

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

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Key Messages

- Early sown chickpea achieved the highest grain yield (4.4 t/ha) of all treatments.
- The benefit to cereal production will be evaluated in the 2022 season.

Aim

The first part of this trial was to demonstrate that growing canola (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 contribution of an early sowing date versus a traditional sowing date to increase the profitability of the legume crop was also evaluated in this trial.

The second part of this trial is to determine the economic value of growing canola followed by a high value legume, and 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 commonly used break crops are 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 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 period generally result in a low or negative gross margin. The integration of high value legumes such as chickpea or lentil have 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 both chickpea and lentil 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.



Comparison of early sown (left) v late sown (right) chickpeas, taken mid-August 2021.

Trial Details

Trial location	Main Trial Site, Hyde Property, Dalwallinu			
Plot size & replication	200m x 18.3m x 1 replication			
Soil type	Medium Clay Loam			
Paddock rotation	2020 Fallow, 2019 Barley, 2018 Wheat, 2017 Field peas			
2021 Crop Type	Scepter Wheat	CBA Captain Chickpea (Early sown)	CBA Captain Chickpea (Late sown)	Twilight Field Pea
Sowing date	17/05/2021	17/04/2021	07/06/2021	07/06/2021
Sowing rate	70 kg/ha	150 kg/ha	150 kg/ha	120 kg/ha
Fertiliser	17/05/2021 - 50 kg/ha MAP Zinc 23/06/2021 - 60 kg/ha Urea	17/05/2021 - 50 kg/ha MAP Zinc	07/06/2021 - 50 kg/ha MAP Zinc	07/06/2021 - 50 kg/ha MAP Zinc
Herbicides, Insecticides & Fungicides	Knockdown 17/05/2021 - 2 L/ha Trifluralin 17/05/2021 - Prosulfocarb 17/05/2021 - Flutriafol 0.4 L/ha 03/07/2021 - Bromoxinil	Data not available		Data not available

Treatments

Treatments	
T1	Cereal Crop – Current grower practice
T2	Chickpea – Early Sown
T3	Chickpea – Late Sown
T4	Field Pea – Late Sown (Standard Practice)

Results

Crop establishment was adequate for all treatments in the trial to allow the crop to fulfil the seasons yield potential (Figure 1). For the break crops evaluated in this trial, the lowest number of weeds were found in the early sown chickpeas while the highest were in the field pea (that were late sown). This was likely due to decreased competition in the late sown treatments that allowed weeds to be more vigorous, while the early sown legumes and wheat treatments achieved canopy closure earlier in the year to shade out weed competition.

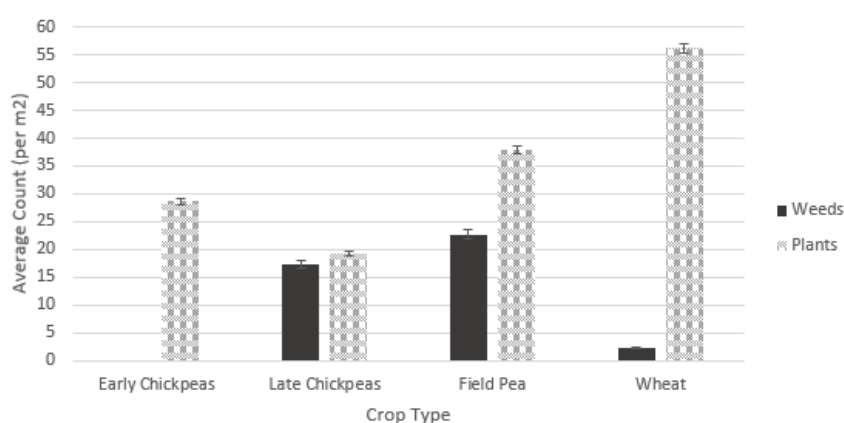


Figure 1: Crop establishment counts by crop type as of GS 30 at double break trial, Dalwallinu, 2021. Error Bars are $\pm$ SE

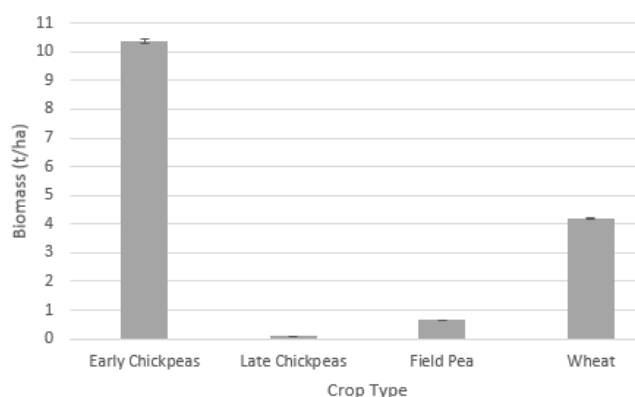


Figure 2: Crop biomass by crop type as of GS 30 at double break trial, Dalwallinu, 2021. Error Bars are $\pm$ SE

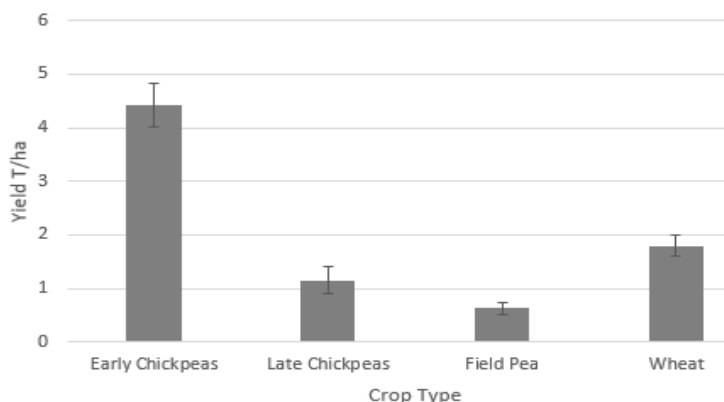


Figure 3: Yield of different crops at double break trial, Dalwallinu, 2021. Error Bars are $\pm$ SE

The early sown (17th April) chickpeas had significantly higher biomass compared to all other treatments when measured at the GS 30 growth stage of wheat timing (Figure 2). This was a direct consequence of the early seeding (17th April) for this treatment and good conditions for early growth. The late sown chickpea and field pea had very low biomass at this early stage. The early sown chickpea had the highest grain yield of all treatments in the trial (Figure 3). The grain yield of wheat was reduced by the impact of frost and yielded less than 2 t/ha compared to 4.4 t/ha for the early sown chickpea. The indeterminant flowering pattern of chickpea was likely to have reduced the impact of frost on grain yield compared to wheat.

The combination of high biomass production and low weed numbers in the early seeded chickpea highlights the potential of a double break crop rotation to be highly effective and profitable rotation option. Previous research has shown that the amount of nitrogen fixed by a legume correlates directly to the amount of biomass produced by that legume, minus the amount of nitrogen taken off in the seed. It is likely that much of the nitrogen that was fixed in the season was removed in the high grain yield (4.4 t/ha), but residual nitrogen in the biomass will likely have a positive impact on the following crops as it breaks down and releases nutrients.

In wetter seasonal conditions there is a high risk of Ascochyta infection in chickpea which can severely reduce plant growth and grain yield. This disease was closely monitored at this site but was not detected in this season. As a preventative, one fungicide application at the start of flowering for the early seeded chickpea was completed on the 24th of June.

Acknowledgements

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Peer Review

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