Research Topic 1: Site Selection Layout and Drainage

Research Topic 5: Management of Erosion and Sedimentation

Research Site/Demonstration Number: SA01SEQ-01 and SA05SEQ-01

Grower Collaborator: Piñata Farms – Wamuran

Location 1: Pates Road, Wamuran

Start date: February 2019

Outline:

To evaluate:

1) the benefits of farm planning to better identify surface water flow to reduce / mitigate soil erosion and
2) effectiveness of surface stabilisation practices on soil erosion with moderate to high erodible soils.

Objectives:

1) Phase 1: Improve farm planning practises to identify and better implement manage strategies which mitigate surface water run-off.

2) Phase 2: To improve the methodologies of implementing surface stabilisation practices to better manage soil erosion.

    a. living surface covers (living mulch)

    b. synthetic surface covers (geo polymers)

3) To understand the impact of erosion on mechanically controlled / isolated compaction.

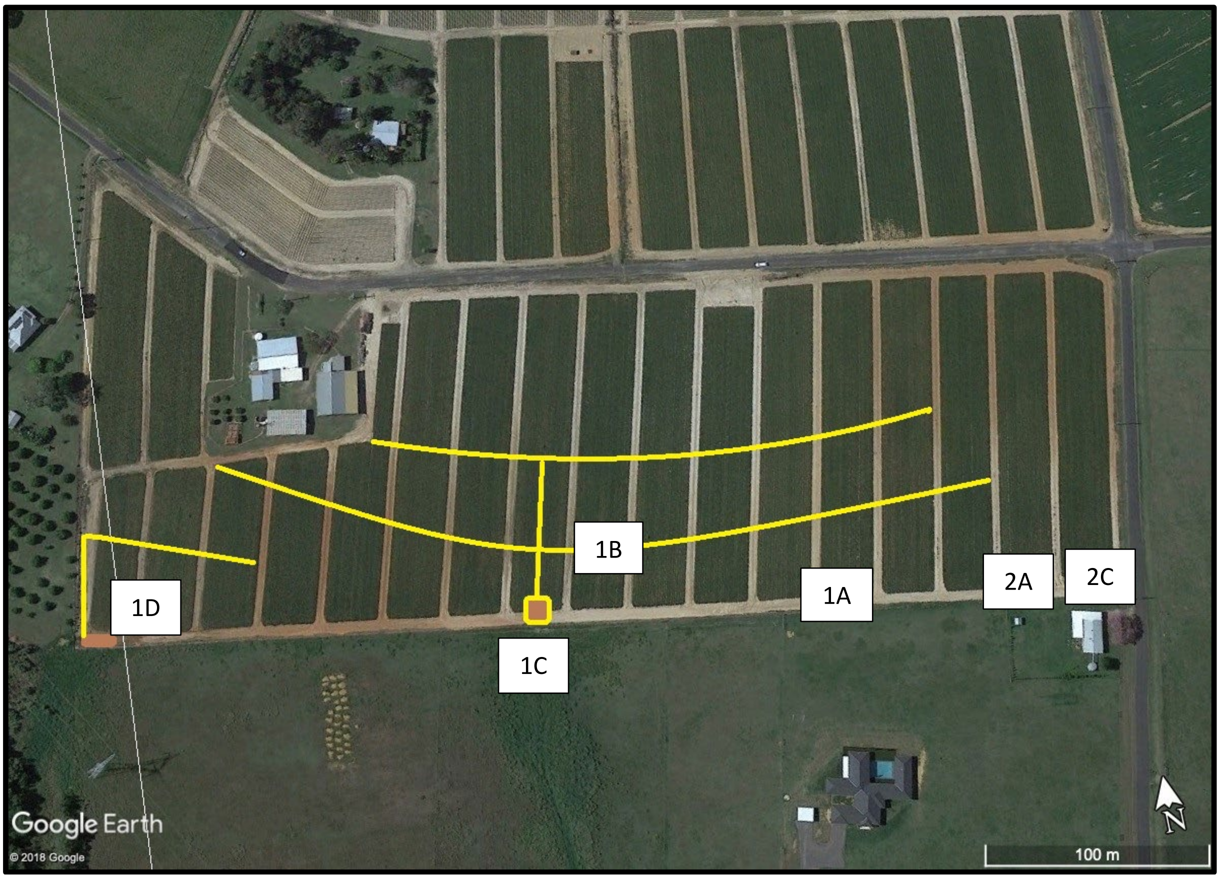
4) To reduce in-field soil erosion in highly erodible soil types.

5) To undertake a cost analysis of implementing soil erosion practices.

Methodology:

The trial site has followed a previous crop of 73-50 hybrid which was only taken to plant crop due to poor health. The previous crop harvested below industry standards in Spring 2018 with major issues of *Phytophthora* root rot, nematode, black beetle/white grub and natural flowering.

The soil was prepared to standard industry conditions with good soil tilth, no crop residue and good soil moisture with a soil pH of 4.3. The average slopes of the block are 2 - 3%. The block was established with industry standard herbicide practices which included a pre-plant incorporation and post plant drench immediately after planting.



Phase 1: Trial map – Pates Road Wamuran
(the yellow lines indicate the position of the contour banks)

Phase 1 - Demonstration Practice:

Demonstration Number	Demonstration
Treatment 1 (ABCD)	In-field surveying of contour banks/drains and strategically located silt traps and bioreactor. Monitoring and evaluation of soil erosion at: • Sample Point 1A: in field • Sample Point 1B: contour drains • Sample Point 1C: silt traps • Demonstration 1D: bioreactor
Treatment 2 (AC)	Standard Practices - no contour drains / banks Monitoring and evaluation of soil erosion at: • Sample Point 2A: in field • Sample Point 2C: silt traps

Assessment/Evaluation Method and Delivery Schedule:

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Soil erosion (t/ha) – edge of field	0 to 42 months
Soil erosion (t/ha) – within contour drain	0 to 42 months
Soil erosion (t/ha) – silt trap	0 to 42 months
Nitrogen (ppm) – bioreactor	0 to 42 months
Cost analysis ($/ha)	42 months

Trial location prior to contour draining/soil opened up with plough to assist drying out.

Results:

The initial results have indicated contour drains are highly successful in mitigating soil erosion and off-farm deposition. After the first rainfall event of 20mm, the contour drains/banks and silt traps reduced soil movement and erosion in comparison to the control treatment.

Initial assessment results	Treatment	Control
Soil erosion (t/ha) – edge of field	1.8	8.4
Soil erosion (t/ha) – within contour drain	0.9	NA
Soil erosion (t/ha) – silt trap	3.4	16

In-Field Erosion: Contour Drain vs Standard Practices

Contour Drains 3 months

Contour Drains 9 months

Erosion standard practices

Over the last six months, the treatments with contour drains have had substantially less erosion than standard practices. This can be seen in the amount of soil erosion captured in the contour drains and silt traps (refer to table of results). The soil captured in the contour drains can be easily cleaned out using a grader at any point in the growing cycle of the crop. The width of the contour drains is wide enough to be accessed by a grader. The soil in the contour drain can be shifted onto the contour bank. The great advantage of the contour drains has been to maintain the majority of the soil within the confines of the block.

Silt from Contour Drains

Erosion after first rainfall

Erosion after 16 months

	Treatment	Control
Soil erosion (t/ha) – edge of field	33	87
Soil erosion (t/ha) – within contour drain	11	NA
Soil erosion (t/ha) – silt trap (out-field)	41	104

Surface Flow Bio-reactor

Bio-reactor after setup

Erosion after first rainfall

Erosion after 16 months

<u>Demonstration Practice Phase 2A:</u>

Treatment_Number	Treatment
<u>Treatment 1</u>	Living mulch treatments: 1) 25kg oats 2) 25kg rye grass Combined with controlled mechanical compaction with narrowed tractor tyres.
<u>Treatment 2</u>	Standard Practices - no ground cover

Two different living mulch species were planted, rye grass and oats 6 weeks after planting. Planting of the living mulch involved an initial tillage operation with a tine into the inter-row to a depth of 10cm to open a furrow. Seed was then planted by hand. A second tillage operation with the tine and then a final pass compressing the inter-row with the tractor tyres. The treated rows were 100m in length.

Opening the planting furrow

Seeding the inter-row space and burying seed/controlled compaction

Assessment / Evaluation Method and Delivery Schedule:

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Soil erosion (t/ha) – edge of field	Quarterly over 0 to 42 months
Cost analysis ($/ha)	42 months

Progress Report

Current Progress:

Phase 1 and Phase 2A

February 2019
Grower identified
Site selected
Trial planned

March 2019
Block cultivated
Pre-plant pesticide and nutrition applied

April 2019
Bed-formed
Site planted
Treatments planted

July 2019
Erosion assessed.

Phase 2B

January 2020
Planned modifications to the current industry standard sprayer.

January 2021
Modifications to the current industry standard sprayer complete

May 2021
Application of Phase 2B treatments

Issues Encountered: Constant rainfall disrupting land preparation during establishment of block. The site has subsequently been relatively dry for the majority of the trial period.
Other notes: The site also supports a fumigation trial.

Results:

Phase 2A - Soil stabilisation with living mulch

The initial results have indicated that living mulch can be planted with moderate success into pineapple fields that have been treated with industry standard herbicide programs. Both rye grass and oats was able to establish into a soil with herbicide residue present. However, growth was limited to 10 – 15cm before the living mulch died. This also coincided with the first rainfall event of 20mm.

The vegetative mass/cover of both living mulch crops was able to stabilise the soil to a moderate degree. In this case, the oats were more successful than the rye grass.

The addition of mechanically controlled compaction (tractor tyres) in the inter-row further assisted the living mulch seed to establish but also supported stabilisation within the highly erodible areas of the furrow. The compaction from the tractor tyres and the pattern of the tread assisted the minimisation of soil erosion.

Prior to the first sampling the site received 20mm rainfall over a four-hour period.

Soil Stabilisation – Living Mulch (2 weeks after planting)

Rye grass (left), oats (right)

After 20mm rainfall:
(left) high erosion where there was no ground cover, (right) low erosion in the presence of living mulch

The amount of soil eroded from each treatment was measured by laying 10m lengths of plastic at the ends of the rows that was wide enough to collect the eroded soil. 10m was enough to collect all the soil that washed out of the ends of the inter rows and after the rain event the soil on the plastic was collected and weighed.

Treatment	Amount of Soil Eroded (kg)
Rye grass	6.4
Oats	5.5
Nil	16.0

Note: Sampled July 2019 – total rainfall at that time 20mm

After 4 months the living mulch has died from the effects of the standard herbicide treatment

Even after the living mulch had died, the vegetative matter remains and continues to stabilise the inter-row minimising erosion. However, the vegetative matter within the rye grass area was minimal. Soil erosion measured in the rye grass area was marginally more than the well-established oats. The controlled compaction in both treatments has most likely had a major impact on the soil erosion.

In conclusion, the amount of soil erosion within the living mulch does not meet erosion targets. However, the living mulch generates a better result then standard practices of no ground cover / bare soil.

<u>Phase 2B – Synthetic Surface Cover (Geo polymers)</u>

The conclusions from phase 2A can now be used to plan phase 2B. The main learning from phase 2A is the impact of controlled compaction in the inter row using the tractor tyres / trend pattern. Secondly, living mulch planted in the inter row reduced soil erosion compared to standard practices (bare soil). However, the levels of soil erosion in the living mulch did not meet target requirements.

Phase 2B will consist the practice of control compaction in the inter row using the tractor tyres / tread pattern in combination with the application of Geo-polymers. The spraying of Geo-polymers requires precision application onto the inter row. This application will be done through modifications to current spray equipment.

Current industry spray equipment to be modified.

The above equipment will be fitted with multiple sets of spray jets. Each set of spray jets will consist three high volume hydraulic nozzles. The nozzles will be arranged in a unique pattern spraying the bottom of the inter row and both sides of the seedbed. Each set of spray jets will be located at the back of the sprayer and follow behind the wheels of the tractor.

The practice will consist controlled compaction in the inter row using the tractor tyres / tread pattern in combination with Geo-polymers. This will compact and create a harden crust on bottom and sides of the inter row to minimise the erosion from its source (sides of the bed) and slow water velocity moving through the inter-row space.