PATHWAYS TO WATER QUALITY IMPROVEMENTS IN THE MYRTLE CREEK SUB-CATCHMENT PROJECT

2019/2020 WET SEASON - SITE 1 CASE STUDY

SITE DETAILS

BLOCK SIZE: 3.6 ha

SAMPLED AREA: 2,955 m^2

ROW SPACING: 1.8 m

VARIETY: Q240(1)

CROP CLASS: 5R

HISTORICAL ANNUAL YIELD: 80 tph

SOIL TYPE:
Proserpine (deep sandy soil)

LOCATION IN SUB-CATCHMENT:
Foxdale

***(Below left) Figure 1** Fertiliser slot in Treatment 1 was covered following application; **(Below right) Figure 2** Fertiliser slot in Treatment 2 remained uncovered following application.*

NUTRIENT AND PESTICIDE APPLICATION DETAILS

Fertiliser application date: 7 August 2019
Herbicide application date: 16 November and 24 December

Treatment 1

- 480 kg/ha of GF SIDEDRESS 3 with ENTEC® (27-0-21-0).
  - Total N & P applied: 129 kg/ha N and 0.0 kg/ha P.
  - Applied by contractor A with Stool Zippas attached.

Treatment 2

- 480 kg/ha of GF SIDEDRESS 3 without ENTEC® (27-0-21-0).
  - Total N & P applied: 129 kg/ha N and 0.0 kg/ha P.
  - Applied by contractor B without Stool Zippas attached (chain used as slot closure mechanism).
- ENTEC treatment slows down the bacteria that convert ammonium to nitrate, holding nitrogen in the stable ammonium form for longer.
- High pressure overhead irrigation applied mid-October 2019. No run-off was generated from this irrigation.
- Block flood irrigated on 27 November 2019 and 10 December 2019. Run-off was generated from these irrigations.
- Contractor A and B both use a stool splitter fertiliser applicator.
  - Sub-surface fertiliser application.
  - Some sections of where the product was placed in Treatment 2 remained uncovered post-application which may have contributed to nitrogen loss via volatilisation (Figure 2).
- Imidacloprid has never been applied to this block.

Herbicide Applications:

- 2019:
  - 16 November (spray 1)
    - 1.2 L Gramoxone ® 250 (paraquat)
    - 1.2 L Agritone ® 750 (900 g/ha MCPA)
  - 4 December (spray 2)
    - 1.4 L 2,4-D Amine ® 625 (875 g/ha 2,4-D)
- 2018:
  - MCPA, paraquat

Tested for:

- Dissolved Inorganic Nitrogen
- Filterable Reactive Phosphorus
- MCPA
- 2,4-D

RUNOFF EVENT DATA

EVENT	DATES	DAYS FROM FERTILISER APPLICATION	DAYS FROM HERBICIDE APPLICATION (SPRAY 1 / SPRAY 2)
1 - irrigation	27 November 2019	112	12 / n/a
2 - irrigation*	10 December 2019	125	25 / n/a
3	28 to 29 December 2019	143	43 / 5
4	26 to 29 January 2020	172	72 / 34
5*	12 February 2020	190	89 / 51
6	15 February 2020	193	92 / 54
7	22 to 23 February 2020	200	99 / 61

* Event 2 and 5 only generated run-off for Treatment 2

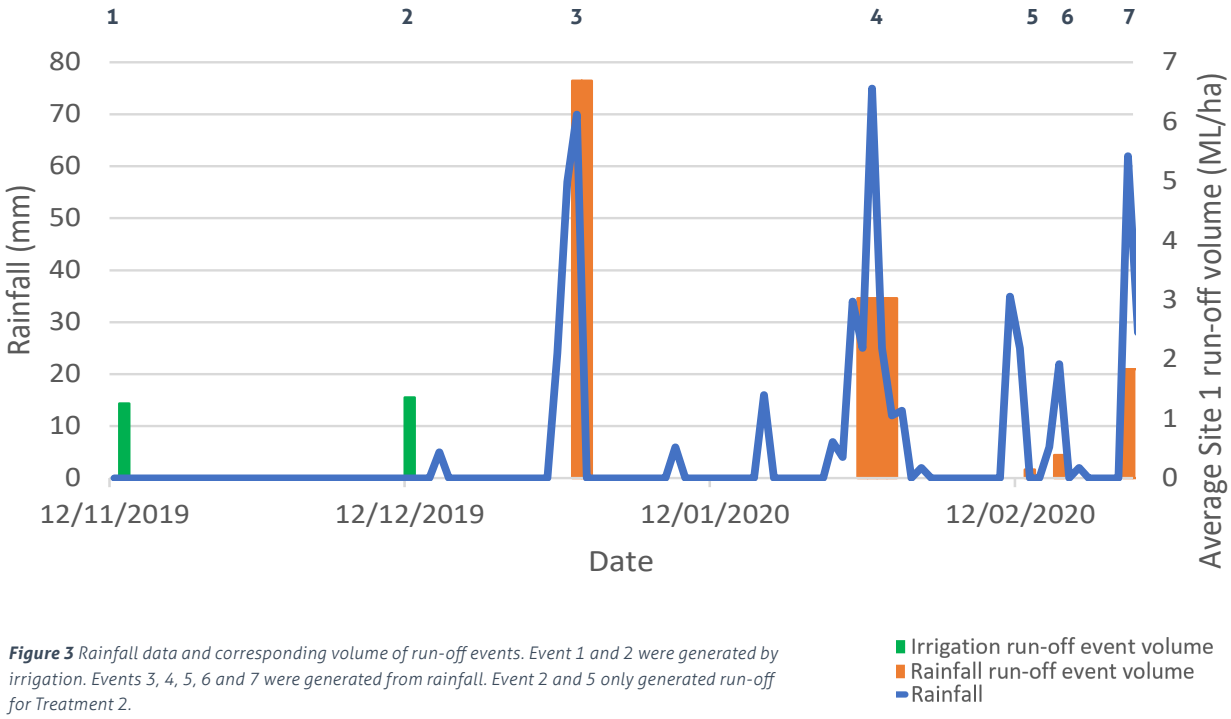

Figure 3 *Rainfall data and corresponding volume of run-off events. Event 1 and 2 were generated by irrigation. Events 3, 4, 5, 6 and 7 were generated from rainfall. Event 2 and 5 only generated run-off for Treatment 2.*

RESULTS

NOTE: Nutrient and pesticide concentrations and pesticide loads are estimates only. Freshwater aquatic ecosystem species protection values cannot be applied to paddock-scale monitoring. These values are referenced only for discussion. Phosphorus (P) concentrations are indicative and actual concentrations are likely to be slightly higher. *Treatment 1 did not trigger sampling in event 2 or 5.

DIN (Dissolved Inorganic Nitrogen)

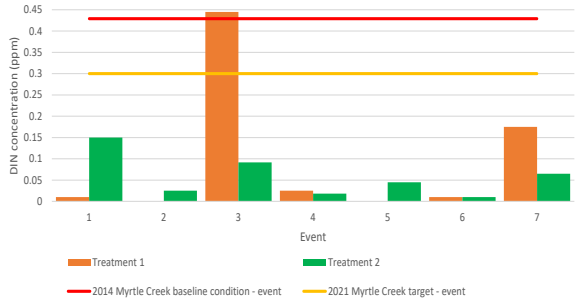

Figure 4: *DIN concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's DIN water quality in 2014 event conditions was 0.429 ppm and 2021 event target is 0.300 ppm, both for the Myrtle Creek. Provided for discussion only.*

FRP (Filterable Reactive Phosphorus)

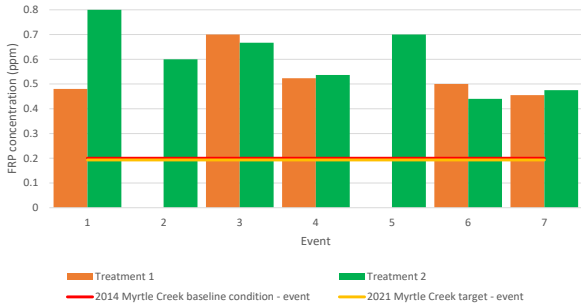

Figure 5 *FRP concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's FRP water quality in 2014 event conditions was 0.200 ppm and 2021 event target is 0.193 ppm, both for the Myrtle Creek. Provided for discussion only.*

2,4-D

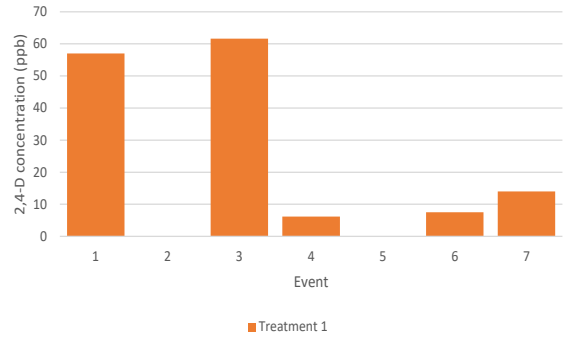

Figure 6: *2,4-D concentration in run-off (ppb) from Treatment 1. Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. 2,4-D value is 280 ppb (not shown). Provided for discussion only.*

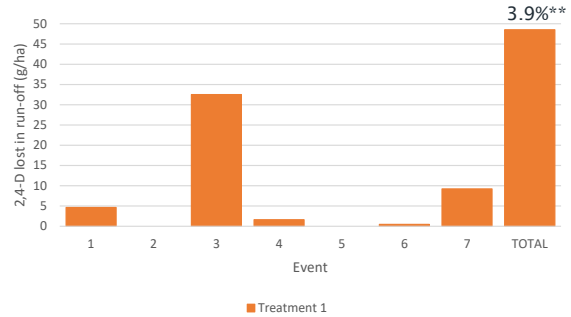

Figure 7: *Estimated 2,4-D in run-off (g/ha) from Treatment 1, calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of 2,4-D applied lost in run-off.*

***Please note 2,4-D had not been sprayed this season before event 1 and 2 and therefore product lost in event 1 and 2 does not count towards the total percentage lost.*

MCPA

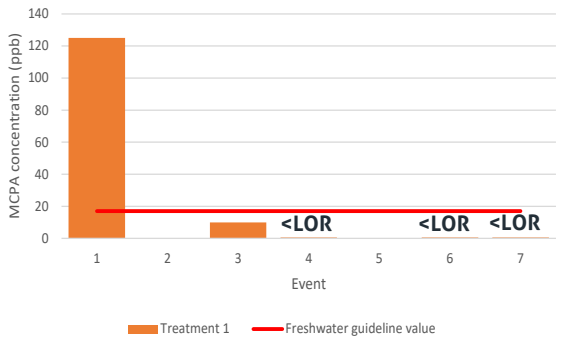

Figure 8: *MCPA concentration in run-off (ppb) from Treatment 1. Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. MCPA value is 17 ppb. Provided here for discussion only.*

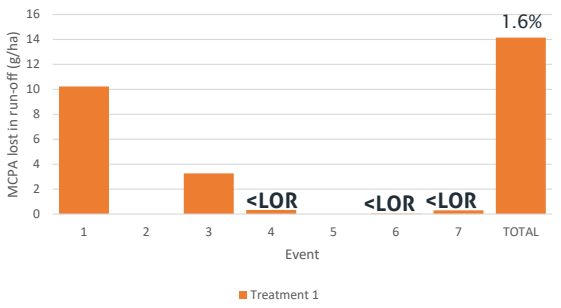

Figure 9: *Estimated MCPA in run-off (g/ha) from Treatment 1, calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of MCPA applied lost in run-off.*

<LOR - please note in this event concentrations were below the lowest observable reading (LOR) of the laboratory equipment. Concentration is provided as half the LOR.

DISCUSSION

Please note that all concentrations are estimates only. This is not a replicated research trial. Due to equipment limitations, water samples were unable to be collected for the entire events. This may result in actual concentrations being higher or lower than the estimates provided. The information is provided as a guide for comparison between treatments at this site only.

At this site there was significantly more run-off generated on Treatment 2 than Treatment 1. This may be due to a wheel track / old headland / pipe being located on Treatment 2, causing more run-off due to compacted ground. This may skew results, and not provide an accurate representation of nutrient and pesticide concentrations in run-off.

A slightly higher average concentration of DIN in run-off was observed in Treatment 1 (ENTEC®) than Treatment 2. However, due to significantly more run-off on Treatment 2, DIN concentrations may be diluted. Loads (g/ha of nutrient) are not provided due to the unpredictable nature of nutrient run-off. ENTEC® helps to protect against unpredictable weather and is often used based on the farmers weather prediction of the coming season. Due to limited waterlogging and denitrifying situations at this site this season, it is expected that the difference in nitrogen loss would be small.

DIN concentrations are generally below the Mackay Whitsunday Water Quality Plan's DIN water quality in event current conditions (2014) and 2021 event target for the Myrtle Creek. Whilst paddock-scale run-off cannot be directly compared, this indicates a positive result.

No P was applied at this site this year. However, P was still detected. This is likely due to historical applications of high rates of P via mill mud.

High 2,4-D and MCPA losses may be skewed by large run-off losses in Treatment 2. Hence, for 2,4-D and MCPA, only Treatment 1 is provided.

Paddock-scale concentrations of pesticides would be expected to be of higher concentrations than in-creek concentrations due to scale and dilution.

Previous research shows losses of 13% of many applied herbicides if run-off occurs after 48 hours (this excludes pendimethalin and flumioxazin which have significantly lower losses due to the ability to bind to soil particles/lower solubility: see The Pesticide Risk Matrix handout for more information) (Fillols, E 2018). This suggests that application rate is the major influence on losses.

REFERENCES / FURTHER INFORMATION

The Pesticide Risk Matrix - Attachment 1

Run-off Loads Compared to Application Rate. Fillols, E 2018.

Mackay Whitsunday Water Quality Improvement Plan 2014-2021. Folkers, A., Rhode, K., Delaney, K. & Flett, I. 2014.

FOR FURTHER INFORMATION PLEASE CONTACT

Molly O'Dea **E** mo'dea@sugarresearch.com.au **M** 0439 619 082

The Pathways to Water Quality Improvement in the Myrtle Creek sub-catchment project is funded by the Queensland Government's Reef Water Quality Program and delivered by Sugar Research Australia and Sugar Services Proserpine.

SSP

sra Sugar Research Australia

Queensland Government