

Increasing the Profitability of the Double-Break Rotation Through the Incorporation of an Early Sown High-Value Pulse

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Key Messages

- The wheat on wheat rotation in this trial showed a reduction in yield compared to wheat on legumes.
- Frost was an issue on many early sown wheat on wheat paddocks in the area.
- Yellow spot inoculum had built up in the wheat on wheat plot.

Aim

To demonstrate that growing either canola or fallow (with effective weed control options) followed by a high-value legume (with higher economic value) can lead to an effective and profitable double-break crop sequence. The second part of this trial is to determine the impact of this rotation on the grain yield and profitability of a cereal crop in the first year following the double break crop sequence.

Background

One of the constraints in the use of a single or double break crop sequence is that the gross margin of the most used break crops is generally less than growing a cereal crop. As a result, break crops are used sparingly by growers in crop rotations with the aim of maintaining the most profitable sequence of crops while maintaining reasonable control of weeds and diseases. However, the short-term decrease in economic return from growing a break crop is likely to be offset by the longer-term benefits of decreased production costs and increased productivity of cereal crops for the following seasons.

The most desired traits of a break crop are to be highly effective in controlling weeds and disease while also being highly profitable. Current highly effective break crop options of canola and lupin are rated as moderate to low profitability (respectively) by growers, while pasture phases or fallow periods generally result in a low or negative gross margin. The integration of high-value legumes such as chickpeas or lentils has been successful in medium to low-rainfall environments of Eastern Australia to improve crop rotation profitability while maintaining effective weed control.

Recent studies in WA found that profitable grain yields of chickpeas are achievable in the medium rainfall zone (MRZ) of the WA Wheatbelt. The impact of earlier sowing of these pulses has also been demonstrated to significantly increase in the profitability of these high-value legumes. The downside of high-value legumes is that potentially these break crop options have less developed (and therefore less effective) weed management packages for the WA environment.

Trial Details

Trial location	Matthew Hyde, Dalwallinu		
Plot size & replication	18.3m x 200m, not replicated		
Soil type	Medium Clay Loam		
Paddock rotation	2017: Field Peas	2018: Wheat	2019: Barley
	2020: Fallow	2021: Treatments	2022: Wheat
Sowing date	09/05/2022		
Sowing rate	65 kg/ha Sceptre Wheat		
Fertiliser	09/05/2022 - Flexi 40 L/ha, Map Zn 60 kg/ha 16/06/2022 - Urea: 60 kg/ha		
Herbicides, Insecticides & Fungicides	09/05/2022: 2 L/ha Treflan, 2.5 L/ha Boxergold 27/05/2022: Trident 1 L/ha 09/05/2022: 400 ml/ha Flutriafol		
Harvest date	10/01/2023		

Treatments applied in 2021

T1: Cereal Crop

T2: Chickpeas – Early Sown

T3: Chickpeas – Late Sown

T4: Field Pea – Late Sown
(Standard Practice)

Soil composition in 2021

Depth (cm)	pH (CaCl ₂)	N (NO ₃) (mg/kg)	N (NH ₄) (mg/kg)	Col P (mg/kg)	Col K (mg/kg)	KCl S (mg/kg)	EC (ds/m)	OC (%)	PBI
0 - 10	7.7	7	2	22	704	2.8	0.129	1.05	160.5
10 - 30	7.8	4	1	7	549	3.7	0.121	0.81	156.2
30 - 50	7.8	2	1	6	409	7.1	0.133	0.71	154.1

Results

In 2021, the wheat treatment was the highest yielding of the four treatments averaging 4.4 t/ha. The field peas averaged 1.8 t/ha, early sown chickpeas 1.1 t/ha and late sown chickpeas 0.6 t/ha (Figure 1). *Please note in the 2021 Liebe Group Research & Development Booklet, these yields were reported incorrectly due to a labelling error.*

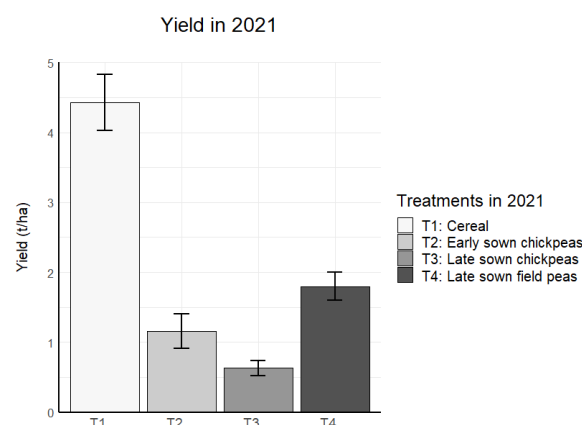


Figure 1. The yields significantly differed between the four treatments in 2021* at Hyde's property in Dalwallinu.
*Please note that the data was mis-labelled in the Liebe Group's R&D book in 2021-2022.

In the 2022 wheat, there were some differences in plant establishment (Figure 2), NDVI (Figure 3), and weed densities (Figure 4) between the treatments.

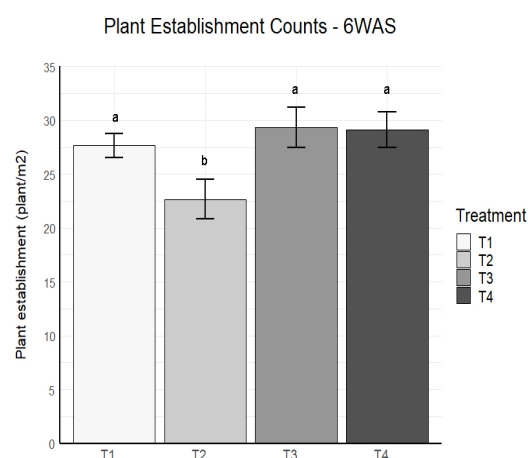


Figure 2. Wheat crop establishment at 6 weeks after sowing (6WAS) was lower for T2 (early sown chickpeas in 2021). Error bars are $\pm$ SEM. The ab represents statistical difference ($P < 0.05$) according to the one-way ANOVA test and Least Significance Test posthoc test.

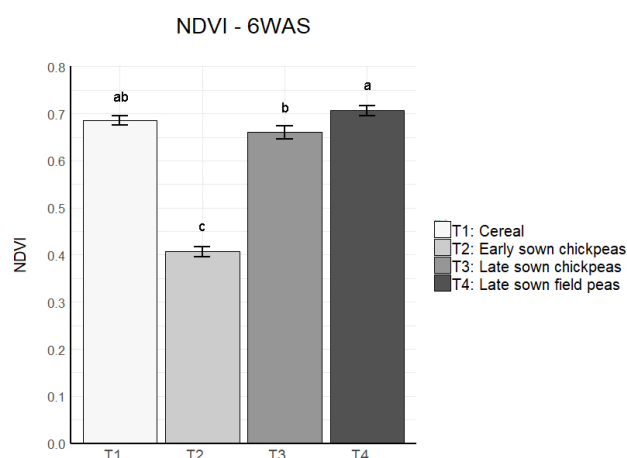


Figure 3. The NDVI was lower for T2 (early sown chickpeas in 2021) compared to the three other treatments at 6WAS. Error bars are $\pm$ SEM. The ab represents statistical difference ($P < 0.05$) according to the one-way ANOVA test and Least Significance Test posthoc test.

Overall, plant establishment and NDVI were lower for T2 (early sown chickpeas in 2021) in comparison to the other three treatments but T1 and T4 had the most weeds at GS30. This did not however result in any yield penalty, with T1 (wheat on wheat) yielding the lowest of the four treatments (Figure 5).

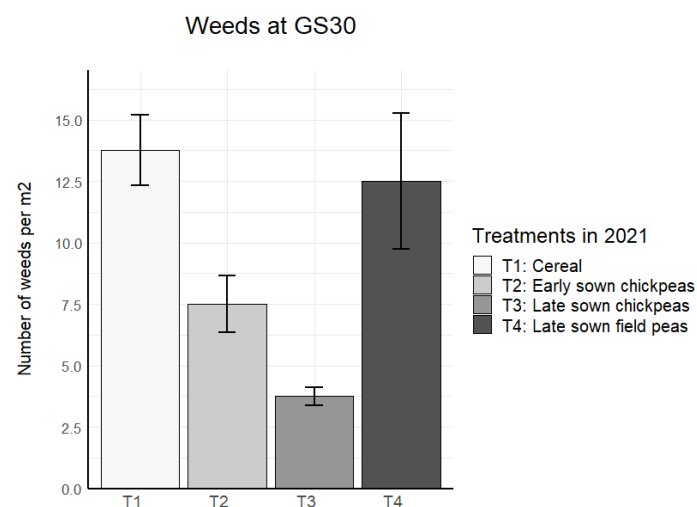


Figure 4. Weed density at GS30 was lowest for T3 (late sown chickpeas in 2021), followed by T2 (early sown chickpeas in 2021). Error bars are $\pm$ SEM.

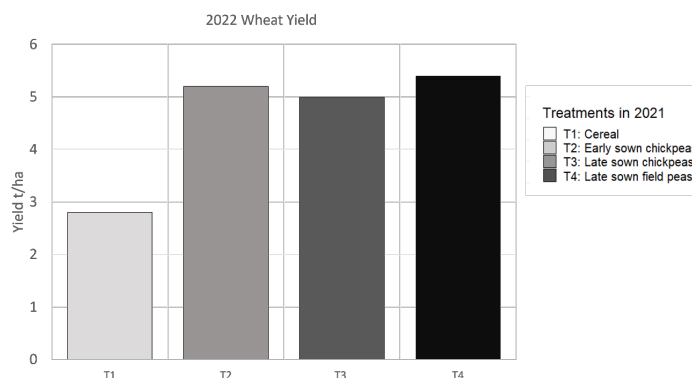


Figure 5. 2022 Wheat yield taken from host farmers yield monitor show lower yield associated with the fallow/wheat/wheat rotation. Note this data is unreplicated.

Comments

The yield results in 2022 show a yield decline in the fallow/wheat/wheat rotation compared to the other fallow/legume rotation treatments. The host farmer commented that this was likely due to frost, which was a common issue for them in their early sown wheat on wheat crops this season. Possible explanation for this was the higher stubble load from 2021 led to increased inter-row shading and subsequently lower ground temperatures.

Plant establishment and NDVI was significantly lower for the fallow/early sown chickpea rotation however this did not have an overall effect on yield when compared to the other fallow/legume treatments.

In 2021, Predicta B testing found Crown rot to be a medium disease risk in this paddock and *Pratylenchus neglectus* and charcoal rot posed low disease risk. No other diseases or pests were found in 2021. In 2022, however predicta B testing showed increased levels of *Pyrenophora tritici-repentis* (yellow spot) had built up in the continuously cropped wheat strips compared to the other treatments. In the fallow/legume treatments, *Ascochyta* blight fungi had established.

Acknowledgments

This is a GRDC-invested project, WMG2003-001SAX, led by the West Midlands Group. This site is managed by the Liebe Group as one of four sites across the Wheatbelt that aims to evaluate the crop rotation benefit of a double break crop rotation. Thanks to the Hyde family for their assistance, hosting, implementing and managing the trial.

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