Project Catalyst Trial Report

Evaluating N Rates on High Organic Carbon Sites

Grower Information	
Grower Name:	Peter Hackett
Entity Name:	PJ&LJ Hackett
Trial Farm No/Name:	PCK-0756A
Mill Area:	Plane Creek
Total Farm Area ha:	189
No. Years Farming:	50
Trial Subdistrict:	Koumala
Area under Cane ha:	165

Trial Status

Completed

Author: Laura Sluggett (Farmacist). For further information contact Laura on Mb. 0429 474 698.

Background Information

Aim: To investigate whether there are yield and nitrogen use efficiency (NUE) impacts associated with adoption of the Six-Easy-Steps (6ES recommended nitrogen (N) rates

Background:

The Hackett family farm consistently produces above district average cane yields (tC/ha) and tonnes of sugar per hectare (tS/ha). Farming practices used to maximise production include: growing fallow break crops (including soybean and rice), electromagnetic (EM) mapping soils and using targeted soil sampling for more precise nutrient management, rapid adoption of new sugar cane varieties, applications of organic matter (chicken manure) and precision irrigation scheduling.

Like many growers, Peter has historically applied nutrients at slightly above recommended 6ES rates, keen to ensure nutrients are not limiting production.

Peter was keen to evaluate the performance of 6ES N rates, compared to his standard practice in a replicated trial. This trial was conducted to compare cane yield, sugar yield and NUE outcomes of N application rates above the 6ES recommendations compared to the 6ES recommended rate.

Potential Water Quality Benefit:
Reduction in applied inorganic N fertiliser mitigates the risk of potential loss to local catchments.

Expected Outcome of Trial:
It is anticipated that there will be no difference in yield across all three treatments.

Service provider contact: Farmacist Pty Ltd

Where did this idea come from: Peter Hackett in consultation with Farmacist

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	**September 2018**	Apply fertiliser treatments
Stage 2	**April 2019**	Leaf sample to determine sufficiency of nitrogen supply
Stage 3	**August 2019**	Commercial harvest – cane yield, sugar content and N uptake
Stage 4	**September 2019**	Apply fertiliser treatments
Stage 5	**March 2020**	Leaf sample to determine sufficiency of nitrogen supply
Stage 6	**September 2020**	Final trial harvest and biomass

Project Trial site details	
Trial Crop:	Sugar cane
Variety: Rat/Plt:	2R Q240
Trial Block No/Name:	4-01
Trial Block Size Ha:	6.7ha
Trial Block Position (GPS):	-21.57, 149.25
Soil Type:	Cherry Tree Solodic – gravelly grey-brown duplex soil

Block History, Trial Design

The block selected for the trial had a uniform soil type to eliminate the effects of natural soil variability upon yield and NUE results. The site was growing Q240, a known vigorous variety.

The trial design consisted of three treatments with five replicate plots (Figure 1):

- **T1** – 6ES (150 kgN/ha)
- **T2** – 6ES + 15% (168 kgN/ha)
- **T3** – 6ES + 25% (184 kgN/ha)

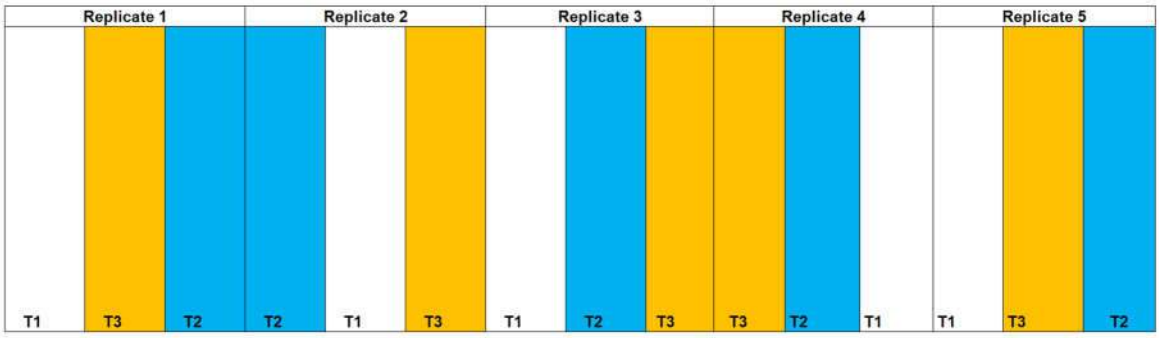
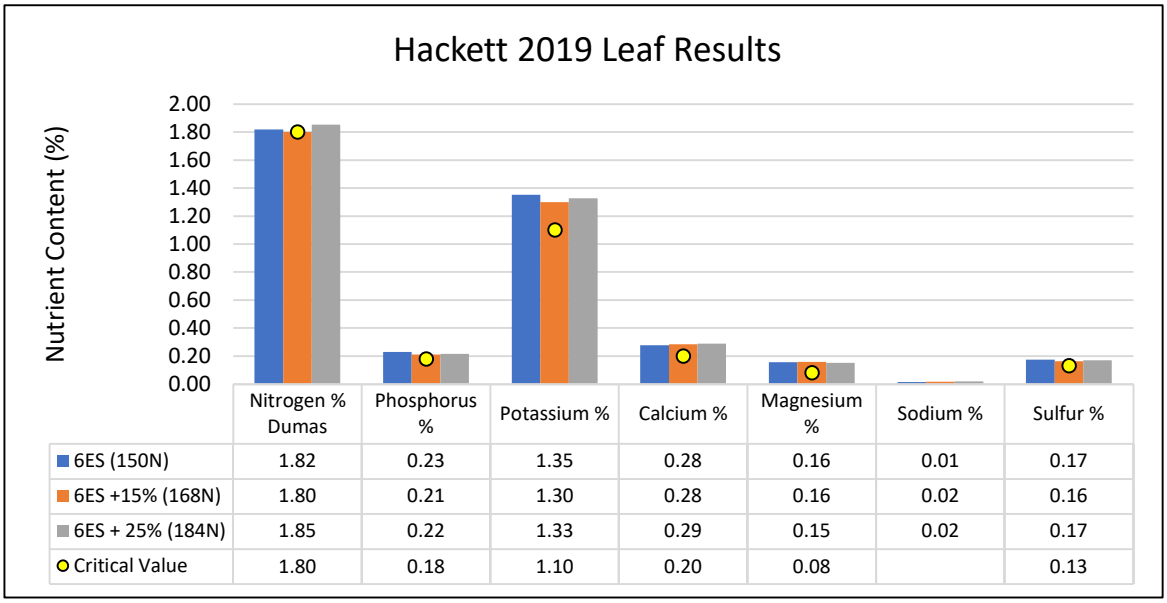


Figure 1 Trial design and replicate layout

Results:

Leaf samples March 2019

Leaf samples were taken in March 2019, following the established third leaf sampling protocol. Results, shown in Figure 2, indicated that all nutrients were at an adequate level as they met or exceeded the critical value.



	Nitrogen % Dumas	Phosphorus %	Potassium %	Calcium %	Magnesium %	Sodium %	Sulfur %
6ES (150N)	1.82	0.23	1.35	0.28	0.16	0.01	0.17
6ES +15% (168N)	1.80	0.21	1.30	0.28	0.16	0.02	0.16
6ES + 25% (184N)	1.85	0.22	1.33	0.29	0.15	0.02	0.17
Critical Value	1.80	0.18	1.10	0.20	0.08		0.13

Figure 2 2019 3rd leaf sample analysis results

2019 Harvest Results

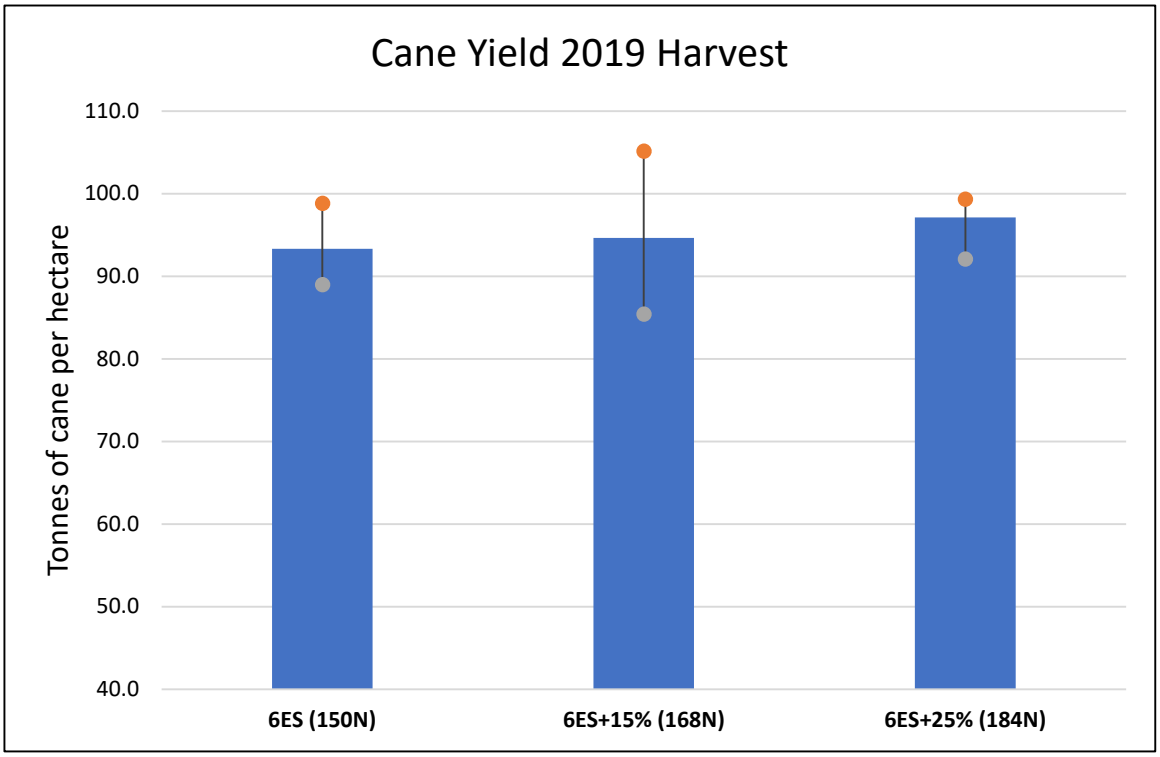


Figure 3: 2019 Commercial Harvest Cane Yield

The 2019 cane yield results (Figure 3) show an increase in average cane yield to increased N application. Both T2 (168kgN/ha) and T3 (184kgN/ha) had an increased yield of 1.3 tC/ha and 3.8tC/ha respectively over Treatment 1 (150kgN/ha), which averaged 93.3tC/ha.

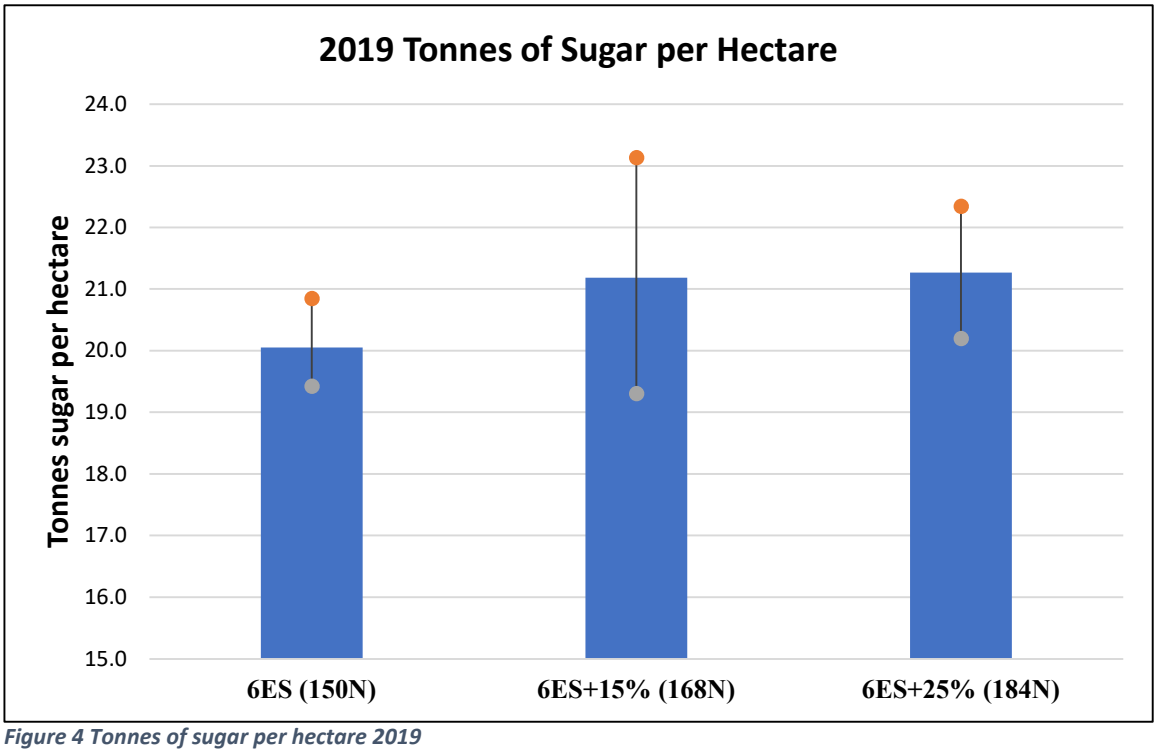


Figure 4 Tonnes of sugar per hectare 2019

The average tS/ha increased with increased N application rate (Figure 4). When compared to T1 (6ES), T2 and T3 produced higher sugar yields of 1.2tS/ha and 1.3tS/ha respectively. However, the difference between T2 and T3 was insignificant at only 0.1tS/ha.

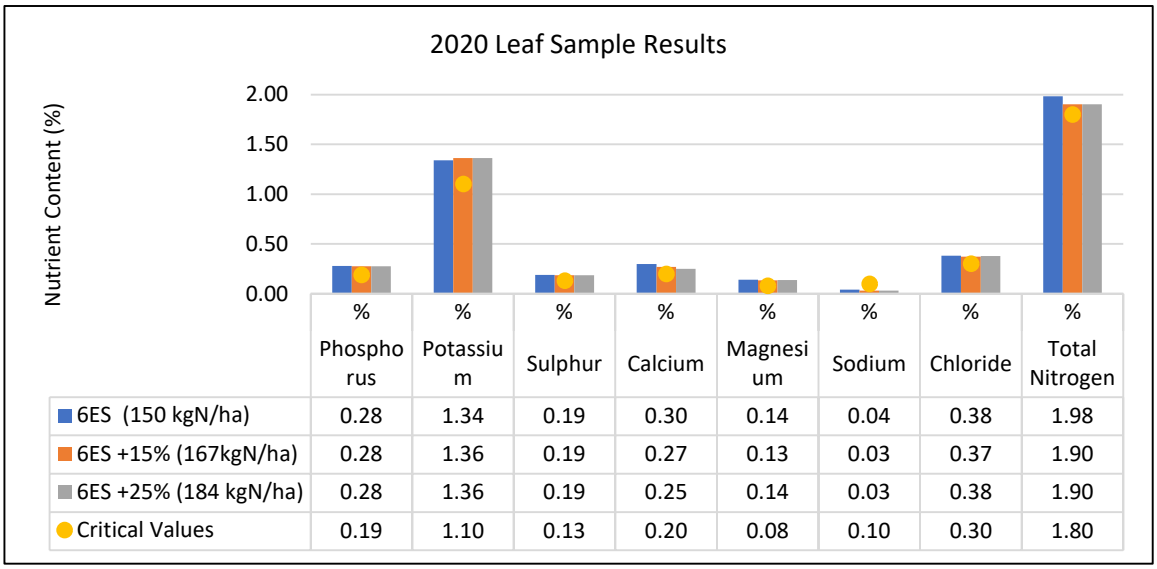
Figure 5 2019 crop at harvest – slight lodging occurred in several treatments.

2019 Results Summary

In summary, leaf sampling at 6 months after harvest showed all treatments were at, or above the critical value for 3rd leaf N content. Although the mean cane and sugar yields at harvest trended higher with increasing N application rate, these results were not statistically significant.

2020 Leaf Sample results

All treatments had leaf samples collected to determine 3rd leaf nutrient content. Laboratory results are provided in Figure 6. All treatments returned sample results above the critical values for all nutrients – indicating that no nutrients were limiting to crop yield.



	% Phosphorus	% Potassium	% Sulphur	% Calcium	% Magnesium	% Sodium	% Chloride	% Total Nitrogen
6ES (150 kgN/ha)	0.28	1.34	0.19	0.30	0.14	0.04	0.38	1.98
6ES +15% (167kgN/ha)	0.28	1.36	0.19	0.27	0.13	0.03	0.37	1.90
6ES +25% (184 kgN/ha)	0.28	1.36	0.19	0.25	0.14	0.03	0.38	1.90
Critical Values	0.19	1.10	0.13	0.20	0.08	0.10	0.30	1.80

Figure 6 2020 Leaf Sample Results

2020 Harvest Results

The 2020 commercial harvest cane yields are displayed in Figure 7 below. There was little variation in cane yield between treatments and no trend in cane yield associated with N application rate.

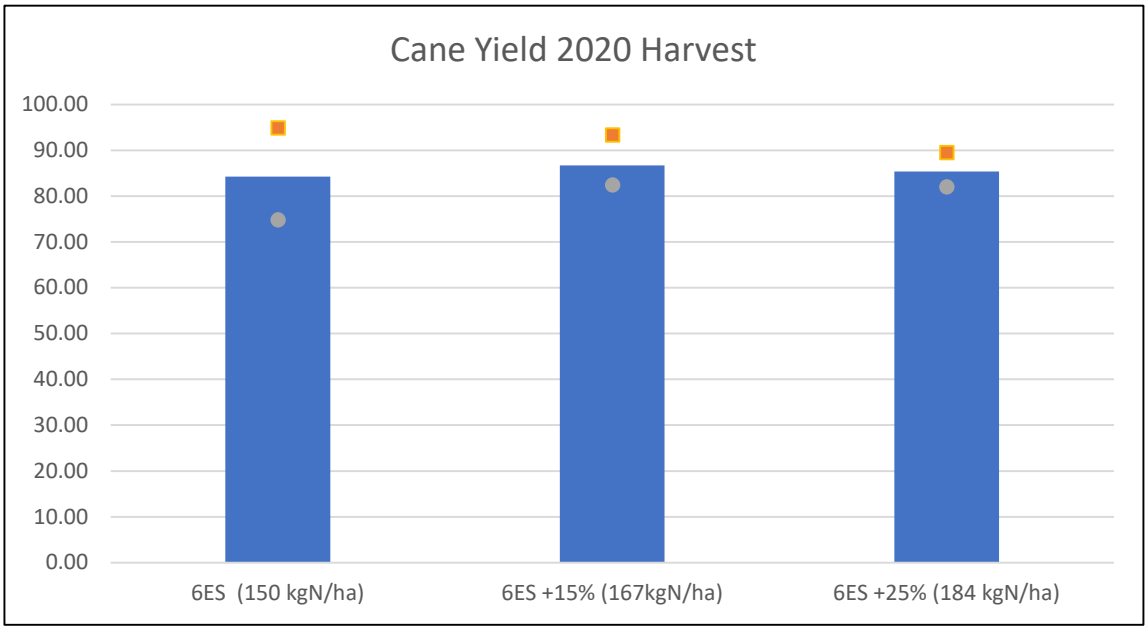


Figure 7 2020 Tonnes Cane per Hectare

Treatment sugar yields are presented in Figure 8. There was no trend in sugar yield and no statistical difference in sugar yield between treatments for the 2020 harvest.

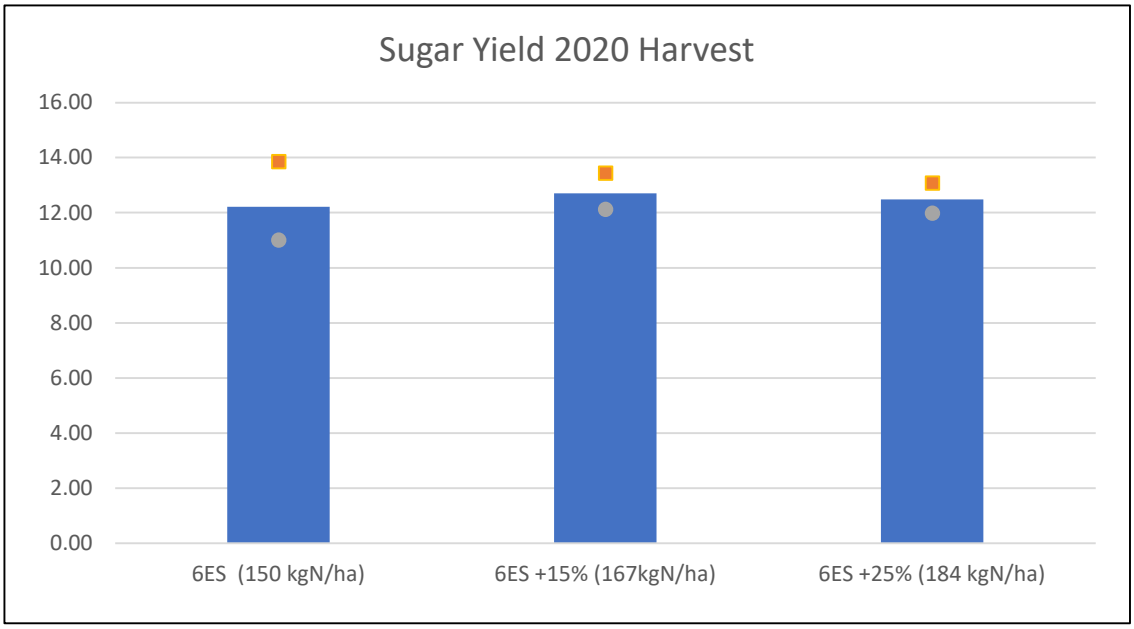


Figure 8 Sugar Yield 2020

The NUE was calculated using the formula NUE = Yield / N kg Applied (Figure 9). N use was most efficient for T1 (150kgN/ha) due to the lower N application. As yields were similar across all treatments, NUE decreased as the N application rate increased.

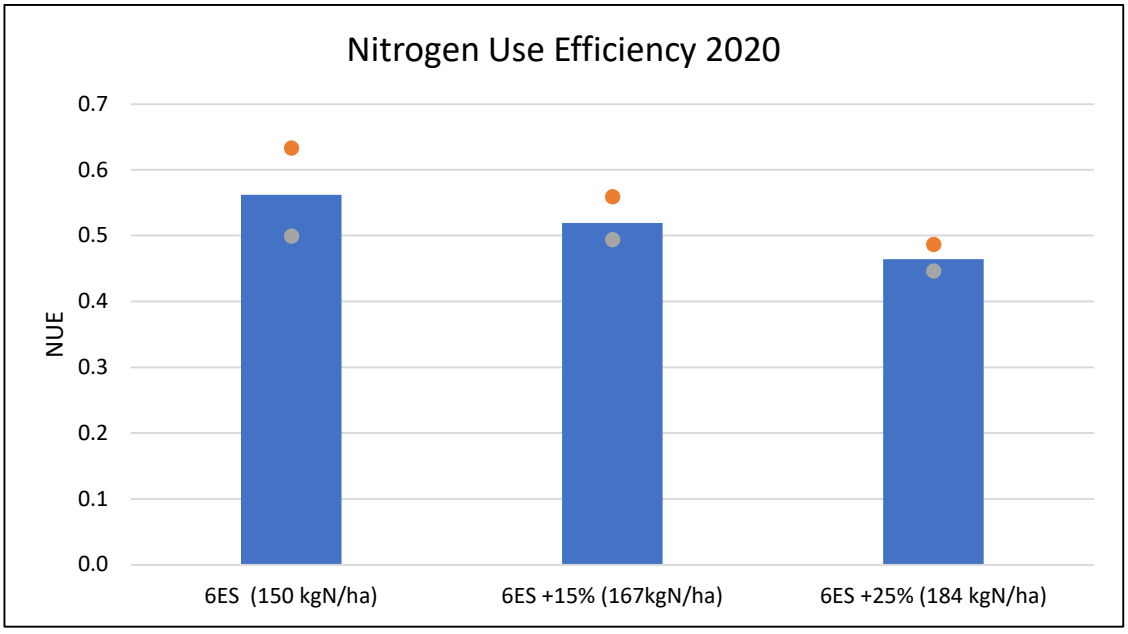


Figure 9 Nitrogen Use Efficiency for 2020 Harvest

Figure 10 Ratooning trial December 2019

2020 Result Summary

The 2020 leaf sampling results displayed no difference between treatments. This was the same result as 2019. At harvest, the data displayed an insignificant increase in tC/ha, with only 2tC/ha difference between 6ES (150kgN/ha) and 6ES + 25% (184kgN/ha).

tS/ha produced were similar between treatments. The primary trend was that as N rate increased to 6ES + 25% (184kgN/ha), the tS/ha decreased.

Conclusions and comments

Over the two trial harvests conducted, there were no significant cane or sugar yield differences identified in the trial. NUE decreased with decreasing N fertiliser application.

There are differences in the trends between treatments across the 2 years of the trial. It would be beneficial to continue the trial for a third year to gain more clarity of the effect of the practice change and influence of seasonal variation.

Figure 11: 2020 planting a soybean break crop

Advantages of this Practice Change:
Changing to 6ES N rates will not result in a reduction in crop yield or sugar yield based on these two trial harvests. This will lead to a reduction in fertiliser expense and improved NUE and a likely reduction in N runoff risk.

Disadvantages of this Practice Change:
There was a trend to increasing cane yield with increased N rate in the 2019 trial harvest. The practice needs to be monitored on other soil types, across seasonal variation and on more vigorous cane varieties.

Will you be using this practice in the future:
Yes, this practice is now utilised in the future on the relevant management zones.

% of farm you would be confident to use this practice:
Approximately 75% of the combined farms will be utilising this practice in the future.