Project Catalyst Trial Report

Sub Surface Application of Mud

Grower Information	
Grower Name:	Alan, Karen & Grant Matsen
Entity Name:	Clearacre Pty Ltd
Trial Farm No/Name:	MKY-04670A
Mill Area:	Mackay Sugar
Total Farm Area ha:	474ha
No. Years Farming:	>40 years – 3rd generation
Trial Subdistrict:	Dawlish
Area under Cane ha:	414ha

Trial Status

Completed

Author: David Clancy and Rob Sluggett (Farmacist). For further information contact Rob on Mb. 0459 688 844.

Background Information

Aim: To compare crop nutrient uptake and run off between sub-surface and surface applied mill mud.

Background:

Alan and Grant Matsen were seeking to increase their farm productivity through robust sustainable practices that would ensure the farms future viability for the following generations. While investigating ideas, the Matsen's heard about some promising yield results in cereal crops in Victoria, after animal manure had been buried below the surface.

Initially, the Matsen's sourced chicken and cow manure for their own farm, however this proved to be economically unviable. Therefore, the decision was made to trial sub-surface applied mill mud as an alternative option.

The burying of soil ameliorants below the surface of the soil can have the potential to improve soil qualities down the profile, increase organic carbon levels and potentially expand the topsoil and root zones. The deep placement of ameliorants also reduces the likelihood of run off, promotes microbial activity and has the potential to increase a crops nitrogen use efficiency (NUE).

Three treatments applied were:
T1- No mud
T2- Mill mud @ 100t/ha was band applied in open furrows and then bed formed
T3- Mill mud @ 100t/ha was surface applied and incorporated into the soil

KP water event samplers, which automatically collect samples at pre-set intervals during a 'water' event, were placed in each treatment. The samples collected to be analysed for nutrient run off.

A soybean crop (A6785) was planted in December 2017 and the plant cane crop was then planted in May 2018.

Potential Water Quality Benefit:

Reduce the risk of nutrient and sediment run-off.

Expected Outcome of Trial:

Improved soil structure, increased yield in treatment zones, improved water quality runoff.

Service provider contact: Farmacist Pty Ltd

Where did this idea come from: Alan Matsen

Plan - Project Activities		
	Date:	**Activities:**
Stage 1	**October 2017**	Collect soil samples and mill mud samples for analysis. Install KP samplers to measure water quality in runoff Mill mud applied
Stage 2	**April 2018**	Soybean biomass samples
Stage 3	**March/April 2018**	Soybean harvested
Stage 4	**May 2018**	Sugar cane planted
Stage 5	**September 2019**	Sugar cane harvested
Stage 6	**September 2020**	Sugar cane harvested

Project Trial site details	
Trial Crop:	Soybean and sugar cane
Variety: **Rat/Plt:**	Soybean – A6785
Trial Block No/Name:	MKY-04670A-08-02
Trial Block Size Ha:	6.05ha
Trial Block Position (GPS):	149.15002, -21.400047
Soil Type:	Sunnyside soil – Deep soil with a sandy to loam topsoil over a grey to brown clay

Block History, Trial Design

The trial site was Electromagnetic (EM) surveyed EC to determine the location of soil boundaries (Figure 1), with Zone 1 the lowest EC readings and Zone 5 the highest EC readings. High EC is often associated with soils that are heavier in texture and can have drainage issues.

The trial paddock had no previous mud application history. The whole paddock was ripped before the mill mud applications. The sub-surface treatment received an additional rip to create the open furrow. Mill mud was then banded on top of the furrow (Figure 4) using a specialised spreader.

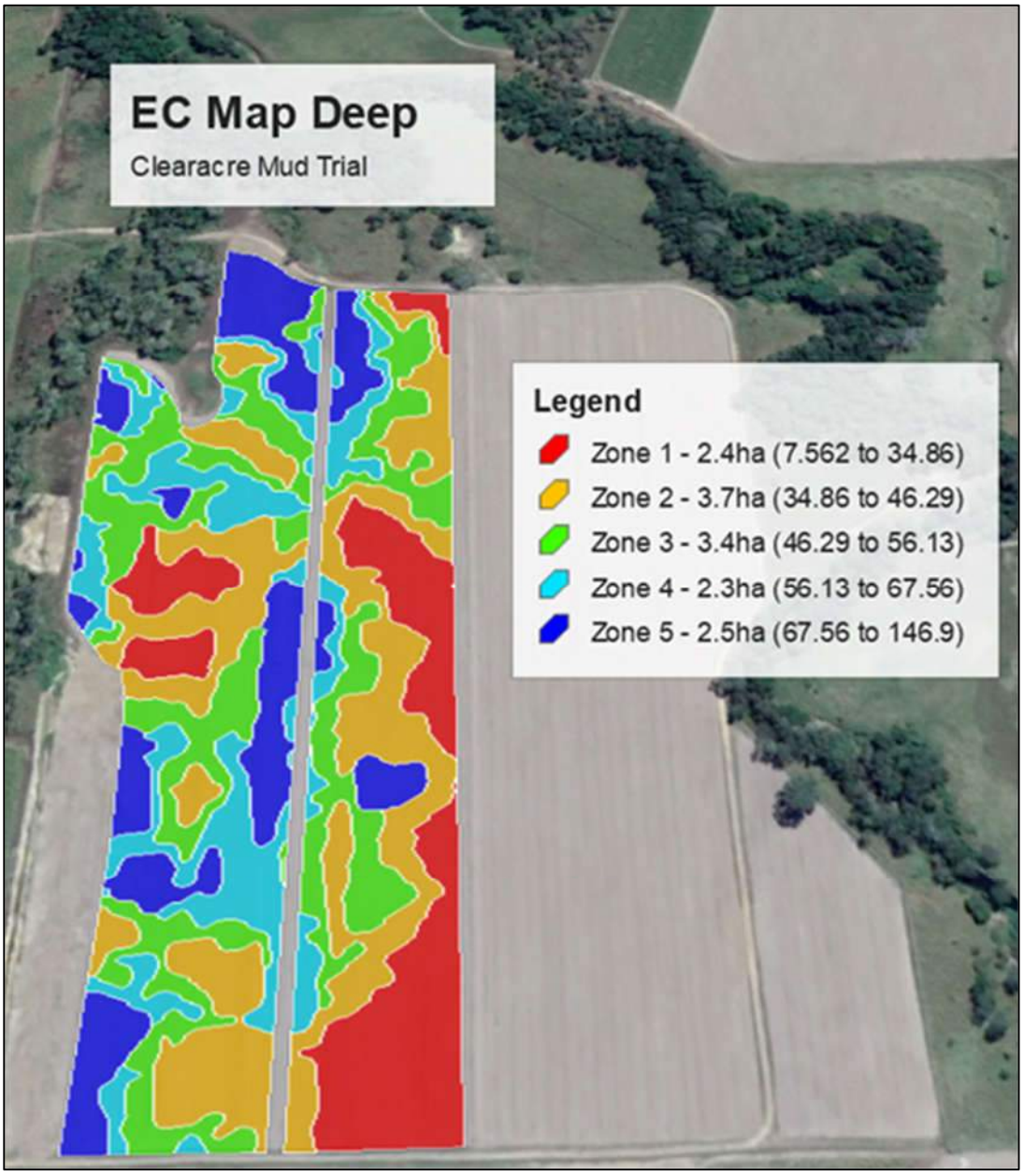


Figure 1 - EC Map of trial paddock (Red indicating lighter soil and dark blue indicating heavier soil

Three treatments were applied to the paddock with three replicates as shown in Figure 2.

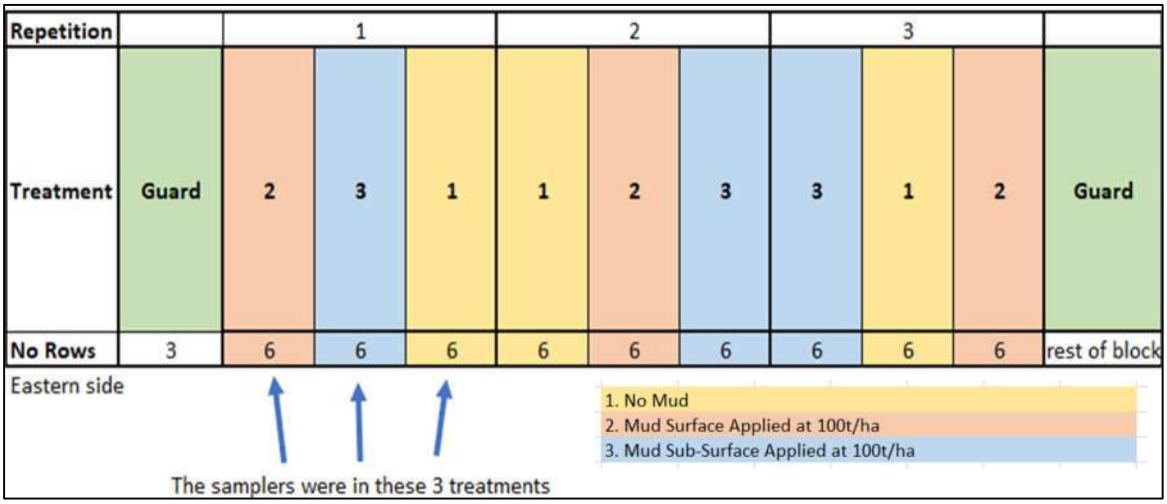


Figure 2 - Field layout with treatments and repetitions

Figure 3 - Grower Alan Matsen

Figure 4 - Mill mud distribution

Figure 5 - Banded spreader used to apply mill mud

Results

A soybean crop was planted on the 28th December 2017. Due to planter malfunction and paddock influences, the crop was extremely variable as shown in Figure 6 below. Due to this factor, soybean samples were considered unreliable and were not included in the trial data.

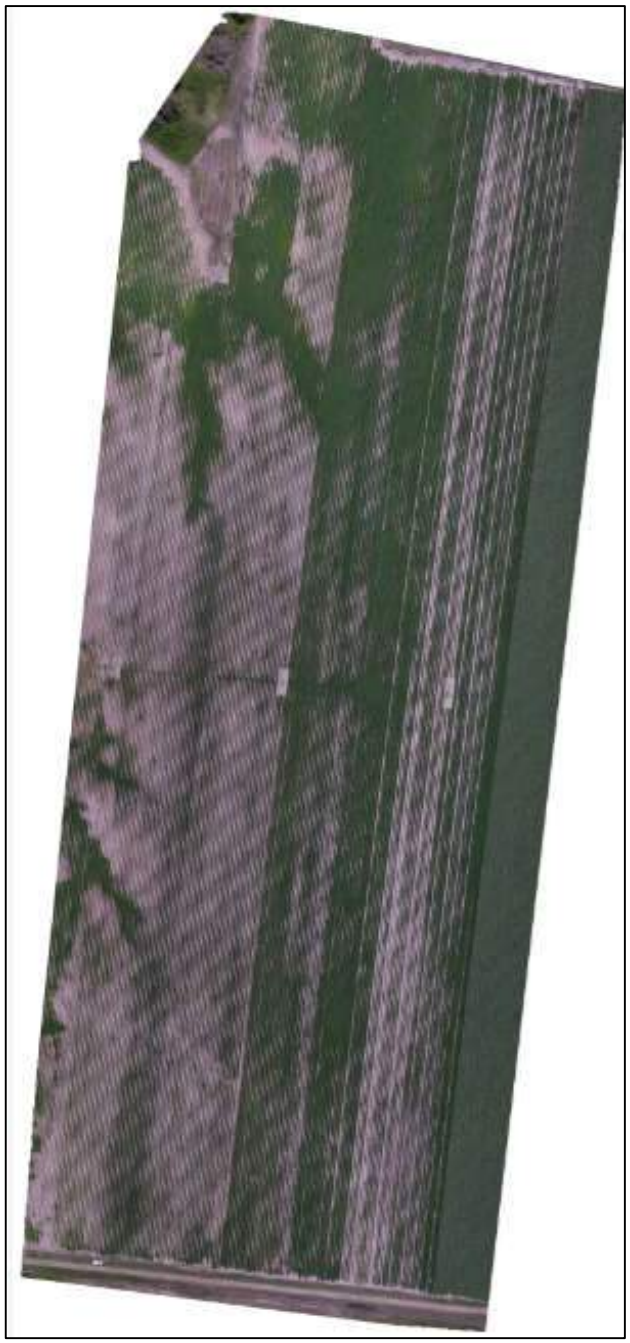
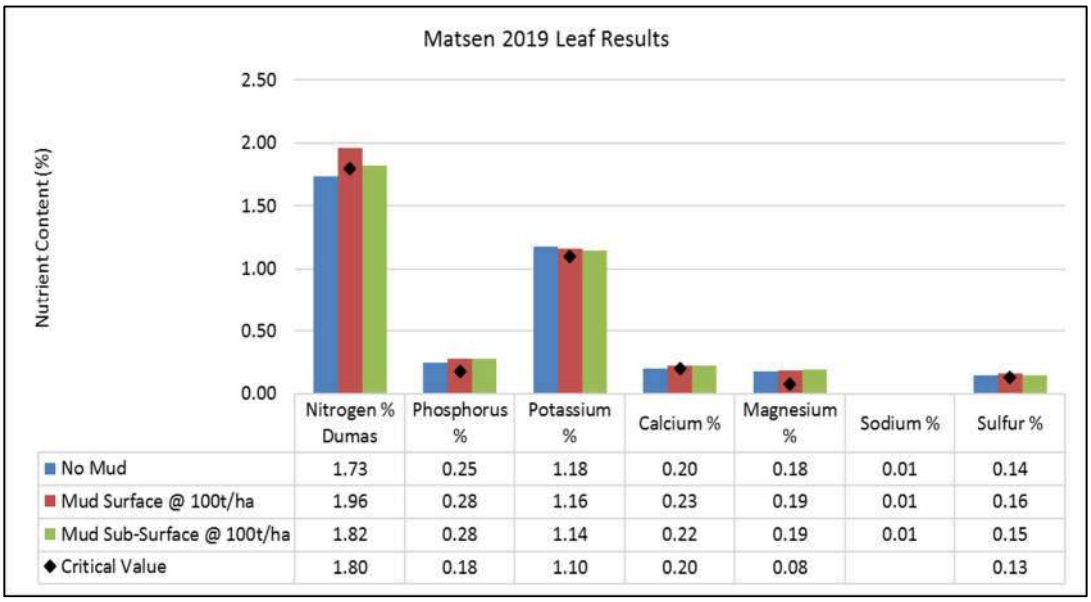


Figure 6 - Aerial image of soybean planted in December 2017

Leaf samples 2019

Leaf samples of the sugarcane were taken in March 2019, following the standard third leaf sampling protocol. Results are shown in Figure 7 and indicate slight increased nutrient values of treatments that had the mill mud applied versus the control (no mud). Nitrogen showed the largest variation between treatments.



	Nitrogen % Dumas	Phosphorus %	Potassium %	Calcium %	Magnesium %	Sodium %	Sulfur %
No Mud	1.73	0.25	1.18	0.20	0.18	0.01	0.14
Mud Surface @ 100t/ha	1.96	0.28	1.16	0.23	0.19	0.01	0.16
Mud Sub-Surface @ 100t/ha	1.82	0.28	1.14	0.22	0.19	0.01	0.15
Critical Value	1.80	0.18	1.10	0.20	0.08		0.13

Figure 7 - Leaf test results 2019

2019 Harvest Data

The results from the 2019 harvest are shown below in Figure 8 and Figure 9. The sub-surface mud having the highest cane and sugar yields, with increases of 3.5tC/ha and 0.3tC/ha respectively over the surface applied treatment. Both treatments with mill mud applied out performed the control treatment.

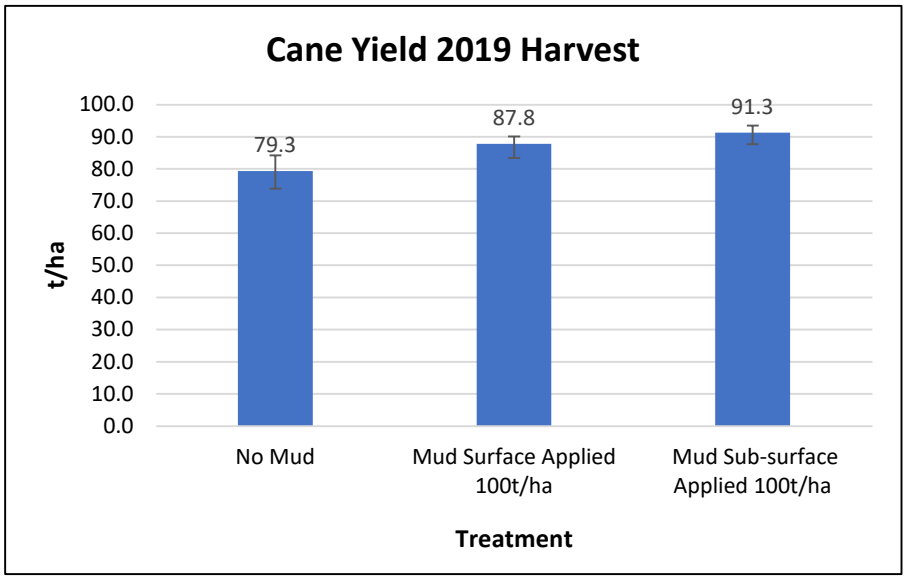


Figure 8 – 2019 tonnes of cane per hectare (tC/ha)

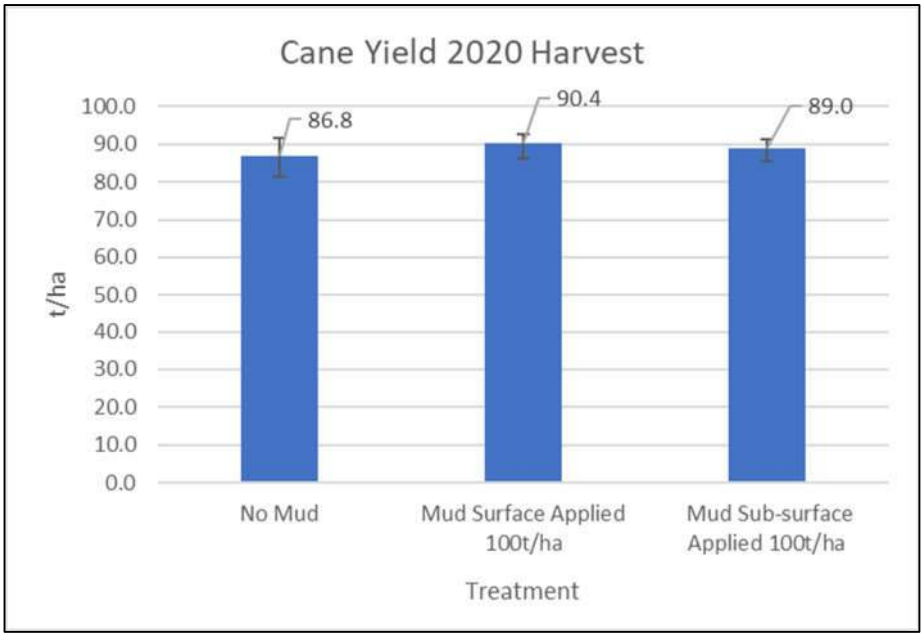


Figure 9 –2019 tonnes of sugar per hectare (tS/ha)

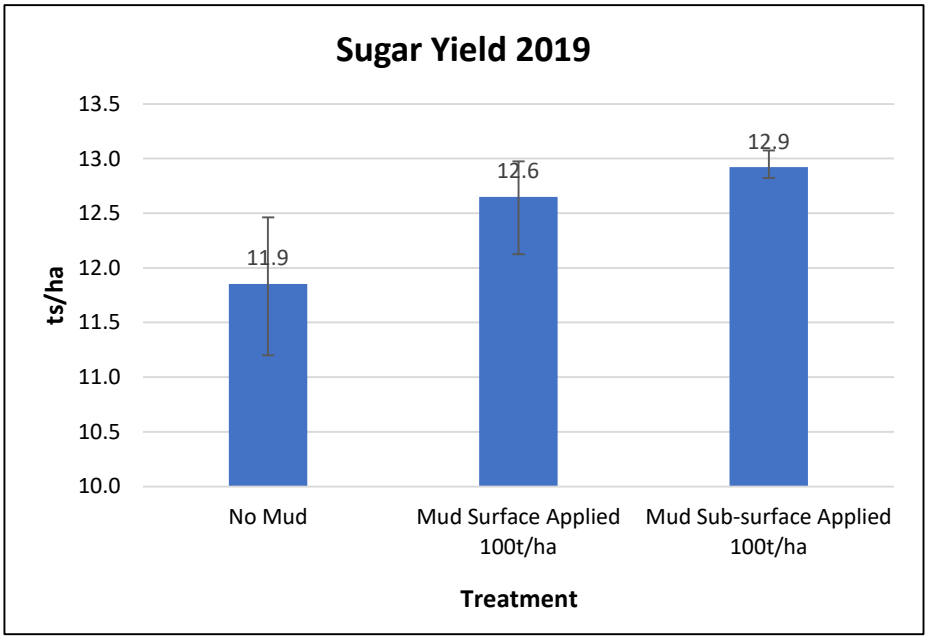


Figure 10 –2020 tonnes of cane per hectare (tC/ha)

2019 water runoff data

The results from the 2019 water run-off quality showed the subsurface application had the least amount of total nitrogen at 5.99mg/L compared to the surface application at 6.63mg/L.

Phosphorus runoff showed an average 0.88mg/L in the subsurface application which was higher than the surface application of 0.52mg/L.

Please refer to Document 'Water quality results-Catchment Solutions 2018-19' for the full analysis of runoff data.

2020 Harvest Data

The results from the 2020 harvest are shown in Figure 10 and Figure 11. There was some variation in cane and sugar yields between treatments.

The surface applied mud treatment produced the highest cane yield of 90.4tC/ha followed by the sub-surface applied mud at 89 tC/ha. Interestingly, sub-surface applied mud produced the lowest sugar yield of 11.5tS/ha and surface applied mud produced the highest sugar yield of 11.8tS/ha.

Sub-surface mud did not appear to show any significant improvements in cane and sugar yield in comparison to the other treatments.

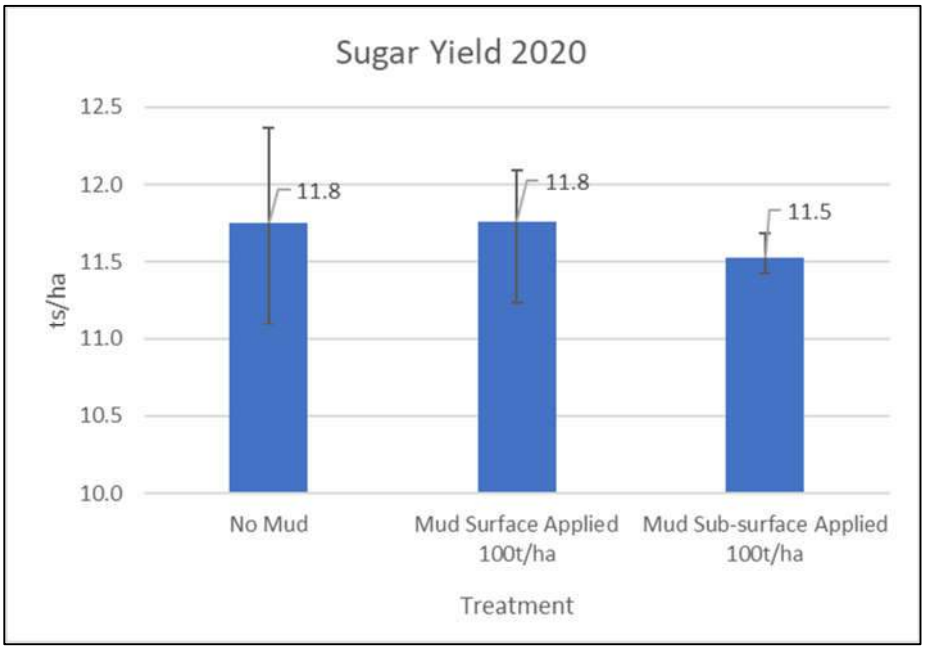


Figure 11 – 2020 tonnes of sugar per hectare (tS/ha)

Conclusions and comments

The 2019 harvest demonstrated that the sub-surface applied treatment out preformed the other treatments. As the results were not significant, the trial was continued into 2020.

The 2020 harvest indicated that sub-surface mud did not show any significant improvements in cane and sugar yield in comparison to the other treatments.

This trial will be harvested again in 2021, with those results the grower will conclude whether it will be a practice he wants to adopt.

Advantages of this Practice Change:
Applying the mud subsurface should reduce its risk of exposure to the environment and nutrient runoff.

Disadvantages of this Practice Change:
Extra time and investment involved in applying the product to the subsurface.

Will you be using this practice in the future:
Alan is still looking into the validity of this practice. Latest harvest results suggest that the benefits of sub-surface applied mud may not be as good as first hypothesised. Additional trials and more comprehensive testing will give a better indication to whether sub-surface mud is a viable option.

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