

Increasing the profitability of the double break rotation in the MRZ of WA Wheatbelt through incorporation of an early sown high value pulse

GRDC, West Midlands Group & Facey Group
Contact: Facey Group – agrec@faceygroup.org.au

AIM

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.

TRIAL DETAILS

Property:	Trevor Leeson, Cuballing East Rd GPS -32.7797647785, 117.38187966
Plot size & replication:	4 treatments x 3 plots 12m x 65m, (total length 200m)
Soil type:	Sandy loam/gravel
Crop Variety:	Scepter wheat and lentils PBA Hallmark XT
Sowing Date:	Wheat & Early sown lentils 20 th may; Late sown lentils 15 th June
Seeding Rate x depth	Wheat 80kg, 3cm; Lentils (TOS1 &2) 36kg, 3cm
Fertiliser:	IBS MacroPro Extra 95kg/ha, 50L Flexi N Post emerge Lentils 50L Flexi N
Paddock rotation:	2019 Canola
Herbicides:	Whole site Pre-emergent residual and Knockdown_19/05 Sakura 118gm; Terbyne Xtreme 0.86 kg; Alpha Cypermethrin 0.15L; Chlorpyrifos 0.15L; Glyphosate 450 2L; Wetter 0.2% Lentils TOS2 additional Glyphosate knockdown before seeding 14/06. Lentils post emergent broadleaf 7/07/2020, TOS1 25gm Broadstrike + 0.2 % BS1000 wetter; 120ml Brodal TOS2 25gm Broadstrike + 0.2% BS1000 wetter
Insecticides:	Chlorpyrifos 100ml, Alpha scud 75ml
Fungicides:	Wheat treated with Vitaflo C

METHODOLOGY:

A farm scale demonstration trial, with each treatment strip designed to accommodate the host growers seeding, harvesting and spraying equipment. The project is funded over two growing seasons with the 2020 trial sown into a 2019 Canola stubble.

Four treatment plots, 12m wide x 200m long, divided into three equal quadrants were established in 2020. Treatments include 2 x wheat (grower practice) and an early and late sown legume, with three replicates/quadrants within each treatment (Table 1).

PBA Hallmark XT lentils were sown on two different dates to represent an early sow – to coincide with the break of season where soil moisture may not be adequate for germination in the top 0 – 10cm of soil, (in this instance a seeding depth greater than 10cm could be used to

make access of sub surface moisture for early germination). The second time of sowing for lentils was four weeks later. Two treatment strips of wheat from the surrounding crop were pegged out to provide benchmarking against a subsequent wheat crop to be sown across the entire trial site in 2021.

Pre sowing - soil and predictaB samples were taken to provide baseline for soil nutrition and health.

In season measurements of plant germination numbers, weed counts, NDVI, biomass, foliar disease score, legume nodulation and harvest yield and grain quality were to be undertaken.

Harvest cuts were completed by hand, with three cuts per quadrant to form a bulk sample. Grain analysis was provided by the farmer with bulk delivery to CBH Group

Similar measurements are to be undertaken in the 2021 growing season on the proceeding wheat crop to determine the agronomic and economic benefits of using a high value pulse in a double break crop rotation.

Table 1: Trial Layout

1. Site layout and treatment location for each site in this project.

2. Treatments at each site.

Quadrant 3	(1,3)	(2,3)	(3,3)	(4,3)
Quadrant 2	(1,2)	(2,2)	(3,2)	(4,2)
Quadrant 1	(1,1)	(2,1)	(3,1)	(4,1)
	tmt 1	tmt 2	tmt 3	tmt 4

Tmt 1	Wheat 1
Tmt 2	lentil early sown
Tmt 3	lentil late sown
Tmt 4	Wheat 2

RESULTS & DISCUSSION

Rainfall for the year was recorded at the site (*Table 2*).

Table 2: Trevor Leeson on farm rainfall data - 2020

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
10	39.5	25.5	3.5	40	35	28	43	18	5.5	37	0	285

Germination counts were completed across each treatment (with three counts per quadrant) an average across each treatment was recorded (*Table 3*). Wheat germination and Early Sown lentils were undertaken on 26 June 2020 with growth stages of Z14 (wheat) and 3 – 4 node (lentils). Late sown lentil counts were completed on 17 July 2020. Wheat establishment was adequate however both the early and late sown lentils were lower than recommended for plant establishment of 100 to 120 plants/sqm.

Table 3: Mean in-season crop measurements for the double break crop trial site. Early measurements were taken 6 weeks after seeding, late measurements taken at early stem elongation (GS.30).

<i>Treatment</i>	<i>Early plant emergence plants/sqm</i>	<i>NDVI reading</i>	<i>Late plant establishment plants/sqm</i>	<i>Broadleaf Weeds per/sqm</i>	<i>Grass Weeds Per/sqm</i>	<i>Biomass at Maturity t/ha</i>
Wheat 1	158	0.52	235	0	20	6.84
Early Sown Lentils	69	0.31	61	3	28	1.15
Late Sown Lentils	51	0.14	33	3	24	0.93
Wheat 2	121	0.43	157	0	6	5.80

NDVI measurements were conducted on 6th August 2020 – wheat at Z23, Early Sown Lentils at 5-6 node and Late Sown Lentils at 3-4n node, refer *Table 4*. The results for wheat are indicative of measurements for this type of crop at this level of maturity, however the lower NDVI averages for early and late sown lentils indicate much lower levels of plant development and biomass.

Plant biomass cuts were taken when wheat was at growth stage Z39 and lentils at first flower.

Weed assessments were undertaken at the same time as plant biomass cuts. Grass and broadleaf weeds were recorded across each treatment, with three recordings per quadrant. Weeds were higher across both of the lentils treatments, reflective of the more open canopy and lack of crop competition. There was no explanation for the difference in weeds between each of the wheat treatments. Observations throughout the trial and later in the season, whilst not reflective in the assessment – was the Later Sown Lentil treatment was cleaner than the

early sown, reflective of the double knock prior to sowing. The importance of crop competition in season was well observed at this site.

Foliar disease score and nodulation scores were completed. No foliar disease was detected in any treatments (data not presented). Nodulation scores were completed in the early and late sown lentils with a ranking of poor to nil across both treatments.

Pre thresh biomass weights were recorded for each of the treatments with a clear link to grain yield.

Wheat 1 averaged 2.42t/ha and Wheat 2 averaged 2.61t/ha – similar to of the remainder of the paddock (*Table 4*). The early and late sown lentils were harvested the same as the wheat. After much attempt to thresh samples with a low biomass and low seed formation there was negligible grain to provide a sample or undertake a grain quality analysis.

Table 4: CBH Grain Quality Summary for wheat (paddock delivery)

Grade	ASW1
Protein %	9.60
Moisture	10.00
Temp Degrees	33.00
Hectolitre Wt	82.04
Screenings %WT	1.63
Residue DEC	1.00
Half Litre GM	410.20
Screenings GM	6.70
Gluten	18.70
Trial Hardness	72.80

CONCLUSION

The learnings from this site in 2020 have provided growers with clear learnings in how best to incorporate high value crops into the system, for the purpose of a double break.

The lentils did not perform to expectations resulting from multiple factors which compounded over the season including adequate pH to depth and herbicide management for grass and broadleaf weeds. It is important to ensure careful site selection by testing early for subsoil constraints, such as soil acidity, for these acid sensitive species. It is also important to source the best agronomic advice as there is limited knowledge of growing lentils in the region.

The trial has another two (2) years to be demonstrated and based on the learnings of 2020 and new site will be selected and more rigorous agronomic strategies put in place for 2021 and a follow up wheat crop to monitor impact of a high value pulse in the double break rotation as well as impact on the subsequent wheat crop in 2022.

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