Project Catalyst Final Report

Groundwater Nitrate Monitoring and Reduced N rate Trial

Grower Information	
Grower Name:	Sam Marano
Entity Name:	
Trial Farm No/Name:	BKN-01687A
Mill Area:	Inkerman
Total Farm Area ha:	
No. Years Farming:	
Trial Subdistrict:	
Area under Cane ha:	

Trial Status

- Completed

Background Information

Aim: To develop a site-specific nitrogen reduction rate that the grower can implement on their blocks that are irrigated with underground water high in nitrates.

Background: (Rationale for why this might work)

There are a number of growers in the Burdekin that are irrigating their sugarcane with water that is high in nitrates. This nitrogen is plant available and can be used as part of the farm's fertiliser program. There a number of issues with reducing fertiliser rates according to the amount applied via irrigation water. Firstly, the level of nitrates may vary throughout the season so there is no set amount of nitrogen that is applied to paddock per irrigation. Secondly, the number of irrigation events may be increased or decreased, depending on the annual rainfall volume and pattern. Due to this variability, developing an area wide "nitrogen-reduction-rate" for farms in areas with ground water nitrates is a difficult and inexact process. To compensate for this, monitoring the level of nitrates in irrigation water on a specific block will be conducted for 6-12 months. This data will be used to calculate the total amount of nitrogen applied to the paddock through irrigation over a season. After this, a "safe" reduction rate (or rates) will be developed and implemented in a trial, comparing it to the recommended 6 Easy Steps rate of fertiliser. There will also be a 20m strip of "Zero-N" where no fertiliser will be applied. This will be used to assess how available the irrigation-nitrates are to the crop. The trial will be reimplemented and harvested for a second year.

Potential Water Quality Benefit:

Reducing nitrogen fertiliser rates to compensate for nitrogen applied with the irrigation water, could see (in high nitrate areas) large reductions of fertiliser applied. With less fertiliser applied, there is less risk of the applied nitrogen being lost to run off/deep drainage.

Expected Outcome of Trial:

That a "safe" nitrogen deduction value will be produced for the grower, that he will be able to implement on his farm, without risks to water quality and his productivity.

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Where did this idea come from: There have been a number of ground water nitrate projects conducted in the Burdekin, though the focus has been placed on an area-wide solution. This idea was developed to provide a number of growers will safe nitrogen reduction values that are specific to their farms.

Plan - Project Activities	Date : (mth/year to be undertaken)	Activities :(breakdown of each activity for each stage)
Stage 1	**September 2016-August 2017**	- A specific block has been selected for monitoring - Regular monitoring of irrigation water samples for nitrates - The grower is keeping a record of irrigation timings and lengths in this period, for that block - A bucket a stopwatch assessment will be conducted to assess flow rate - This data will be used to assess the total amount of nitrogen being applied to the crop over the season - This data will be then used to develop a “safe nitrogen reduction”
Stage 2	**August 2017-October 2018**	- A trial will be implemented on the monitored block - This trial will compare the 6 Easy Steps rate to the reduced rate of fertiliser. There will also be a zero N treatment. - Biomass samples will be taken to assess nitrogen uptake - This trial will be harvested and the data will be analysed for differences in yield between the treatments
Stage 3	**October 2018-October 2019**	- A trial will be re-implemented on the monitored block - This trial will compare the 6 Easy Steps rate to the reduced rate of fertiliser. There will also be a zero N treatment. - Biomass samples will be taken to assess nitrogen uptake - This trial will be harvested and the data will be analysed for differences in yield between the treatments
Stage 4		
Stage 5		
Stage 6		

Project Trial site details

Trial Crop:	Sugarcane
Variety: **Rat/Plt:**	3R Q208
Trial Block No/Name:	BKN-1687A 04-01
Trial Block Size Ha:	
Trial Block Position (GPS):	
Soil Type:	

Block History, Trial Design:

The bores at this farm have been tested for nitrates and the levels have been found to be between 8-12mgNO3-N/L.

A trial was implemented on a 3R Q208 crop (2 treatments, 4 replications, 30m Zero N section).

The grower's current N rate is T1 (170N) and the reduced rate is T2 (100N).

Sam Marano
Groundwater Nitrates

Farm	BKN-01687A
Block	1-4
Variety	Q208
Ratoon	3R

	Guard	T1	T2	T2	T1	T2	T1	T1	T2	GUARD 30m 0N	Guard
		R1		R2		R3		R4			
No. Rows	6	9	9	9	9	9	9	9	9	3	3
Area	0.3474	0.5212	0.5212	0.5212	0.5212	0.5212	0.5212	0.5212	0.5212	0.3474	

Treatment	N rate (kgN/ha)	Product	Rate (kg/ha)	Reps	Total Area (ha)	Product Required (kg)
1	171	Urea SS	480	4	2.7796	1334.208
2	100	Urea SS	280	4	2.0848	583.744
3	0	None	0	1 (30m)		

Treatments:

T1 – Urea SS @ 480kg/ha (170N)
T2 - Urea SS @ 480kg/ha (100N)
T3 – 30m Zero N

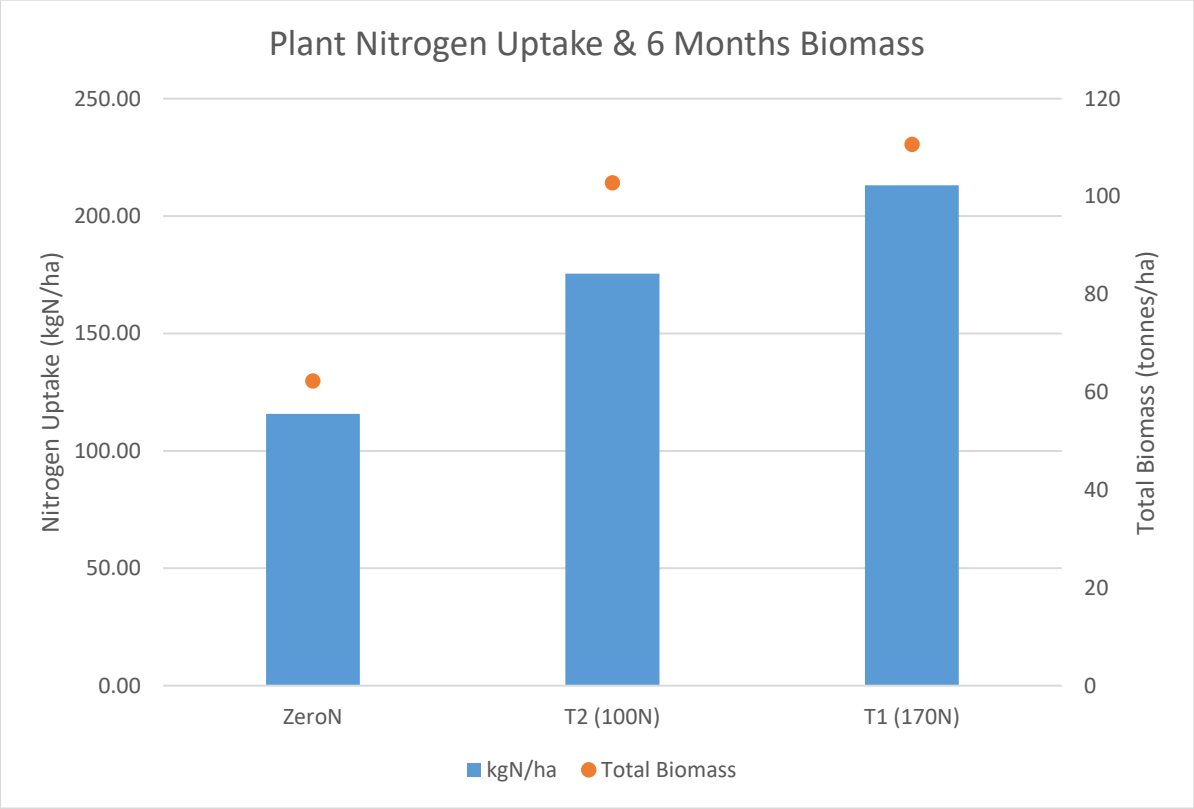
Results:

2017-2018 Results

Monitoring Data:

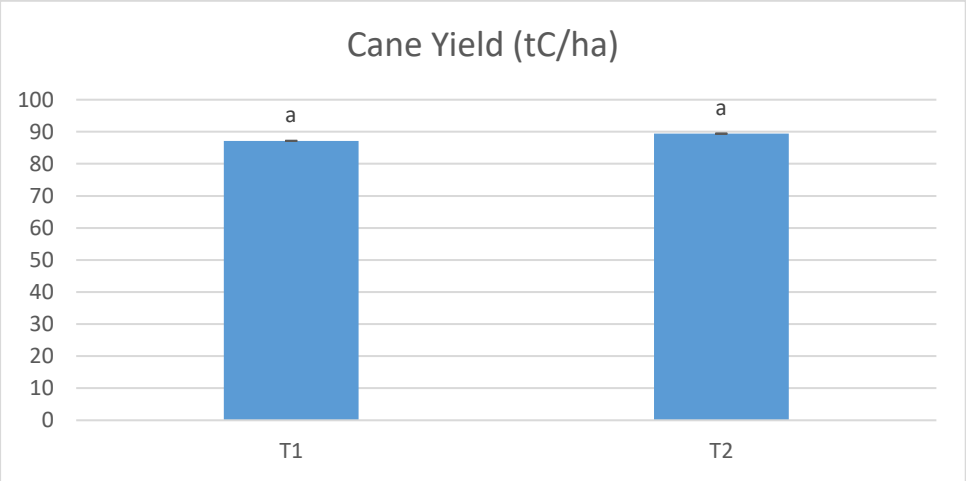
Date	Nitrate-N in water (mg/kg) Combined Pumps	Nitrate-N in water (mg/kg) Submersible	Nitrate-N in water (mg/kg) Well
31/08/2017	8.1	-	-
18/12/2017	11.5	-	-
31/2/2018	9	-	-
12/04/2018	19	-	-
1/06/2018	12	-	-
21/06/2018	-	4.2	14
22/06/2018	-	3.1	14
2/07/2018	-	14	14

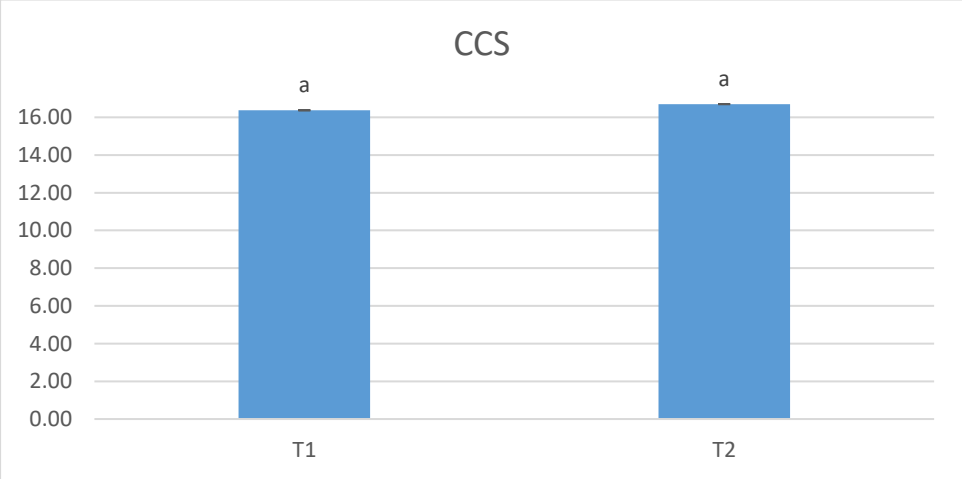
Plant Uptake Data:

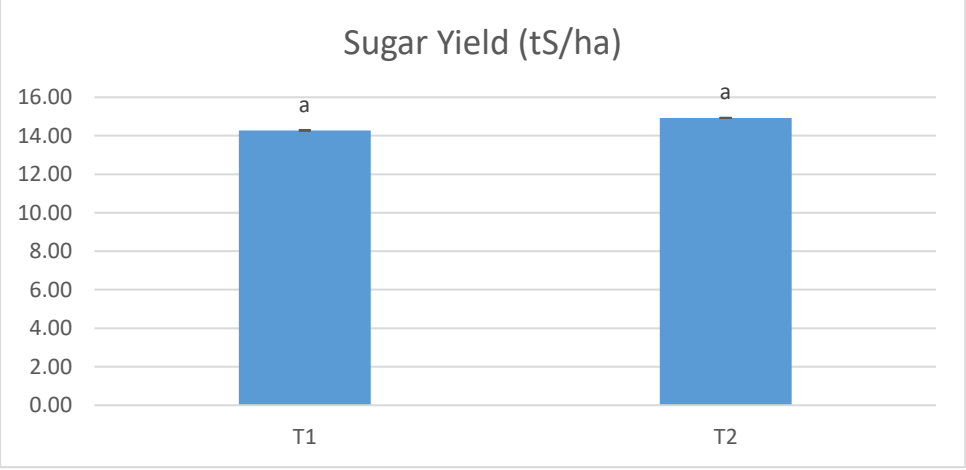


Average	Nitrogen Uptake (kgN/ha)	Total Biomass (t/ha)
ZeroN	115.69	62.34
T2 (100N)	175.53	102.78
T1 (170N)	213.16	110.69

Harvest Results:







Treatment Averages	Cane Yield (tC/ha)	CCS	Sugar Yield (tS/ha)
T1	87.16699	16.38	14.28
T2	89.39791	16.70	14.93

This trial has been completed and the block has been ploughed out.

Conclusions and comments

Regarding the nitrate levels in the underground:

- The nitrate levels remain fairly stready throughout the year; however, they do spike following significant rainfall events (>80mm) that occur during fertilising periods (planting/ratooning). If large rainfall events occur when fertiliser is not being applied, the nitrate levels tend to remain steady.
- Multiple samples should be taken over the year (minimum, 1 during the "wet season/slack," before and after a large rainfall event, during a significant dry period) to assess the acutal nitrate level in the underground stream that the grower is accessing as a one off sample is not enough data to assess the nitrate level accurately.

Regarding using Ground Water Nitrates as part of a fertiliser budget:

- From the first harvest of the trial, it appears **that ground water nitrates can be used as part of a fertiliser budget.** There was no significant difference between the treatment yields (tC/ha, CCS & tS/ha) at 95% confidence. This **suggests that a significant amount of the nitrate applied through the irrigation water is avaliable to the plant.**
- The **amount the nitrate rates can be reduced is still unknown** (plant uptake still needs to be more thoroughly investigated.
- **The amount of nitrogen that rates can be reduced needs to take climatic conditions into consideration**. The amount of nitrate applied through irrigation water will vary significantly depending on rainfall – if there is a large amount of rain, the grower does not need to irrigate; therefore, the nitrate will not be applied in large amounts.
- It is essential to calculate the annual volume of water being applied in order to more accurately assess the amount of nitrogen being applied through irrigation.

Advantages of this Practice Change:

- Reduced amount of synthetic nitrogen fertiliser being applied.
- Economic savings can be made when using irrigation nitrates (applying less synthetic fertiliser = spending less money)

Disadvantages of this Practice Change:

- Reducing nitrogen rates to account for nitrate in the irrigation water can be risky depending on rainfall. If the grower reduces his nitrogen rates significantly, then rain falls over a long period of time and as a result the grower does not irrigate, he may suffer significant productivity losses due to not applying enough fertiliser in the first place.
- Calculating the amount of nitrogen to reduce fertiliser rates by is difficult at this stage. Not enough research has been conducted into plant uptake of irrigation nitrates to make a "safe" recommendation. Additionally, many Burdekin growers do not know their annual water use (ML/ha/year). This is another important element in calculating nitrogen rate reductions.

Will you be using this practice in the future:

The grower already reduces his nitrogen rates to account for irrigation nitrates (from 210N to 180N). He is open to further reducing his nitrogen rates; however, more trials need to be conducted before he has confidence in the practice.

% of farm you would be confident to use this practice :

The grower reduces his N rate on 100% of the farm; however, he would need more evidence to reduce the rate further.