Analysis of bulking pastures with cereals: economic valuation

Key messages

- Sowing cereals into pastures provides up to 70% extra early FOO.
- Out of the three (20 kg/ha, 40 kg/ha and 60kg/ha) seeding rates tested 60kg/ha was the best.
- Bio-economical modelling showed that bulking pastures can provide additional profit up to $19/improved ha.

Introduction

The sheep enterprise is no longer low input low output. Well managed sheep can generate significant farm profits (Young, Thompson et al. 2011, Young, Kingwell et al. 2020). In this article we dig into the novel concept that is "bulking" pastures. Bulking pastures involves sowing cereals into pastures early in the year with the aim of increasing early season FOO. Compared to pasture, cereals grow more erectly and have greater early vigour providing more grazing early in the season. Due to cold temperatures and newly established plants, pasture growth early in the season is limited making extra FOO increasingly valuable early in the season. However, there are trade-offs associated with this management. These include the cost of running and maintaining seeding equipment, the cost of labour and the opportunity cost (if labour/machinery is tied up seeding pastures other tasks cannot be completed).

In the following article we cover the following questions:

(i) What is it worth to sow cereals into pastures?
(ii) What seeding rate should I use?
(iii) How many hectares should I sow?
(iv) If I sow cereals into my pasture do, I need to alter my livestock management?
(v) What is the cost – benefit break down of sowing cereals into pastures?

Method

The pasture bulking trial was conducted by AgPro Management between 2019 and 2021 inclusive. The economic analysis was carried out by Youngs Farm Analysis (https://youngsfarmanalysis.com.au/) using

AFO, a whole farm optimisation model. AFO was selected as the appropriate tool to quantify the profitability of sowing cereals into pastures because it accurately represents the machinery cost and labour requirements of seeding cereals into pasture. Furthermore, AFO can efficiently examine the optimum utilisation of feed resources across the whole farm. It models the whole flock and optimises animal and pasture management across the whole farm through the entire year. Using this modelling method provides information regarding how best to utilise the benefits provided by sowing cereals into pastures and the associated profit.

AFO description

AFO is a bio-economic model that maximises farm profitability by determining the best combination of activities on the farm within the constraint of a limited set of production resources. The sheep and pasture enterprise represents the whole flock and includes a powerful feed budgeting module that optimises management of the feed resource across the whole farm. Being an optimizing model, it calculates the optimum stocking rate and optimum utilisation of all feed resources, ensuring that each system (with and without sowing cereals) being compared is evaluated with maximum profitability.

For this analysis the inputs selected for AFO were those of a typical mixed farm in the great southern with an annual rainfall of 550-600mm. The farm is 2130ha with predominately sand gravel and sandy loam soils.

Full documentation on the model can be found here: https://australian-farm-optimising-model.readthedocs.io/en/latest/index.html

Representation of sowing cereals into pastures

Based off the information obtained from the statistical analysis in part A of the project sowing cereals into pasture increased early season FOO and reduced late season feed quality. Based on the statistical analysis the relationship between FOO/DMD and cereal seeding rate is:

$$FOO\ increase\ (\frac{kg}{ha}) = 4.6 * seed_{rate}$$

$$DMD\ reduction\ (\%) = -0.1 * seed_{rate}$$

For seeding rates between 20 – 60 kg/ha.

Additional factors captured in the modelling:

- Fertiliser application was included at 35kg/ha.
- Feed height was scaled up for bulked pastures to reflect the erect growth of cereals. The result of this change is increased feed availability to livestock.
- Seeding cost was calculated based on the area of bulked pasture. Seeding costs included: machinery running and maintenance, labour requirement, seed cost and fertiliser cost. On a typical sandy loam the total cost of bulking pasture was $40/ha.

Results and discussion

Analysis of seeding rate

Figure 1 shows that profit was maximised at the highest seeding rate used in the trial (60kg/ha). This returned a profit of $19 per sown hectare. It should be noted that extrapolating the results to a wider range of seeding rates is likely to be inaccurate because it is expected that the relationship will diminish.

Figure 1: Profit per sown hectare at three different seeding rates tested in the trial. Note: the results in this figure cannot be extrapolated.

Optimal management

This section outlines the management changes that are optimal to make to get the best return from sowing cereals into pastures. The results in this section reflect the optimal management at the most profitable seeding rate of 60 kg/ha.

The key livestock management changes that were optimal when sowing cereals into pastures were

(i) Increase stocking rate. Stocking rate increased by 9%.

(ii) Reduce supplementary feeding. Supplement fed reduced by 4%.

If livestock management does not change as a result of sowing cereals then the farmer will not receive any financial benefits. This is because increasing feed alone does not provide any income. The income comes primarily from running more sheep but also partly due to saved costs on supplementary feeding.

It was optimal to sow cereals into 30% of pasture. It was not optimal to sow cereals in to pastures on the poor soils because it incurs the same machinery cost but provides less benefits.

Component analysis

In this section the costs and benefits of each component related to sowing cereals into pasture is outlined.

Component analysis	
Seeding costs	-$17
Labour ($35/hr)	-$4
Fertiliser (35 kg/ha)	-$19
6% reduction in DMD August-November	-$8
70% Increase in early FOO	$67
Net	$19

Sensitivity analysis

There was large variation in the measured trial results of sowing cereals into pastures and not enough trial data to be highly confident in the resulting relationships. Thus, in this section a sensitivity analysis is provided looking at the result for different changes in FOO and DMD due to sowing cereals.

The results indicate that sowing cereals into pastures becomes profitable if early FOO increases by more than 30% compared to without sowing cereals. The resulting reduction in August to November feed quality has less impact on farm profit.

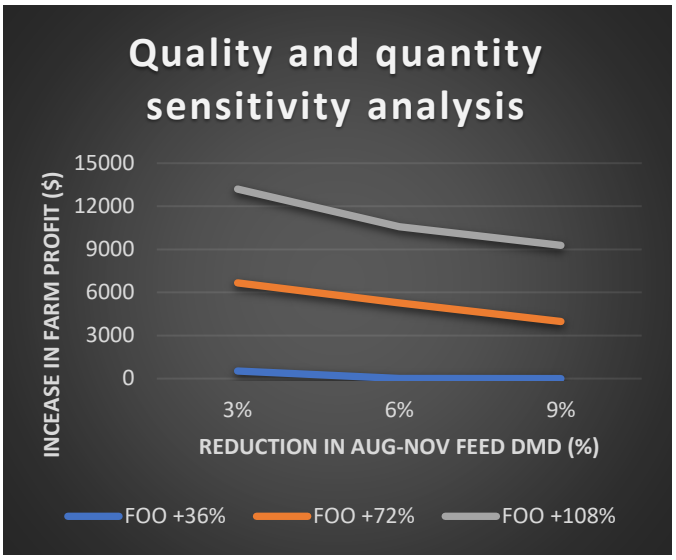

Figure 2: Change in whole farm profit at different levels of early growing season FOO and mid-late growing season DMD due to sowing cereals into pastures. Percentages are in comparison to pasture without cereals.

Conclusions

The analysis has shown, using data obtained from a producer demonstration trail, that sowing cereals into pastures can provide benefits of $19/sown ha. It was optimal to sow cereals into 30% of pastures and increase stocking rate by 9%.

Overall, the report provides some guidance into the potential benefits of sowing cereals into pastures and describes the management methods required to capitalise on the benefits. However, the data used in the analysis was variable without the desired number of replications. Thus, the results are not perfect. Further work could examine a larger range of seeding rates and include feed measurements that include the dry feed period. Furthermore, from an economical point of view it would be more beneficial to measure feed growth rate rather than FOO.

Caveats

Due to scope of this project not all the data required for an accurate analysis was collected. Thus, the resulting assumptions were made:

- Sowing cereals into pasture does not impact dry feed quality.
- The benefits of sowing cereals into pastures is reflected fully in increased early FOO.
- There is no representation of rotational effects of sowing cereals into pasture. It is possible that sowing cereals into pastures increases disease build up and/or nutrient depletion. Due to lack of data this was not represented.
- Modelling was done assuming an average weather year. This may not capture the additional benefits of sowing cereals into pastures in a late break season. This limitation could easily be overcome using the seasonality version of the AFO model however that was beyond the timeframe/budget of this analysis.
- The results from the trial indicated showed significant variability. The result provided are based on the best possible interpretation of the results however they may vary considerably for different circumstances. Further trials are required to validate these results.

Young, J., et al. (2011). "Whole-farm profit and the optimum maternal liveweight profile of Merino ewe flocks lambing in winter and spring are influenced by the effects of ewe nutrition on the progeny's survival and lifetime wool production." Animal Production Science **51**(9): 821-833.

Young, M., et al. (2020). "An economic analysis of sheep flock structures for mixed enterprise Australian farm businesses." Australian Journal of Agricultural and Resource Economics.