Reduced N and mill mud in late ratoons – economic case study, Tully region

Grower: Sam Di Mauro

Sam Di Mauro farms 475 hectares of cane land in the Tully Region. He typically applies mill mud in his fallow period and is interested in finding out whether he can apply the mud in his final ratoon crop as a replacement for his normal synthetic fertiliser application. To test the idea, Sam established a trial comparing a standard rate of liquid fertiliser, a reduced rate of liquid fertiliser and a mill mud treatment with no synthetic fertiliser. The following year Sam trialled three different rates of liquid fertiliser on a late ratoon block to examine whether he can reduce his fertiliser rate without affecting yield and profitability.

Key findings

- The low fertiliser rate treatments had higher average gross margins than the conventional fertiliser rates in both trials.
- The mill mud treatment had the lowest average gross margin in the 2015 trial.
- Statistical analysis showed that the increase in gross margins for the low fertiliser treatments was significant at the five percent level, however the mill mud treatment gross margin was not significantly lower than the standard fertiliser rate.

Trial description

The trials were established on two separate blocks in El Arish, the first harvested in 2015 and the second in 2016. The 2015 trial was on a nine hectare final ratoon block (Image 1), and consisted of four replicates of three nutrient treatments. Treatment 1 is his conventional practice of applying liquid fertiliser at a rate of 1100 L/ha, Treatment 2 is the same fertiliser product at a reduced rate of 600 L/ha, and Treatment 3 is a banded application of mill mud of 100 t/ha (Table 1).

Image 1: 2015 trial site

Table 1: Trial products, application rates and product costs – 2015 trial

	Product	Application rate	Product cost ($/ha)
T1	NKS HiK	1100 L/ha	$473
T2	NKS HiK	600 L/ha	$258
T3	Mill mud	100 wet t/ha	$364

The 2016 trial was on a six hectare final ratoon block consisting of three treatments and three replicates. Treatments consisted of a standard rate of 1000L/ha, a reduced rate of 800 L/ha, and a low rate of 600 L/ha (Table 2).

Table 2: Trial products, application rates and product costs – 2016 trial

	Product	Application rate	Product cost ($/ha)
T1	Liquaforce (custom blend)	1000 L/ha	$440
T2	Liquaforce (custom blend)	800 L/ha	$352
T3	Liquaforce (custom blend)	600 L/ha	$264

Table 3 and Table 4 show the amount of nitrogen, phosphorus, potassium and sulphur applied in the two trials.

Table 3: Treatment nutrition analysis (kg/ha) – 2015 trial

Treatment	N	P	K	S
T1	148.5	9.9	22.0	9.9
T2	81.0	5.4	12.0	5.4
T3	Mill mud		100 t/ha	

Table 4: Treatment nutrition analysis (kg/ha) – 2016 trial

Treatment	N	P	K	S
T1	145.0	10.0	90.0	0.0
T2	116.0	8.0	72.0	0.0
T3	87.0	6.0	54.0	0.0

Methodology

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

The analysis assumes a sugar price of $430 per tonne[2]; a labour rate 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

Table 5 shows the production results from the 2015 trial block. The reduced fertiliser rate (Treatment 2) had a lower average yield in tonnes of cane but slightly higher CCS than the standard rate, while the mill mud treatment saw a decrease in both tonnes of cane and CCS. A statistical analysis of cane yield did not reveal a significant treatment effect, however the mill mud treatment produced significantly lower tonnes of sugar per hectare than both of the other treatments.

Table 5: Yield and CCS results – 2015 trial

	Treatment	TCH	CCS	TSH
T1	NKS HiK (standard)	105.5	10.0 *ab*	10.5 *b*
T2	NKS HiK (reduced)	100.1	10.3 *b*	10.3 *b*
T3	Mill mud	95.5	9.7 *a*	9.3 *a*
P-value		*0.12*	*0.02*	*0.03*

TCH: tonnes of cane per hectare; CCS: commercial cane sugar; TSH: tonnes of sugar per hectare. Values followed by a different letter are statistically different at the 5% level. P-values less than 0.05 indicate a statistical difference between two or more treatments.

The economic results of the 2015 trial are shown in Table 6. The standard and reduced rates of fertiliser both produced similar revenue, while the mill mud treatment resulted in a reduction in revenue of $345 per hectare.

Due their lower fertilising costs, the reduced fertiliser and mill mud treatments had lower variable costs than the standard fertiliser rate (by $256 and $185 per hectare respectively).

Table 6: 2015 economic results

	Standard rate ($/ha)	Reduced rate (diff. to T1, $/ha)	Mill mud (diff. to T1, $/ha)
Gross revenue	$2,472	$4	-$345
Variable costs	$1,405	-$256	-$185
Gross margin	$1,068	$260	-$160

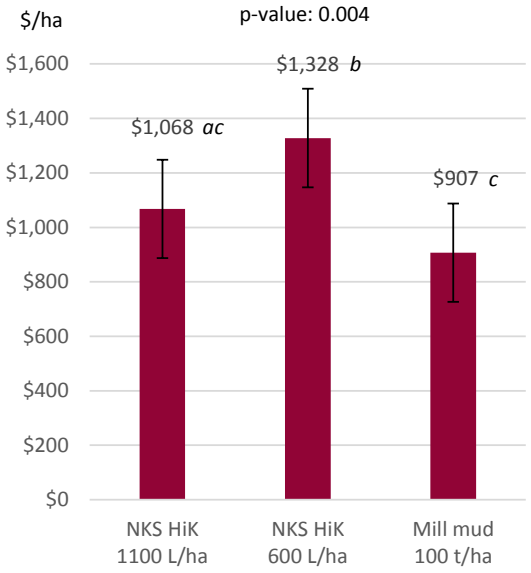
Figure 1 presents the average gross margins for each treatment, along with error bars showing the 95% confidence interval. Lower costs led to the reduced fertiliser treatment

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

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

having the highest average gross margin ($1328 per hectare) compared to the standard fertiliser rate ($1068 per hectare). The lower cost of the mill mud treatment was not enough to offset the reduction in revenue, resulting in an average gross margin of $907. Statistical analysis revealed that the reduced fertiliser treatment's gross margin was significantly greater than the gross margins of both the standard fertiliser rate and mill mud treatments. The mill mud gross margin was not significantly different to the standard rate treatment, however it was significantly lower than the reduced rate treatment.

Figure 1: Average gross margin – 2015 trial



Values followed by a different letter are statistically different at the 5% level.

Results from the 2016 trial site are shown in Table 7. CCS and tonnes of sugar were similar for all three treatments, however the medium rate of fertiliser produced significantly lower tonnes of cane per hectare than the standard rate. While the low fertiliser treatment produced fewer tonnes of cane than the standard rate on average, the difference was not statistically significant.

Table 7: Yield and CCS results – 2016 trial

	Treatment	TCH	CCS	TSH
T1	Liquaforce (standard)	67.3 *b*	11.2	7.5
T2	Liquaforce (medium)	62.8 *a*	11.6	7.3
T3	Liquaforce (low)	65.8 *ab*	11.6	7.7
P-value		*0.05*	*0.22*	*0.25*

TCH: tonnes of cane per hectare; CCS: commercial cane sugar; TSH: tonnes of sugar per hectare. Values followed by a different letter are statistically different at the 5% level. P-values less than 0.05 indicate a statistical difference between two or more treatments.

The economic results from the 2016 trial are shown in Table 8. The standard and medium rate of fertiliser treatments produced almost identical revenues ($1880 and $1871 per hectare respectively), while the low rate resulted in a higher revenue of $1963 per hectare.

Reflecting the lower fertilising costs, the medium and low rate treatments had lower variable costs ($959 per hectare and $894 per hectare respectively) compared to the standard rate ($1081 per hectare) (Figure 5).

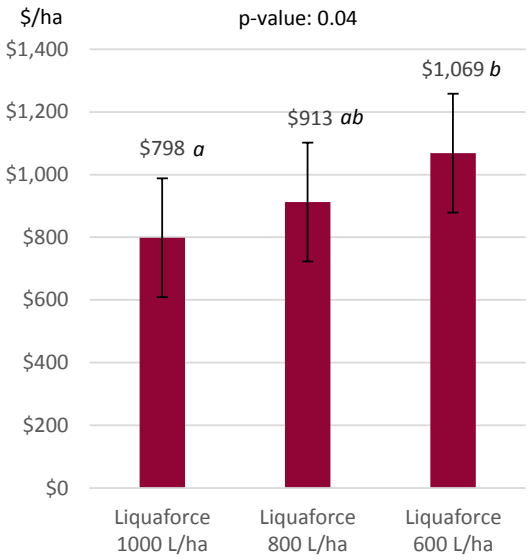
Table 8: 2016 economic results

	Standard rate – T1 ($/ha)	Medium rate (diff. to T1, $/ha)	Low rate (diff. to T1, $/ha)
Gross revenue	$1,880	-$8	$84
Variable costs	$1,081	-$122	-$187
Gross margin	$798	$114	$271

Similarly, lower fertilising costs drove the differences in gross margins, with the medium and low rate treatments recording higher average gross margins ($913 per hectare and $1069 per hectare respectively) compared to the standard rate ($798 per hectare) (Figure ***2***). Statistical analysis showed that the gross margin of the medium rate treatment was not

statistically different to the standard rate, however the low rate treatment was.

Figure 2: Average gross margin – 2016 trial



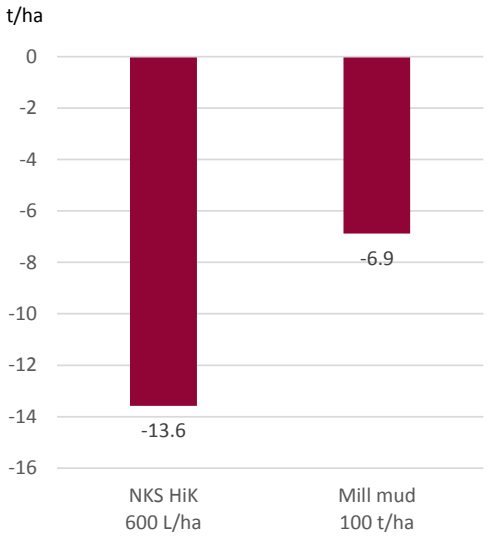
Values followed by a different letter are statistically different at the 5% level.

Break-even analysis

Due to their lower cost, treatments 2 and 3 in both trials could sustain decreases in yield before becoming less profitable than the standard fertiliser rate treatment. The following break-even analysis shows how much cane yield would need to decrease in these treatments to result in the same gross margin as the standard fertiliser rate. The break-even analysis assumes a constant CCS.

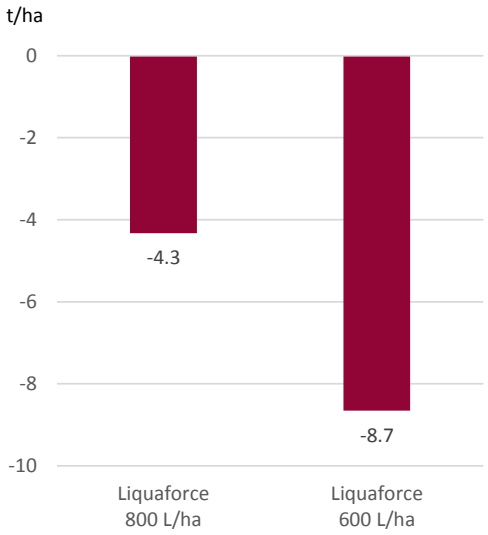
In the 2015 trial, the low fertiliser rate treatment could afford a yield decrease of 13.6 t/ha before it became less profitable than the standard rate treatment, while the mill mud treatment could sustain a yield decrease of 6.9 t/ha (Figure 3).

Figure 3: Break-even analysis – 2015 trial



In the 2016 trial, the medium and low fertiliser rate treatments could see decreases of 4.3 tonnes per hectare and 8.7 tonnes per hectare respectively before they became less profitable than the standard rate treatment (Figure 4).

Figure 4: Break-even analysis – 2016 trial



Sensitivity analysis

As the price of sugar is highly variable, an analysis of the sensitivity of the results to changes in the price of sugar is useful.

Figure 5 and Figure 6 build on the previous analysis, showing the break-even yields for treatments 2 and 3 (in both trials) at different

sugar prices. The graphs show that at lower sugar prices, the reduced fertiliser treatments could afford greater decreases in yield before becoming less profitable than the standard fertiliser rate treatments.

Figure 5: Sensitivity of break-even yields to sugar price – 2015 trial

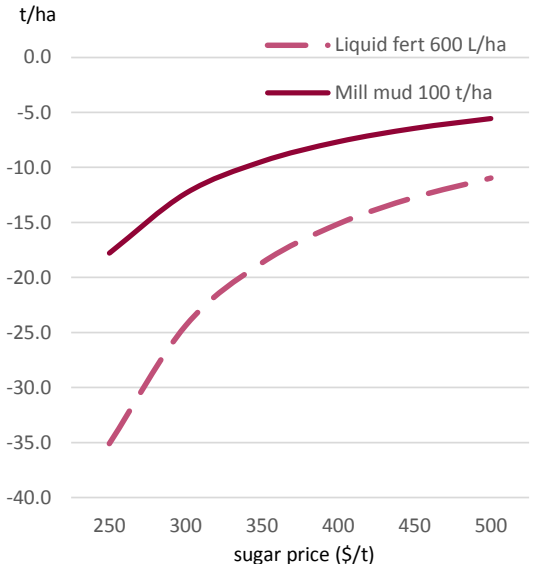
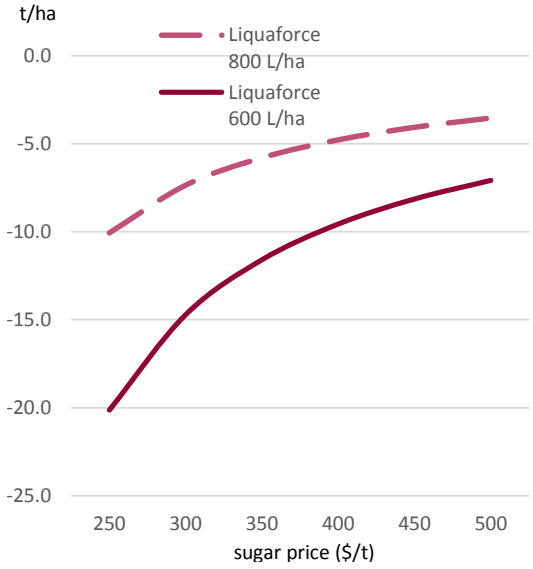


Figure 6: Sensitivity of break-even yields to sugar price – 2016 trial



Conclusion

This study examined the economic impact of applying lower rates of fertiliser in final ratoon blocks, as well as comparing the profitability of applying mill mud in place of synthetic fertilisers.

The 2015 trial did not produce evidence that reducing fertiliser rates would negatively affect production; however, the mill mud treatment did see a significant drop in tonnes of sugar. Due to fertiliser savings, the reduced rate treatment had a significantly higher gross margin than the standard rate treatment. The mill mud treatment had the lowest average gross margin in the 2015 trial, however it was not significantly lower than the standard rate.

In the 2016 trial, while tonnes of cane was statistically lower for the medium rate, overall tonnes of sugar per hectare was not statistically different between the three treatments. Fertiliser savings resulted in the low rate treatment having a significantly higher gross margin compared to the standard rate treatment.

Acknowledgments

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