/ha)	Dry Matter (t/ha)	Test Weight (kg/hl)
DirectDrill	15	7.83 ± 0.21 -	17.68 ± 1.03 -	83.88 ± 0.36 -
SpeedTill	15	7.74 ± 0.2 -	16.78 ± 1.01 -	82.72 ± 0.35 -
DirectDrill	25	8.01 ± 0.2 -	20.04 ± 1.03 -	84.01 ± 0.36 -
SpeedTill	25	8.05 ± 0.2 -	16.71 ± 0.99 -	83.81 ± 0.36 -
DirectDrill	35	8.07 ± 0.2 -	18.63 ± 0.97 -	83.94 ± 0.35 -
SpeedTill	35	7.9 ± 0.21 -	17.94 ± 1 -	83.65 ± 0.36 -
DirectDrill	45	7.99 ± 0.19 -	18.47 ± 0.98 -	83.68 ± 0.36 -
SpeedTill	45	8.25 ± 0.2 -	18.42 ± 0.99 -	83.72 ± 0.36 -

Notes: values expressed as mean ± standard error of prediction
 - no subscripts relevant for this response

Table 27: Harvest Traits for Screenings and Protein

Cultivation	Seeding Rate	Screenings	Protein
DirectDrill	15	0.26 ± 0.04 -	13.57 ± 0.28 -
SpeedTill	15	0.5 ± 0.08 -	12.97 ± 0.28 -
DirectDrill	25	0.3 ± 0.05 -	13.28 ± 0.28 -
SpeedTill	25	0.29 ± 0.04 -	13.43 ± 0.28 -
DirectDrill	35	0.28 ± 0.04 -	13.39 ± 0.28 -
SpeedTill	35	0.36 ± 0.05 -	13.43 ± 0.28 -
DirectDrill	45	0.27 ± 0.04 -	13.43 ± 0.28 -
SpeedTill	45	0.26 ± 0.04 -	13.26 ± 0.28 -

Notes: values expressed as mean ± standard error of prediction
 - no subscripts relevant for this response

A summary of the experiment statistics is below:

Table 28: Key statistics for each response analysed

Statistic	Yield (t/ha)	Dry Matter (t/ha)	Test Weight (kg/hl)	Screenings	Protein
LSD	0.53	2.63	0.98	0.42	0.61
Mean	7.98	18.08	83.68	0.31	13.35
Cultivation p-value	0.94	0.20	0.18	0.17	0.59
Seeding Rate p-value	0.35	0.35	0.35	0.20	0.91
Interaction p-value	0.62	0.29	0.30	0.11	0.23
CV %	6.28	13.90	1.07	48.65	4.98

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