Extended fallow and legume break crop – economic case study, Ingham region

Growers: Richard and Robert Gherardi

Richard and Robert Gherardi are growing soybeans in rotation with sugarcane on their 100 hectare farm near Ingham. They are investigating growing soybeans in both a six month and twelve month fallow rotation, with the twelve month fallow achieved by harvesting fourth ratoon cane in June.

Both the soybean rotation crop and the extended fallow are expected to result in better germination in plant cane, improved soil health leading to increased yields, and possibly allowing for a decrease in fertiliser application in the following plant cane. Offsetting these potential benefits are the costs of growing the legume crop, and a possible yield decrease in other blocks due to changes in harvest scheduling needed to achieve the extended fallow.

Key findings

- A yield increase of 3.7 tonnes per hectare in the following plant cane crop would be required to offset the cost of growing the legumes.
- Production results from the 2016 harvest will provide more indication of the effect of the extended fallow and legume crops, however there may be longer term soil health benefits that won't be captured by this trial.

Trial description

The four treatments being evaluated are presented in table 1. Each treatment was applied to 15 rows over an area of approximately 1.2 hectares. The trial is non-replicated.

Table 1: Trial treatments

No.	Description
T1	6 month bare fallow
T2	6 month soy fallow
T3	12 month bare fallow
T4	12 month soy fallow

Fourth ratoon cane was harvested in July 2014 (for the 12 month fallow) and November 2014 (for the 6 month fallow). In the soy fallow treatments Leichardt soybeans were planted in January 2015 and sprayed out in March 2015. In all treatments sugarcane was planted in May 2015 and will be harvested in 2016.

Methodology

The following economic analysis examines the impact of each treatment on the Gherardis' fourth ratoon, fallow and plant cane gross margins.[1] The Farm Economic Analysis Tool (FEAT) was used to model their typical ratoon growing expenses such as fertiliser application costs, pesticides and other machinery operations.

The impact of each fallow treatment on subsequent plant cane yield will not be known until the cane is harvested in 2016. As such, a break-even analysis was conducted to

[1] Gross margin equals revenue minus variable costs, which include chemical, fertiliser, machinery and harvesting costs.

determine the yield increase required to offset the cost of growing a soy fallow.

Other parameters used in the analysis include: a sugar price of $430 per tonne;[2] a labour price of $30 per hour; and a fuel price of $1 per litre (net of the diesel rebate and GST). Fertiliser and pesticide prices were sourced from local suppliers.

Results

Production results of the fourth ratoon harvest are shown in table 2. The cane harvested in June 2014 for the 12 month fallow had a higher yield and CCS than the cane harvested in November. Richard noted that the cane variety that was harvested in the 4th ratoon (KQ228) tends to deteriorate with a late harvest, which may have contributed to the difference in sugar yield. However, as the trial was not replicated, it is not clear whether the yield difference observed was due to the difference in harvest time, or was caused by other factors.

Table 2: 4th ratoon production results

Time of harvest	Yield (t/ha)	CCS
Nov 2014 (6 month fallow)	82.7	11.7
June 2014 (12 month fallow)	92.1	13.2

Table 3 shows the fourth ratoon revenue, variable costs and gross margin. The greater yield and CCS in the July-harvested cane led to higher gross margins of $750 per hectare for the 12 month fallow treatments. The higher yield also resulted in a small increase in harvesting costs in the 12 month fallow treatments, however growing costs were the same for all treatments.

Table 3: 4th ratoon gross margin

Treatment	Revenue ($/ha)	Variable costs ($/ha)	Gross margin ($/ha
6 month bare	$2,429	$1,157	$1,272
6 month soy	$2,429	$1,157	$1,272
12 month bare	$3,258	$1,235	$2,023
12 month soy	$3,258	$1,235	$2,023

As the Gherardis harvested fourth ratoon cane in June to achieve the 12 month fallow, this meant that another crop stage needed to take its place in the November round. It is possible that the yield gain resulting from the earlier harvest of fourth ratoon cane was offset by an equivalent reduction of yield in the cane that was pushed into the November harvest round.

The soy fallow treatments had higher costs compared to the bare fallow treatments, due to the cost of planting, an additional weed control spray and a desiccation spray to spray out the legumes (see table 4).

Table 4: Fallow costs

Treatment	Cost per hectare
T1 (6 month bare)	$299
T2 (6 month soy)	$504
T3 (12 month bare)	$299
T4 (12 month soy)	$504

In order for the legume crop to be worthwhile economically, the Gherardis would need to offset the growing costs with an increase in yield and/or a reduction in other costs. Yield benefits can occur as the legume crop increases the amount of organic matter in the soil and acts as a disease break. Cost savings can be realised by reducing the amount of fertiliser applied to plant cane to compensate for the nitrogen supplied by the legumes. In addition, fallow spray costs can potentially be

[2] $430 per tonne is the 5 year average (2010-14) of QSL's seasonal and harvest pools.

reduced, as the legumes provide ground cover to suppress weeds.

A break-even analysis was conducted to determine the plant cane yield required for the legume treatments to have the same profitability as the bare fallow treatments (assuming the legume costs are to be offset solely by an increase in yield). The analysis indicates that the legume fallow would need to result in a yield increase of 7.6 tonnes per hectare to offset the additional $205 per hectare associated with growing the soy crop[3].

In this trial, the Gherardis did not adjust their fertiliser rates on the legume fallow treatments as the soy crop failed. However if they had achieved a soy crop of 2 tonnes per hectare and reduced their nitrogen by 90 kilograms per hectare (based on the Six Easy Steps recommendations), they would have saved $115 per hectare[4]. This would have partially offset the additional $205 per hectare associated with growing the soy crop, and reduced the break-even plant cane yield increase to 3.7 tonnes per hectare.

Conclusion

This study examined the economic impact of an extended fallow and legume break crops on a cane farm in the Herbert.

Results indicate that a yield increase of 3.7 tonnes per hectare would be required to offset the cost of growing a legume crop. Harvesting fourth ratoon cane early to achieve the extended fallow resulted in higher yield and CCS, however as the trial was not replicated, it is not clear whether the yield difference observed was due to the different harvest time, or was caused by other factors.

Production results from the 2016 harvest will provide more indication of the effect of the extended fallow and legume crops, however there may be longer term soil health benefits that won't be captured by this trial.

Impact of the cane harvest schedule

The timing of the cane harvest schedule may have some important implications for this trial. If the extended fallow means that some ratooning cane is pushed into the final harvest round, then the ratooning cane could be subject to a drop in yield in the following season. Di Bella et. al. (2008)[5] conducted trials to measure this effect in the Herbert. They recorded an average decrease of 28.4 tonnes per hectare in the following year in late harvest crops compared to early harvest crops, which was partially offset by an increase in CCS of 2.4. The yield loss was attributed to a lack of time to accumulate biomass before the onset of the wet season, resulting in increased risk due to waterlogging and lower solar radiation.

Using the results from the DiBella study, a modelling exercise was completed as part of this case study to examine the potential economic impacts that this effect would have on a representative farm in the Herbert.[6] The model assumes: the 12 month fallow is adopted farm-wide, with third ratoon cane replacing fourth ratoon in the later harvest rounds; and a harvest schedule of 6 rounds with 10% of cane harvested in the final round, which would be subject to the 28.4 tonnes

[3] The analysis assumes a constant CCS in plant cane, based on the Gherardis' previous harvest results. In addition, yield and CCS for the previous 4th ratoon crop are held constant for all treatments.

[4] Based on a urea price of $586/t excl. GST

[5] Di Bella LP, Stringer J, Wood AW, Royle A and Holzberger G. (2008). What impact does time of harvest have on sugarcane crops in the Herbert River district. *Proceedings of the Australian Society of Sugar Cane Technologists*. 30, 337-348.

[6] Farm with plant, 4 ratoons and fallow; yield and CCS based on the ten year average for the Herbert region; sugar price of $430/t

hectare yield loss (and CCS increase) in the following year.

The model showed that the extended fallow resulted in an average drop in 4th ratoon yield the following year of 15.4 tonnes per hectare, decreasing net revenue by $159 per hectare. To offset this loss, the extended fallow would need to lead to an increase in plant cane yield of 5.2 tonnes per hectare.

These results are indicative only and would be influenced by a range of variables, including cane varieties and seasonal factors. Further research would be needed to investigate this effect under trial conditions.

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