Pasture cropping may improve whole farm profitability in mixed farming systems in the Northern Agricultural Region

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Key messages

Pasture Cropping into perennial grass pastures can improve the medium term economics of mixed farming systems otherwise based on annual pastures in the Northern Agricultural Region (NAR). Benefits arise from higher livestock production and the additional value of the grain in the year of pasture cropping relative to livestock performance.

Location and soil type impact on the profitability of pasture cropping, with southern areas of the NAR typically more profitable due to less competition between crop and pasture. On poor soils, which cannot sustain continuous cropping lupins are more profitable than cereals.

The length of the pasture phase has a strong impact on the profitability of perennial pasture vs annual pasture systems, with a 3 year phase appearing to be the point at which perennials show significant benefits to the system.

Aims

The use of subtropical perennial grass pastures on marginal country has been shown to improve whole farm profitability in the Northern Agricultural Region (NAR) by as much as 20% in previous MIDAS modelling. Half of this benefit comes from a reduction in supplementary feeding costs, with the other half coming from the deferred grazing of annual winter pastures at the break of season (Finlayson et al, 2011). Pasture cropping refers to the oversowing of a winter grain crop into these summer active pastures.

The aim of this analysis was to look at the actual cost and benefits from a number of trials in the NAR, and determine how pasture cropping compares to traditional crop, pasture rotations.

Method

Location

This economic analysis is based on the 2012 and 2013 results from the Mingenew Irwin Group (MIG) Pasture Cropping trial on Midlands Road, in the Irwin Shire, using 1.5m replicated plots which looked at different production options for the poor grey sand soil type, which cannot support continuous cropping rotations.

Crop and pasture options

The options assessed were wheat, pasture cropped wheat, lupins, pasture cropped lupins, volunteer annual pasture and perennial grass pasture (cv. Gatton Panic). The panic grass was sown at 44cm row spacing in August 2011, with the first crop planted inter-row in May 2012. The assumptions for livestock production are described later in the paper.

Rainfall

Rainfall in 2012 was a decile 1 year, which means it was historically in the lowest 10% of years for annual rainfall. 2013 was a decile 4 year with a 6 week gap in rainfall over June and July.

Crop Management

All wheat, and pasture cropped wheat plots were given the same agronomic treatment in 2012 and 2013. While a number of different treatment options were assessed (including different seeding and nitrogen rates), this study only reports on treatments with the standard agronomic package (2012: 90kg K-Till Extra at seeding, combined with top ups of 35kg of NS51 in June and July, 1.5L SpraySeed pre seeding with another 1.5L at seeding combined with 1.5L Treflan, post seeding treatments of 1L Decision 0.5L DC Trate, two treatments of 0.8L Barracuda the second combined with 0.2L Lontrel.) (2013: 80kg K-Till Extra at seeding, 80kg NKS 32 and 50L Flexi-N in June and July respectively, 1.5L Roundup PowerMAX pre seeding, 1L SpraySeed and 1.5L Treflan at seeding and treatments of 0.5L Barracuda, and 0.67L Velocity with 1% Hasten post establishment). Similarly, all lupin and pasture cropped lupin plots were given the same fertiliser and chemical treatment in both years of the trial.

Results

In 2012, only the lupin treatments returned a positive gross margin, while all treatments were positive in 2013 (Table 1). There were significant yield penalties for wheat and lupins in both years when pasture cropped (Table 2), up to the equivalent of $330/ha in wheat in 2013 (assuming a farm-gate wheat price of $300/t).

Table 1 Pasture cropping trial gross margins for 2012 and 2013

Gross Margins – ($300/t farm gate Lupins/Wheat)	Wheat	Pasture Cropped Wheat	Lupins	Pasture Cropped Lupins	Annual Pasture	Perennial Pasture
2012 Gross Margin $/ha	-$11	-$145	$223	$70	$18.	$87
2013 Gross Margin $/ha	$533	$ 205	$432	$ 199	$47	$ 104

Table 2 Pasture Cropping Yield Penalties for 2012 and 2013

Pasture Cropping Yield Penalties	AVG 2012 Yield (kg/ha)	% of maximum yield (2012)	Avg 2013 Yield (kg/ha)	% of maximum yield (2013)
Standard Lupins	1471	100%	2351	100%
Pasture Cropped Lupins	1043	71%	1720	73%
Standard Wheat	1114	100%	3203	100%
Pasture Cropped Wheat	662	59%	2103	66%

Typically we would expect the yield penalty to decrease as rainfall increases, however the 6 week dry spell between the 31st May and the 10th July 2013 resulted in the season's rainfall declining from decile 7 to decile 1, before late rains brought it back up to decile 4. The damage that this period had on yields may have been exacerbated in pasture cropped treatments, increasing the penalty that we would typically expect to occur in a decile 4 rainfall year.

Given the more consistent performance of lupins, lower yield penalties and local knowledge indicating lupins are better complemented to a pasture cropping system it was decided to focus analysis on rotations based around lupin and volunteer pasture, to compare to a perennial pasture and a pasture cropping system.

Assumptions

One of the characteristics of the soil type where this pasture cropping trial is being undertaken is that water use efficiency improves as rainfall decreases and nutrient leaching becomes less of an issue. It has been assumed for the purpose of this analysis that the relationship is linear. Obviously this relationship can be changed depending on the nature of rainfall events across the season, with a few heavy falls likely to cause more leaching than a large number of lighter rain events.

The livestock component of this analysis was treated as a self replacing merino flock, with a base stocking rate of 3 DSE/ha for annual pasture. These stocking rates were adjusted based on the rainfall decile of the season and use of perennial pastures, however the impact of changes to the current price of meat and wool were not put through sensitivity analyses. Supplementary feed was a combination of lupins, oats and hay. Perennial pastures were assumed to reduce the amount of time stock needed to be supplementary fed by 30 days in the decile 1 conditions experienced, with this period of time decreasing as rainfall increased to a minimum of 14 days (decile 9).

This analysis also assumed that the perennials were already established, thus there was no establishment cost. This is seen as a fixed cost to be amortised over its beneficial life (much the same as claying/mouldboarding) and would not be included against a single year's crop gross margin.

Rotation Analysis

It appears that lupins are the most consistent crop choice on these poor grey sands, however given we know that the soil type cannot support continuous cropping, this is not a long term solution. In the analysis conducted on 2012 data, it appears that there is minimal difference between pasture cropping of perennial pasture or conventional crops compared to annual pasture over 3 years, however if the rotation goes to a 3rd year of pasture the pasture cropping system begins to pull ahead.

Table 3 Decile 1 (2012) Rotational gross margins – traditional cropping vs pasture cropping Gross Margin @ wheat price of $300/t

Rotation	Year 1	Year 2	Year 3	Year 4	Average 4yr Gross Margin $/ha/yr
L, A, A, A	$ 223	$18	$18	$18	$69
PL, P, P, P	$71	$87	$87	$87	$83
W, A, A	-$11	$18	$18	$18	$11
PW, P, P	-$145	$87	$87	$87	$29
P,P,P	$87	$87	$87	$87	$87
A,A,A	$18	$18	$18	$18	$18

Key: L = Lupins, A = Annual Pasture, P = Perennial Pasture, W = Wheat, PL = Pasture Cropped Lupins and PW = Pasture Cropped Wheat

The analysis based on the better season of 2013 indicates the traditional crop/annual pasture rotation is significantly ahead over 3 years, and even over 4 years calculations suggest a minor $5/ha/yr benefit to the traditional system. It is not until there are 4 years of pasture to 1 year crop in this rotation that perennials become the significantly better option. Only time will tell if this result was an outlier caused by events unique to the 2013 season, however local knowledge suggests that this result is not what we would expect in a decile 4 rainfall year, and was heavily influenced by the six week dry spell during the growing season.

Table 4 Decile 4 (2013) Rotational gross margins @ wheat price of $300/t – traditional cropping vs pasture cropping

Rotation	Year 1	Year 2	Year 3	Year 4	Average 3yr Gross Margin $/ha/yr
L, A, A	$ 432	$ 47	$ 47	$47	$143
PL, P, P	$244	$104	$104	$104	$139
W, A, A	$ 533	$ 47	$ 47	$47	$169
PW, P, P	$244	$104	$104	$104	$139
P,P,P	$ 104	$ 104	$ 104	$104	$104
A,A,A	$ 47	$ 47	$ 47	$47	$47

Key: L = Lupins, A = Annual Pasture, P = Perennial Pasture, W = Wheat, PL = Pasture Cropped Lupins and PW = Pasture Cropped Wheat

Conclusion

With over 7000 different possible combinations of seasonal conditions it is difficult to predict exactly how pasture cropping will fare in any particular for this reason analysis so far has assumed all years across the rotation are the same rainfall decile.

The results obtained in 2012 support the ability of pasture cropping into perennial pastures to improve whole farm profitability with 4 year rotations that include one year of pasture cropping out performing traditional crop, annual pasture rotations by around $60/ha, or $15/ha/yr. Despite the yield penalty observed in 2013 being over 1t/ha for wheat, and 0.6t/ha for lupins, the 4 year rotation analysis shows that there is minimal difference between the two systems.

It can be concluded that pasture cropping has the potential to improve the whole farm profitability, but will be strongly dependent on the length of the pasture phase in the rotation, and the yield penalty experienced during the crop phase. Current trial data suggests that rotations that include 3 years of perennial pasture appears to be the point at which pasture cropping systems begin to outperform traditional crop/ annual pasture rotations.

It has been estimated that around 15% of the cleared land in the Northern Agricultural Region is consistently unproductive for cropping purposes. If this is taken as an indication for the average farm, then the use of pasture cropping in a 4 year rotation could improve whole farm profitability by between $1 and $10.50/ha.

Key words

Pasture Cropping, Economics

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