Enhanced efficiency fertiliser trials – economic case study, Mossman region

Grower: Glen Fasano

Glen Fasano is trialling various enhanced efficiency fertilisers on his 400 hectare farm near Mossman. Enhanced efficiency fertilisers have the potential to reduce the amount of nitrogen lost to the environment, which could improve water quality leaving farms and reduce fertilising costs. Two types of enhanced efficiency fertilisers are tested in this trial: controlled release fertilisers and fertilisers with additives that inhibit nitrification. The controlled release product is a polymer coated fertiliser blend designed to slow the release of nutrients, making them available for uptake by the crop over a longer period, while reducing the probability of losing nutrients through denitrification, surface runoff or deep drainage. The other two products trialled, ENTEC and eNtrench, are nitrification inhibitors that can be added to granular fertiliser. Nitrification inhibitors slow the rate of nitrification (the conversion of ammonium nitrogen to the highly mobile nitrate form) and reduce the risk of losses from nitrous oxide emissions and leaching caused by significant rain events following fertilising.

Key findings

- The enhanced efficiency fertilisers would need to generate a yield increase between 1 and 5 tonnes per hectare to break even with the standard fertiliser blend applied at the same rate.
- The standard fertiliser product applied at a reduced rate (20 kg of nitrogen per hectare lower) could result in a yield decrease of up to 4 tonnes per hectare before it was less profitable than the standard fertiliser at the higher rate.
- eNtrench at the lower rate (20 kg of nitrogen per hectare lower) could see a yield decrease of almost 2 tonnes per hectare before becoming less profitable than the standard fertiliser at the higher rate.

Trial description

The trials have been conducted in 2014-15 and 2015-16 on two different first ratoon blocks. The 2014-15 trial was established on a 5.6 hectare block in Mowbray, and compared three products: a standard fertiliser blend (CK140S), a controlled release (CR) product, and an ENTEC treated blend. All three products had the same NPKS ratios, and were applied at rates of 150 kilograms and 130 kilograms of nitrogen per hectare, making a total of six treatments. Each treatment was replicated three times.

The Mowbray trial was harvested in late July and early August 2015. While yield results were obtained for each replicate, incomplete CCS data was collected, which means the impact of the trial treatments on revenue and gross margin[1] could not be calculated.

A second trial was established in 2015 on a 6.6 hectare block in Newell Beach. The treatments were the same as the Mowbray trial, however a fourth product was added: the

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

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same fertiliser blend treated with eNtrench, a nitrification inhibitor similar to ENTEC. Fertiliser was applied in October 2015, and yield results will not be available until after the 2016 harvest.

Table 1 summarises the treatment products, rates and costs for both trials.

Table 1: Treatment products, rates and costs

Product	Rate (kg N/ha)	Cost ($/ha)
Standard	150	$510
ENTEC	150	$583
CR	150	$607
eNtrench*	150	$542
Standard	130	$442
ENTEC	130	$506
CR	130	$526
eNtrench*	130	$474

*Newell Beach only

Methodology

A statistical analysis was conducted on the Mowbray trial yield results to determine whether the observed differences were statistically significant.

As the Newell Beach trial is still underway (and therefore harvest results are not yet available) and due to the incomplete CSS results from Mowbray, the following economic analysis focusses on determining the yield response that would be required for each treatment to result in the same gross margin as the standard fertiliser blend at 150 kg/N/ha.

The analysis incorporates Glen's typical growing expenses, such as fertiliser application costs, pesticides and other machinery operations. These were modelled using the Farm Economic Analysis Tool (FEAT). For the purpose of the analysis, CCS is held constant, and was set at the average of the available trial results for Mowbray, and set at Glen's typical first ratoon CCS for the Newell Beach analysis.

Other parameters 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

Table 2 presents the yield results (tonnes of cane per hectare) from the Mowbray trial. A statistical analysis conducted on the yield results showed that the standard blend at 150 kg/N/ha resulted in a significantly higher yield than the standard blend at 130 kg/N/ha, ENTEC at 130 kg/N/ha and CR at 150 kg/N/ha. The yield result from the CR at 130 kg/N/ha treatment was also found to be significantly higher than ENTEC at 130 kg/N/ha. There was no significant difference between any of the other treatments.

Table 2: Mowbray yield results

Treatment	Yield (tch*)	Significance**
Standard 150	104.1	a
CR 130	102.9	ab
ENTEC 150	97.9	abc
Standard 130	97.3	bc
CR 150	96.9	bc
ENTEC 130	94.9	c

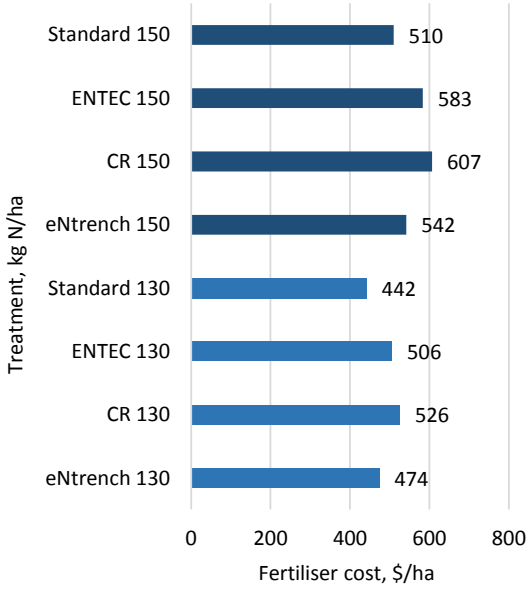
*Tonnes of cane per hectare
**Treatments that share the same letter are not statistically different.

Figure 1 compares the fertiliser costs of each treatment. The controlled release product had

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

the highest cost, followed by ENTEC, eNtrench and the standard fertiliser blend. In each case, reducing the rate from 150 kg/N/ha to 130 kg/N/ha reduced the fertiliser cost by 13%, generating cost savings from $68 per hectare for the standard blend and eNtrench, to $81 per hectare for ENTEC.

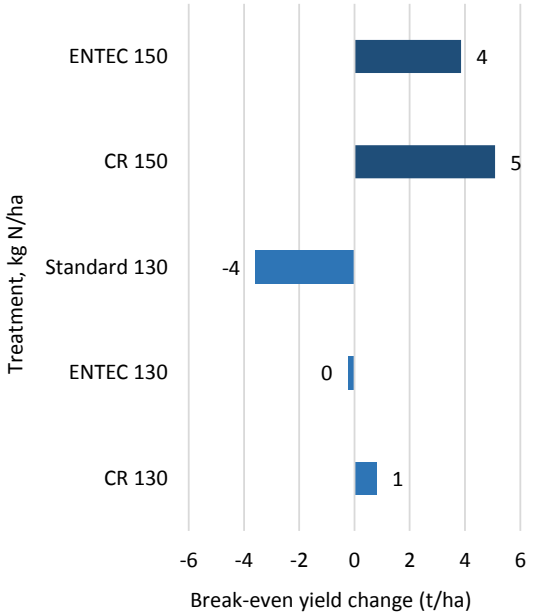
Figure 1: Fertiliser costs, $/ha



The following break-even analysis was conducted to determine the yield response required for each treatment to result in the same gross margin as the standard fertiliser blend at 150 kg/N/ha (figures 2 and 3).

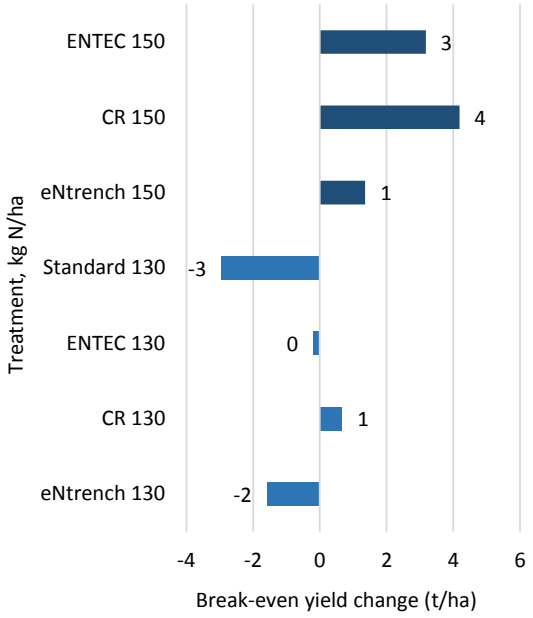
The graph for Mowbray (figure 2) shows that ENTEC and CR at 150 kg/N/ha would both need to result in a yield increase of 4 and 5 t/ha respectively in order to be worthwhile. The lower rate of the standard blend could result in a yield decrease of 4 t/ha before it became less profitable than the higher rate, while the lower rate of CR would need to result in a slight yield increase.

Figure 2: Break-even yield analysis, Mowbray



The Newell Beach graph (figure 3) shows a similar pattern, with the addition of eNtrench, which would need to result in a yield increase of just over 1 t/ha at the higher rate, and could afford to result in a yield decrease of almost 2 t/ha at the lower rate, to break even with the standard blend at 150 kg/N/ha.

Figure 3: Break-even yield analysis, Newell Beach



Sensitivity analysis

The preceding break-even analysis assumed a sugar price of $430 per tonne. The following graphs (figures 4 and 5) examine the sensitivity of the break-even yields to changes in the price of sugar. The graphs show that at lower sugar prices the relatively expensive treatments (particularly the higher rates of CR and ENTEC) require a larger yield increase to break even, while the treatments that result in cost savings (the lower rates of standard fertiliser and eNtrench) can result in a larger yield decrease before becoming less profitable.

The converging of the lines at higher sugar prices means that fewer tonnes per hectare of cane are required to offset the cost differences between treatments.

Figure 4: Sensitivity of break-even yields to sugar price, Mowbray

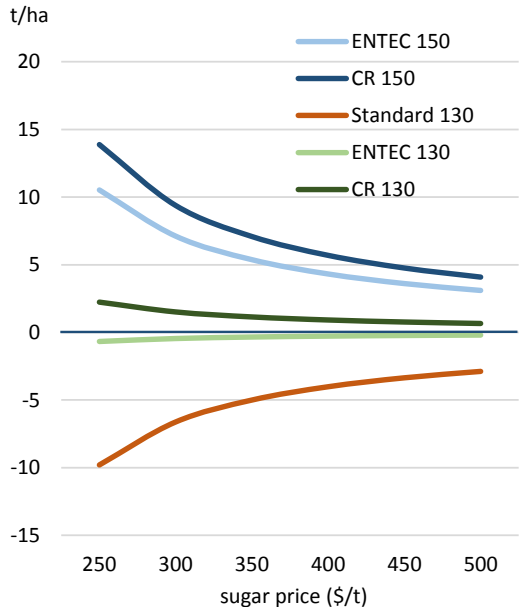
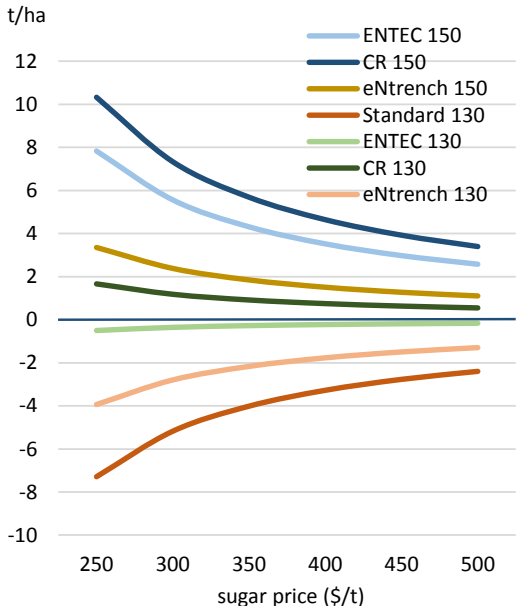


Figure 5: Sensitivity of break-even yields to sugar price, Newell Beach



Conclusion

This study examined the economic viability of using a range of enhanced efficiency fertilisers on a sugarcane farm near Mossman.

Results indicate that, at a sugar price of $430 per tonne, the controlled release product and the products treated with ENTEC and eNtrench would need to generate a yield increase between 1 and 5 tonnes per hectare to break even with the standard fertiliser blend applied at the same rate. Applying the standard fertiliser product at a reduced rate would provide a yield buffer of up to 4 tonnes per hectare compared to the standard fertiliser at the higher rate, while eNtrench at the lower rate could see a yield decrease of almost 2 tonnes per hectare before becoming less profitable than the standard fertiliser at the higher rate.

Additional production results from the 2016 harvest will provide a clearer indication of the efficacy and cost effectiveness of the products trialled.

Acknowledgments

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