Project Catalyst Trial Report

Mill Mud and Ash Subsurface to Correct Soil pH at Depth

Grower Information	
Grower Name:	George Henry
Entity Name:	Burrakin Pty Ltd
Trial Farm No/Name:	F2663
Mill Area:	Tully
Total Farm Area ha:	163.87
No. Years Farming:	Too many
Trial Subdistrict:	Murray Upper
Area under Cane ha:	163.87

Background Information

Aim:
To improve soil pH at depth and improve soil structure

Background: (Rationale for why this might work)

There are many and varied soil types on this farm, and many areas where subsurface drainage is required to prevent fields from being too wet to achieve satisfactory yields and to enable normal farming operations to occur. SIS mapping and historical knowledge of the farm have been used to identify areas to implement subsurface drainage. This block had subsurface drainage issues and ag-pipe was installed to rectify this issue. However, after the installation of the ag-pipe there was still something restricting growth in these areas. Further investigation has revealed that the soil pH below 20cm depth (4.9 pH) is much lower than the soil pH in the top 20 cm (5.4 – 5.7 pH) in the same areas.

George believes that the low pH at depths is causing the growth restrictions he is observing in this field, and he also believes that the installation of the subsurface drainage in these areas along with the drier season has exacerbated the issue.

When George has been digging in these areas he has also noticed that the roots will only go down to a shallow depth and then they cease.

Potential Water Quality Benefit:
By improving the soil pH at depth, Geroge is expecting that the roots will penetrate deeper into the soil which will allow better utilisation of the nutrients that he appies to the paddock, and will reduce the amount of nutrients that are able to leach below the root zone of the crop.

Expected Outcome of Trial:
It is expected that the soil pH at depth will increase with the addition of the mill mud banded at depth resulting in better crop yields with the same amount of inputs.

Service provider contact: Charissa Rixon – T.R.A.P. Services

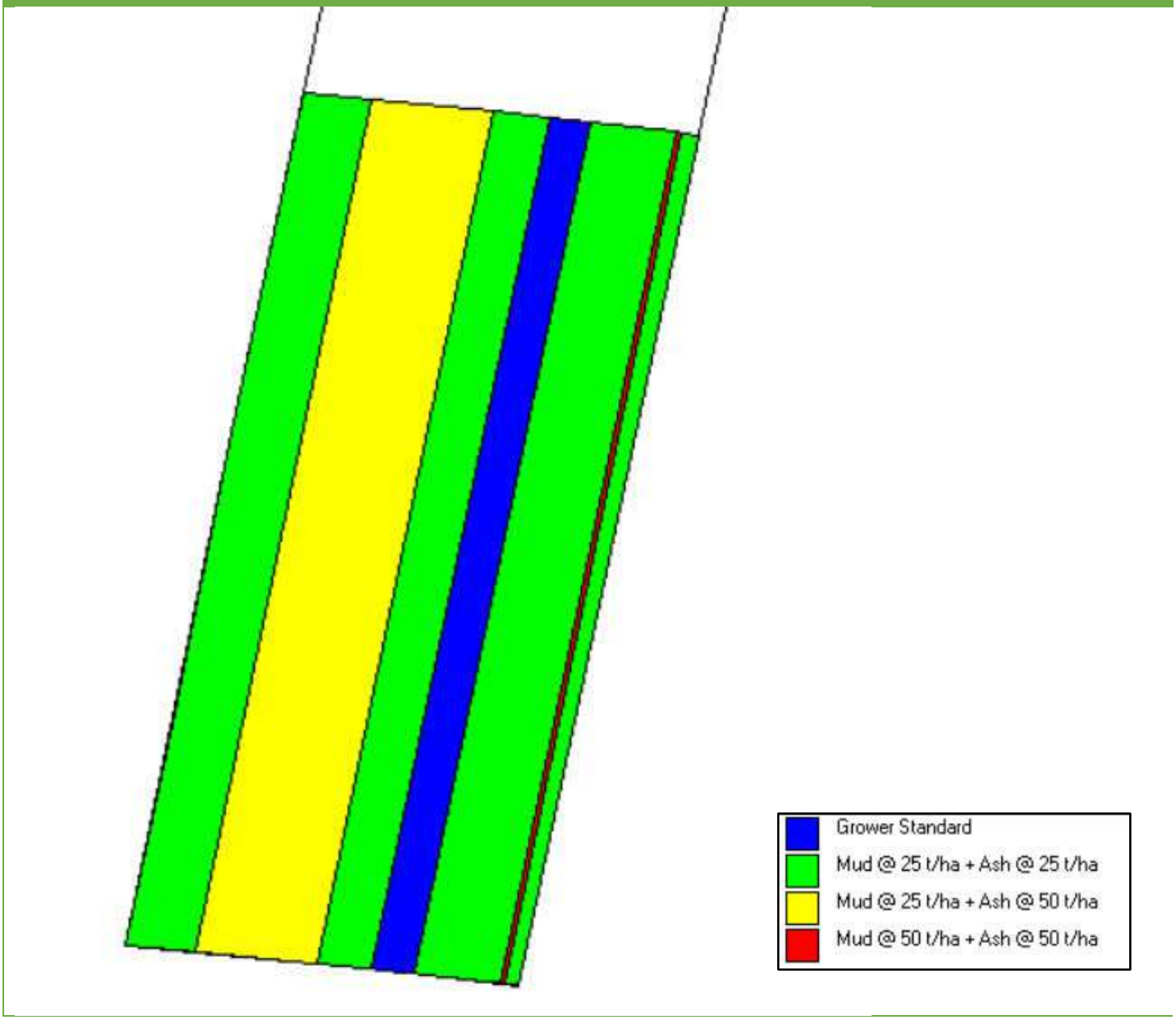
Where did this idea come from: This idea has come from George doing his own research and following articles in various publications and from his investment in SIS mapping.

Plan - Project Activities	Date : (mth/year to be undertaken)	Activities :(breakdown of each activity for each stage)
Stage 1	**June 18**	Apply Mill mud and mill ash into a furrow below the row pre-plant.
Stage 2	**July 18**	Plant Cane
Stage 3	**May 19**	Obtain yield imagery and if available compare to previous yield images for the same block.
Stage 4	**September 19**	Harvest small areas with weigh bin to validate yield response,
Stage 5	**October 2019**	In identified areas do shallow and deep soil tests to test soil pH levels in the various treatments.
Stage 6	**Mar 2020**	Sampling at depth to check soil pH. In field analysis only
Stage 7	**September 2020**	Harvest small areas with weigh bin to validate yield response. Collect stalks for small mill CCS samples. Collect data and report.

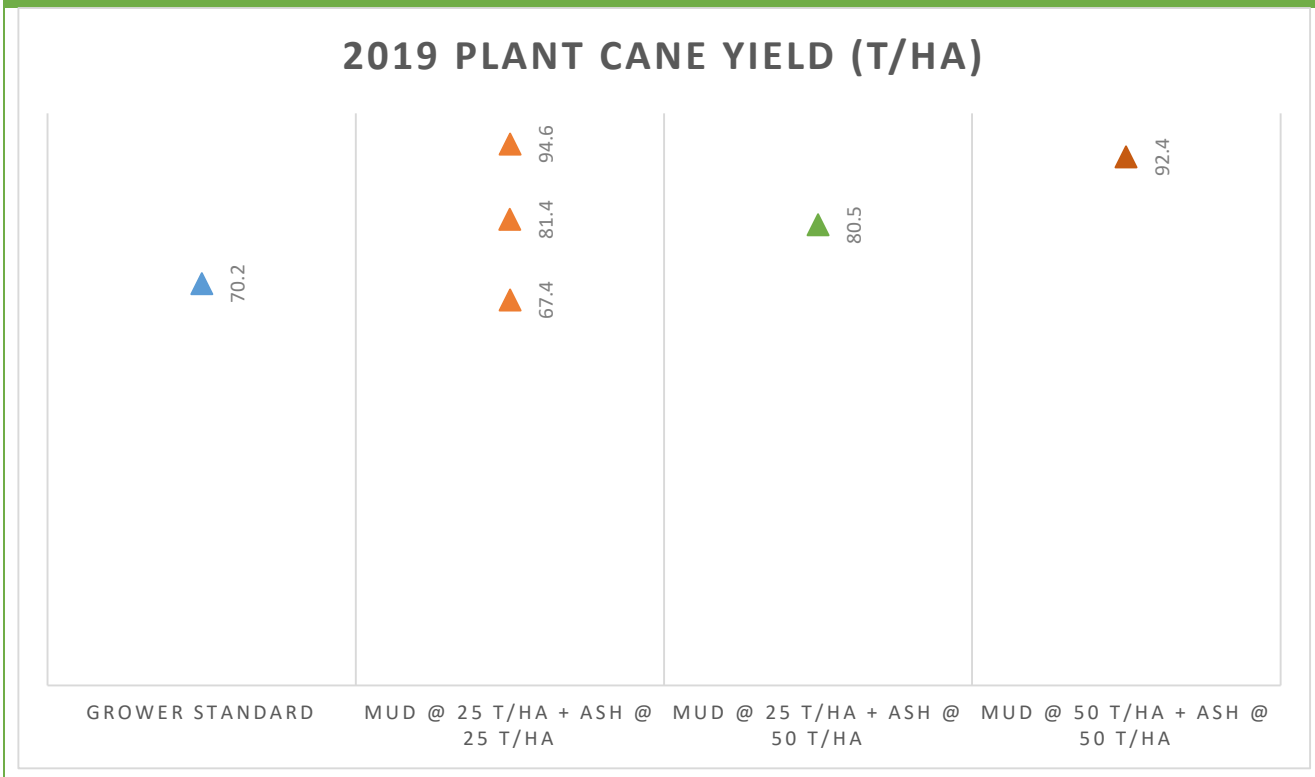
Project Trial site details

Trial Crop:	Sugarcane
Variety: Rat/Plt:	Plant Q208
Trial Block No/Name:	Block 5C
Trial Block Size Ha:	18.64 Ha
Trial Block Position (GPS):	18.0740°S 145.8003°E
Soil Type:	Feluga Red Variant, Warrami, Hillview Fine Variant

Block History, Trial Design:



Results:



Harvest started from the Eastern side of the block, and approximately 100m of 1 row was commercially harvested and then weighed using a weigh bin. The Mud @ 25 t/ha + Ash @ 25 t/ha treated strip on the western side of the block was not sampled. The results from this trial indicate that in the first year ater the addition of Mill Mud and Ash at depth, there was a yield benefit.

It would be beneficial to take soil samples from various depths and test the soil pH at the different depths. After the harvest of the 1st ratoon crop it would be good to dig out beside a stool of cane and see if the rooting depth varies.

2020 1st Ratoon Crop

Soil Physical Properties

	Water Infiltration Rate (mm/min)	Effective Rooting Depth (mm)
Lime	92	700+
Mud @ 25 t/ha + Ash @ 25 t/ha	47	200*
Mud @50 t/ha + Ash @ 50 t/ha	37	700+

* Do not consider this reading to be accurate, and suspect that there is compaction caused by harvesting where this test was taken.

The water infiltration rate and the effective rooting depth was determined for the 3 different treatments. The water infiltration rate was determined by measuring the reduction in water depth in a 15cm diameter cylinder that was placed 7.5cm deep into the ground on the shoulder of the hill. The recorded infiltration rate is the rate which was consistent for 3 consecutive readings. The application of mill mud and ash below the planting drill, reduced the water infiltration rate compared to the lime treatment, and as the rate of mil mud and ash increased the infiltration rate decreased. These results are indicative only as they are not replicated.

Once the water infiltration test was completed, the effective rooting depth was measured at the same place to ensure soil moisture was constant across all sampling sites. There was no difference in the effective rooting depth in this trial.

Soil Chemical Properties

Sample Name	Reference	Lime @ 2.5 t/ha	Mud + Ash @ 25 t/ha each	Mud + Ash @ 50 t/ha each	Lime @ 2.5 t/ha	Mud + Ash @ 25 t/ha each	Mud + Ash @ 50 t/ha each
Sampling Date	17/11/2017	10/08/2020			10/08/2020		
Crop	Preplant	Ratoon 2nd					
	0 - 20 cm				40 - 60 cm		
pH (1:5 Water)	6.3	6.1	5.6	6.3	5.6	6.4	5.7
Cation Exch. Cap. cmol(+)/kg	4.33	2.55	2.64	3.21	1.43	2.33	1.95
Calcium (Amm-acet.) cmol(+)/kg	3.50	1.80	1.80	2.40	0.77	1.70	1.10
Aluminium Saturation %	2.9	7.5	9.2	4.6	29.0	7.8	20.0
Magnesium (Amm-acet.) cmol(+)/kg	0.49	0.35	0.31	0.36	0.15	0.28	0.23
Silicon (BSES) mg/kg	130.0	73.0	82.0	130.0	120.0	230.0	120.0
Silicon (CaCl2) mg/kg	17.0	16.0	16.0	22.0	23.0	25.0	21.0
Organic Carbon %	1.10	0.89	1.00	0.60	0.35	0.39	0.34
Phosphorus (BSES) mg/kg	32	29	110	200	10	13	34
Phosphorus Buffer Index (PBI-Col)	61	56	47	71	81	66	63
Potassium (Nitric K) cmol(+)/kg	1.90	1.90	1.90	2.30	2.00	2.30	2.20
Potassium (Amm-acet.) cmol(+)/kg	0.20	0.17	0.24	0.32	0.09	0.12	0.19
Sulphur (MCP) mg/kg	3	5	5	7	19	7	18
Zinc (HCl) mg/kg	0.6	3.8	29.0	4.7			
Copper (DTPA) mg/kg	1.00	0.66	0.64	0.67			
Iron (DTPA) mg/kg	57.0	60.0	90.0	86.0			
Manganese (DTPA) mg/kg	8.2	11.0	8.8	2.0			

3 cores at 0 – 20 cm and 40 – 60 cm were taken from around the site of the water infiltration, bulked and subsampled, before being sent to Nutrient Advantage for analysis.

There are a couple of points of interest to note.

- There is no difference in organic carbon for any of the treatments.
- To achieve similar soil calcium levels as 2.5 t/ha of Lime, a banded application of 50 t/ha of mill mud + 50 t/ha or Ash was required.
- The phosphorus levels where mill mud @ 25 t/ha + ash @ 25 t/ha is sufficient for at least one crop cycle.
- The potassium levels were higher where mill mud + ash was banded, and continued to increase as the rate of mill mud + ash increased.

Conclusions and comments

A paddock next to the trial where George has also trialled this practice has shown that pH at depth where the mill mud/ash blend had a pH of 6.0 compared to 4.5 – 5.0 where there was no mud or ash applied.

The mud is stored for a month or two before it is mixed with the mill ash and then applied. The mill mud is getting hard to get, so is starting to use just ash mixed with gypsum/kiln dust/dolomite mixture from a local supplier.

Advantages of this Practice Change:
This practice has improved yields on blocks that were identified to have low pH at 30 to 40 cm, and the roots were visually showing that they had been burnt off and were not able to access the soil moisture. The banding of the mill mud and ash at the low rate will supply sufficient phosphorus for the crop cycle and also allow a reduction in the amount of potassium being applied. This means an overall saving in synthetic fertilizer, which may contribute to improved water quality.

Disadvantages of this Practice Change:
Time to mix and apply the mixtures. Currently using a single row zonal rotary hoe to work the stool up and then designed a ripper with flares to open up the drill before applying the mixtures.

Will you be using this practice in the future:
I will continue to use this practice on areas that have been identified as having low pH as a soil constraint at depth. As this is improving yields in these areas.

% of farm you would be confident to use this practice :
100% of the farm will eventually be done, but I am concentrating on the lower producing blocks first.