Research Topic 1: Site Selection Layout and Drainage

Research Topic 5: Management Erosion and Sedimentation

Research Site/Demonstration Number: SA01WB-02 and SA05WB-02

Grower Collaborator: Littabella Pines

Location 2: South Littabella Road, Yandaran

Start Date: April 2019

Phase 1

Outline: To evaluate the use of aerial imagery, topographic maps and/or in-field surveying to establish better layout of pineapple blocks incorporating contour drains and other erosion management practices to mitigate off-farm deposition in moderate to heavy soil types.

Objectives:

1) To compare the different methodologies of implementing better farm layout practices using aerial imagery, topographic maps and/or in field surveying.

2) To reduce off farm deposition of moderate to highly erosible soil types.

3) To improve surface water flow and soil drainage reducing key pest issues such as *Phytophthora* root rot.

4) To increase yield in plant and ratoon crops.

5) To identify additional advantages to keeping soil in-field and positive effects on cost of production.

Phase 2

Outline: To evaluate the benefits of different erosion products and practices in-field and out-field to manage surface and subsurface off-farm deposition in low to medium textured soil types and slopes.

Objectives:

1) To improve the methodologies of implementing better surface and sub-surface erosion practices.

2) To evaluate different anti-erosion products and their impact on mitigating soil erosion.

3) To identify additional advantages to maintaining soil in-field and positive effects on cost of production.

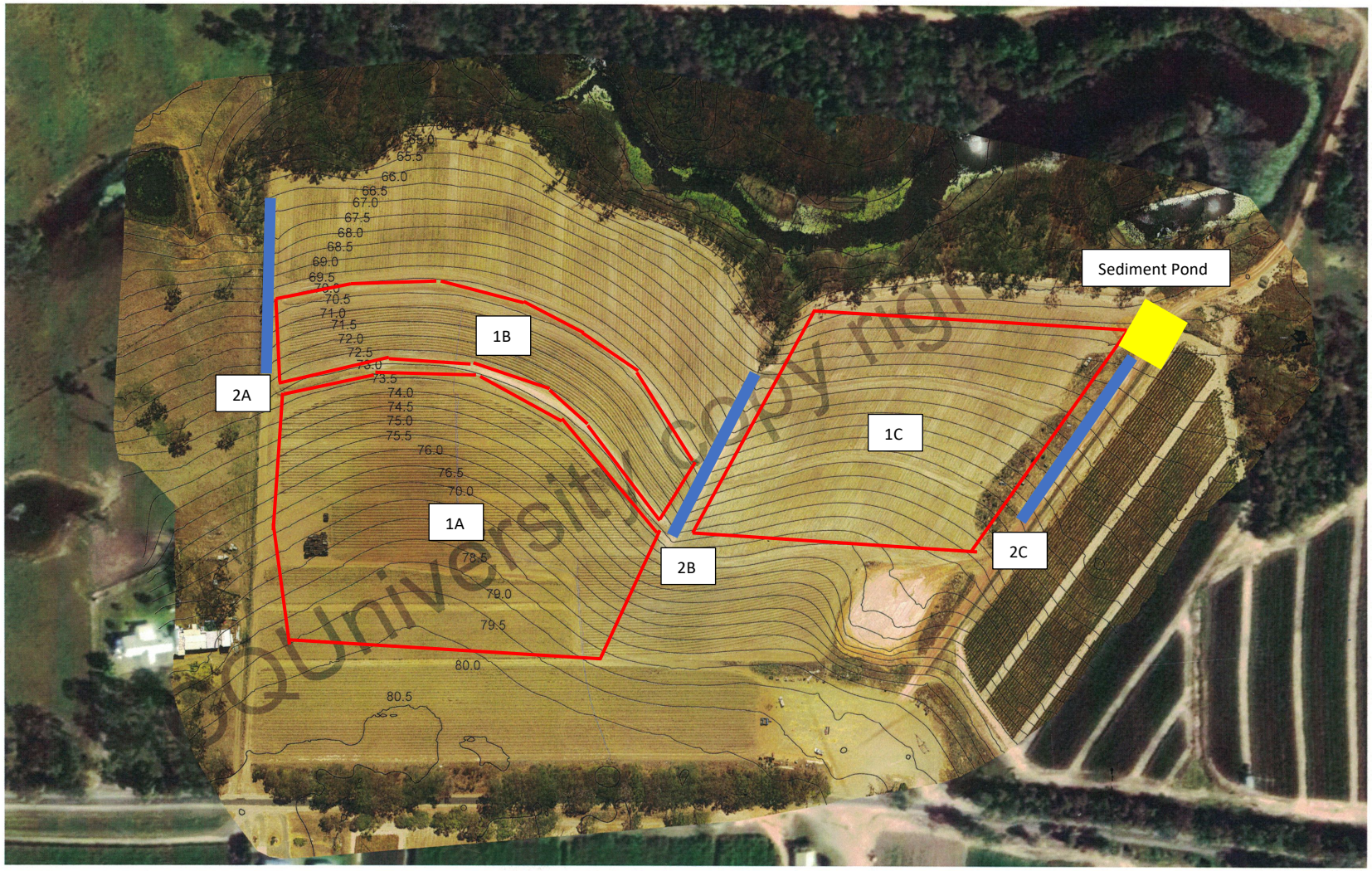
4) To evaluate methodologies for capturing, managing and treating surface water to reduce the loss of soil, pesticides and nutrients.

Methodology:

The trial site is strategically located draining into Littabella Creek and subsequently into a High Environmental Value (HEV) area – the Great Barrier Reef Marine Park.

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.

Trial site - prior to treatments



Contour map of trial location (image courtesy of Central Queensland University).

Phase One

Aerial imagery taken from a drone (courtesy of the University of Central Queensland) was used to survey the site for three different field layouts:

Treatment 1A - beds planted up and over slopes with no contour banks (standard practice),

Treatment 1B– beds planted to contours on 1-2% slope, and

Treatment 1C – beds planted down slope separated by contour drains / banks on 1-2% slope.

Field Layouts 3 months after planting

Treatment 1A (standard)

Treatment 1B

Treatment 1C

Phase Two

Aerial imagery taken from a drone was used to survey the site for three different primary drainage locations and layouts:

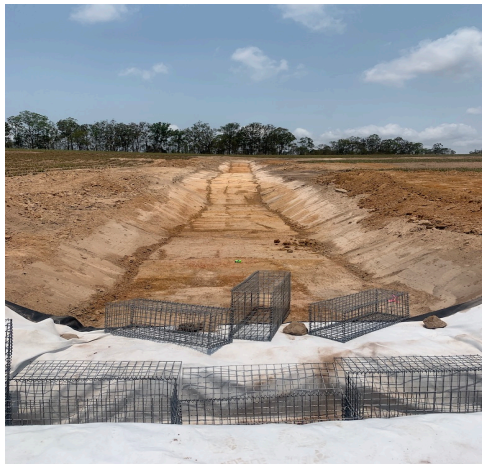
Treatment 2A – open drain with no ground cover with a silt trap located at the bottom (standard practice),

Treatment 2B – open drain with Geofabric as ground cover, segregated by gabian basket levy banks with a silt trap located at the bottom,

Treatment 2C – open drain with Dute Mesh as ground cover planted with vegetation with a silt trap located at the bottom.

Treatment 2B

Prior to installation



Completed earthworks of drain

Gabian basket levy bank

Eroded soil after first rainfall event

Soil after initial clean out

Covered drain at 12 months

Treatment 2C

Prior to installation

Completed earthworks of drain

Dute Mesh and cropped with sorghum

Assessment / Evaluation Method and Delivery Schedule:

Phase 1

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Rainfall and intensity	Over a period of 0 to 42 months
Soil erosion (t/ha) – edge of field	Post rainfall events monitored over a period of 0 to 42 months
Cost analysis ($/ha)	12 months

Phase 2

Assessment and Evaluation Method	Assessment and Evaluation Delivery Schedule
Rainfall and intensity	Over a period of 0 to 42 months
Soil erosion (t/ha) – within primary drains	Post rainfall events monitored over a period of 0 to 42 months
Soil erosion (t/ha) – silt trap	Post rainfall events monitored over a period of 0 to 42 months
Cost analysis ($/ha)	12 months

Progress Report:

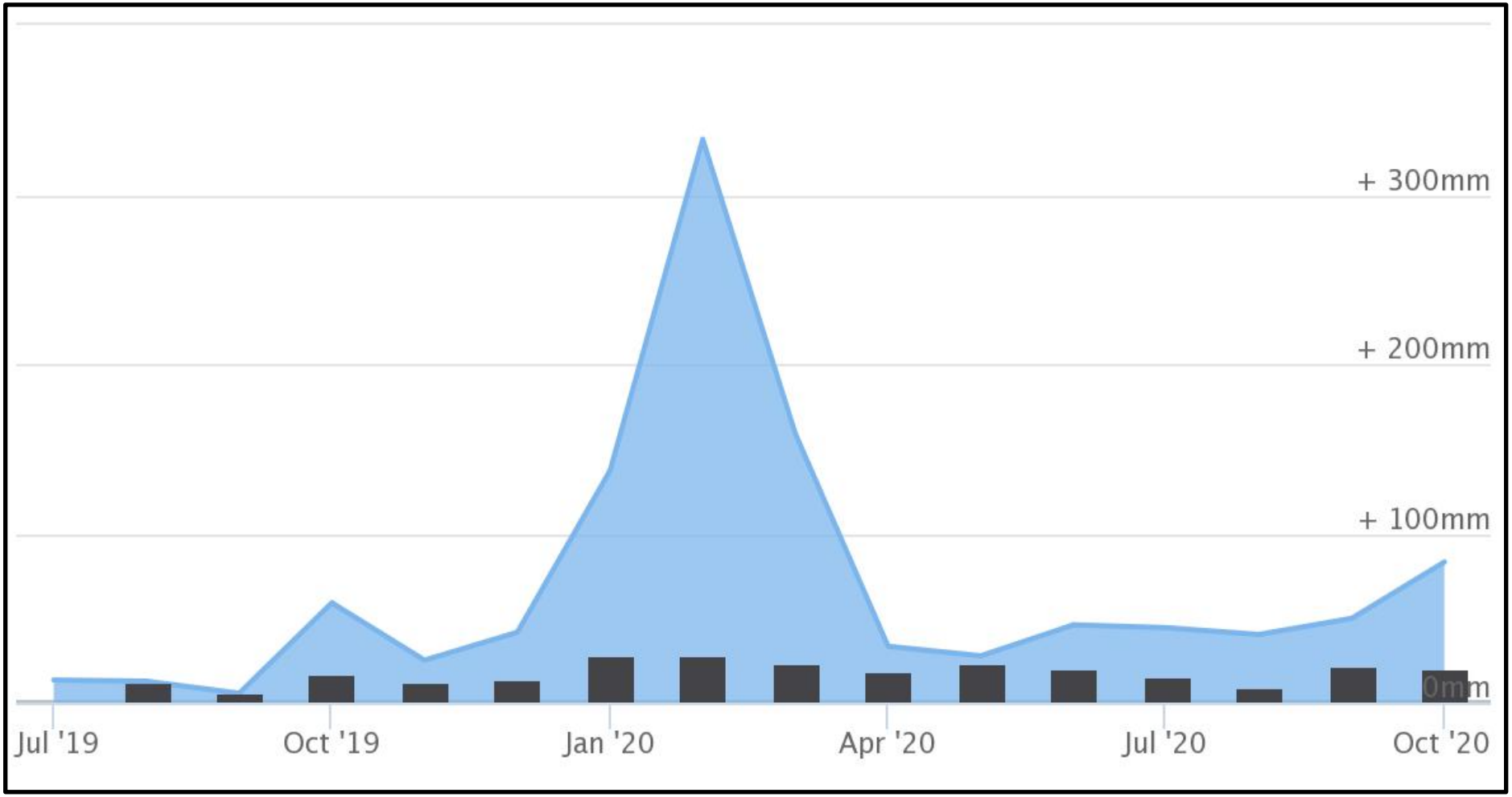
May 2019 Block was land prepped Pre-plant pesticide and nutrition applied June 2019 Bed-formed Initial demonstrations applied. Site planted Oct 19 Treatments were installed Feb 20 First Major Rainfall event First assessment – Phase 1 Observations - Phase 2 Oct 20 Second Major Rainfall event First assessment – Phase 1 Observations - Phase 2
Issues Encountered: There have been only two major rainfall events throughout the duration of this research site. Both separated by 6 months of dry conditions.
Other Notes: Site has been selected for its strategic location – it drains into Littabella Creek which runs into the nearby ocean with the Great Barrier Reef off-shore. Staff are collaborating with Growcom and DAF with on-farm initiatives in this trial.

Results:

Phase 1

Soil erosion levels were measured using metal troughs buried at the edge of the pineapple fields in each treatment. Two metres of plastic sheeting were laid on the surface of the ground and seed beds leading into the troughs. The plastic sheeting allowed unobstructed flow of water and sediment directly into the troughs. The troughs captured water at each rainfall event and once the water had evaporated the sediment remained in the trough. From the period of April 2019 to November 2019 there were no rainfall events. However, from late December 2019 to April 2020 a significant number of rainfall events occurred throughout this period. The next 6 months there was little rainfall and no major rainfall events until October 2020.

Yandaran Rainfall Data



The following results are erosion measured in equivalent tonnes per hectare:

Treatment	February 2020
1A - Standard	86.2
1B - Contour planting	26
1C - Contour Bank	55

Key Points:

- Significantly high amount of soil erosion in the standard practices, lowest soil erosion in pineapples planted along the 1% contour and moderate to high levels soil erosion in the treatment with pineapples planted down slope separated by contour drains / banks.

- Both standard and pineapples planted along the 1% contour treatment - soil erosion was captured on the edge of field (outside the block).

- The treatment with pineapples planted down slope separated by contour drains / banks sediment was captured within the block by the contour banks / drains.

- Clear, visible signs of waterlogging were observed in the treatment with pineapples planted along the 1% contour which would lead to issues of phytophthora root rot.

Treatment 1A - initial rainfall event with high amounts of sediment.

Treatment 1B - low amounts of sediment and water logging in field

All Treatments – summer to spring 2020 minimal sediment captured

Phase 2

Treatment 2A

Treatment 2A consisted industry standard practices with no coverage or stabilisation of the drain. Observations over the 12 month period indicated severe scouring has occurred 40 - 60cm down to the hard rock and clay layers within the soil profile. The drain has had no capacity to retain any sediment and will continue to scour further over future rainfall events. A reinforced silt trap at the bottom of the drain was constructed to capture sediment but has not had the capacity to retain all of the erosion coming off the catchment area. High levels of sediment have overflowed the silt trap and left the farm.

Standard practices - scouring within drain at 12 months

Treatment 2B

Treatment 2B consisted an open drain stabilised by Geofabric, segregated by gabian basket levy banks with a silt trap located at the bottom. The catchment area emptying into this drain is from beds planted up and over slopes with no contour banks (standard practice). Within this treatment a high level of erosion from the catchment area has been contained within the drain. The containment of the sediment has primarily occurred above each of the gabian basket levy banks.

Sediment captured in primary drain

Sediment removed from primary drain

Treatment 2C

Treatment 2C consisted an open drain stabilised by Dute Mesh as a ground cover then planted with a vegetative crop of sorghum. The drain then emptied into a sediment pond at the bottom. The catchment area emptying into this drain consisted beds planted down the hill separated by contour drains. Within this treatment moderate levels of sediment were captured in the drain, however a good volume of sediment over-flowed into the sediment pond.

Fully Grown Sorghum

Eroded soil captured on Dute Mesh

Vegetated drain at 12 months

Note: The volume of sediment within each drain is yet to be calculated within the demonstration.