Project Catalyst Trial Report

Sub Surface Applied Mill By-Products

Grower Information	
Grower Name:	Wilmar Sugar
Entity Name:	Wilmar Sugar
Trial Farm No/Name:	Sub-surface applied mill by-products trial F# 0848A
Mill Area:	Victoria
Total Farm Area ha:	6,600 in total across Herbert, Burdekin, Proserpine and Plain Creek
No. Years Farming:	11 years since becoming Wilmar Sugar in 2010.
Trial Subdistrict:	Orient
Area under Cane ha:	1012.15 @ Farm# 0848

Background Information

Aim:
This project aims to investigate the use of varying rates of mill mud and ash banded sub-surface into the planting line, and whether transporting the mill by-products is economically viable, when the paddock is outside the traditional mill truck transportation area.

Background: (Rationale for why this might work)

Mill by-products have traditionally been used as an ameliorant to improve soil conditions and as a source of nutritional value. By banding the mill by-products sub-surface into the planting line, the benefits are localised to the growing region of the soil and not lost to run off due to heavy rainfall events. Furthermore, banding the mill by-products means that less is required to be transported. This may reduce costs associated with transporting to areas outside the usual region of transportation by the mill trucks.

Potential Water Quality Benefit:
Banding mill by-products sub-surface reduces the risk of loss to run off to the Great Barrier Reef. This is particularly important regarding phosphorous.

Expected Outcome of Trial:
That the varying rates of mill by-products will have a positive impact on productivity. Though the rates in this trial are much lower than the commercially applied rates, banding will localise the benefits to the stool and reduce total volume of product required, predicted to reduce overall costs.

Service provider contact: Megan Zahmel 0447 317 102

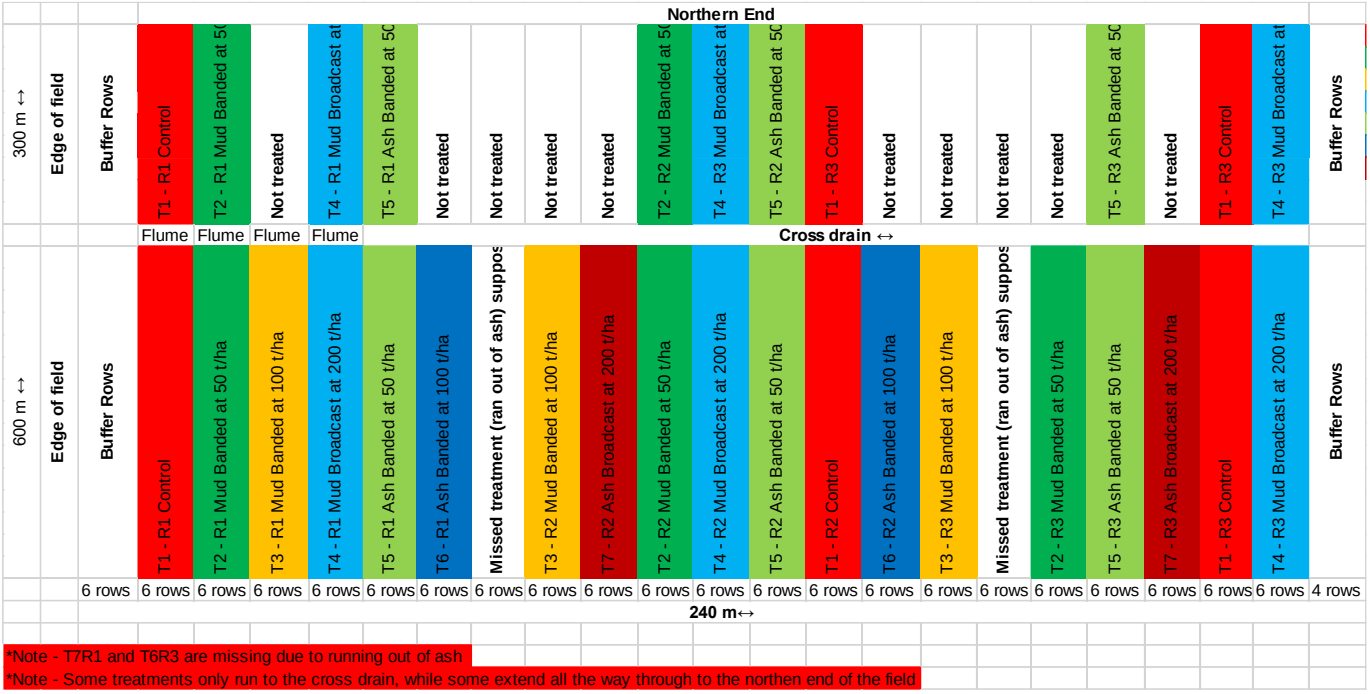
Where did this idea come from: Wilmar/ Peter Larsen

Plan - Project Activities	Date: (mth/year to be undertaken)	Activities :(breakdown of each activity for each stage)
Stage 1	**Establish trial**	Baseline soil nutrient samples – 1st of Dec 2015 Application of Mud and Ash – Dec 2015 Flumes set up to monitor water runoff quality. - 5th Jan 2016 Nutrient soil samples after mud application – 4th May 2016 Planted May 2016
Stage 2	**Sampling 2017**	Stalk counts and biomass - 10th Nov 2016 - 16th Feb 2017 Water runoff data collected – 26/01/2016 – 23/03/2017 Harvest results for 2017 – completed see attached results
Stage 3	**Sampling 2018**	Harvest – Oct 2018 Soil samples - Nov 2018
Stage 4	**Sampling 2019**	Harvest and CCS results – 11th of September 2019
Stage 5	**Sampling 2020**	Final harvest and CCS results

Project Trial site details

Trial Crop:	Sugarcane
Variety: **Rat/Plt:**	Plant Q208 2016
Trial Block No/Name:	B# 1-2 F# 0848A Mill By-product sub-surface applied
Trial Block Size Ha:	22.3 ha
Trial Block Position (GPS):	Refer to google earth map
Soil Type:	shallow loam overlying a sodic clay

Block History, Trial Design:



Block History:

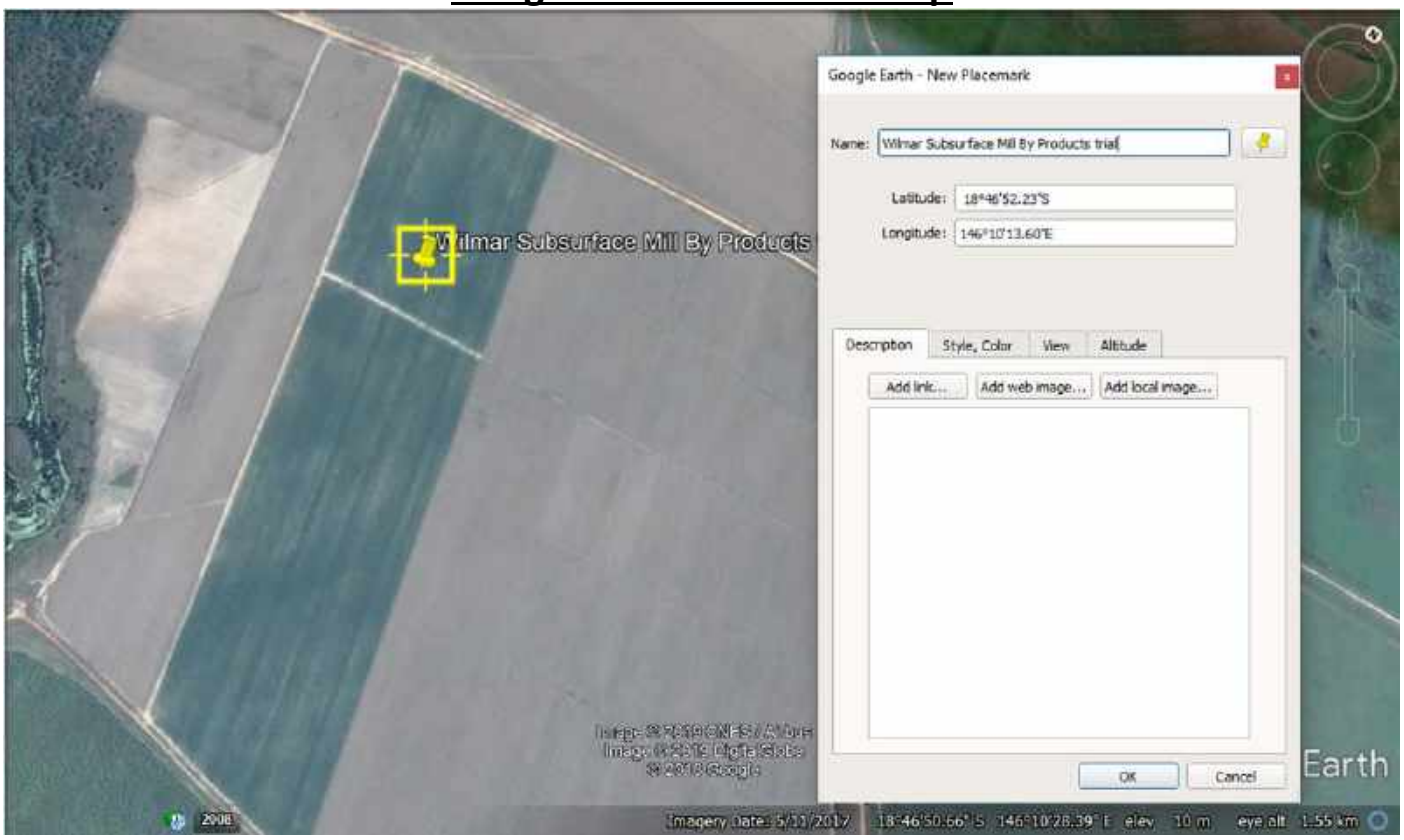
Previous variety MQ239, only went to 2R
Last fallowed - 2016

Treatments:

T1	Control (Lime 2t/ha)
T2	Mud Banded 50 t/ha
T3	Mud Banded 100 t/ha
T4	Mud Broadcast 200t/ha
T5	Ash Banded 50 t/ha
T6	Ash Banded 100 t/ha
T7	Ash Broadcast 200 t/ha

Results:

Google Earth reference Map



2017 Season Results

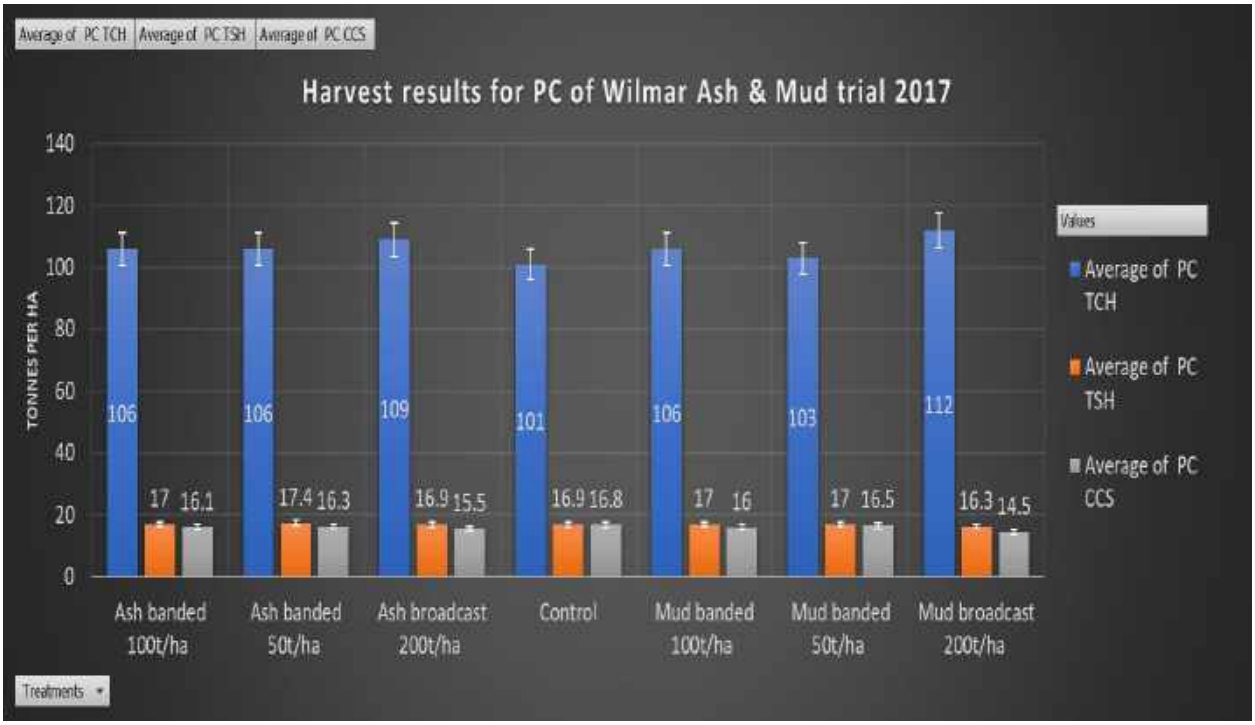
2017 Economic results

Treatment	Average TCH	Average TSH	Average CCS	Average Revenue	Average total expense*	Average gross margin
Control	101.0	16.9	16.8	$ 4,711	$ 1,178	$ 3,532
Mud banded 50t/ha	102.9	17.0	16.5	$ 4,706	$ 1,218	$ 3,488
Mud banded 100t/ha	105.5	16.9	16.0	$ 4,636	$ 1,491	$ 3,144
Mud broadcast 200t/ha	112.5	16.3	14.5	$ 4,316	$ 2,054	$ 2,262
Ash banded 50t/ha	106.4	17.4	16.3	$ 4,792	$ 1,250	$ 3,543
Ash banded 100t/ha	105.3	16.9	16.1	$ 4,637	$ 1,490	$ 3,147
Ash banded 200t/ha	108.9	16.8	15.5	$ 4,560	$ 2,022	$ 2,538

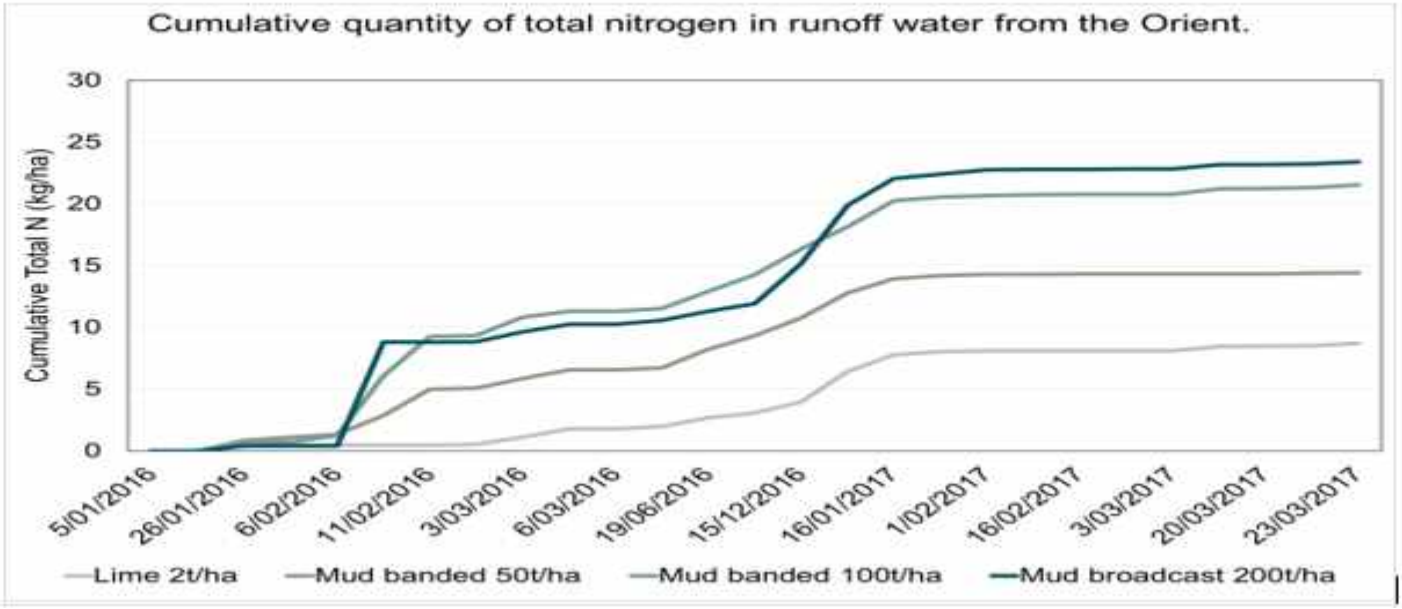
*Cost of ameliorant, land prep, harvesting

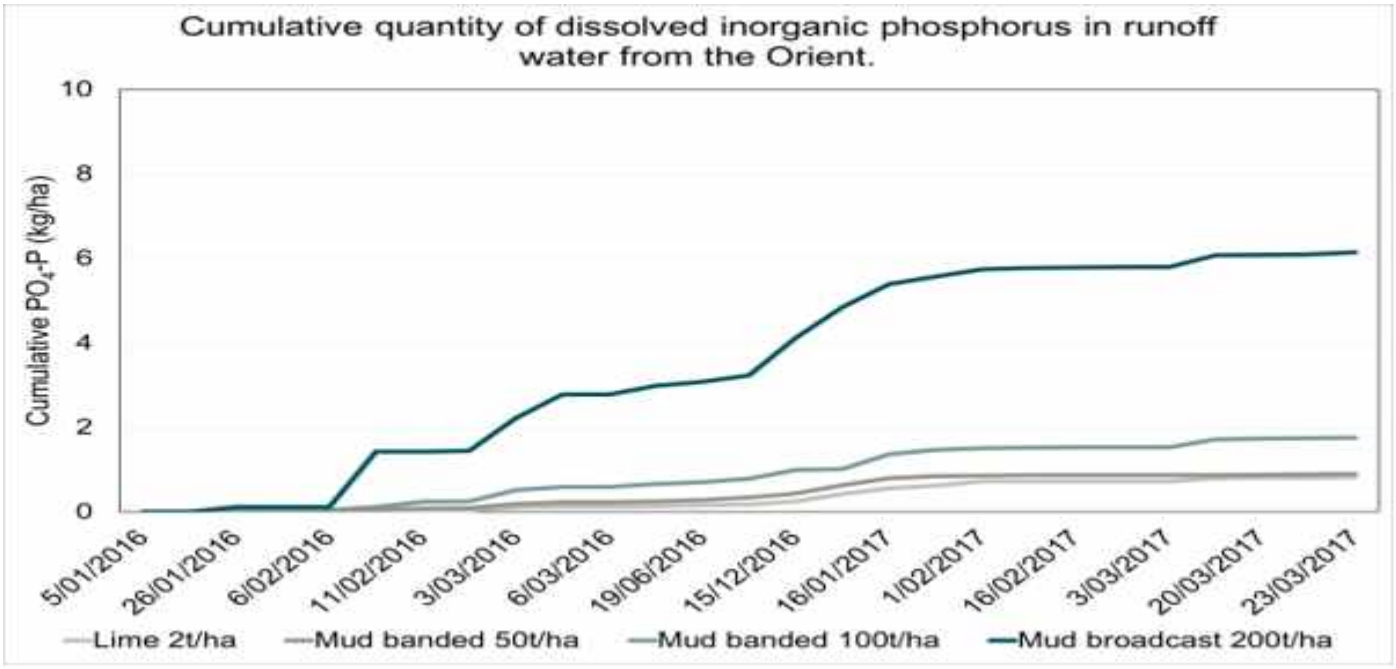
Sugar price	400	$
Constant	0.6353	
Levies	0.518	$/t
Harvesting cost	8.5	$/t
Mud cost/t delivered	5	$/t
Ash cost/t delivered	5	$/t
Lime	134	$/t
Extra operation cost	40	$/ha

Yield & Sugar Data for Plant Cane 2017



Water Quality Data for 2017 - Mud treatments



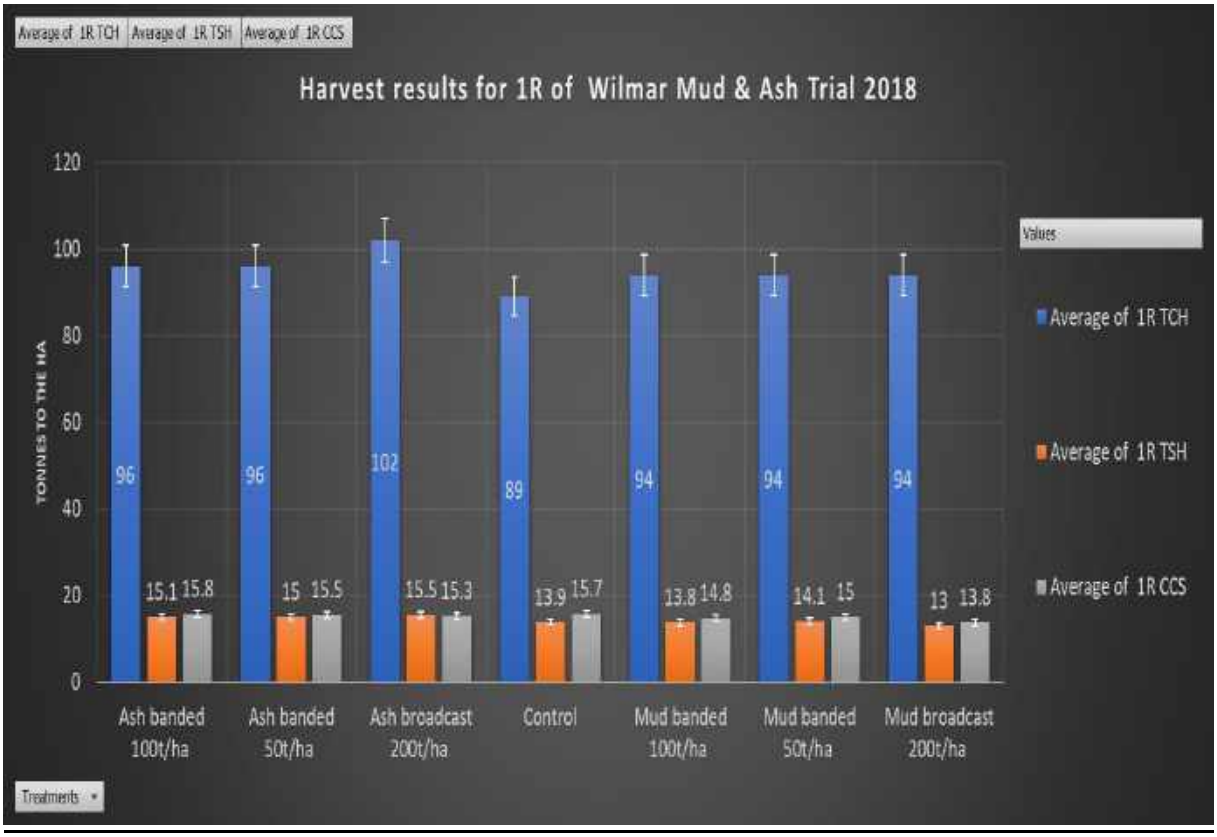


2018 Season Results

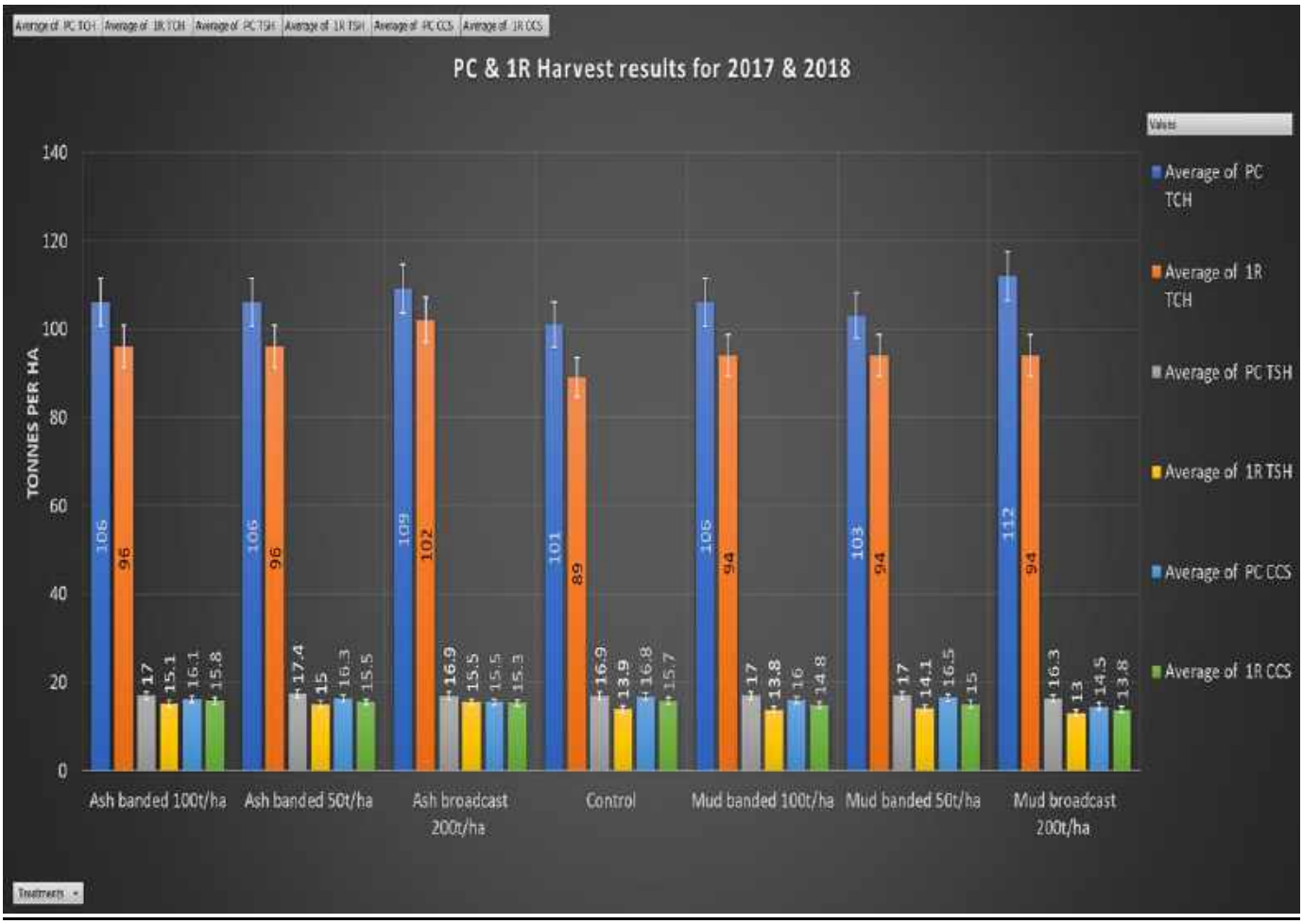
2018 Economic results

	CCS		TCH		TSH		Revenue to date	Total extra expenses to date	Gross margins to date
Treatments	**PC**	**1R**	**PC**	**1R**	**PC**	**1R**	**PC & 1R**	**PC & 1R**	**PC & 1R**
Control	16.8	15.7	101	89	16.9	13.9	$8,512	$1,843	$6,669
Mud banded 50t/ha	16.5	15	103	94	17	14.1	$8,498	$2,201	$6,297
Mud banded 100t/ha	16	14.8	106	94	17	13.8	$8,345	$2,474	$5,871
Mud broadcast 200t/ha	14.5	13.8	112	94	16.3	13	$7,715	$3,040	$4,675
Ash banded 50t/ha	16.3	15.5	106	96	17.4	15	$8,852	$2,254	$6,598
Ash banded 100t/ha	16.1	15.8	106	96	17	15.1	$8,781	$2,254	$6,289
Ash broadcast 200t/ha	15.5	15.3	109	102	16.9	15.5	$8,775	$3,077	$5,698

2018 Yield & Sugar Data for 1st Ratoon



Plant cane & 1st ratoon summary of yield and sugar data

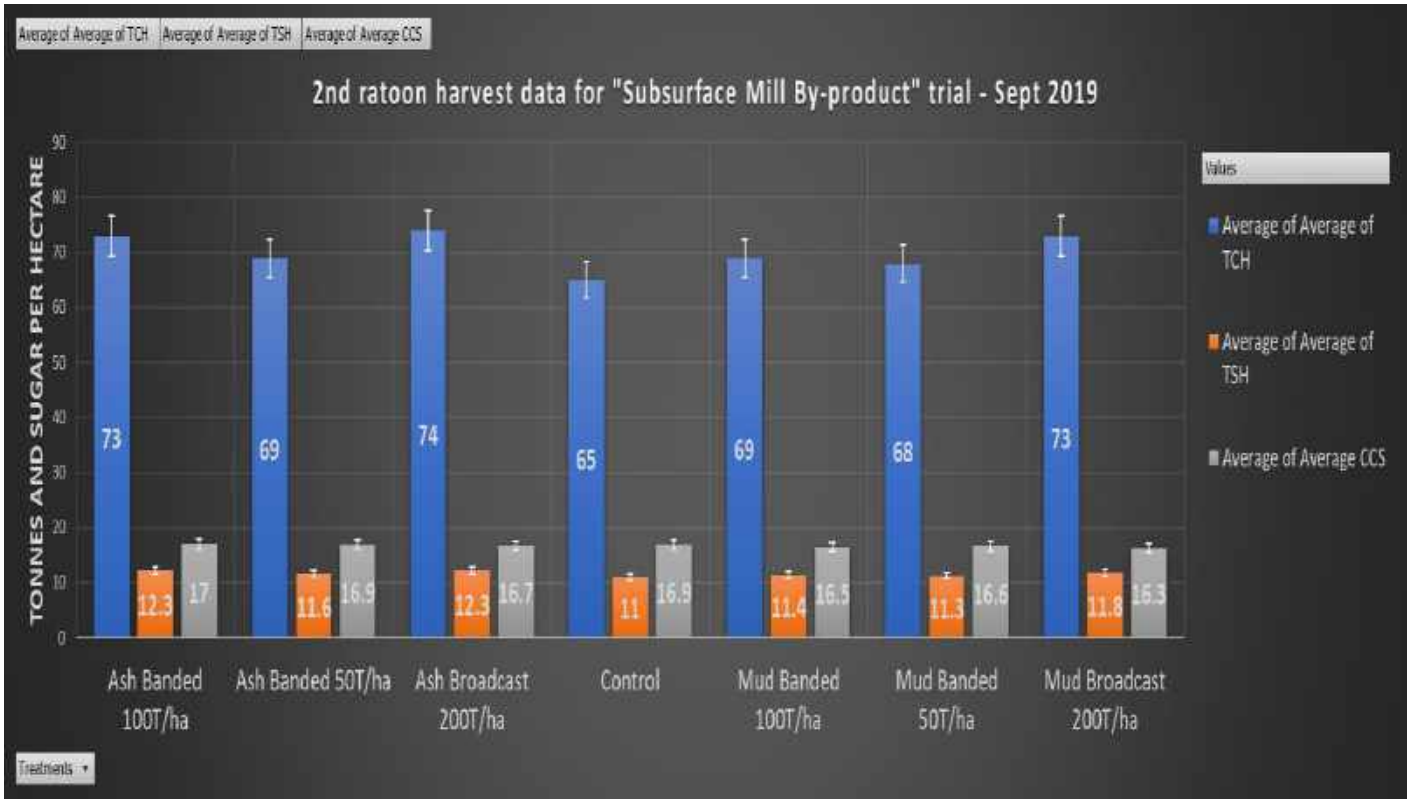


2019 Season Results

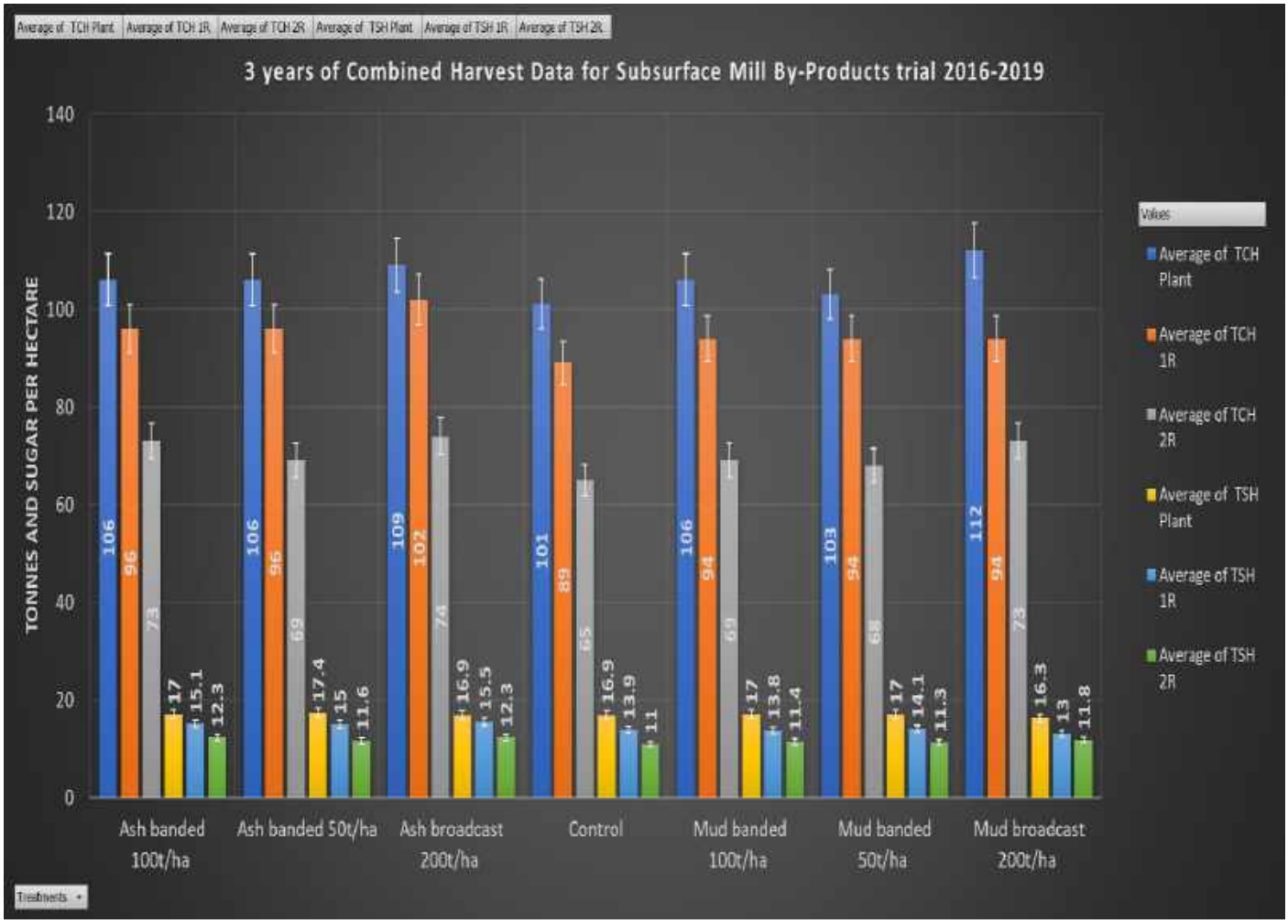
2019 Economic Results for 2R crop

Treatments	Average of TCH	Average of TSH	Average CCS	Average Revenue $$	Average Gross Margin $$
Control	65	11	16.9	3064	976
Mud Banded 50T/ha	68	11.3	16.6	3139	1025
Mud Banded 100T/ha	69	11.4	16.5	3146	1024
Mud Broadcast 200T/ha	73	11.8	16.3	3255	1098
Ash Banded 50T/ha	69	11.6	16.9	3240	1118
Ash Banded 100T/ha	73	12.3	17	3443	1286
Ash Broadcast 200T/ha	74	12.3	16.7	3426	1260

2019 Harvest results. 2nd Ratoon data



Combined harvest data over 3 year



2020 Season Results

2020 Economic Results for 3R crop

Treatments	Average of TCH	Average of TSH	Average CCS	Average Gross margin ($)
Control	44.8	6.51	14.53	1314
Mud Banded 50T/ha	42.8	6.06	14.17	1193
Mud Banded 100T/ha	48.3	6.81	14.10	1335
Mud Broadcast 200T/ha	48.4	6.49	13.42	1222
Ash Banded 50T/ha	52.3	7.73	14.78	1582
Ash Banded 100T/ha	51.8	7.56	14.6	1524
Ash Broadcast 200T/ha	62.1	8.76	14.10	1733

Economic Results for P, 1R, 2R, 3R crops combined

Treatments	Average Gross margin ($) over the cropping phase
Control	8959
Mud Banded 50T/ha	8515
Mud Banded 100T/ha	8030
Mud Broadcast 200T/ha	6995
Ash Banded 50T/ha	9298
Ash Banded 100T/ha	9099
Ash Broadcast 200T/ha	8691

Conclusions and comments

2017 & 2018 Conclusion: The trial has two years of harvest and economic data currently. So far, the data suggested that 50T/ha of either Mud or Ash is the sweet spot for gaining results in yield and sugar per hectare as well as being economically sound. The water quality data suggests that there is a greater reduction in nitrogen and phosphorus runoff at 50t/ha banded compared to the conventional practice of 200t/ha broadcast. To summarise the data so far, it would predict that 50t/ha banded subsurface can be achieved, have benefits to the crop and be an economically sound practice.

2019 Conclusion: The trial results suggest to date that between 50T/ha and 100T/ha banded of either the mud or ash products are the sweet spot for yield, sugar and economic value. The control plots are statistical down compared to the other treatments that had mill by-product applied.

2020 Conclusion: The trial results concluded that the broadcast application of ash had the highest gross margin. Interesting the mud broadcast 200T/ha treatment continues to have the lowest CCS throughout the trial in every year. All mill ash treatments had significantly higher cane and sugar yields when compared to the mill mud treatments. It must be noted that the 2020 crop was severely impacted due to drought.

Photo above- Wilmar Herbert farm manager- Cameron Barber standing between a mill ash (left) treatment and a control treatment plot (right) in the trial. Note difference in cane yields. Photo taken 6 April 2020.

Overall Conclusion at the end of the project period:

Over the whole cropping period (P, 1R, 2R, 3R) the Ash Banded 50T/ha had the best gross margin compared to all other treatments. There is potential for the rate of mill by-products to be reduced without negatively effecting yield.

The areas that normally would not get access to mill by-products can now potentially utilise this great organic product for the industry because it could be cost effective to apply these products at lower rates than previous undertaken by industry.

It must also be noted that mill mud treatments had lower CCS levels compared to the control and ash treatment in most years. Further investigation is required to investigate why and to develop management strategies to manage this issue.

Overall, this trial has been successful achieving improved water quality outcomes and improving cane yield compared to the control treatment. The water quality data clearly shows that as mill mud application rates increases so does the amount of nitrogen and phosphorus detected in water monitoring samples. The data also shows that sub-surface application of mill mud has a positive benefit on managing phosphorus run off.

Advantages of this Practice Change:

Banding mill by-products via sub-surface application reduces the rate that it is applied, reducing the amount of nitrogen and phosphorous applied to the paddock, thus reducing the amount of these nutrients that may leave the farm in run off. This is especially important considering the proximity of the Herbert river catchment to the Great Barrier Reef.

Traditionally, only growers that are close to the mill can afford mill by-product applications due the high rate that it is applied and the wet weight of the product. By banding mill by-products subsurface into the planting line, rates can be reduced. This may increase the number of growers that will be able to afford mill by-product applications.

Disadvantages of this Practice Change:

There still needs to be more work done on applying the product subsurface. There were initial issues with getting the mud and ash deep enough into the soil profile to minimise nutrient runoff opportunities and to get the products deeper into the root zone of the plant (especially on sodic soils).

Will you be using this practice in the future?

Yes, but refining the application equipment is ongoing.

Since the project inception Wilmar have built the above mounder renovator used in the Herbert. This implement is used in the mounding up after mill by-product application and prior to planting. The use of this implement is now used across the Wilmar farms in the Herbert.