Case Study 2

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Australian Government

Reef Catchments Action On The Ground Carbon Farming Trial

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Assessment of banded surface applied mill mud as a component of a seasonal nutrient program in sugarcane.

Site Location: Eton
Coordinates: Latitude -21.21733 Longitude 148.95261 (WGS 84)
Soil profile class: Marian
Aus Soil Classification: Brown Chromosol
Variety: KQ228
Crop Class: 1st ratoon

Trial objectives

- Assess the potential of mill mud banded at relatively low application rates as a total seasonal nutrient program in ratoon sugarcane
- Assess the potential of incorporating banded mill mud applications at low rates as part of seasonal nutrient program for sugarcane
- Compare sugarcane yields from mill mud based seasonal nutrient programs with standard industry endorsed '6 Easy Steps' nutrient programs

Introduction

Mill mud is a by-product of the sugar milling process and traditionally applied at rates in excess of 150 wet tons / ha. To address water quality issues in the Central cane growing region mill mud is now banded at 50 tons/ha with modified truck applicators. The Deguara family have developed a 3 row, tractor drawn mill mud applicator which is capable applying mill mud at an application rate of 50 ton/ha. With a GPS equipped tractor, mill mud can be accurately applied between dual row sugarcane (50cm apart) in a 2m row configuration. The Deguara family have adopted controlled traffic farming with all machinery set at 2m wheel centres. Tillage operations have been reduced where possible to conserve organic carbon and improve soil health.

Incorporating mill mud into a seasonal nutrition program is seen as a means to potentially reduce granular urea inputs and optimise nutrient cycling through enhanced soil health. Gerry traditionally applies a liquid Dunder blend (potassium source) fortified with urea to provide the crops nitrogen requirements.

Methods

Deep EC mapping patterns derived from a Veris 3100 soil survey and satellite yield ratio mapping were utilised to assess paddock variability and select the most appropriate bed to establish the trial (Figure 1).Four years of satellite yield estimation data was transformed into the yield ratio mapping surface using Mapinfo® software. Yield estimation point data for the block was converted into a yield estimate ratio by dividing the actual value for each point by the site average of yield data for those years where the cane class matched Plant, 1st or 2nd ratoons.

The trial design incorporates 4 nutrient treatment programs with 3 replications per treatment). Randomised replicate plots are block length (370m) and 6 metres wide (3 x 2m row spacing).
The trial paddock has had a history of mill mud applications generally applied during the fallow phase of crop cycles. Soil analysis validated high phosphorus levels and indicated potassium requirements of 85 kg/ha, sulphur levels were moderate with applications requirements of 10 kg/ha. The four nutrient treatments in the trial are designed to assess the potential of mill mud applied at low rates to mineralize sufficient nitrogen to achieve comparable yields to a standard '6 Easy Steps' nutrient program (Table 1).

Table 1: Detail of nutrient treatments and nutrients applied on a per hectare basis

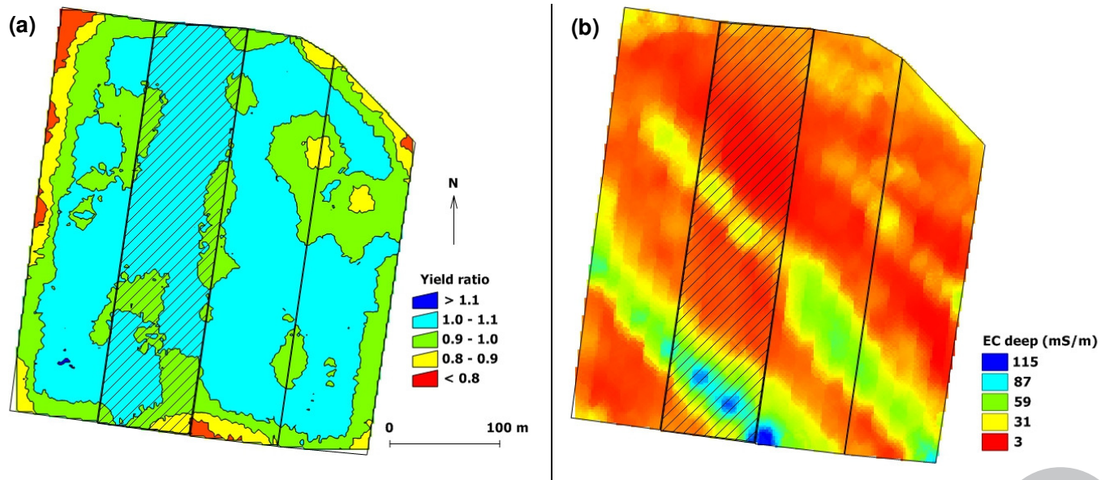
Treatments	Rate	Total nutrients applied (kg/ha)			
		N	P	K	S
1: Mill mud	50 tons/ha Mud	**25**	**25**	**15**	**10**
2: Mill mud plus Dunder based 'Liquid one shot' (LOS)	50 tons/ha Mud	25	25	15	10
	2.9 m³ LOS	138		78	12
	Total T2	**163**	**25**	**93**	**22**
3: Mill mud +Urea	50 ton/ha Mud	25	25	15	10
	293 kg/ha Urea	135			
	Total T3	**160**	**25**	**15**	**10**
4: 'Six Easy Steps'- 'Liquid one shot'	3.4 m³ LOS	**161**		**92**	**14**

The mill mud treatments were applied on the 13 November 2012 with the balance of the nutrients applied on the 1 December 2012. The trial paddock was irrigated on 3 occasions between the 19

November and 18 January 2013 with an average application of 30mm/per irrigation delivered via a centre pivot.

Leaf sampling regimes from all plot replicates were conducted on the 12 February 2013 and re- sampled on the 4 April. BSES leaf sampling protocols were followed with 30 leaves collected from 30m of row for each replicate along the southern headland of the trial. Leaf samples were refrigerated on site at 6° C and oven dried at 60° C for 24 hours prior to dispatch to BSES laboratories. On the 4 April soil biology samples were extracted from two of the '6 Easy Steps' replicate strips (rows 8 and 32) and two of the Mill mud plus LOS replicate strips (rows 11 and 29). Samples were refrigerated on site and forwarded to T. Pattison (Senior Nematologist, DAFF, South Johnston Research Centre) for soil health analysis.

Figure 1. (a) Satellite yield ratio mapping layer showing selected location of trial (hatched area) (b)Deep EC surface layer



Results and discussion

Cane on this site was harvested on October 11 2013.

Discussion Points

- As expected, due to insufficient Nitrogen needed to maintain satisfactory plant growth, the cane and sugar yield for treatment T1 (mud only) is significantly lower than other treatments on this site. However it is worth noting that T1 cane and sugar yields are similar to the regional average.
- Continuation of the mud only application (T1) will determine what (if any) impact on yield from the availability of residual Nitrogen from the previous mud application.
- Cane and sugar yields for treatments T2, T3 and T4 are significantly higher than the region average.
- Results to date indicate reducing nitrogen applications in association with alternative nutrient sources (T3 and T4) has no impact on cane and sugar yields when compared to the industry standard application (T2).
- Leaf N% results across all treatments in April were marginally below the accepted industry threshold.
- Treatment T4 provides a marginally higher return to the grower than other treatments.
- Soil organic carbon levels at the site will continue to be monitored to identify trends.
- Failure to reduce Nitrogen application when used in conjunction with alternative nutrient sources has the potential to reduce water quality, increase Nitrous Oxide emissions and enhance the vigour of weeds.

Mill mud spreader.

Results

Soil and Leaf analysis

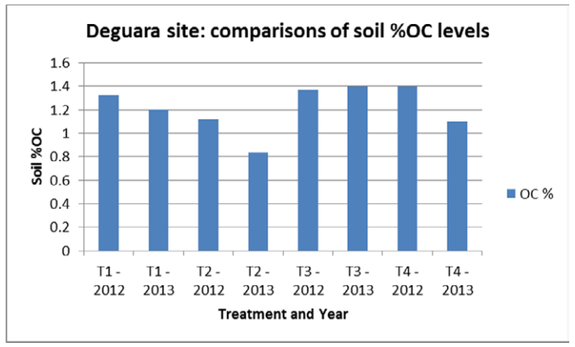


Figure 2 - Deguara site Average %OC (2012 and 2013)

Project Catalyst farm visit to David Cox's farm in Ayr.

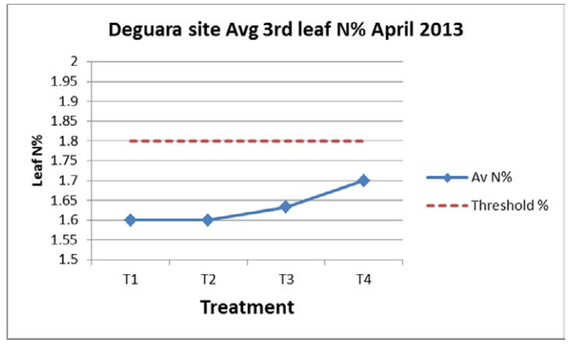


Figure 3 -Deguara site 3rd leaf N% analysis.

Harvest Results – October 11 2013

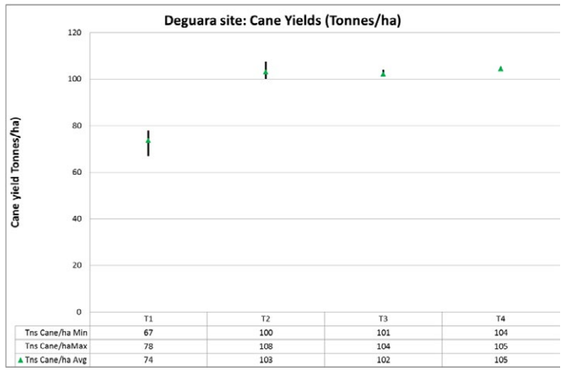


Figure 4 - Deguara site Cane yields (tonnes/ha) showing the average achieved per treatment and the spread between replicates (min to max).

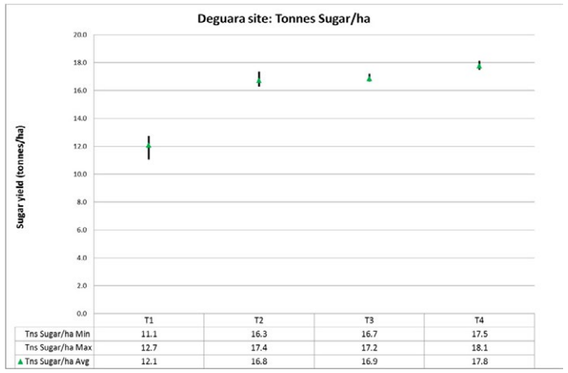


Figure 5 - Deguara site Sugar yield (t/ha) – showing the average achieved per treatment and the spread between replicates (min to max)

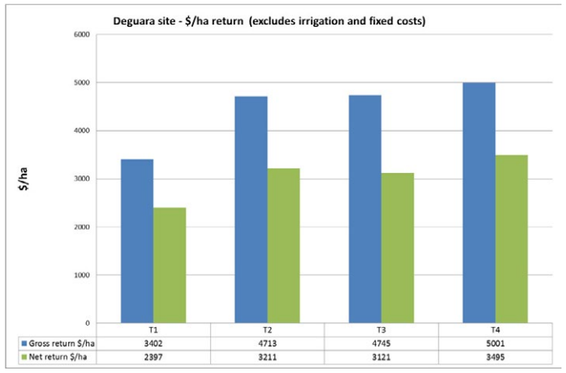


Figure 6 - Deguara site $/ha return (excluding irrigation and other fixed costs

Banded Mill mud.