final report

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Crop Grazing: Demonstrating Profitable Success

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Executive Summary

The project aimed to demonstrate advantages of crop grazing on profitability and enhance producer understanding of how to best apply the tool in different seasons and situations. The objectives were to do so by demonstrating the impact on four properties in Western Australia's Great Southern, with sites running for three years. It was expected that this would show an increase in feed by deferring pastures during crop grazing, and a condition score advantage in ewes grazing crops compared to those grazing pasture. In addition, harvest yield was expected to be impacted by less than 10%. Economic analysis was conducted to show impacts on lambing performance and overall profitability.

The project was run as productivity driven sheep profits are hitting a ceiling in traditional mixed farm enterprises. This is partly due to the autumn-winter feed gap limiting stocking rates and growth rates. Current practice is to hand feed lower stocking rates, resulting in sub-optimal stocking during the growing season. Crop grazing can rectify this by providing an alternative feed source to reduce hand feeding and potentially increase stocking rates. During the period while stock are crop grazing, pasture can be deferred, leading to greater pasture growth and allowing ewes to lamb onto higher Feed on Offer (FOO). This is directly correlated with higher lambing percentages, particularly if high-value, highly responsive animals such as twin-bearing ewes are grazed.

However crop grazing is something farmers tend to avoid due to lack of knowledge or confidence in the method. This is due to past attempts to crop graze without the correct knowledge. There is also a shortage of quantifiable evidence on crop grazing's impact on whole-farm profitability. Running demonstration sites on several properties across different seasons & grazing intensity allows producers to see results for themselves and understand how grazing crops can work for them. Communication and extension activities allow the findings to be shared widely, with surveys finding that 93% of producers increased confidence in the tool, as well as an increase in adoption.

Using paired-paddock methodology, performance of sheep grazing crops was compared to sheep grazing available pastures. Crops were grazed for 10 to 44 days during June, July and August, which coincided with three years of late season breaks. Stocking rates varied between 0.5 to 7.2 DSE/ha, using ewes lambing in June-July, or dry hoggets. Pasture tests were conducted at the start and end of grazing, and lambing results collected or modelled using the Lifetime Ewe Condition Score Comparison Calculator.

At the start of grazing, when crops passed the 'pinch and twist' test, crops had on average 27% higher metabolisable energy, 2.56 times more Feed On Offer (FOO) and were 18% more digestible compared to pastures. Crop was also more accessible, being erect and easier to eat compared to prostrate pastures. Grazing these crops allowed paddocks to be spelled, with deferred pasture having 69% more FOO compared to pastures grazed during the crop grazing period.

Crop grazing sheep were measured to be in better condition compared to those grazing normal pastures. Ewes had a 0.28CS advantage over ewes grazing pastures, while hoggets had a 0.35CS advantage. This led to a modelled additional 5.2% lamb survival in twins, partly due to increased birthweight of 120grams which contributed to 10.7% increase weaning survival. Ewe survival increased by 0.47%. Reduced costs of feeding were calculated at 12c/h/day and combined with reproductive impacts resulted in sheep net benefits at $11.42/ewe and $4.75/hogget grazed on crops.

Crop yield impacts ranged from a loss of 400kg/ha to an increase of 1360kg/ha. This converted to a financial impact of -$100/ha to +$408/ha. Excluding 2017's abnormal increases in yield due to the

impact of disease, average impact of grazing on crop was a 4.1% yield loss. This resulted in an average financial impact of -$21.56/ha, or when including 2017's abnormal year, +$81.13/ha.

To give the impact on whole business gross margin, yield impact was combined with sheep benefits. It is important to remember that this data is calculated using the extremely variable stocking rates producers used to graze crops, often with understocking paddocks. There was an average benefit of $15.67/ha for reproducing ewes. With the abnormal 2017 data included, the average benefit increased to $131.80/ha. It was also profitable to graze hoggets, which only used the feed and labour-saving costs to offset yield impact. Hoggets averaged a $10.19/ha profit.

This means producer confidence in utilising crop grazing as a tool has been supported, showing that it can be done without negatively impacting overall profits. Overall, this means less hand feeding and better sheep health coming into lambing, resulting in higher lamb and weaner survival. Not only is this an economic win, but an emotional one too, as hand feeding during lambing or in the lead up can be stressful with mismothering and lamb abandonment. Further research should be conducted into impacts on carrying capacity, impact of crop variety on yield impacts, and an economic analysis to include the value of deferred pasture. Further extension activities would also help share the project's findings.

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1 Background

The aim of this project was to demonstrate the advantages of crop grazing on farm profitability. In addition, we meant to enhance producer understanding of how to apply the tool to best advantage in different seasons and situations.

The project was undertaken as there was an issue with productivity driven sheep profits hitting a ceiling in traditional mixed farm enterprises. The autumn feed gap is a period of the year that limits stocking rates and per head growth rates due to lack of available feed. Current practice is to hand feed, with lower stocking rates.

As with most on-farm issues there is the production problem & then there is the problem of farmers not having the confidence to try the solution. Crop grazing is something farmers tend to fear and avoid due to lack of knowledge or confidence in the method. This is due to some having played with crop grazing and not understood its place, or how to limit its impact on crop yields, which has led to bad experiences and results. There is also a lack of quantifiable evidence of the impact of crop grazing on whole-farm profitability, which contributes to this low confidence.

Current common practice to address this feed gap is to lower stocking rates from summer until late winter, in order to reduce expensive hand feeding costs. This can involve selling off lighter store sheep early and having fewer wethers on farm or just running a lighter stocking rate all year round. This can result in sub-optimal stocking rates during the growing season. Crop grazing can rectify this by providing an alternative feed source to reduce hand feeding and potentially increase stocking rates.

It is estimated that currently 10-15% of farmers were already utilizing this method in the Southern Dirt and the Facey group area. With a large majority of properties in the region being mixed enterprises, this project is relevant to a wide audience. With three years of late season breaks, the project has come at a perfect time, with more producers than ever turning to crop grazing.

1. The Production problem: Accessing the crop area of the farm as a feed source at this time of year unlocks potential to increase stocking rate, as well as allowing high value animals such as twin bearing ewes and lambs access to easily accessible high value feed as shown in the aforementioned MMPIG producer research site project. To quantify this, there is potentially a 10-20% increase in stocking rate opportunity, due to unlocking the area and a 20-30% increase in growth rates opportunity, from accessing the higher value, easily accessible feed. During the period while stock crop graze, pasture can be deferred, leading to greater pasture growth and allowing lambing ewes to lamb onto higher FOO levels. This can be directly correlated with higher lambing percentages.

2. The confidence problem: Running demonstration sites on several properties in different situations and seasons allows the producers to see unbiased and objective results for themselves and understand how grazing crops can work for them.

Having already been involved with a similar project run through the Moora-Miling Pasture Improvement Group (MMPIG) MLA Producer research site, AgPro Management had data to show the impact on real farm situations over a period of three years, finishing in 2016. The project involved varied seasons which presented different opportunities and challenges to consider when crop grazing, leading to a deep understanding of the challenges and benefits of crop grazing. Economic modelling in the MMPIG project showed a range of net cost/benefits of crop grazing, with a loss of $97.60/ha in a year where there was abundant feed and the crop suffered from excess

selective grazing in a weedy paddock. Another year resulted in a net profit of $322.50/ha, where grazing benefitted the crop yield as well as the sheep enterprise due to grazing causing the crop to flower later and avoid a frost.

The project had a significant impact on the MMPIG group and other farmers who received information from the trial, successfully raising awareness about the potential of crop grazing and factors to consider surrounding the option. This led to interest from producers in the southern region, wanting to try it themselves.

2 Project Objectives

By March 2020, this project will have:

- Demonstrated the impact grazing crops has on sheep management on 4 properties in southern WA regarding:
  - Condition Score - 10% increase in comparative advantage condition score (CS) of twin bearing ewes grazing crop over ewes on pasture.
  - Feed available - 100% increase in Feed on Offer (FOO) available through deferment of pastures during period of crop grazing.
  - Harvest yield – less than 10% impact of grazing crop v non grazed crop.

- Demonstrated the economic benefits of chaff carts as a sheep management tool through BCA modelling including the following
  - Increased lamb survival rate by 8% (due to increased ewe condition score).
  - Reduced supplementary feeding costs.
  - Reduced labour spent feeding.
  - Impact on crop yields.

- Developed a comprehensive benefit cost analysis as to the overall benefits of crop grazing.
- Led to 60% of the 21 core producers to adopting the practice and 60% of the 300 observer producers to intend to adopt.
- Increased the understanding in the wider industry about the benefits of crop grazing on a mixed farming enterprise.
- Reinforced importance of ewe condition score on ewe productivity to producers in region.

3 Methodology

3.1 Demonstration site set up

This was a paired-paddock producer demonstration site; with twin-bearing ewes grazing crop before returning to pasture that was deferred for the crop grazing period. This was compared with twin-bearing ewes grazing pasture for the entire duration of the project; all other factors are the same. In areas where pasture could not be deferred due to feed shortages, pasture cages or exclusion zones were created in order to measure deferred feed.
Grazing commenced when the crops pass the 'pinch and twist' test, the point at which plants aren't pulled from the ground by grazing. Stocking rates and grazing timing were determined by each host producer; however grazing was not allowed to continue beyond crop growth stage 30 or grazed to the white part of the plants. These are the points at which yield is significantly impacted.

The sites were to be repeated over three years on four host properties each year. In some cases, hosts could not continue the next year and new sites were found. This enabled comparison across

different environments, management and systems, as well testing the accuracy of results. The hosts were based in Wagin, Boyup Brook and Kojonup, as well as the Stirlings area.

The producers and core members of the group were directly involved with the field work, giving them immediate involvement to enhance understanding and training in skills such as the pinch and twist test, to assess when the crop is ready for grazing, condition scoring as a method of sheep health evaluation and pasture cuts as a way of understanding the importance of pasture quantity and quality was grazed.

3.2 Demonstration site measurements

3.2.1 Feed quality and quantity

Feed value of the crop, pasture and deferred pasture were measured. Members of the core group helped to take 0.1sqm pasture cuts from the crop and pasture sites pre and post grazing. These cuts were sent for analysis of Feed On Offer (kgDM/ha), digestibility, (%DM), crude protein (%DM) and metabolisable energy (MJ/kgDM). Pastures were grazed for the same duration as the crops. Deferred pasture growth was measured for this duration, with pasture cages placed throughout the grazed pasture paddocks to measure how much FOO would have grown if the paddock had been deferred for the same time as the crop.

The crop was analysed at grazing commencement, as were pastures. The pastures were also measured at the end of the grazing period to see the difference between grazing and deferring FOO. The grower group members who carry out this work took photographs of their quadrats, to visually show the difference in feed on offer and plant height.

3.2.2 Ewe condition score and lambing percentage

Condition score and weight changes (if both were possible) of the two mobs at each site were measured and compared to see the impact of crop grazing on sheep productivity. Condition scoring was the preferred method, which is assessing the level of body fat and tissue over the loin area. This was because condition scoring is a more accurate comparison of sheep's health than weight changes. Weights are less subjective, but will vary based on animal age, pregnancy status and adult standard reference weight. The industry standard condition scoring method is outlined in Fig. 1 below. (LifeTimeWool.com).

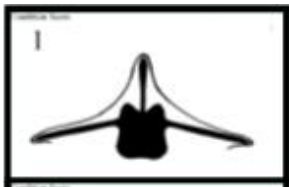
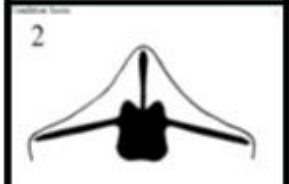
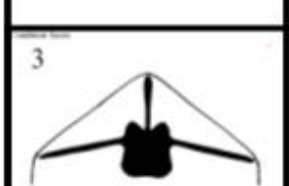
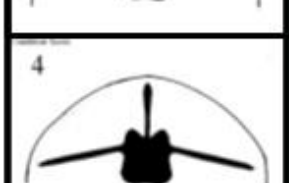
 1	**Backbone** The bones form a sharp narrow ridge. Each vertebra can be easily felt as a bone under the skin . There is only a very small eye muscle. The sheep is quite thin (virtually unsaleable)	**Short Ribs** The ends of the short ribs are very obvious. It is easy to feel the squarish shape of the ends. Using fingers spread 1cm apart, it feels like the fingernail under the skin with practically no covering
 2	**Backbone** The bones form a narrow ridge but the points are rounded with muscle. It is easy to press between each bone. There is a reasonable eye muscle. Store condition- ideal for wethers and lean meat.	**Short Ribs** The ends of the short ribs are rounded but it is easy to press between them. Using fingers spread 0.5cms apart, the ends feel rounded like finger ends. They are covered with flesh but it is easy to press under and between them.
 3	**Backbone** The vertebrae are only slightly elevated above a full eye muscle. It is possible to feel each rounded bone but not to press between them. (Forward store condition ideal for most lamb markets now. No excess fat).	**Short Ribs** The ends of short ribs are well rounded and filled in with muscle. Using 4 fingers pressed tightly together, it is possible to feel the rounded ends but not between them. They are well covered and filled in with muscle.
 4	**Backbone** It is possible to feel most vertebrae with pressure. The back bone is a smooth slightly raised ridge above full eye muscles and the skin floats over it.	**Short Ribs** It is only possible to feel or sense one or two short ribs and only possible to press under them with difficulty. It feels like the side of the palm, where maybe one end can just be sensed.
 5	**Backbone** The spine may only be felt (if at all) by pressing down firmly between the fat covered eye muscles. A bustle of fat may appear over the tail (wasteful and uneconomic).	**Short Ribs** It is virtually impossible to feel under the ends as the triangle formed by the long ribs and hip bone is filled with meat and fat. The short rib ends cannot be felt.

Fig. 1: Condition scoring assesment

Below summarises the link between condition score and weight, with one condition score equivalent to 19% of the standard reference weight of a sheep. Based on this, hoggets were determined to have approximately 7.5kg per condition score.

Table 1: Condition score and stardard reference weight

Standard weight	40kg	50kg	60kg	70kg
One condition score	7.5kg	9.5kg	11.4kg	13.3kg

Source: Lifetime Wool Project

Lambing percentage was collected from the producers for each mob. If this was unfeasible, percentages were modelled using the Lifetime Ewe Condition Score Profile Comparison Calculator. This assumes that the condition score advantage occurred in late pregnancy, and that the ewes did not fall below condition score 3 before giving birth. This analysis included impact of condition score changes on lamb, ewe and weaner survival, as well as birth weight.

3.2.3 Crop yield, Feed and labour costs

Crop yield from the grazed and non-grazed crop paddocks was collected by the producers at harvest time. This was done by their built-in yield monitors, which were calibrated before each paddock is harvested.

The costs of each producer's labour and feed per head for the mob not grazing crop was recorded. This included quantity of feed used, which then used industry averages to calculate feed costs. Labour time required and costs also were then calculated using industry averages, to ensure a more reliable comparison across properties, as the purchase price of feed can vary.

3.3 Economic Analysis

Economic modelling was used to estimate the value of crop grazing to the sheep enterprise in terms of reproductive impacts and feeding costs. Overall, this was as per head, and extrapolated to per hectare based on each producers' crop grazing stocking rate. This allowed the impact on sheep enterprises to be combined with the impact on crop enterprises, to give an overall farm profitability assessment.

Impacts on ewe, lamb and weaner survival and productivity were calculated using the Lifetime Ewe Condition Score Profile Comparison Calculator. This assumes that the condition score advantage occurs in late pregnancy, and that the ewes did not fall below condition score 3 before giving birth.

Costs saved were calculated using feed cost and labour costs of the sheep not grazing crops. Feed costs used were based on the 5-year average of grain, and industry averages utilised to calculate the cost of labour.

The impact on the crop enterprise was measured by recording the yield loss and calculating the financial impact per hectare, using the 5-year average price of the crop grazed at each property.

For example, Producer A grazes barley, with a yield loss of 0.5t/ha. The average price for barley is $250/t. The calculation is:

-0.5 x 250 = -$125/ha.

The impact on sheep and crop enterprises per hectare was finally combined to give the impact on farm profitability per hectare. The modelling is further outlined in Appendix 1.

3.4 Extension and Communication Activities

Extension was at the core of this project, with many observer producers relying on extension and communication activities to receive updates about the host sites. This included two annual field days each year, to give involved producers and industry the ability to see the visual impact of crop grazing on both crop and sheep. It also provided a forum beyond the WhatsApp chat to discuss results and distribute producer fact sheets. Summary articles were produced annually for the group, as well as progress reports and annual reports for MLA.

The project was shared as widely as possible, including presentation of data at field days, workshops and conferences. At the conclusion of the project, case studies on four of the host producers were also be published.

For core producers, there was the additional yearly planning workshop, where the plan for the season and results from the past year was discussed. This included a review of condition scoring, pasture cuts and pinch and twist skills.

4 Results

4.1 Feed test results

4.1.1 Crop feed test results

Feed tests were undertaken on crops at each site every year, on the day sheep commenced grazing. Table 2 outlines the average of the three years' crop results, although we have only two years' data for wheat, oat and canola. It was seen that the metabolisable energy of crops ranged from 12.2MJ/kgDM to 14.4MJ/kgDM, while crude protein content and dry matter digestibility varied more than energy content. A breakdown of each sites' performance each year is demonstrated in Tables 3 to 5 below.

Table 2: Crop quality and quantity at start of grazing, overall averages of the three years

Crop Type	Energy (MJ/kgDM)	FOO (kgDM/ha)	Crude Protein (%DM)	Dry Matter Digestibility (%)
ALL CROP TYPES	13.0	767	33.7	85.4
BARLEY	13.1	557	36.5	85.8
CANOLA	13.6	1514	30.1	88.45
OATS	12.8	176	37.1	83.7
WHEAT	12.35	910	29.5	81

Table 3 shows 2017's results, with energy lower than the three-year average, with a close spread of 12.3 to 12.9MJ/kgDM. Digestibility was average, from 81.5% to 87.5%, while crude protein was usually above average, ranging from 31.4% to 37.8%.

Table 3: 2017 crop quality and quantity, grazing commencement

Property	Grazing treatment	Energy (MJ/kgDM)	FOO (kgDM/ha)	Crude Protein (%DM)	Dry Matter Digestibility (%)
REID	BARLEY	12.9	600	37.8	87.5
SOUTH	BARLEY	12.5	506	34.2	81.5
SCANLON	BARLEY	12.9	-	31.4	86.8
SOUNNESS	BARLEY	12.3	-	36.1	86.2

Table 4 shows 2018's results-similar results to 2017 with energy levels close to the 3-year average, and a range of digestibility and crude protein levels. Despite being crops with a lower protein average there were two outliers within the crude protein data, of 20.6% and 25.7%. FOO had a huge range, with Webb's grazing wheat and canola having significantly higher biomass than seen previously.

Table 4: 2018 crop quality and quantity results, grazing commencement

Property	Grazing treatment	Energy (MJ/kgDM)	FOO (kgDM/ha)	Crude Protein (%DM)	Dry Matter Digestibility (%)
SOUTH	OAT	12.8	129	37.1	83.7
SOUTH	BARLEY	13.2	461	38.8	86.1
SCANLON	BARLEY	12.5	439	41.7	82.3
WEBB	CANOLA	12.8	2196	20.6	83.9
WEBB	WHEAT	12.2	1186	25.7	80.0

2019's crop feed test results in Table 5 showed some higher metabolisable energy results than past years, particularly from canola and barley. Crude protein was above average, as was digestibility. The cereal fodder showed a lower than average crude protein, as well metabolisable energy which was to be expected.

Table 5: 2019 crop quality and quantity, grazing commencement

Property	Grazing treatment	Energy (MJ/kgDM)	FOO (kgDM/ha)	Crude Protein (%DM)	Dry Matter Digestibility (%)
REID	BARLEY	13.6	676	34.6	89
CALDWELL	CANOLA	14.4	833	39.6	93
CALDWELL	CEREAL FODDER	12.8	326	20.3	84
RITSON	BARLEY	13.9	660	36.7	90
SOUTH	OATS	-	222	-	-
WEBB	WHEAT	12.5	633	33.3	82

4.1.2 Pasture feed test results-initial

Over the three years of the project, pasture tests were also conducted on the day crop grazing began at each site. They were also tested at the end of grazing. This section focuses on the results from the start of grazing.

Yearly averages of pasture quality and quantity varied, as seen in Table 6. FOO, protein and digestibility were most different, whereas energy was relatively stable.

Appendix 2 shows the breakdown of each year's pasture results, with energy ranging from 7.4MJ/kgDM to 12.9MJ/kgDM. Digestibility varied from 86.8% to 64%, and protein from 18.1% to 31.5%. Feed on Offer had a large range, from just 75kgDM/ha to 431kgDM/ha at the start of grazing.

Table 6: Average pasture quality and quantity at commencement of grazing

Year	MJ/kgDM	FOO (kgDM/ha)	Crude Protein %	Dry Matter Digestibility %
2019	9.8	328	21.7	66.4
2018	10.7	214	30	68.5
2017	10.2	105	20	74.7
Overall average	*10.2*	*216*	*23.9*	*69.9*

4.1.3 Difference between grazed and deferred pasture

Deferring pasture led to significant increases in feed on offer, with every site recording more FOO in the deferred pasture compared to grazed. The size and significance of this difference varies across properties-this can be seen in Appendix 3. Table 7 summarising the data in yearly performance, where the difference has been converted into a percentage due to varying initial FOO levels.

On average, deferring feed led to a 69% increase in feed compared to the grazed pastures. This was approximately 346kgDM/ha, seen in Table 7 as an increase from 665kgDM/ha to 1041kgDM/ha. Overall, 2019 saw highest increases in deferred FOO at 113%, the first two years recording similar increases of 31-34%.

Table 7: Average pasture quality and quantity of grazed and ungrazed at at end of grazing

Year	Grazing treatment	Average FOO (kg/DM/ha)	Benefit compared to grazed (kgDM/ha)	Increase in pasture deferred compared to grazed (%)
2017	DEFERRED	651	151	34%
2017	GRAZED	500		
2018	DEFERRED	1124	210	31%
2018	GRAZED	915		
2019	DEFERRED	1131	600	113%
2019	GRAZED	531		
Average	**DEFERRED**	**1041**	**376**	**69%**
Average	**GRAZED**	**665**		

4.2 Crop Yield Impacts

The overall impacts of crop grazing varied dependent on the season. 2017 resulted in positive yield impacts, and 2018 & 2019 negative impacts. For this reason, results will be discussed separately.

2017 saw increases in yield due to crop grazing. This will be explained in the discussion. Table 8 outlines the yield increases of 550kg/ha and 1360kg/ha, with no impact on yield seen at South's. Two sites had incomplete data, so were not shown below: one demonstration site was not grazed due to concerns about the season. Another site did not have a reliable crop comparison, with all barley being accidentally grazed.

Table 8: 2017 impact of crop grazing on harvest yield

Property	Ungrazed yield (t/ha)	Grazed Yield (t/ha)	Yield Impact (kg/Ha)	Yield impact (%)	Flowering delay (days)	Variety
Reid	4.00	4.55	+550	+13.8	14	Scope barley
South	3.32	3.32	0	0	13	Scope barley
White	1.60	2.96	+1360	+85.0	-	Scope barley

In 2018, impact on harvest yield varied across the properties, as seen in Table 9. Unlike 2017, harvest losses were recorded at all sites. Reid and Scanlon experienced small yield losses in their grazed cereals, compared to Webb's more significant yield. The 400kg loss in Webb's wheat could be due to it being a grazing variety, but further measurements would have been required throughout the season to confirm this. Similarly to 2017 South's had no yield penalty. Webb's grazing canola did not have a comparison, as it was turned into a pasture.

Table 9: 2018 impact of crop grazing on harvest yield

Property	Ungrazed yield (t/ha)	Grazed Yield (t/ha)	Yield Impact (kg/Ha)	Yield impact (%)	Flowering delay (days)	Variety
Reid	3.91	3.90	-58.5	-0.3	16	Bass Barley
South	3.50	3.50	0	0	10	Oats
Scanlon	6.10	5.40	-72.0	-11.8	10	Bass Barley
Webb	4.00	3.60	-400.0	-10.0	8	Longsword Wheat, Canola

In 2019, there was no difference in the crop yield at two sites. One site saw a 100kg decrease in yield due to grazing. A further two sites had incomplete data as at South's all crops were grazed, and at Webb's sheep broke through a fence.

Table 10: 2019 impact of crop grazing on harvest yield

Property	Ungrazed yield (t/ha)	Grazed Yield (t/ha)	Yield Impact (kg/Ha)	Yield impact (%)	Flowering delay (days)	Variety
Ritson	3.6	3.6	0	0	9	Flinders Barley

South	-	-	-	-	11	Oats
Webb	-	3.80	-	-	6	Illabo Wheat
Caldwell	3.9	3.8	-100	-2.6	13	Canola, oats
Reid	3.8	3.8	0	0	9	Rosaline barley

4.3 Sheep Impacts

4.3.1 Condition Score changes

Over the three years of the project, sheep that grazed crop were in better condition than sheep that did not. Each site was managed differently, with grazing intensity and days determined by feed availability, crop growth stages, the need to spell pastures, available stock and lambing timing.

On average, sheep were grazed for 26 days at 7.5DSE/ha. "Comparative advantage" or "advantage" refers to the difference between condition score of sheep that grazed pasture compared to those that crop grazed. On average, crop grazing sheep had a condition score advantage of 0.31CS. Table 11 shows the impact of crop grazing on the different sheep classes grazed, with hoggets having larger advantages than reproducing ewes.

Table 11: Average condition score advantages

	Overall	**Pregnant & lambing ewes**	**Hoggets**
Average	0.31	0.28	0.35
Maximum	0.50	0.43	0.50
Minimum	0.20	0.20	0.28

In 2017, Condition score was measured at 3 sites, showing sheep were in 0.25-0.4CS better condition after grazing crops compared to pastures (Table 12).

Table 12: 2017's Changes in condition score due to different grazing treatments

Property	**Grazing period**	**Total days crop grazing**	**Pasture grazing CS change**	**Crop grazing CS change**	**Comparative Advantage of crop grazing**	**Stock Class**	**Stocking Rate (DSE)**
Reid	18 July- 7 August	37	0.15	0.4	0.25	Lambing ewes	6.9
South	21 June-27 July	36	0.61	0.18	0.43	Twin-bearing ewes	2
Sounness	25 June-20 July	25	0	0.2	0.2	Wether hoggets	6

Table 13 shows that despite some shorter grazing periods than 2017, 2018's crop grazing sites were on average in 0.25CS better than those on pasture. Some mobs on pasture lost condition compared to other years.

Table 13: 2018's Average changes in condition score due to different grazing treatments

Property	Grazing period	Total days crop grazing	Pasture grazing CS change	Crop grazing CS change	Comparative Advantage of grazing crops	Stock Class	Stocking Rate (DSE)
Reid	19 June- 24 July	44	0.20	0.45	0.25	Lambing ewes	6.8
South	18 June-7July	20	-0.7	-0.30	0.40	Lambing twinning ewes	0.5
Scanlon	26 June-13 July	21	-0.03	0.25	0.28	Ewes, 1week pre-lambing	6.4

2019 saw producers needing to use dry sheep, so average weight change was measured, using a random selection of 50 animals from each mob. This was converted into condition score as discussed in methodology. This year saw the biggest condition score advantages in the project, ranging from 0.3CS to 0.6 CS.

Table 14: 2019's Changes in condition score due to different grazing treatments

Property	Grazing period	Total days crop grazing	Average Advantage of grazing crops (KG)	Comparative advantage of grazing crops (CS)	Stock Class	Stocking Rate (DSE)
Reid	13 July- 31 July	18	4.6	0.30	Wether hoggets	6.7
South	24 June- 17July	23	-	0.25	Lambing twinning ewes	2
Ritson	13 July- 31 July	18	4.4	0.50	Ewe hoggets	7.2
Caldwell	3 July- 6 August	26	2.9	0.32	Ewe hoggets	6.9

4.3.2 Impact on lambing percentages

Lambing percentages in twin-bearing ewes were modelled based on condition score changes for sites with condition score data from pregnant or lambing ewes. Across the three years, average condition score advantage from grazing crops was 0.31CS, with pregnant or lambing ewes seeing condition score advantages of 0.2 to 0.43 CS. On average, the ewes that grazed crops were 0.31CS higher than those that did not. As seen in Table 15, this resulted in average lambing increases in twin bearing ewes of 5.2%. Twin bearing weaning rates were modelled to increase by 10.7% and birthweights by 0.12kg. Singles were also modelled, with a 1% in singles as a result of any increase in condition score.

Table 15: Average impact of grazing on lambing outcome

	CS advantage (CS)	Lambing % increase		Birthweight increase (kg)	Weaning increase (%)
		Singles	Twins		
AVERAGE					
	0.31	1	5.2	0.12	10.7

The breakdown from each year can be seen in Appendix 4, which also includes impact on ewe and lamb fleece value. Impacts on lambing percentage in twins ranged from 4 to 7% and weaning rates from 9 to 14%. Ewe survival was increased by 0.47% on average.

4.3.3 Sheep profitability

The impact of condition score changes on ewes was used to determine profitability with the Lifetime Ewe Condition Score Profile Comparison Calculator. This modelled the financial impact of condition score advantages, based on the lamb, weaning and ewe survival increases in Table 15 above, as well as impact on fleece weights. Full results for each site can be seen in Appendix 4.

Table 16 below outlines the financial impact from condition score advantages for each site. This averages out to a production benefit per ewe of $6.26, ranging from $5.15/hd to $8.44/hd.

Table 16: Condition score impact on ewe productivity

Year	Property	CS advantage (CS)	Total benefit per ewe ($/hd)
2017	**South**	0.43	$8.44
	Reid	0.25	$5.15
2018	**South**	0.40	$7.92
	Reid	0.25	$5.15
	Scanlon	0.28	$5.72
2019	**South**	0.25	$5.15
Average		*0.31*	*$6.26*

The benefit per ewe is combined with costs saved in feed and labour to give overall sheep profitability. Table 17 below shows the cost of feed and labour per ewe for the project duration, based on the following:

- Feed Ration – Lupins, 200g/head/day
- Feeding three times per week
- Feeding costs at $30/hour inclusive of labour, machinery and fuel. We have estimated 1.5 hours to feed 1000 sheep per feed, which equates to 1.9 cents per head per day
- Feeding lupins, at $400 per tonne

Feed and labour savings were calculated to be between $1.98/hd to $29.62/hd, which varied due to grazing length and pasture availability at the time.

This was combined to give the overall sheep profitability which is shown in Table 17. This is expressed as both per head and per hectare. This was done as the host producers ran very different stocking rates, averaging 4.2/ha but varying from 1 ewe/ha to 6.9/ha. It showed that sheep

profitability ranged between $9.90/hd and $14.35/hd, and when expressed as per hectare, $9.90 to $97.61/ha. This is based on average feed and labour savings of $5.17/hd, and additional production worth $6.26/hd.

Table 17: Ewe profitability at each site

Year	Property	Extra value($/hd)	Feed & labour saving ($/hd)	Sheep net benefit ($/hd)	Stocking Rate (Ewe/ha)	Sheep net benefit ($/ha)
2017	**South**	$8.44	$4.25	$12.69	2	$25.38
	Reid	$5.15	$7.81	$12.96	6.9	$89.43
2018	**South**	$7.92	$1.98	$9.90	1	$9.90
	Reid	$5.15	$29.62	$14.35	6.8	$97.61
	Scanlon	$5.72	$13.31	$9.95	6.4	$63.70
2019	**South**	$5.15	$4.98	$8.69	2	$17.38
Average		***$6.26***	***$5.17***	***$11.42***	***4.2***	***$50.57***

Using the same calculation except for impact on reproduction, we calculated the impact on the hoggets grazed. This did not include the value of their condition score advantage, only feed and labour savings, shown as $0/hd extra value. Table 18 below shows that grazing hoggets gives a sheep net benefit of $31.75/ha, only $18.82 less than the impact on ewe benefits per ha. This was based on an average stocking rate of 6.7/ha, compared to ewe's 4.2/ha.

Table 18: Hogget profitability at each site

	Extra value($/hd)	Feed & labour saving ($/hd)	Sheep net benefit ($/hd)	Stocking Rate (hd/ha)	Sheep net benefit ($/ha)
Average	***$0***	***$4.75***	***0***	***6.7***	***$31.75***

4.3.4 Crop profitability

Crop profitability varied with each season, and site. For this reason, the average impact of each year has been displayed in Table 19 below, outlining overall average and average with the 2017 outliers removed. The difference between the two results is drastic, with an $81.13/ha profit compared to a $21.56/ha loss.

Table 19: Average crop impacts from grazing

	Yield impact(kg/ha)	Cost of Yield impact($/ha)
2017	+637	191
2018	-133	-34.79
2019	-33	-8.33

AVERAGE	*157*	*81.13*
Average outliers removed (2017 excluded)	*-83*	*-21.56*

Full results for each site are shown in Table 20, with the highest cost of yield being $100/ha in 2018, and the lowest financial impact a positive $408/ha in 2017.

Table 20: Crop impacts from grazing

Year	Property	Yield impact (kg/ha)	Cost of Yield impact ($/ha)
2017	**South**	0	0
	Reid	+550	+$165
	White	+1360	+$408
2018	**South**	0	0
	Reid	-58.5	-$17.55
	Scanlon	-72	-$21.6
	Webb	-400	-$100
2019	**Ritson**	0	0
	Webb	-	-
	Reid	0	0
	Caldwell	-100	-$25

4.3.5 Overall profitability

To determine the impact of crop grazing on the whole business, the financial cost of the yield impact was combined with sheep profitability. This gives an overall economic value of crop grazing per hectare, based on the host producer's crop grazing stocking rate.

Overall profitability varies across sites and seasons but does not include the value of deferred feed as it proved too difficult to accurately assess across the years. Table 21 shows the overall net benefit of crop grazing, where the impacts on sheep benefits is combined with the yield impact.

On average crop grazing led to whole farm profitability of $131.80/ha. However, this data is slightly skewed due to the 2017 increase in yield due to grazing, which averaged a huge net benefit of $248.40/ha. Removing 2017's data gave an average of $15.67/ha profit due to crop grazing at various stocking rates. This is the figure to focus on.

Yield impacts in 2018 and 2019 were offset by the sheep benefits to give overall net benefits of $22.28 and $9.05/ha.

Table 21: Economic impact of crop grazing on whole businesses (Ewe data only)

	Sheep net benefit ($/ha)	Yield impact ($/ha)	Net benefit of crop grazing ($/ha)
2017	57.40	191.00	248.40
2018	57.07	-34.79	22.28
2019	17.38	-8.33	9.05
Overall average	*50.57*	*81.13*	*131.80*
Average excluding 2017	*37.23*	*-21.56*	*15.67*

Table 22 outlines the difference between overall profitability between crop grazing hoggets and crop grazing reproducing ewes. The impact on hogget productivity could not be included, so only the impacts on feed and labour costs have been included. This is why the sheep benefit, and therefore net benefit of crop grazing, is lower than that of the ewes shown in Table 21.

Table 22: Economic impact of crop grazing on whole businesses for all stock classes (2017-2019)

	Sheep net benefit ($/ha)	Yield impact ($/ha)	Net benefit of crop grazing ($/ha)
Hoggets only	31.75	81.13	112.88
Hoggets, 2017 excluded	31.75	-21.56	10.19
All stock classes	41.16	81.13	122.29
All stock classes, 2017 excluded	40.93	-21.56	42.96

4.4 Outputs: Extensions and Communication Activities

Core producers met at the start of each year to discuss and plan the project, as well as review skills necessary for the project.

Two field walks were held each year, with an average of 14 producers in attendance at each event. This ranged from 13 to 15 attendees. Discussions at the field walks were as follows, focusing on the profitability of crop grazing and how to minimise the impact on crop yield:

- Higher energy and protein of crops compared to pasture
- Balance of sheep and crop profitability
- FOO comparison between pasture and crop
- How to minimise impact on crop yield
- Grazing timing and length
- Impact of crop species on feed quality
- Profitability variability due to stocking rate

- Issues with utilising lambing ewes
- Time required to appropriately manage crop grazing
- Value of fertiliser post grazing

Annual reports were produced for the Facey, Southern Dirt and AgPro newsletter, and were also distributed to interested grower groups. Each report can be seen in Appendix 5. In addition, summary sheets, with facts about crop grazing, were shared with attendees at the field walks. The project and its findings were also presented at Lifetime Ewe Management groups, local field days and through social media. Case studies have been produced for distribution after project completion, to give a producer perspective of the tool. Seven MLA progress reports were also produced.

4.5 Adoption and Practice Change

4.5.1 Changes in Knowledge, Skills and Confidence

The project led to 93% of producers increasing their confidence in crop grazing, to an average level of 7.4 out of 10. There was an increase in producers' knowledge, skills and confidence in pasture manipulation and selecting its timing. This was measured by the responses to the pre and post project survey questions (appendix 6 and 7), as well as anecdotal data reported in the discussion. 85% of producers surveyed for the closing data agreed that they found the project to be valuable and recommended the PDS program, ranking both satisfaction and project value as 7 out of 10.

4.5.2 Adoption Rate

Adoption rate was measured as above, in the survey responses. Core and observer data were unable to be distinguished, as initial data did not capture this metric. The project resulted in an increase of 24% in producers who currently graze crops, and 5% who have tried crop grazing since the project began but have not continued the practice. This can be seen in Fig. 2 below. The figure also shows that before the project, 50% of producers had never grazed crops, but this dropped to 30% post project. However further results (in Appendix 6 and 7) also showed that 22% of producers also intend to adopt crop grazing in the future.

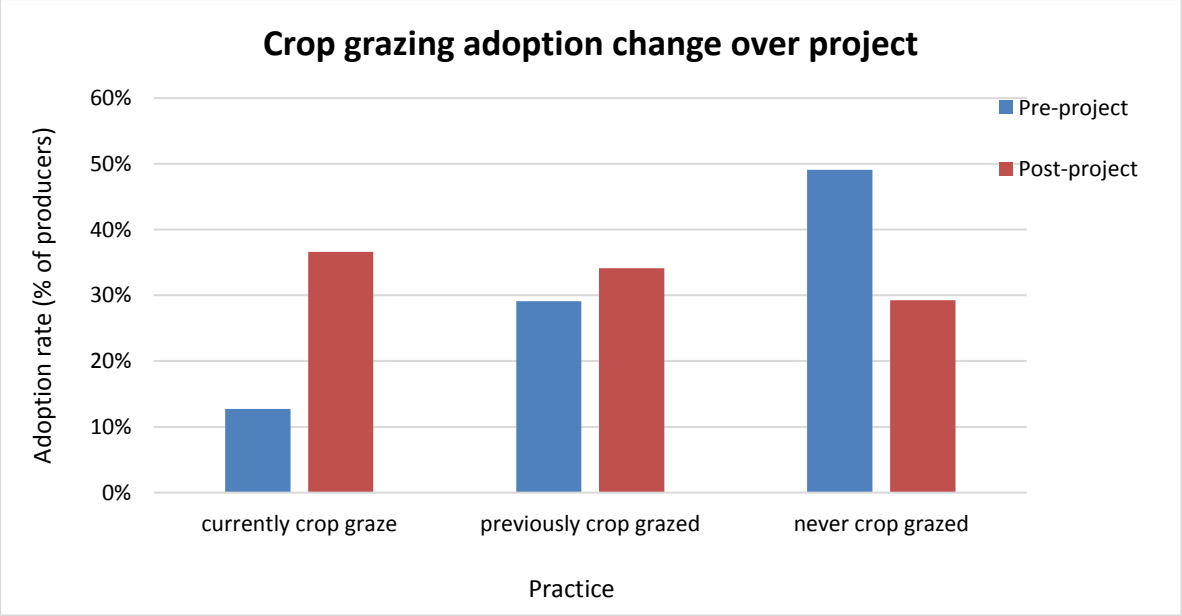


Fig. 2: Crop grazing adoption rates

Condition scoring was another metric measured, with 27% of producers intending to adopt the practice. 44% of core and observer members already condition scored regularly, with 29% intending to adopt.

Overall, 78% of the 41 respondents said the likelihood of them adopting crop grazing had increased.

5 Discussion

5.1 Impact on crop yield and crop profit

A wide range of crop species and varieties were used, showing producers that all crops are suited to grazing. Impacts of crop grazing on crop yield varied depending on the season. This was due to varied seasons, altered management, grazing crop early, and grazing timing and intensity. With a series of late breaks, the grazing window moved further into the year than expected, which in turn decreased the time crops had to recover post grazing. There was much discussion between groups involved about the impact of grazing on crop and crop yield regarding the shortened season.

Despite this, 2017 and 2018's spring rains meant crop had ample time to recover, while 2019 had a very short spring impacting yield. 2017's results were further impacted by widespread occurrence of powdery mildew, as grazing opened up the canopy to led to less disease in grazed crops compared to those ungrazed. This resulted in multiple sites seeing yield increases due to grazing, as the ungrazed crop's; yield was affected by the disease. At the Reid site, the ungrazed site recorded a lower yield than the grazed, but powdery mildew was not present. The host believes that this may be due to the ungrazed area having poorer soils, as well as the impact of an extended spring, which allowed the grazed area to recover. This shows that crop grazing is a tool that can be harnessed to benefit the crop. Although it is difficult to predict the severity of diseases each year, one producer cites crop grazing as a key tool for frost mitigation. Every two days of grazing leads to a one-day delay in flowering, which can push flowering out of the frost risk period. However this delay can also result in heat stress and poor maturity, so should only be utilised in areas where long springs are common.

Impact on crop profitability over the three years averaged a $81.13/ha profit but varied from a loss of $100 to profit of $408. Removing the impact of 2017, the financial impact was a$21.56 loss per hectare. It is important to remember that although these impacts ranged from losses of 400kg/ha to benefits of 1360kg/ha, it should be viewed as a percentage of potential yield. When viewed as a percentage, this range was +13.8% to -11.8%. On average losses were 4.1% compared to ungrazed crops, once the impact of 2017's powdery mildew was excluded. This is much lower than host producers' predictions of 7 to 15% yield loss.

Overall, the results showed that the impact of crop grazing on crop yield and crop profit can be minimised. It highlights the importance of correct grazing timing, and correct stocking rates and alleviates producers' fears from past, inexperienced crop grazing attempts to increase their understanding of the tool.

5.2 Feed test results

FOO varied at each site and across the years due to rainfall and plant growth patterns, time of sowing and grazing timing. Crop FOO also varied due to species and variety, while pasture FOO levels also reflected stocking rate and grazing period for each property.

As seen in Table 24, crops were a higher value feed than pastures, especially considering the late break which led to significantly slower pasture establishment. Crops had an average of 27% more energy and 2.56 times more FOO than pastures at the start of grazing. This shows producers the value of crops as feed, particularly as feed is so tight. The significantly higher energy and FOO for crops compared to pastures at this point in the season makes it 'rocket fuel', as one host producer quoted. This is particularly valuable to high-value animals with increasing energy demands, such as twin bearing ewes, who have clear increases in reproduction in response to improved feed.

The results have led to producers not only utilizing crop grazing, but also sowing cereals into or as pastures. This is to create further flexibility in their grazing system and provide sheep with more feed at the break of the season. Some producers have adopted this practice in addition to crop grazing, but also as a stand-alone practice for those not wanting to risk crop grazing but want to capture it's feed value impact on sheep profitability.

Table 24: Average crop and pasture feed at start of grazing each year

Year	CROP MJ/kgDM	PASTURE MJ/kgDM	CROP FOO (kgDM/ha)	PASTURE FOO (kgDM/ha)
2019	13.4	9.8	558	328
2018	12.7	10.7	882	214
2017	12.7	10.2	553	105
Overall average	12.9	10.2	767	215.7

It is interesting to note that of the crop species utilised, canola had the largest biomass and energy content, followed by barley. This can help to guide producers in their decisions on what to graze, although it must be noted that the canola was a grazing variety, and at one site was then turned into

hay. There is also the impact of sowing time to be considered, with oats for example having the lowest average FOO, but usually sown later than other crops.

The value of deferring pasture was too difficult to assess economically but deferring pastures by crop grazing animals allowed pastures to grow significantly, which is extremely valuable in tough seasons. Producers saw that grazing crops led to flexibility in pasture management, spelling pastures and allowing them to be manipulated if timing is right, in order to set them up for spring. Better pastures mean increased carry capacity, and increased stocking rate is one of the key profit drivers in a sheep system.

Every site recorded more FOO in the deferred pasture compared to grazed, with on average 69% more feed compared to the grazed pastures. This means a 69% increase in ability to meet the flock's feeding requirements. This is even more important at lower feed on offer levels (below 1000kgDM/ha), as it means an increased ability to meet the needs of pregnant ewes.

The physical amount and percentage increases varied across years and sites, due to differences in rainfall, environment and crop grazing timing, as well as initial starting FOO.

5.3 Sheep profitability

Sheep that grazed crops were in better condition than those that did not, regardless of crop type, grazing length or timing, and sheep type. The average ewe advantage of 0.28 CS is significant, as shown in the profitability calculations. It is important to note that even relatively short grazing windows (18days) can result in over 0.5CS increase- a fantastic management tool to get sheep in better condition rapidly and cheaply.

The issue remaining is the timing, as the last three years, lambing has aligned with the time crops are able to be grazed. This is due to late opening rains, delaying crop and pasture germination and growth, and has meant animals are requiring supplementary feeding. The timing makes crop grazing ewes difficult, as movement can cause mismothering. The movement required to crop graze is also very slow and time consuming when using pregnant or lambing ewes. Some producers believed crop grazing was the better option compared to supplementary feeding, due to less disruption. However this timing issue is why several producers grazed hoggets. These hoggets showed higher condition score responses than the ewes, at 0.35 average CS advantage compared to 0.28, which shows the impact of reproduction on nutritional demand. Despite this higher comparative advantage, ewes had the higher profitability response due to the impacts on lambing.

The condition score advantage is valuable, averaging an additional 5.2% lamb survival in twins. This is partly due to an increased birthweight of 120grams, which also contributed to a 10.7% increase in survival to weaning. Over a mob of ewes, let alone a flock, this is a huge increase in production, particularly in years where autumn-winter feed is tight. Ewe survival also increased by 0.47% as a result of the 0.28CS advantage.

When we look at these production impacts and convert them into economics impact, the value of crop grazing to the sheep enterprise is big, even over extremely variable stocking rates of 0.5DSE/ha to 6.9DSE/ha. This is an issue when it comes to combining sheep and crop data, to give overall profitability, as the profit varies significantly when using different stocking rates. To compare 'apples to apples' this will be discussed as per head data until combined with the cropping data.

Cost savings were calculated to be 12cents/hd/day in supplementary feed and labour, which was the feed and labour that the pasture grazing mob required, but the crop grazing mob did not as they had full feed rations coming from the crop. The impact of labour and feed can always be debated, as it

changes with each property and their management. Industry averages for feed prices, time required and per hour labour rates have been utilised to ensure fair comparison.

Every animal that crop grazed, whether it be hogget or ewe, led to increased sheep profitability per head. Fig.3 below outlines overall performance, with the hoggets shown as dotted columns compared to ewes' benefits. This enables us to compare the outcomes of each site, with their variable stocking rates. Once an appropriate stocking rate is applied, this per head benefit has the potential to hugely increase producers' sheep productivity and profitability.

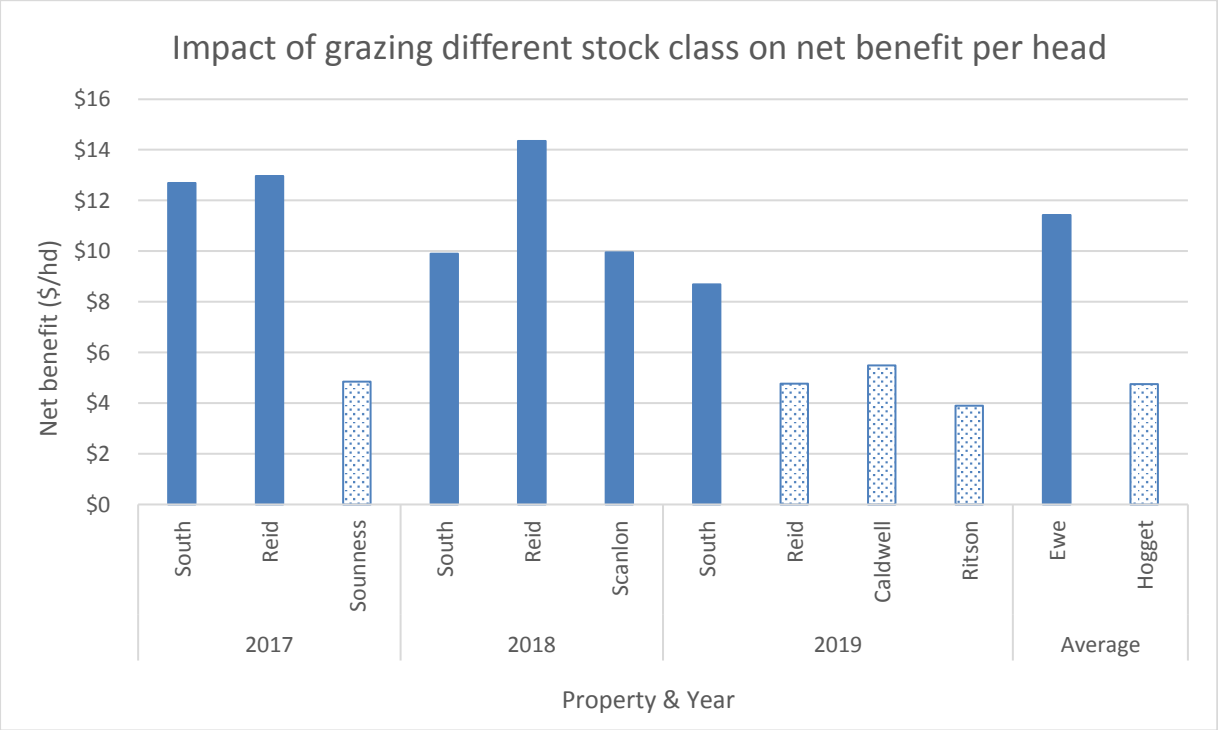


Fig. 3: Impact of crop grazing on sheep profitability

5.4 Overall profitability impacts

Overall profitability should include the value of deferred feed, which would further increase the overall benefit. However only the impact of reproductive performance and feed and labour has been included.

Overall, the project has shown that crop grazing is a valuable tool, both economically and for the flexibility it provides producers. The project data showed clearly that crop grazing not only benefits the sheep enterprise, but the business as a whole, as seen in Fig.4. Financial impacts of decreased crop yield were compensated for by increases in sheep productivity and profitability, with an average benefit of $15.67/ha for reproducing ewes when outliers are removed. It is important to remember that this data is calculated using the extremely variable stocking rates producers used to graze crops, often with understocked paddocks. This data therefore reflects an average of conservative crop grazing strategies and indicates that overall profitability would be much higher if average or optimal stocking rates were used. The outlier of Reid 2017 has been included to show the impact of powdery mildew, significantly increasing overall profitability due to increases in yield.

It was also profitable to graze hoggets, which only used the feed and labour-saving costs to offset yield impact. This is shown in the figure as dotted columns, averaging $10.19/ha profit in 2019.

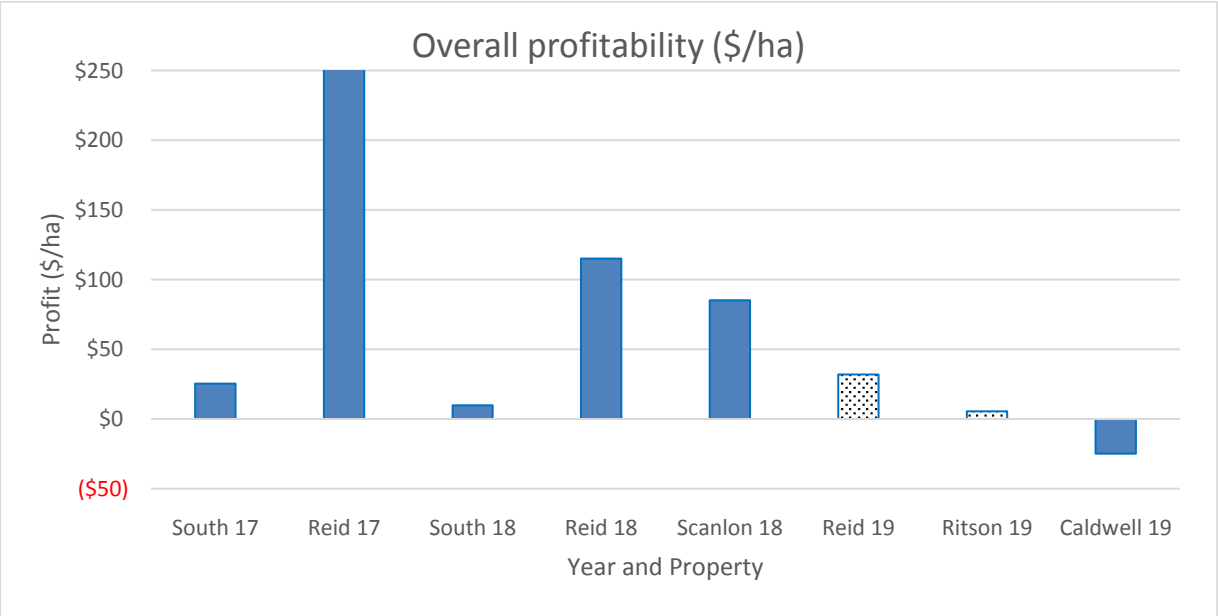


*Fig. 4: Overall profitability for each site**
** Only sites with complete data sets are shown*

This means producer confidence in utilising crop grazing as a tool has been supported, showing that it can be done without negatively impacting overall profits. This is over a variety of stock classes and stocking rates, mitigating producers fears. Overall, this means less hand feeding and better sheep health coming into lambing, resulting in higher lamb and weaner survival. Not only is this an economic win, but an emotional one too, as hand feeding during lambing or in the lead up can be stressful with mismothering and lamb abandonment.

Using high value animals to crop graze, such as the twin bearing ewes, maximised sheep profitability. This should be kept in mind for producers crop grazing. The figure above shows higher sheep net benefits, and therefore overall profits, from reproducing ewes compared to the hoggets. Until the length of the season can be accurately predicted, crop grazing will carry a small risk, so high-value animals must be used to ensure the best reward for the risk. We have also shown that crop grazing hoggets can result in profit when hand-feeding is still required. This was done as the lambing window aligned with the crop grazing window during the late breaks. This could also be utilised for finishing lambs out of season on crops, particularly with the recent change to dentition.

Increased carrying capacity is another impact crop grazing can have on the sheep enterprise. This would be interesting to further explore, as increasing stocking rate usually leads to increased profitability. Another perspective we did not look at was the impact of lambing into crops, where the crop is providing shelter and reducing the need to leave the birth site, both of which impact lamb survival beyond condition score. There is also the impact of moving animals during lambing, as needed at some sites as crop reached growth stage 30.

5.5 Meeting Project Objectives

The project objectives have been met, as outlined below.

By March 2020, this project will have:	
Demonstrated the impact grazing crops has on sheep management on 4 properties in southern WA regarding: o Condition Score - 10% increase in comparative advantage condition score of twin bearing ewes grazing crop over ewes on pasture	Demonstrated across 8 properties in the south of WA: Average of 11% (0.28CS) advantage increase in condition score in pregnant, twin bearing ewes, 0.35 in hoggets grazing crops compared to those grazing pasture.
o Feed available - 100% increase in Feed on Offer (FOO) available through deferment of pastures during period of crop grazing.	Average increase of 69% in FOO available due to deferring pastures
o Harvest yield – less than 10% impact of grazing crop vs. non grazed crop.	On average, harvest yield decreased by 4% compared to ungrazed crops. This does not include the impact of increased yields in 2017, which skews the average to a positive impact of 7% difference.
Developed a comprehensive benefit cost analysis as to the overall benefits of crop grazing.	Developed with results as reported above. Value of pasture deferral ideally would have been included.
Led to 80% of the 21 core producers to adopting the technology and 60% of the 300 observer producers to intend to adopt this technology	Initial survey data did not ask to determine if observer or core. The project has led to 22% of producers adopting crop grazing as a result of this project, and 22% intending to. These numbers do not however align with the 30% increase of producers who say they now regularly crop graze, and 10% increase in those who say they have in the past.
Increased the understanding in the wider industry about the benefits of crop grazing on a mixed farming enterprise.	93% of surveyed producers said the project had increased their understanding of crop grazing. This does not capture the wider industry to who the findings have been presented to, but anecdotal feedback suggests wide reaching impacts.
Reinforced importance of ewe condition score on ewe productivity to producers in region.	All producers involved were reminded with all data distributions, and all meetings, the LTEM principles. 44% of producers now condition score regularly, with a further 29% intending to adopt.

Project deliverables have been achieved as outlined below:

• Case studies on each of the 4 PDS hosts on completion of the project.	• 4 host case studies attached as Appendix 8.
• Beginning of the season workshop for producers each year, reinforcing importance of ewe nutrition, condition scoring and crop grazing 'rules'.	• 3x beginning of season workshops conducted
• Fact sheets for attendees at each field day (also posted on social media after).	• Fact sheets produced for each field day
• Survey results- quantifying attitudes and use of crop grazing.	• Survey results as reported on in Results section and attached in Appendix 7 & 6.
• Annual progress reports and articles on the findings/experiences of the demo sites.	• Annual articles distributed through Facey, Southern Dirt and AgPro news channels, attached as Appendix 5.
• New knowledge and data from the PDS sites.	• New knowledge and data collected as reported on above.

6 Conclusions/Recommendations

The project has increased involved producers' and the wider industry's understanding of crop grazing. This has come about due to the on-site results combined with extension and communication activities. Further extension activities could include presentations at conferences, particularly those targeting industry advisors, to better equip them with the tools to assist producers. This should include agronomists, as they are often the source of producers' crop advice. Future research should look at the value of deferred pasture and impact of crop variety on yield impacts, to give more information about crop grazing.

Overall profitability gains were demonstrated across the three years and 8 host properties. This has reinforced the Lifetime Ewe management principles of condition score management, as sheep profitability was mostly determined by the response to condition score changes, with feed and labour cost being the minor influencer. This was further supported by the differences between hogget and ewe profitability.

Crops were shown to have 27% more energy and 256% more feed on offer in autumn compared to pastures. In addition, crop grazing allowed pastures to be deferred, leading to 69% increase in pasture feed on offer compared to grazed pastures. This has led to an increase in adoption and use of crops for grazing, not just as crops but also with producers sowing cereals into or as pastures. Utilising crop's energy and biomass early in the season for the sheep enterprise creates flexibility for producers and increases their sheep productivity. It can be used to finish out of season lambs and look after other high-value animals such as twin-bearing ewes with high nutritional demands. Both these stock classes respond rapidly to condition score changes, so are the best stock to graze crops.

The project's timing was ideal, with producers across W.A. experiencing a string of late breaks and therefore extremely limited pasture availability coming into June-July lambing. The project's findings have helped to create and demonstrate flexibility within WA mixed enterprise systems, showing that crop yield impacts will be compensated for by the sheep productivity to give overall profit gains.

7 Appendices

Appendix 1: Values used for economic analysis

FEED			
TYPE	**VALUE**	**% DM**	**Energy MJ/Kg**
Oats	250	0.92	10.7
Lupins	400	0.92	13.7
Peas	350	0.91	13.0
Barley	300	0.91	11.9
Wheat	250	0.91	12.9
Hay	180	0.90	9.1
Silage	150	0.45	9.8

Appendix 2: Each year's average pasture results

Year	Property	Crude Protein %	Dry Matter Digestibility %	MJ/kgDM	FOO (kgDM/ha)
2019	REID	19.8	64	9.3	342
2019	CALDWELL	21.3	72	10.7	366
2019	RITSON	19.8	64	9.3	339
2019	SOUTH	18.7	65	9.6	190
2019	WEBB	28.9	67	9.9	402
2018	REID	31.5	66.3	10.5	431
2018	SCANLON	27.7	68.8	10.2	153
2018	WEBB	30.0	64.0	10.7	198
2018	SOUTH	30.6	75.0	11.3	75
2017	SCANLON	21.9	86.8	12.9	-
2017	SOUTH	18.1	62.6	7.4	105

Appendix 3: Grazed and Deferred Pasture results

3.1: Pasture quantity available <u>after</u> the grazing period in deferred and grazed treatments 2017

Property 2017	Grazing treatment	Average FOO (kgDM/ha)	Benefit (kgDM/ha)	%
SOUTH	DEFERRED	702	102	17%
SOUTH	GRAZED	600		
SCANLON	DEFERRED	600	200	50%

SCANLON	GRAZED	400		

3.2: Pasture quantity available <u>after</u> the grazing period in deferred and grazed treatments 2018

Property	Grazing treatment	Average FOO (kgDM/ha)	Benefit (kgDM/ha)	%
REID	DEFERRED	779	335	75%
REID	GRAZED	444		
SOUTH	DEFERRED	1188	23	2%
SOUTH	GRAZED	1165		
SCANLON	DEFERRED	959	170	22%
SCANLON	GRAZED	789		
WEBB	DEFERRED	1570	310	25%
WEBB	GRAZED	1260		

3.3: Pasture quantity available <u>after</u> the grazing period in deferred and grazed treatments 2019

Property 2019	Grazing treatment	Average FOO (kgDM/ha)	Benefit (kgDM/ha)	%
REID	DEFERRED	920	320	53%
REID	GRAZED	600		
RITSON	DEFERRED	1680	1185	239%
RITSON	GRAZED	495		
SOUTH	DEFERRED	760	376	98%
SOUTH	GRAZED	384		
CALDWELL	DEFERRED	582	236	68%
CALDWELL	GRAZED	346		
WEBB	DEFERRED	1712	882	106%
WEBB	GRAZED	830		

Appendix 4: Impact on reproduction

4.1: Impact of condition score advantage on lambing performance, survival and economic value, 2017

		Lamb survival increase (%)			
2017	**CS advantage (CS)**	**Singles**	**Twins**	**Birthweight increase (kg)**	**Weaning increase (%)**
South	0.43	1	7	0.17	14
Reid	0.25	1	4	0.1	9

4.2: Impact of condition score advantage on lambing performance, survival and economic value, 2018

		Lamb survival increase (%)			
2018	**CS advantage (CS)**	**Singles**	**Twins**	**Birthweight increase (kg)**	**Weaning increase (%)**
South	0.40	1	7	0.16	13
Reid	0.25	1	4	0.11	9
Scanlon	0.28	1	5	0.08	10

4.3: Impact of condition score advantage on lambing performance, survival and economic value, 2019

		Lamb survival increase (%)			
2019	**CS advantage (CS)**	**Singles**	**Twins**	**Birthweight increase (kg)**	**Weaning increase (%)**
South	0.25	1	4	0.1	9

Appendix 5: Annual reports*

*Please note that data from the annual reports may be different to that reported in the project due to exclusion of outliers.

5.1: Annual report year 1

A crop grazing project is underway with the help of MLA, the Facey Group and Southern Dirt, showing how to better manage crop grazing. With five sites across Wagin, North Stirlings and Boyup Brook, the producer demonstration sites are aiming to increase confidence in, and understanding of, the tool as a way to decrease the autumn-winter feed gap and increase farm profitability.

The three year project, run by Georgia Reid and Ed Riggall, aims to demonstrate how crop grazing can create whole farm benefits, increasing profitability and productivity, with any yield impact offset by the value of deferred pasture, sheep weight and condition gain, and subsequent performance (particularly lamb survival).

Stocking paired paddocks on each of the four properties (a pasture and a crop paddock each) at 7-10DSE for 2-5weeks resulted a 2-week flowering delay, but no yield impact. This was assisted by the soft finish and spring rains.

Producers were initially planning to use twinning ewes, in order to help meet their higher energy requirements, but due to the late break, lambing timing coinciding with the beginning of grazing, hoggets and wethers were used on three properties.

The first year of the project showed that with a late break and extended supplement feeding, crop grazing cereals can help reduce feed costs and improve sheep condition. Cereal crops are a high quality feed, with feed tests were undertaken on both the pasture and young crop, determining that the barley crops had on average 30% higher metabolisable energy and 50% more crude protein than the pastures, which also had lower feed on offer at the time.

The project will continue until the end of the 2019 growing season, with local producers and industry members welcome to attend the field days in winter.

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5.2: Annual report year 2

Crop grazing is a way to harness an under-utilised source of autumn feed, when pastures are still tight and lambing/pregnant ewes have high energy demands. Recent demonstration sites in Wagin have shown that crop grazing can have great productivity benefits to sheep enterprises, without heavy yield penalties. This 'superfood' can be used to decrease the amount of supplementary feeding required in autumn, spell pastures, and improve ewe condition, which in turn impacts lamb survival.

As well as having higher concentrations of energy and protein, crops have more biomass than pastures earlier in the season. However, other than the obvious benefits, Murdoch University research has shown that sheep can maintain on 200-300kg/ha FOO on crops, compared with 800-1000kg/ha of pasture FOO. This is due to cereals' upright nature, being more easily grazed and giving more nutrition per mouthful than prostate pastures.

This year, crop grazing in Wagin showed cereal crops to be a significantly more valuable feed compared to pasture at the same time, with:

- 10% higher crude protein
- 15% higher Digestibility
- 27% more energy
- 200% more feed on offer

Property	Grazing treatment	Crude Protein %	Dry Matter Digestibility %	MJ/kgDM	FOO (kgDM/ha)
1	OAT	37.1	83.7	12.8	129
1	BARLEY	38.8	86.1	13.2	461
1	PASTURE	30.6	75.0	11.3	75
2	BARLEY	41.7	82.3	12.5	439
2	PASTURE	27.7	68.8	10.2	153

Crop grazing pregnant ewes in June led to condition score increases of 0.25 CS in 3 weeks, compared to pasture grazing mobs losing condition (-0.05CS). This was at Site 2, with very little green feed due to the late break.

In comparison, at Site 1, twin-bearing, lambing ewes grazing crop lost 0.4CS less than those grazing pastures at the same time. This is to be expected, as energy requirements peaking during lactation can't be met by green feed, leading to loss of condition.

In the next 6 months, lamb survival data will be analysed, as will crop yield impacts. In 2017, crop grazing did not have an impact on crop yield. This was attributed to the extended spring rains, with this year's data keenly awaited!

5.3: Annual report year 3

Aim: To demonstrate the advantages of crop grazing on farm profitability and enhance producer understanding of how to apply the tool to best advantage in different seasons and situations.

Background

Productivity driven sheep profits are hitting a ceiling in traditional mixed farm enterprises. The autumn winter feed gap limits stocking rates and per head growth rates, due to lack of available feed. Current practice is to hand feed, with lower stocking rates. This can involve selling off lighter store sheep early and having fewer wethers on farm or just running a lighter stocking rate all year round. This can result in sub-optimal stocking rates during the growing season. Crop grazing can rectify this by providing an alternative feed source to reduce hand feeding and potentially increase stocking rates.

Crop grazing is something farmers tend to avoid due to lack of knowledge or confidence in the method. This is due to some having played with crop grazing and not understood its place, or how to limit its impact on crop yields, which has led to bad experiences and results. There is also a lack of quantifiable evidence of the impact of crop grazing on whole-farm profitability. Running demonstration sites on several properties across different seasons & grazing intensity allows producers to see results for themselves and understand how grazing crops can work for them.

Accessing the crop area of the farm as a feed source at this time of year unlocks potential to increase stocking rate, as well as allowing high value animals such as twin bearing ewes and lambs access to easily accessible high value feed as shown in the MMPIG producer research site project. To quantify this, there is potentially a 10-20% increase in stocking rate opportunity, due to unlocking the area and a 20-30% increase in growth rates opportunity, from accessing the higher value, easily accessible feed. During the period while stock are crop grazing, pasture can be deferred, leading to greater pasture growth and allowing lambing ewes to lamb onto higher FOO levels. This can be directly correlated with higher lambing percentages.

Crops were grazed at 4 sites each year across the Great Southern for between 10 and 44 days during June-August. Stocking rates varied, between 0.5 to 7.5 ewes/ha. For example, one site grazed at approx. 6.6DSE for 20-21 days, while another grazed for 44 days at 1ewe/ha during lambing. Other producers crash grazed at 26DSE/ha; however we did not have full sheep data.

FEED

At the start of grazing, when crops passed the 'pinch and twist' test, crops had better quality feed than pastures at the time. Crops had on average 27% higher metabolisable energy, triple the Feed On Offer and were 18% more digestible compared to pastures. Crop was also more accessible, being erect and easier to eat compared to prostrate pastures. Grazing these crops allowed paddocks to be spelled, with deferred pasture having 69% more Feed On Offer compared to pastures grazed during the crop grazing period.

SHEEP BENEFITS

Crop grazing sheep were measured to be in better condition compared to those grazing normal pastures, especially as pastures were tight in the last three years due to a series of late breaks. Crop grazing led to the sheep being in 0.36 CS better than mobs that only grazed pastures.

These condition score advantages were modelled to result in production benefits of $6.60 to $10.74 per ewe, based on increased ewe survival (4-6%) as well as impacts on wool growth and lambing percentages. On average, lambing percentage increased by 5.4% in twins and 1% in singles. This was due to average increased birthweight of 110grams. The increase in lamb survival and birthweight led to an increasing in weaning percentage of 10.4%.

There were further benefits to the sheep enterprise, such as reduced labour in time spent feeding, and reduced feed costs. This was included in the modelling to give crop grazing a benefit of $9.27 to $109/ha to the sheep enterprise, or $8 to $25/ewe grazed.

CROP IMPACT

Yield impacts ranged from a loss of 400kg/ha to an increase of 1360kg/ha. This increase in yield in response to crop grazing was due to the impact of powdery mildew in 2017, with grazing opening the crop canopy and decreasing the impact of the disease.

Excluding the 2017 increases in yield, average impact of grazing on crop was a loss of 83kg/ha, calculated to be a 3% yield loss. This resulted in an average financial impact of -$22/ha, however this ranged from a loss of $160/ha to benefit of $408/ha.

OVERALL FINANCIAL IMPACT

To give an overall impact on whole business gross margin, yield impact was combined with sheep benefits, as shown in the table below. This gave an average net benefit of $40.29/ha with 2017's outliers were removed. It should be kept in mind that this was over very variable stocking rates and different grazing intensities.

	Sheep net benefit ($/ha)	Yield impact ($/ha)	Net benefit of crop grazing ($/ha)
2017	54.30	191.00	245.33
2018	53.20	-34.79	18.43
2019	70.50	-8.33	62.15
Overall average	**59.97**	**49.29**	**108.64**
Average excluding 2017 outliers	*61.85*	*-21.56*	*40.29*

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Appendix 6: Survey Results, Pre-project

- Pre PDS surveys undertaken, of the 55 responses:
  - 14% grazed crops, with 27% tried crop grazing in the past.
  - Of those who had grazed crops, 95% had grazed cereals
  - 96% believed crop grazing could reduce supplementary feeding costs
  - 40% thought grazing would significantly impact crop yield, while 60% believed it would be 'moderate'.
  - 80% of producers were interested in crop grazing on their farm
  - 55% thought crop grazing would increase sheep productivity through increased feed quality and quantity, and 40% could see sheep profitability increase
  - 27% thought it could lead to whole-farm financial benefits

Appendix 7: Survey Results, Post-project

- Post PDS surveys undertaken, 41 responses.
  - 85% of producers would recommend being involved in a PDS project
  - Producers rated their satisfaction with the project as 7.4 out of 10
  - Producers rated the value of the project as 7.2 out of 11
  - 34% of producers had grazed in the past, with 37% currently grazing. 29% have never grazed
  - 78% of producers have said that their knowledge of crop grazing had increased, and 90% said the project had increased their likelihood of crop grazing with a rating of 7.4 out of 10 in confidence
  - 44% already used condition scoring pre-project, 29% have implemented it since the project, and 27% intend to implement.
  - 37% of producers surveyed after the project had already crop grazed, 22% had implemented during the project, 22% planned on implementing and 17% did not intend to implement
  - Those that did not intend to implement was due to previous bad experiences, the risks and wanting to learn more about crop growth stages
  - Producers rated increasing rotation length as the highest benefit of crop grazing, followed by increasing condition score, then reducing hand feeding costs and overall profitability.

Appendix 8: Producer Case Studies

8.1 Reid Family, Boyup Brook, W.A.'s South-West

Property owner:	Peter and Carolyn Reid
Property name:	'Kilamarup'
Location:	Boyup Brook, South West W.A.
Enterprises:	Self-replacing merino flock – 7,000 breeding ewes
	Cropping- barley, canola, sometimes hay and oats
Soil type:	Gravel loams
Annual rainfall:	550mm

Introduction

The "Crop Grazing: Demonstrating Profitable Success" project has been focused on increasing producers' understanding of crop grazing's impact on profitability, and how to best apply the tool in different seasons and situations.

"Kilamarup" was one of the host properties for the duration of the three-year project, used to show the impact of grazing crop on sheep and crop productivity and profitability. Crop grazing is a tool that until recently has been rarely utilised in W.A., often due to producers lacking confidence and understanding of the tool. By following a few basic rules, crop grazing was shown to lead to not only better sheep health, but increased lamb, weaner and ewe survival, and lamb birthweights. Despite small yield impacts, this resulted in overall farm profit.

Current Management

'Kilamarup Farm' is a family owned farm, ran and managed by the Reid family. They are a mixed enterprise consisting of a 7,000 self-replacing merino breeding flock and a crop total of 1300 hectares. They grow various crops such as barley, canola, hay and oats. Approximately half of their

property is pasture, a sub clover and rye grass base. In recent years, cereals have been trickled into these pastures for early growth. These paddocks are often deferred to be best utilized as lambing paddocks. The breeding ewes are joined for 5 weeks, which results in a late June/early July lambing. With these dates, lambing comes just after the break of the season, which, in a bad year could result in scarce pastures. This means that handfeeding requirements could still be high, and needed during lambing which is not ideal. Peter, looking at the cereals in his deferred pastures, thought an alternate option and readily available food source can be found in crop grazing.

Crop grazing on 'Kilamarup'

The Reid family began crop grazing in 2017 when this project began and have done so every year since. Peter and his wife Carolyn graze on their barley crops, and last year grazed every cereal paddock they had. They opt to graze their pregnant ewes on these crops due to this type of sheep being the most valuable on the farm, and having the highest energy demands. The stock levels for crop grazing stay around 7 DSE, lower than their average stocking rate, and the ewes are usually left in the crop for 3 weeks. This can alter depending on the crop growth stage and season. However the Reids have found difficulty grazing ewes due to late season breaks. In some years, they have been forced to trickle ewes out of crop paddocks during lambing, as the grazing window has been delayed.

When speaking to Peter he informed us that there were a few concerns about the impact on the crop and overall profitability. He found higher screenings and a lower yield in paddocks that had been grazed compared to those that weren't, as well as a 13-day delay in flowering. The barley yield impact averaged 300kg, which is about 4%.

Reid's Reasons:

The Reids had a lot to say about the benefits of crop grazing, and why they grazed more than the project required:

1. Allows pastures to be spelled so they can actually grow (late breaks) or get away in normal years.
2. Fantastic in late break seasons. For example, there was no pasture at all available when crops were ready to graze in year 2- we were confinement feeding the rest of the flock
3. In normal years will use to create worm free lambing paddocks, utilising pre lamb drench.
4. Reduces mismothering due to feeding, and meets ewes' increasing requirements.

The Reids plan on crop grazing in the future but the number of paddocks used will depend on the season – "but it's a no brainer in late breaks" Peter added. "A tool in your belt for difficult seasons, which is when you really get the value from it"

The Reid's tips for crop grazing

1. Keep an eye on the crop to monitor grazing severity- don't want the plants to get too low. That's when you lose yield.
2. Take the sheep out earlier than you think.
3.Graze an average or lower than usual stocking rate for a few weeks as soon as the crop passes the pinch and twist test.
4. Sow cereals into or with your pastures to gain benefits of crop grazing without the risk.
5. Learn how to manage crop grazing now so you can do it in tough seasons.

8.2 South Family, Wagin, W.A.'s Great Southern

Property owner:	Clayton and Polly South
Location:	Wagin, Western Australia
Property size:	5,000ha
Enterprises:	Self-replacing Merino/Dohne flock Cropping: Cereal and Canola
Soil type:	Mixture; duplex soils, sand over clay, sandy over gravel, heavy loams
Annual rainfall:	450mm

Introduction

The "Crop Grazing: Demonstrating Profitable Success" project has been focused on increasing producers' understanding of crop grazing's impact on profitability, and how to best apply the tool in different seasons and situations.

The Souths were one of the host properties for the duration of the three-year project, used to show the impact of grazing crop on sheep and crop productivity and profitability. Crop grazing is a tool that until recently has been rarely utilised in W.A., often due to producers lacking confidence and understanding of the tool. By following a few basic rules, crop grazing was shown to lead to not only better sheep health, but increased lamb, weaner and ewe survival, and lamb birthweights. Despite small yield impacts, this resulted in overall farm profit.

Current Management

The South's property is a 5,000 hectare family owned farm, ran and managed by the South family. They are a mixed enterprise consisting of 4,000 Merino/Dohne mix breeding ewes and 2,000 Merino/Dohne mix breeding ewe lambs. The crop area consists of 3,000 hectares, were wheat, canola, barley, oats and lupins are grown. All cereals contribute towards the effective use of crop grazing. Lambing falls from the last week of June and for 3 weeks into July each year. With these dates, lambing comes just after the break of the season, which, in a bad year could result in scarce pastures being available meaning that handfeeding requirements could still be essential. The Souths separate their twin and single bearing ewes for customized management, which is where crop grazing is utilized on the farm.

Crop grazing on Clayton South's farm

The South family began crop grazing around 11 years ago in 2009 and are continuing to do so. Clayton and his family graze their Merino/Dohne mix sheep on a mixture of their crops such as; canola, barley, wheat and oats (everything except the lupins). In the last 4 to 5 years Clayton changed to only grazing the twin bearing ewes on the crops. This is due to the responsiveness of this class- not only are they the most valuable stock on farm, but their reproductive performance is most responsive to increases in condition. The stocking rate for crop grazing is approximately 0.5DSE/ha, or 30 twin bearing ewes per 100 hectares. The ewes are crop grazed for 4-5 weeks and will lamb in the crop. This has multiple advantages, with very low impact on crop yield, ad lib feed for the ewes, shelter for lambing, and also decreased chances of mismothering and abandonment due to the very low stock, a problem that is common in twins.

Clayton informed us that he found that there were no impacts on the crops after being grazed by his sheep. Due to having such a low stock rate on these paddocks he feels that the ewes do not do any damage, but it is also very important to get the sheep off by mid-July – no later! After this his research and experience has shown uneven maturity times and yield across the paddock, in the areas sheep camped in.

The main reasons the Souths crop graze is to defer pasture, which helps them be able to run a higher stocking rate. Its also ideal for reducing twin mob sizes and increasing lamb survival percentages. But this is an opportunity only and claims that if the pastures are available to don't do it-the benefits are reduced, while the risk and impact on crop profitability remains.

The South's tips for crop grazing

Concluding the interview with Clayton we asked what tips or tricks they had learnt from crop grazing for 4 years on various crops. He said low, small numbers on big areas works well but he does not recommend big mobs. He found that they graze evenly, opening up the canopy for weeds which compete with the crop.

8.3 Webb Family, Kojonup, W.A.'s Great Southern

Property owner:	Ben and Emily Webb
Property name:	'Marbarrup Farms'
Location:	Kojonup, South West Australia
Property size:	2,150 ha
Enterprises:	Merino's – 5,500 breeding ewes Cropping
Soil type:	Gravel loams
Annual rainfall:	550mm

Introduction

The "Crop Grazing: Demonstrating Profitable Success" project has been focused on increasing producers' understanding of crop grazing's impact on profitability, and how to best apply the tool in different seasons and situations.

The Souths were one of the host properties for the duration of the three-year project, used to show the impact of grazing crop on sheep and crop productivity and profitability. Crop grazing is a tool that until recently has been rarely utilised in W.A., often due to producers lacking confidence and understanding of the tool. By following a few basic rules, crop grazing was shown to lead to not only better sheep health, but increased lamb, weaner and ewe survival, and lamb birthweights. Despite small yield impacts, this resulted in overall farm profit.

Current Management –

'Marbarrup Farms' is a 2,150 hectare family owned farm, run and managed by the Webbs. They are a mixed enterprise consisting of 5,500 Merino breeding ewes with 1,200 hectares of crop. They grow cereals, canola, hay, silage and pastures which all contribute towards the effective use of crop grazing. The breeding ewes are mated in February which allows lambing to fall between the 12th of July and the 12th of August.

Crop grazing on 'Marbarrup Farms'

The Webb family began crop grazing around 8 years ago in 2012. Since then they have crop grazing on and off depending on various factors annually such as; the type of season, weeds and the amount of feed available on pastures. Ben and his wife Emily graze their Merino sheep on a mixture of crops, hay and silage crops, cereal crops like winter wheat, and have recently tried grazing canola varieties. They graze all sheep classes on these crops, but prefer the younger sheep are used, as logistically the Webbs find it easier to manage. The stocking rates for crop grazing vary between 0.5 – 50DSE/ha,

with the stocking rate determining the length of time on the crop. The Webbs try to get the highest benefits possible from crop grazing- they commonly 'crash graze', and rotate mobs across multiple cropping paddocks as well as set stocking at lower rates for longer periods. Longer periods are particularly useful when Ben is trying to manipulate flowering timing, to push it out of the frost risk period.

When speaking to Ben he informed us that he found that there was around an 8% yield impact on crops that had been grazed. Interestingly, the Webbs found that 60% of this impact occurred on their non-wetting gravel hills.

The Webb's tips for crop grazing
Concluding the interview we asked what tips or tricks the Webbs had learnt from their 8 years of crop grazing.
1. Give mineral calcium
2. Be careful of weeds post grazing
3. Keep on eye on crop up on the non-wetting gravel soil areas
4. Remember withholding periods of chemicals if you've sprayed that paddock!

8.4 Charlie Caldwell, Boyup Brook, W.A.'s South West

Property owner:	Caldwell Family
Property name:	'AN Caldwell & Co'
Location:	Boyup Brook, South West Australia
Property size:	Total – 4,400 ha
Enterprises:	70 % Merinos, 30% Crossbreed Cropping
Soil type:	Mixed – gravel, sand, clay, loam
Annual rainfall:	550mm

The "Crop Grazing: Demonstrating Profitable Success" project has been focused on increasing producers' understanding of crop grazing's impact on profitability, and how to best apply the tool in different seasons and situations.
The Souths were one of the host properties for the duration of the three-year project, used to show the impact of grazing crop on sheep and crop productivity and profitability. Crop grazing is a tool that until recently has been rarely utilised in W.A., often due to producers lacking confidence and understanding of the tool. By following a few basic rules, crop grazing was shown to lead to not only better sheep health, but increased lamb, weaner and ewe survival, and lamb birthweights. Despite small yield impacts, this resulted in overall farm profit.

Current Management
'AN Caldwell & Co Farms' is a 4,440 hectare family owned farm, run and managed by the Caldwell family. They are a mixed enterprise consisting of 4,400 Merino and crossbred breeding ewes. Cropping area is 1400 hectares, of which 700ha is pasture and fodder crops such as hay and standing fodder, and 700ha is cereals, canola and oats. (700 pasture crops/700 harvest crops). Pasture grazing paddocks are a mix of clover and ryegrass with 'a few other things left in there'. Sheep graze this as soon as possible, as well as the dried fodder crops. Ewes are mated in February which allows lambing to begin on the 1st of July.

Crop grazing on 'AN Caldwell & Co'

The Caldwell family began crop grazing around 4 years ago in 2016. Since then they have used this method each year. Charlie Caldwell said management is different every year, as the need is different. “Some years we have plenty of pasture and sheep are in good condition, and others, there’s no pasture as lambing approaches, and the sheep have had a hard summer” he said. “It’s a tool we pull out whenever the situation calls for it”. And when the situation calls, the as to what they Caldwell enterprise grazes the canola, barley and oats. They graze all stock classes on these crops, but usually it will be the sheep closest to the crop paddock who are put in there to crop graze. “Simplicity is key” Charlie explained. “If we are crop grazing, we’re usually short of feed, busy with the feeder and don’t have capacity to move sheep miles”. Grazing stocking rates vary between 15-30 DSE/ha, with the sheep left on the crop for approximately 2- 3 weeks.

Charlie has found that there is no yield impact on the crops after having sheep grazing them, and he’s not concerned about the risk. “If we do it right and keep an eye on the crop, its fine”. His main reason for crop grazing is to spell short pastures, in order to let them better establish.

Caldwells’ crop grazing trips

Concluding the interview with Charlie we asked what tips or tricks he had learnt from crop grazing for 4 years on various crops. His one and only point was that you must check it often, more than you think!