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

2019/2020 WET SEASON - SITE 2 CASE STUDY

SITE DETAILS

BLOCK SIZE: 3.5 ha

SAMPLED AREA: 3,967 m^2

ROW SPACING: 1.8 m

VARIETY: Q208(l)

CROP CLASS: 3R

HISTORICAL ANNUAL YIELD: 90 tph

SOIL TYPE:
Proserpine (deep sandy soil)

LOCATION IN SUB-CATCHMENT:
Foxdale

NUTRIENT AND PESTICIDE APPLICATION DETAILS

Fertiliser application date: 11 October 2019
Insecticide application date: 11 October 2019
Herbicide application date: 18 October and 11 November 2019

Treatment 1

- Pre-emergent herbicide – 18 October 2019 - Valor® 500WG (flumioxazin) @ 600 g/ha
    - Total flumioxazin applied: 300 g/ha

Treatment 2

- No pre-emergent herbicide – 11 November 2019 – Tordon® 75-D @ 1 L/ha & Atrazine @ 2 kg/ha
    - Total active ingredient applied:
        - 2,4-D: 300 g/ha
            - Picloram: 75 g/ha
                - Atrazine: 1800 g/ha
- Approximately 80 mm of flood irrigation applied late October 2019 after harvest & Valor® 500WG application. No run-off occurred from this irrigation.
- Approximately 40-50 mm of flood irrigation on 12 November 2019 and 11 December 2019. Run-off generated both times

Fertiliser application:

- Prossy NKS (26 - 0 – 20 – 2) @ 560 kg/ha
    - Total N applied: 145.6 kg/ha
    - Total P applied: 0 kg/ha

Herbicide applications:

- 2019:
  - as above
    - Valor® 500WG or
    - Tordon® 75-D & Atrazine
  - 19th November 2019
    - 1L Gramoxone (250 g/L paraquat)
    - 1L Tordon® 75-D (300g/L 2,4-D + 75g/L picloram)
    - Sprayed only where sicklepod weeds visible
- 2018/2017 (ratoons)
  - Gramoxone (paraquat)
  - Bobcat® i-MAXX (hexazinone, imazapic)
  - 2,4-D
- 2016 (plant)
  - Flame® (imazapic)
  - Atrazine
  - 2,4-D
- Additional active ingredients applied in previous years:
  - Ametryn, ioxynil, isoxaflutole, metribuzin, hexazinone, diuron (prior to 2015), glufosinate-ammonium

Insecticide applications:

- 2019/2018/2017/2016:
  - Imidacloprid (Confidor® Guard) applied at a rate of 18 mL / 100 m row (1L/ha)
  - 350g/L of active ingredient
  - Confidor® Guard applied in the drill and covered with soil
  - Stool Zippas used

*over 4 years this equates to approximately 1400 g of imidacloprid applied vs 625 g if suSCon maxi Intel® was applied at plant at a rate of 225 g per 100 m of row.

Tested for:

- Dissolved Inorganic Nitrogen
- Filterable Reactive Phosphorus
- Flumioxazin (Valor® 500WG)
- 2,4-D
- Atrazine
- Imidacloprid

RUN-OFF EVENT DATA

EVENT	DATES	DAYS FROM FERTILISER APPLICATION	DAYS FROM HERBICIDE APPLICATION (VALOR® 500WG / TORDON® 75-D & ATRAZINE)
1 - irrigation	12 November 2019	32	39 / 1
2 - irrigation	11 December 2019	61	68 / 30
3	29 December 2019	79	86 / 48
4	27 to 28 January 2020	108	115 / 77
5	23 February 2020	135	142 / 104
6	24 to 25 February 2020	136	143 / 105

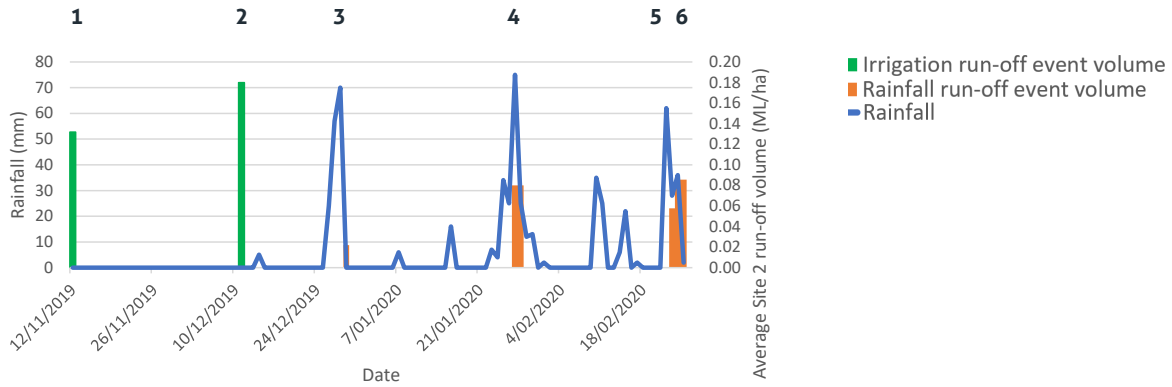

Figure 1 Rainfall data and corresponding volume of run-off events. Event 1 and 2 were generated by irrigation. Events 3, 4, 5, and 6 were generated from rainfall.

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.

DIN (Dissolved Inorganic Nitrogen)

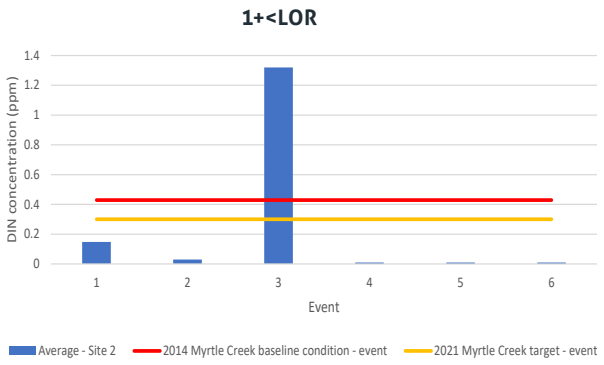

Figure 2: *DIN concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's DIN water quality in 2014 event conditions was 0.429 ppm and 2021 event target is 0.300 ppm, both for the Myrtle Creek. Provided for discussion only.*

FRP (Filterable Reactive Phosphorus)

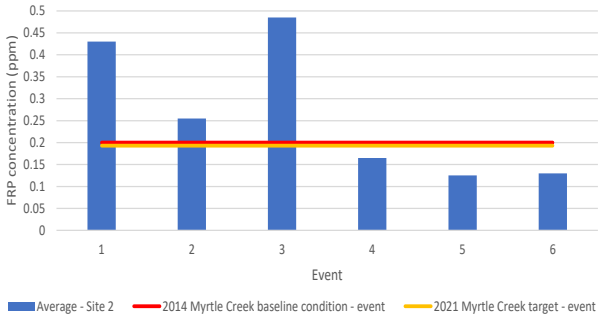

Figure 3: *FRP concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's FRP water quality in 2014 event conditions was 0.200 ppm and 2021 event target is 0.193 ppm, both for the Myrtle Creek. Provided for discussion only.*

IMIDACLOPRID

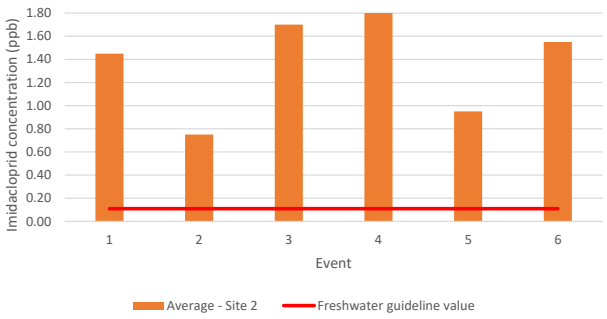

Figure 4: Imidacloprid concentration in run-off (ppb). Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Imidcloprid value is 0.11 ppb. Provided here for discussion only.

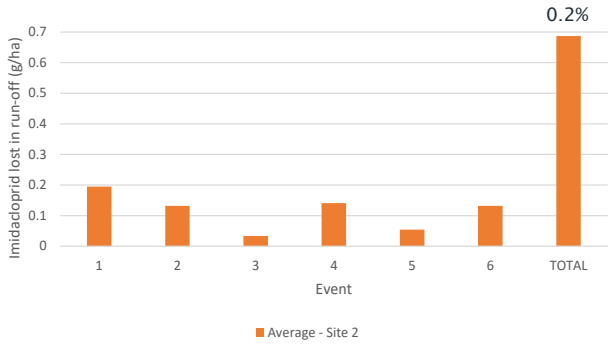

Figure 5: Estimated imidacloprid in run-off (g/ha) calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of imidacloprid applied lost in run-off.

FLUMIOXAZIN (Valor® 500WG)

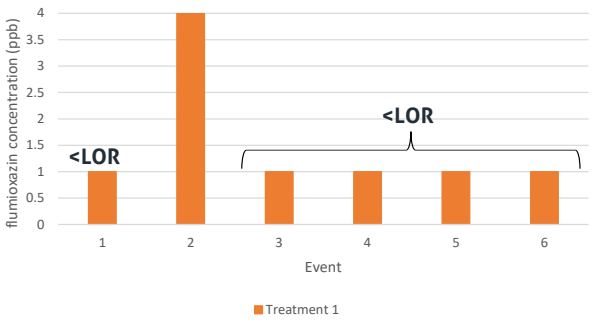

Figure 6: Flumioxazin concentration in run-off (ppb) from Treatment 1. Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Flumioxazin value is 889 ppb (not shown).

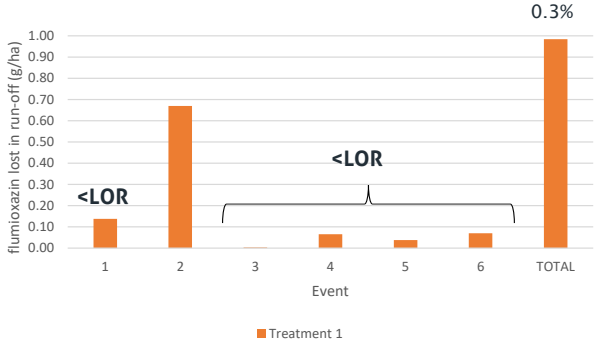

Figure 7: Estimated flumioxazin in run-off (g/ha) from Treatment 1, calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of flumioxazin applied lost in run-off.

<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.

1+<LOR - please note in this event one or more sample concentrations were below the lowest observable reading (LOR) of the laboratory equipment.

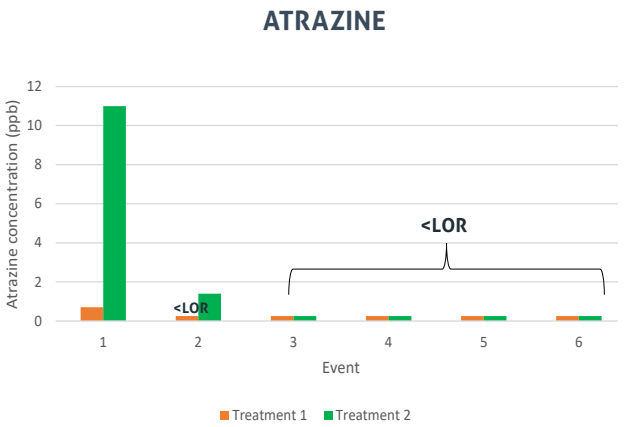

Figure 8: Atrazine concentration in run-off (ppb). Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Atrazine value is 13 ppb (not shown). Provided here for discussion only.

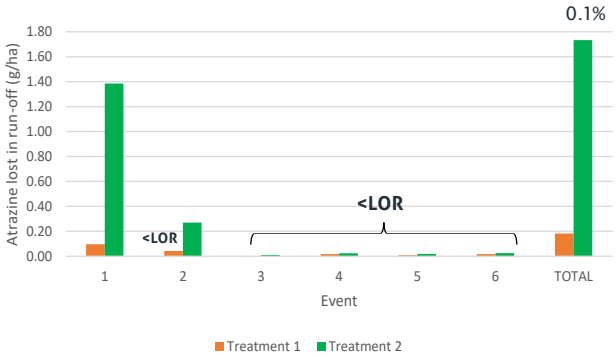

Figure 9: Estimated atrazine in run-off (g/ha) calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of atrazine applied lost in run-off. No atrazine was applied on treatment 1 and hence % lost cannot be calculated.

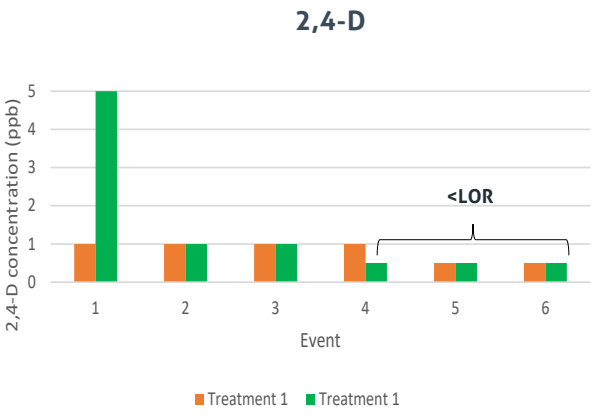

Figure 10: 2,4-D concentration in run-off (ppb). Freshwater guideline value is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. 2,4-D value is 280 ppb (not shown). Provided here for discussion only.

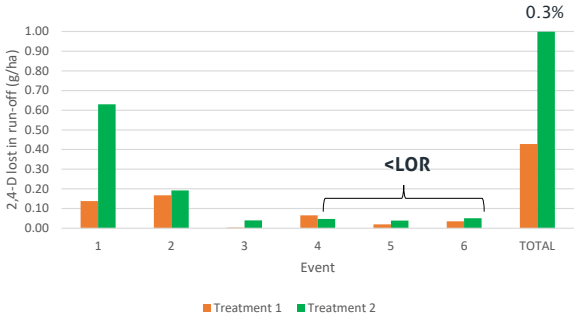

Figure 11: Estimated 2,4-D in run-off (g/ha) calculated using estimated flow values. Percentage presented above the TOTAL bar provide an estimate of the percentage of 2,4-D applied lost in run-off. No 2,4-D was applied on treatment 1 and hence % lost cannot be calculated.

<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.

1+<LOR - please note in this event one or more sample concentrations were below the lowest observable reading (LOR) of the laboratory equipment.

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.

Relative pesticide risks

In order of highest to lowest risk (Draft Pesticide Decision Support Tool):

flumioxazin>imidacloprid>atrazine>2,4-D>picloram

This suggests that if applying in a high-risk period the Tordon/atrazine mix (Treatment 2) may be of lower environmental risk than Valor® (Treatment 1). However on this site there was an interval of 30 and 68 days from application to the first run-off for Tordon®/atrazine and Valor®, respectively. The first irrigation with no run-off would also have helped to incorporate the herbicides. This suggests that both these herbicide strategies were of low environmental risk, given their timing in relation to first run-off. Long-term effective weed management where seed set is prevented may result in reduced soil seed bank, allowing knockdowns to be used instead of pre-emergent herbicides.

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 or so (this excludes pendimethalin and flumioxazin which have significantly lower losses, see: The Pesticide Risk Matrix handout for more information) (Fillols, E 2018). This suggests that application rate is the major influence on losses.

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. The spike in event 3 is expected and corresponds with the first rainfall generated run-off event.

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. FRP concentrations are not significantly exceeding the freshwater target. Whilst paddock-scale run-off cannot be directly compared, this indicates a positive result.

This supports the SIX EASY STEPS recommendation not to apply phosphorus when soil tests indicate no phosphorous is required. In situations where high amounts of mill by-products have been applied, growers can draw down on the phosphorus reserves until a soil test shows it is needed.

REFERENCES / FURTHER INFORMATION

The Pesticide Risk Matrix - Attachment 1

Runoff 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

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