Project Catalyst Trial Report

Investigating the Effect of Various Nitrogen Rates Following a Harvested Legume Crop

Grower Information	
Grower Name:	Andrew Cross
Entity Name:	MHPF Burdekin Farms
Trial Farm No/Name:	Haughton- 0089A
Mill Area:	Invicta
Total Farm Area ha:	385
No. Years Farming: (Grower Experience)	>10
Trial Subdistrict:	Haughton
Area under Cane ha:	291

Trial Status

Completed

The soybean crop was growing rigorously until a combination of Stem Fly and Target Spot attacked the crop a few weeks before harvest. When the crop was harvested only 1.5T/ha was obtained which is drastically less than the projected yield. Even though this occurred, the crop was still biomass sampled to calculate the amount of nitrogen to be deducted for the following sugarcane crop.

The block was planted in March 2020 and marked out with three replicates of the three treatments. The three treatments were N110kg/ha, N140kg/ha, N170kg/ha. Fertiliser was applied over three split applications, one at planting containing nitrogen, phosphorus, potassium and sulphur. Another which consisted of potassium and sulphur and one remaining variable nitrogen rate across the treatments.

Cane was biomass sampled at 8 months in November to analyse levels of nitrogen uptake between the treatments and to assess any increased/ decreased growth. Cane was harvested in June 2021 to analyse the difference between TCH, CCS, and TSH. Cane was fertilised at the same rate across the block shortly after and is now currently growing as 1st ratoon. The plots will be harvested again in July/August 2022 to see if there is a residual effect of N reductions after soybeans.

SRA conducted water sampling on the block to assess N runoff through the Cane 2 Creek project, however this data has not been made available to myself yet.

Background Information

Aim: To determine the most cost-effective method of improving water quality and crop NUE through optimising nitrogen rate following a harvested legume crop.

Background: (Rationale for why this might work)
Randomised, replicated paddock strip trial, soil sampling, legume and cane biomass sampling and sugarcane yield and CCS analysis.

While the grower understands there is a water quality and profitability result in reducing nitrogen application after a harvested legume crop, the amount of this reduction is largely unknown in the region.

Potential Water Quality Benefit:
Improved NUE in treatments where N rate is optimised, along with an improvement in soil health in relation to the legume rotation. Both of these factors combined will have a direct water quality impact.

Expected Outcome of Trial:
The grower sees obvious productivity and soil health benefits from a legume rotation; however, it is expected that the outcome of the trial will result in allowing the grower to better understand the optimum nitrogen rate following a harvested legume crop.

Service provider contact: Burdekin Productivity Services - 47831101

Where did this idea come from: The grower has been considering the optimum rate of N following a harvested legume crop for a number of years, however the idea of conducting a trial to discover the optimum rate came from interactions with BPS staff and progressing through Smartcane BMP.

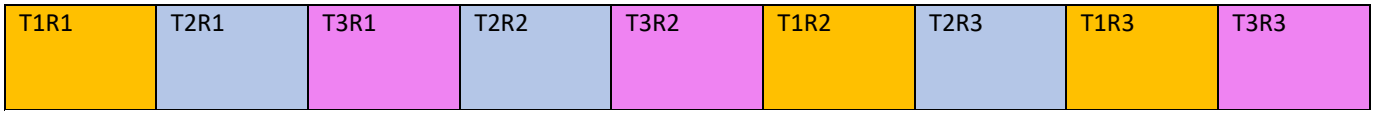
Plan - Project Activities	Date : (mth/year to be undertaken)	Activities :(breakdown of each activity for each stage)
Stage 1	Dec 2019	Soil sample and plant legumes
Stage 2	Feb 2020	Biomass sample legumes
Stage 3	Mar 2020	Plant cane and apply 3 nitrogen treatments
Stage 4	Nov 2020	Biomass sample cane to determine N uptake
Stage 5	Jun 2021	Harvest trial to determine yield, CCS and profitability and optimum N rate
Stage 6	July 2021	Reimplement trial to grow for another season
Stage 7	July/August 2022	Harvest 1st ratoon

Project Trial site details	
Trial Crop:	Sugarcane and soybeans
Variety: **Rat/Plt:**	Soybean: A6785 Cane: KQ228 PL 2021 & 1st RT 2022
Trial Block No/Name:	2-1
Trial Block Size Ha:	Total block size= 22.23ha
Trial Block Position (GPS):	19°36'00.4''S 147°06'06.9''E
Soil Type:	Sand to clay loam over light to medium clay.

Block History, Trial Design:

Block history:
Q240 harvested as 3rd ratoon and ploughed out in October/November 2019. Soil test taken and Soybean crop planted in December 2019. No mill by products have been applied recently.

Cane:
Sugarcane was planted in March 2020, variety KQ228. Moddus was applied at 800ml/ha.
9 rows/treatment replicated 3 times randomly across the block.



Treatments:
Three rates varying 30kg/ha difference in nitrogen. The control rate is 170kg/ha of nitrogen as determined from the soil test results in combination with the Six Easy Steps Guidelines for soybean reduction of N.
The three rates are:
Treatment 1: 110kg/ha N
Treatment 2:140kg/ha N
Treatment 3:170kg/ha N

Results:

Currently:

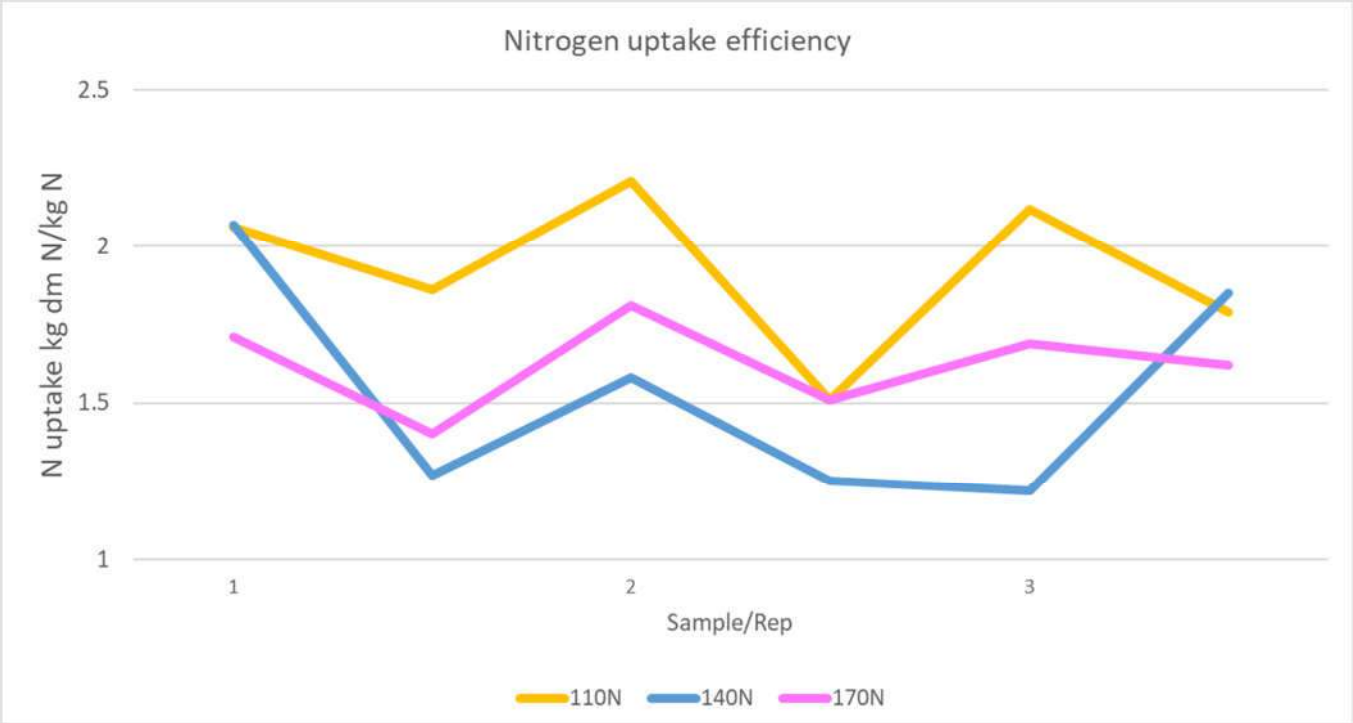
- The soybeans were biomass sampled even though they were affected by pests and disease, this will have affected the data but we decided to continue with the trial. The soybeans were weighed, dried and sent away for nitrogen analysis; the results gave us the amount of nitrogen that was supplied by the legumes to the cane crop that was to follow. This justified our expected cane nitrogen rates of 110, 140 and 170kg/ha.

Soybean biomass data

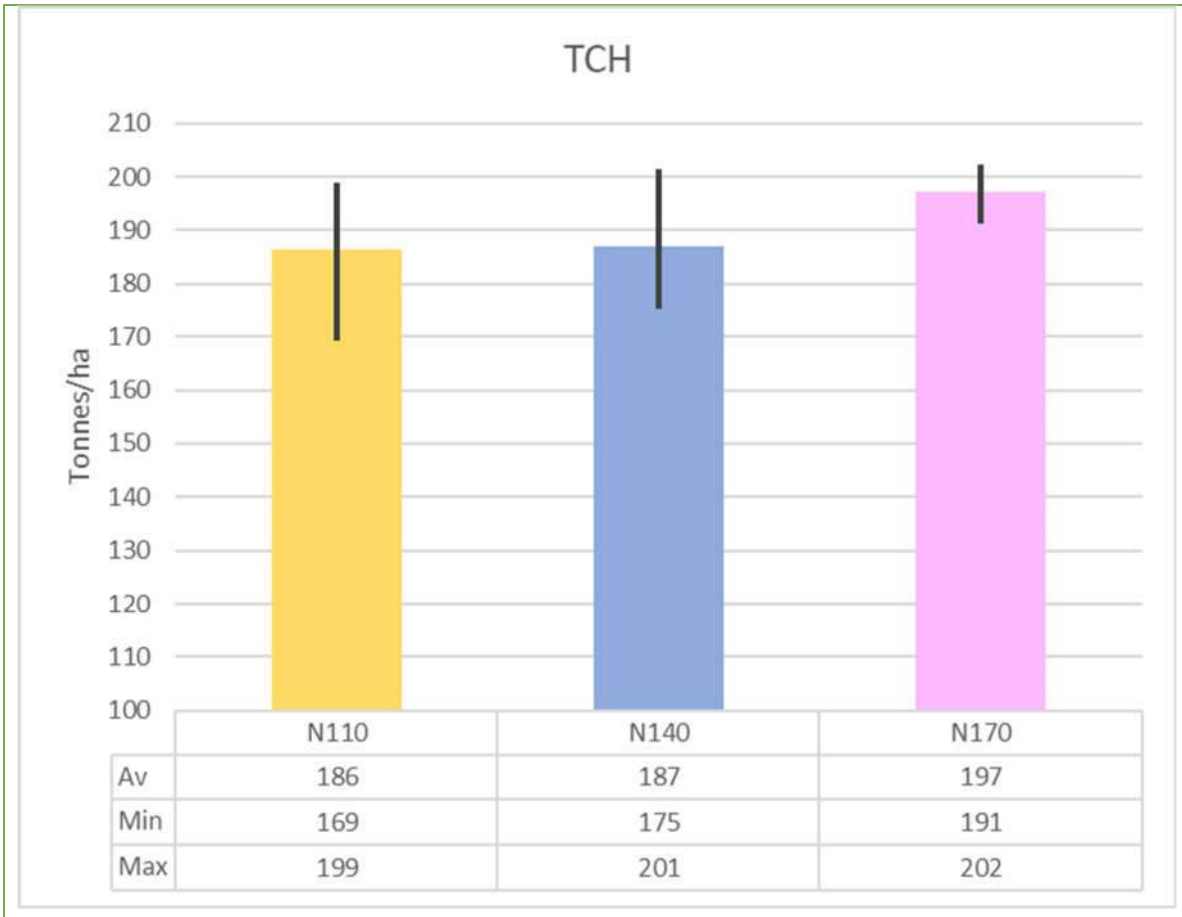
T/ha dry biomass	3.08
N conc	0.036
N kg/ha above	112.0
N kg/ha below	33.6
Total N content	145.6
kg N/ha	48.0

- The cane was biomass sampled at 8 months old twice within each rep. The cabbage and stalk were separated and mulched and the results were analysed to see how much nitrogen was taken up in each treatment. There was slight variation within treatments, however it appears that there the lower N

treatment was just as, if not more efficient at up taking nitrogen, which indicates that the cane is using the N that is available. This is still being verified in more detail.

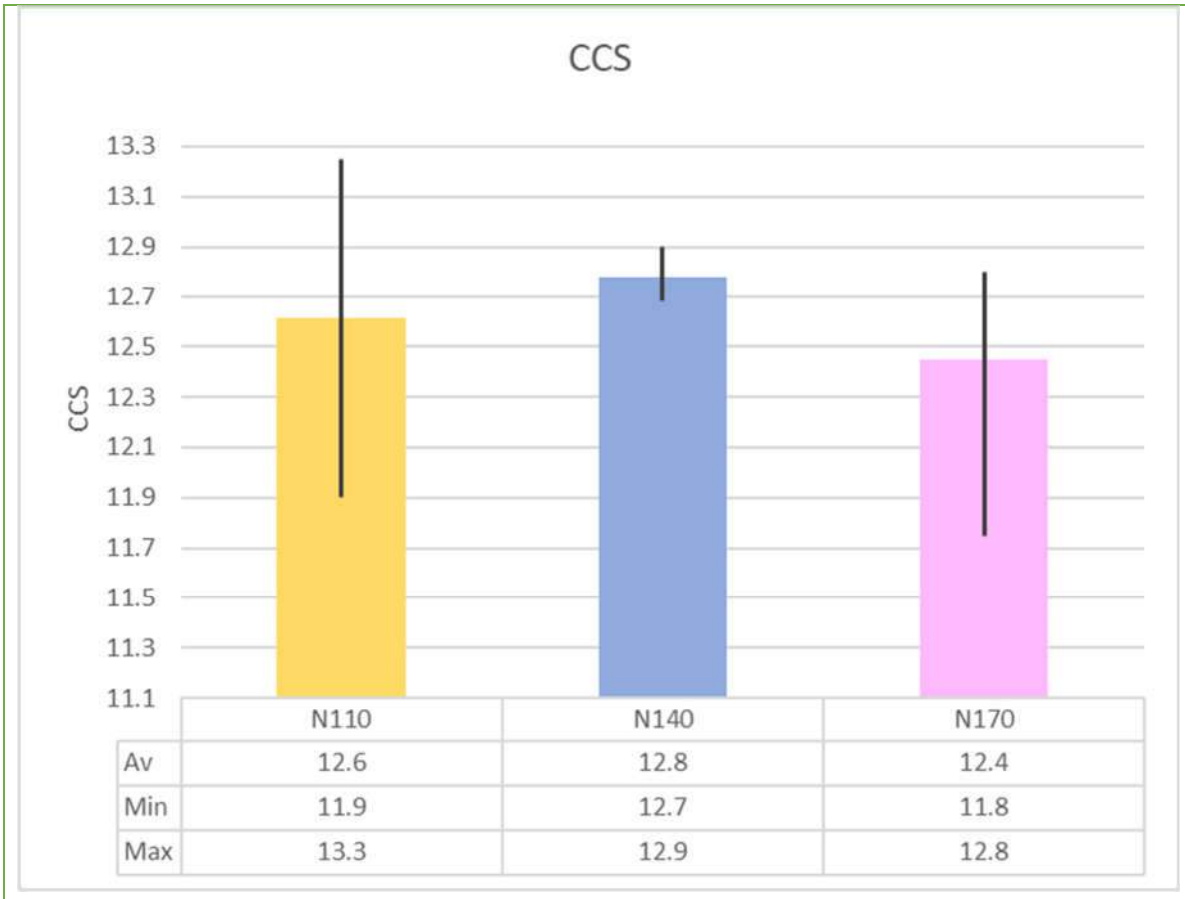


The cane was harvested in June 2021 and the results are displayed below:



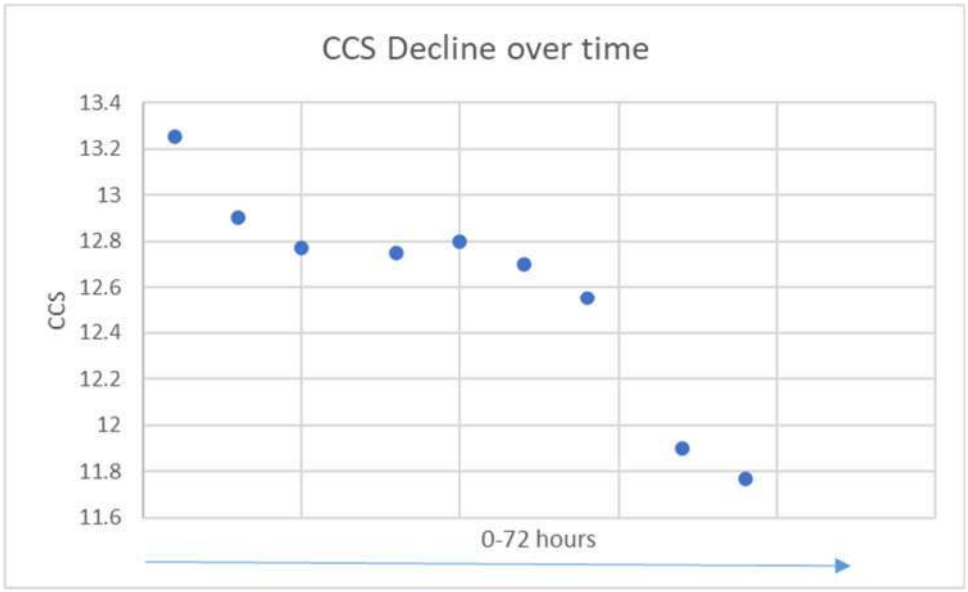
	N110	N140	N170
Av	186	187	197
Min	169	175	191
Max	199	201	202

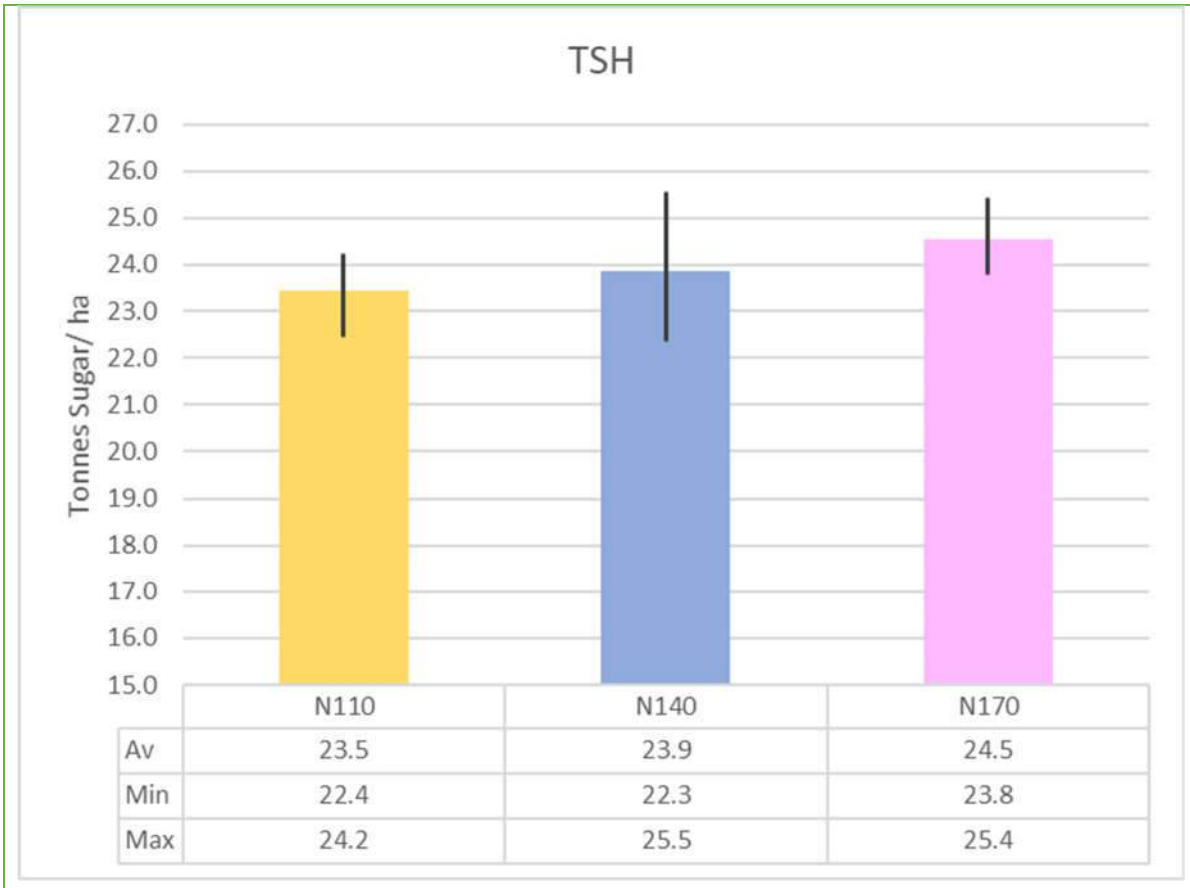
Overall, the tonnes of cane/ha were not significantly different across treatments, however the range of min and max shortened in the higher N rate treatment.



	N110	N140	N170
Av	12.6	12.8	12.4
Min	11.9	12.7	11.8
Max	13.3	12.9	12.8

The CCS varied across treatments. I have noticed a trend in decreased CCS in relation to time from burn to cut, as some treatments were harvested 3 days after burning, which you can see in the table below:





	N110	N140	N170
Av	23.5	23.9	24.5
Min	22.4	22.3	23.8
Max	24.2	25.5	25.4

Overall, the tonnes of sugar/ha had marginal differences between treatments, with only 1 TSH difference on average.

These results demonstrate that there has been little difference in yield between varied N treatments in plant cane.

More analysis is being conducted on the results to find any discrepancies.

Conclusions and comments

It appears that there is greater efficiency in N uptake in the lower N treatments and that the crop is more efficient at using what is available, rather than the higher N treatments that have exorbitant amounts of N. The overall tonnes of cane have some variability between high and low N treatments, however this is not significant. The CCS varied slightly, however the whole block was burnt together and then cane was harvested over a 3 day period, this has the potential to induce CCS losses.
Tonnes of sugar were fairly similar across treatments with minimal variation.
The reduction in nitrogen did not drastically affect the cane's performance. The 1st ratoon harvest data will be show if there are residual effects of applying less nitrogen.

Advantages of this Practice Change:
Enhanced N management and potentially improved productivity / lower costs.

Disadvantages of this Practice Change:
Susceptible to weather and pest/disease issues which was experienced in this trial. Although the soybeans were disease affect, it is still interesting to find out how this would impact the following cane crop since the usual nitrogen potential inputs may not have been as high as was expected.

Will you be using this practice in the future:
Undecided but yes under the right conditions. the grower is particularly interested to see if the lower n rates in the plant cane crop will have a residual effect in the 1st ratoon crop.

% of farm you would be confident to use this practice:
To be decided based on harvest results.