Sugar Research Australia

SSP

Queensland Government

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

2020/2021 WET SEASON - SITE 2

SITE DETAILS

BLOCK SIZE:
5.75 ha

SAMPLED AREA:
0.388 ha

ROW SPACING:
1.8 m

VARIETY:
Q242[Φ]

CROP CLASS:
6R

HISTORICAL ANNUAL YIELD:
90 tph

SOIL TYPE:
Crystal Brook (cracking clay)

LOCATION IN SUB-CATCHMENT:
Foxdale

NUTRIENT AND PESTICIDE APPLICATION DETAILS

Fertiliser + imidacloprid application date: 21 October 2020
Herbicide application date: 17 November 2020

All treatments were applied with the Queensland Government Department of Agriculture and Fisheries Dual Herbicide Sprayer.

Treatment 1
- Inter row: Basta @ 2L/ha (220g/ha glyphosinate ammonia)
- Row: Bobcat i-MAXX @ 3.2L/ha (180g/ha hexazinone and 36g/ha imazapic) and Spray.Seed 250 @ 1.2L/ha (162g/ha paraquat + 138g/ha diquat).

Treatment 2
- Inter row: Basta @ 1L/ha (110g/ha glyphosinate ammonia) and Spray.Seed 250 @ 0.8L/ha (59.4g/ha paraquat & 50.6g/ha diquat)
- Row: Bobcat i-MAXX @ 3.2L/ha (180 gha hexazinone and 36g/ha imazapic) and Spray.Seed 250 @ 1.2L/ha (162g/ha paraquat + 138g/ha diquat).

Treatment 3
- Inter row: Spray.Seed 250 @ 1.5L/ha (111.4g/ha paraquat and 94.9g/ha diquat)
- Row: Bobcat i-MAXX @ 3.2L/ha (180g/ha hexazinone and 36g/ha imazapic) and Spray.Seed 250 @ 1.2L/ha (162g/ha paraquat + 138g/ha diquat).

Treatment 4
- Inter row: Roundup 540 @ 2L/ha (1080g/ha glyphosate)
- Row: Bobcat i-MAXX @ 3.2L/ha (180g/ha hexazinone and 36g/ha imazapic) and Spray.Seed 250 @ 1.2L/ha (162g/ha paraquat + 138g/ha diquat).

Treatment 5
- Inter row: Basta @ 2L/ha (220g/ha glyphosinate ammonia) and Spray.Seed 250 @ 1.5L/ha (111.4g/ha paraquat & 94.9g/ha diquat) and Bobcat i-MAXX @ 1.16L/ha (145g/ha hexazinone + 29g/ha imazapic)
- Row: Bobcat i-MAXX @ 3.2L/ha (180g/ha hexazinone & 36g/ha imazapic) and Spray.Seed 250 @ 1.2L/ha (162g/ha paraquat + 138g/ha diquat).

Treatment 6
- Inter row: control - no herbicide applied.
- Row: control - no herbicide applied.

FERTILISER APPLICATION:

- CB51851 @ 390kg/ha
  - Total nutrient applied:
    N – 113.1kg/ha
    P – 0kg/ha
    K – 70.2kg/ha
    S – 0kg/ha

TESTED FOR:

- Dissolved Inorganic Nitrogen (DIN)
- Filterable Reactive Phosphorus (FRP)
- Imidacloprid
- Hexazinone
- Imazapic
- Glyphosate
- Glufosinate Ammonium
- Paraquat
- Diquat

RUNOFF EVENT DATA

EVENT	DATES	DAYS FROM LAST FERTILISER + IMIDACLOPRID APPLICATION	DAYS FROM LAST HERBICIDE APPLICATION
1*	20–21 November 2020	33	3
2*	9–10 December 2020	55	22
3	25 December 2020	71	38
4	6 January 2021	83	50
5	7-8 January 2021	84	51
6	10 January 2021	85	53
7	11 January 2021	4	54

* Events 1 and 2 were generated by flood irrigation

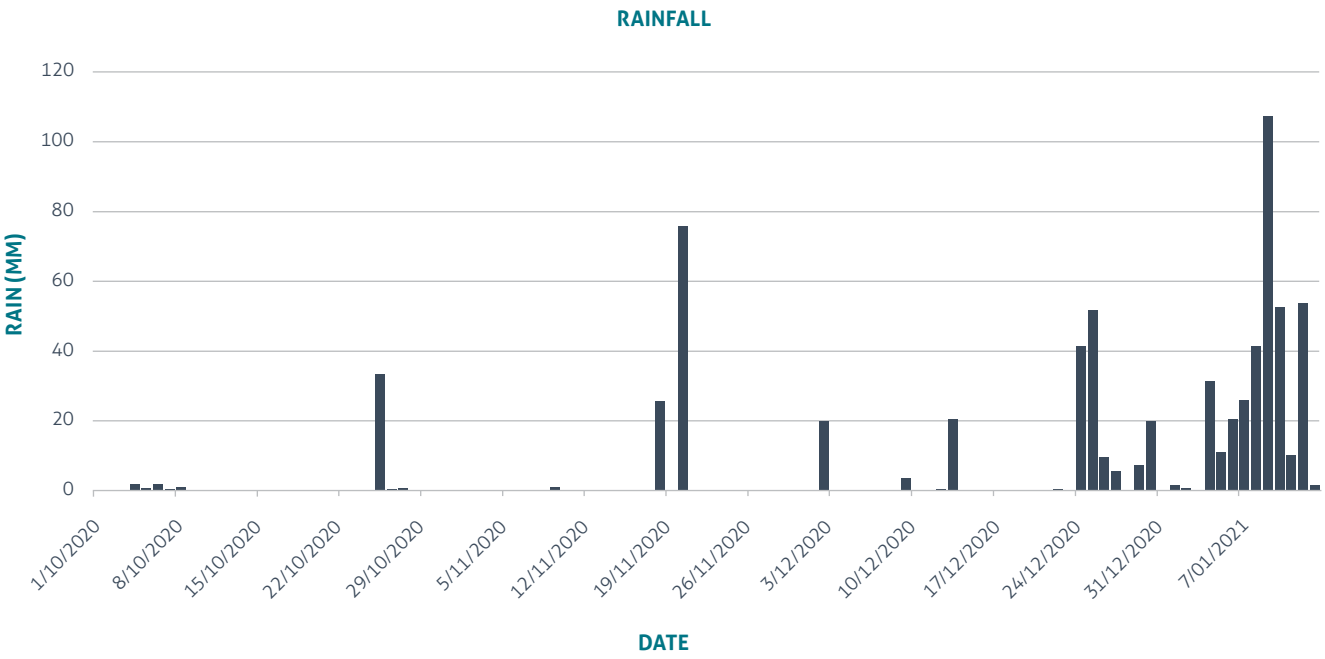

Figure 1 Rainfall data measured at Wandarra weather station.

RESULTS

NOTE: *Nutrient and pesticide loads are estimates only. Freshwater ecotoxicity thresholds cannot be applied to paddock scale monitoring. Freshwater aquatic ecosystem species protection values are referenced only for discussion. P concentrations are indicative and actual concentrations are likely to be slightly higher.*

DIN (Dissolved Inorganic Nitrogen)

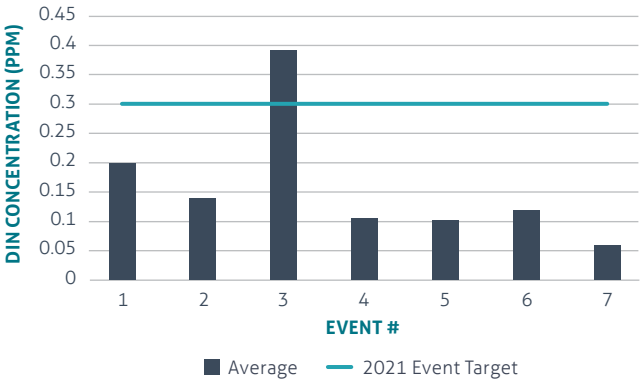

Figure 2 DIN concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's, DIN water quality in event current conditions is 0.429 ppm and 2021 event target is 0.300 ppm, both for the Myrtle Creek. Provided for discussion only.

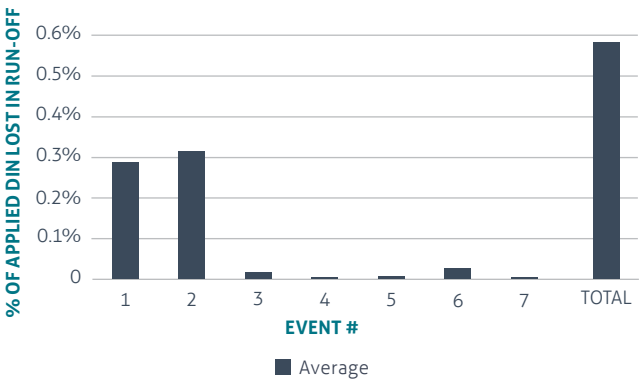

Figure 3 percentage of applied nitrogen lost as DIN in run-off.

FRP (Filterable Reactive Phosphorus)

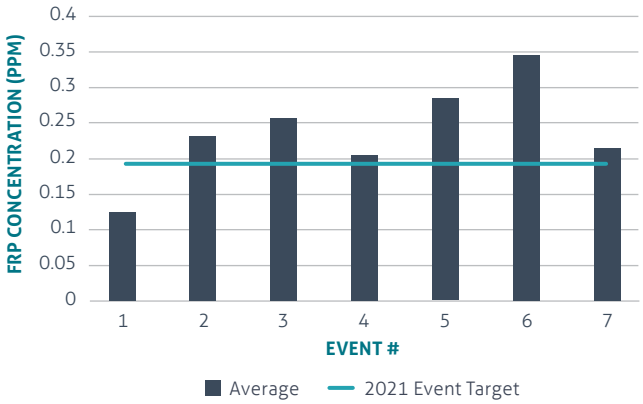

Figure 4 FRP concentration in run-off (ppm). The Mackay Whitsunday Water Quality Plan's FRP water quality in event current conditions is 0.200 ppm and 2021 event target is 0.193 ppm, both for the Myrtle Creek. Provided for discussion only.

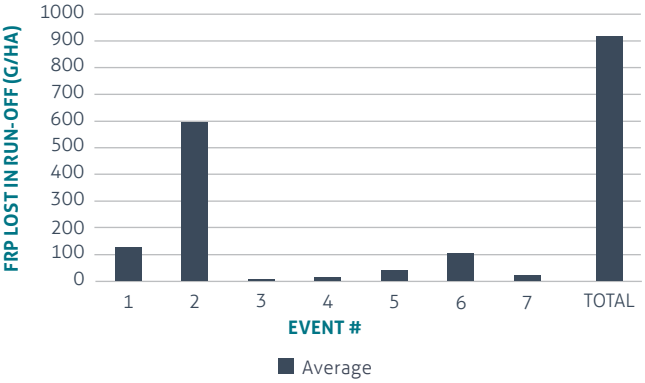

Figure 5 FRP lost in run-off (ppm). There was no phosphorous applied, therefore percentage of phosphorous lost cannot be calculated.

IMIDACLOPRID

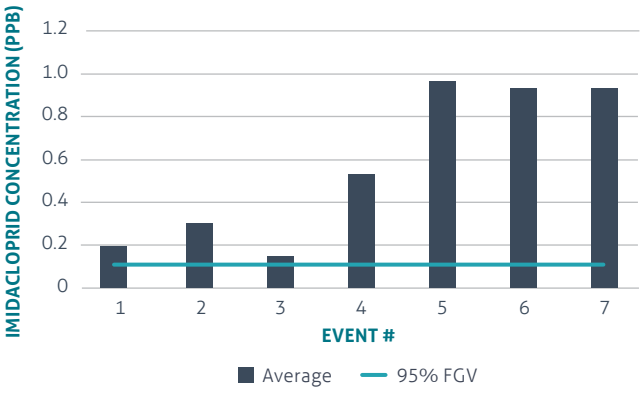

Figure 6 Imidacloprid concentration in run-off (ppb). Freshwater guideline value (FGV) is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Imidacloprid value is 0.11 ppb. Provided here for discussion only.

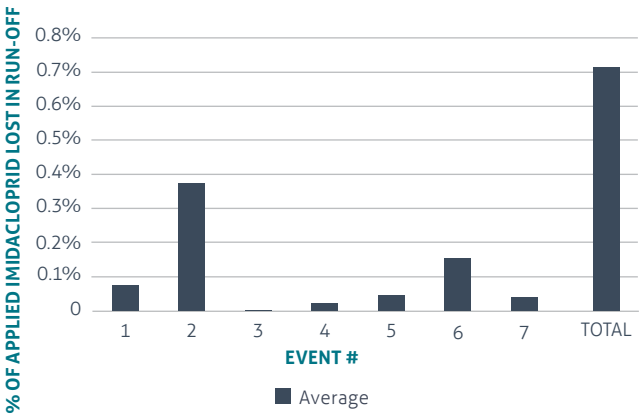

Figure 7 percentage of applied imidacloprid lost in run-off.

HEXAZINONE

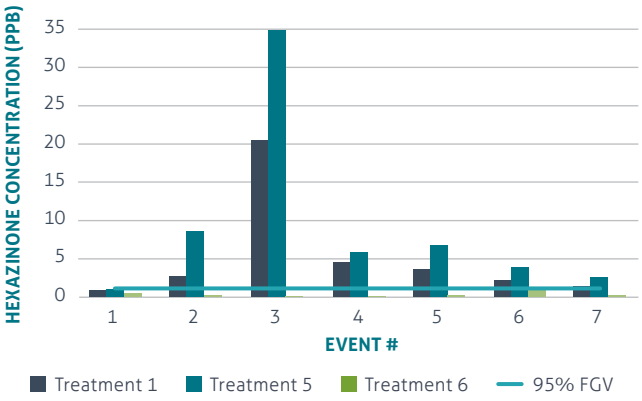

Figure 8 Hexazinone concentration in run-off (ppb). Freshwater guideline value (FGV) is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Hexazinone value is 1.1 ppb. Provided here for discussion only.

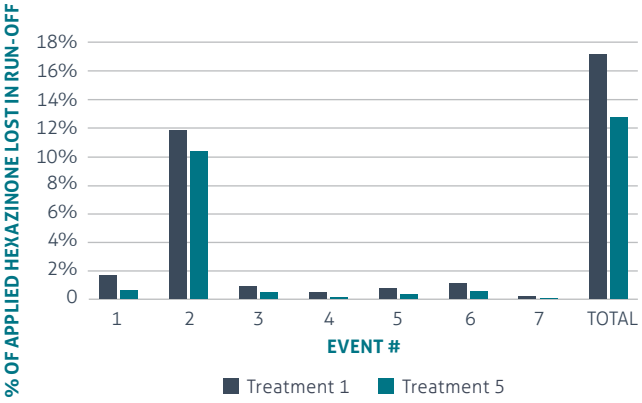

Figure 9 percentage of applied hexazinone lost in run-off.

IMAZAPIC

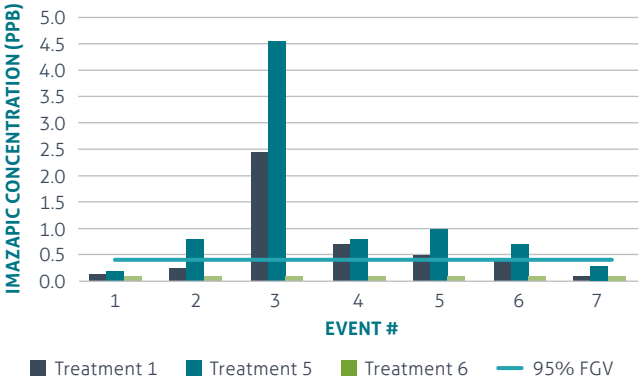

Figure 10 Imazapic concentration in run-off (ppb). Freshwater guideline value (FGV) is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Imazapic value is 0.41 ppb. Provided here for discussion only.

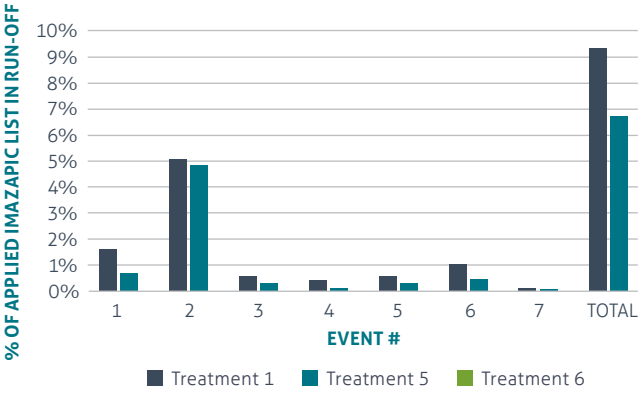

Figure 11 percentage of applied imazapic lost in run-off.

GLYPHOSATE

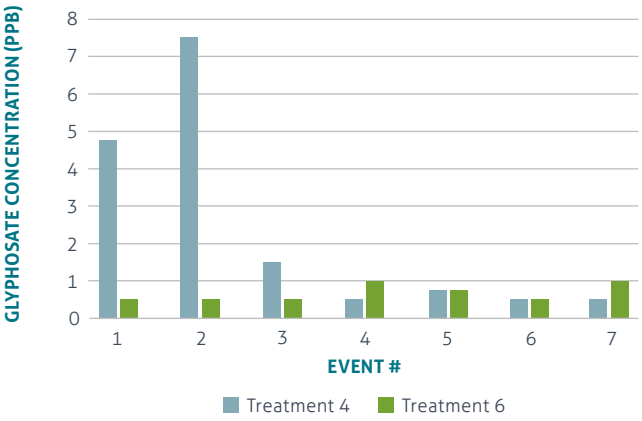

Figure 12 Glyphosate concentration in run-off (ppb). Freshwater guideline value (FGV) is the aquatic ecosystem protection guideline value at the 95% species protection level and is applicable only to freshwater systems. Glyphosate value is 1200 ppb. Provided here for discussion only.

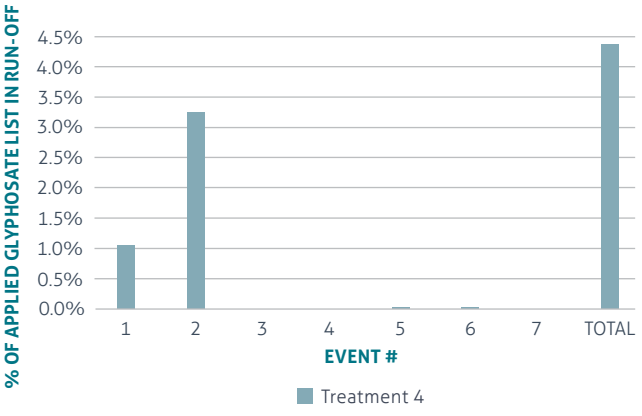

Figure 13 percentage of applied glyphosate lost in run-off.

GLUFOSINATE AMMONIUM

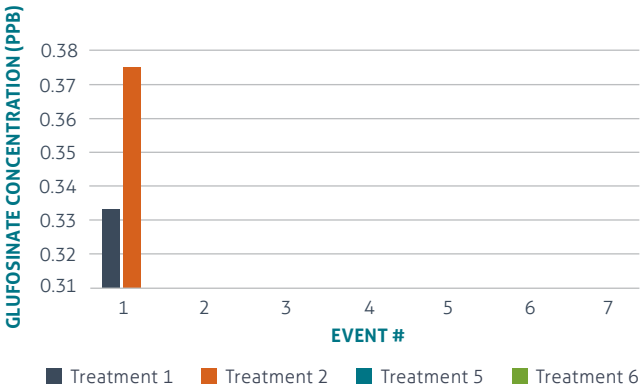

Figure 14 Glufosinate ammonium concentration in run-off (ppb).

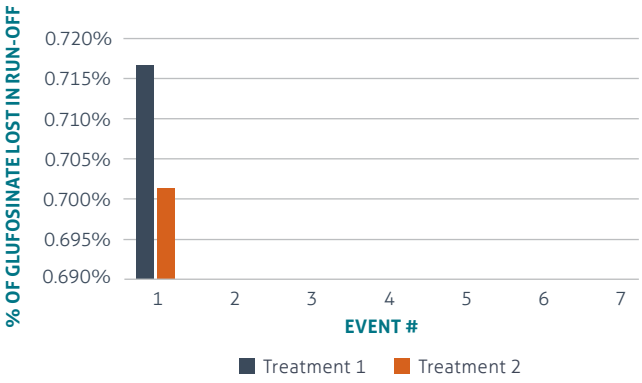

Figure 15 percentage of applied glufosinate ammonium lost in run-off.

IRRIGATION WATER TEST

One grab sample was taken during the first flood irrigation event, straight from the cup.

The test showed the following levels of chemical:

- Glyphosate = 1 ppb
- Imidacloprid = 0.9 ppb
- Diuron = 0.3 ppb
- Glufosinate ammonium, paraquat, diquat, hexazinone, imazapic, atrazine were all undetected.

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. All flow data used to calculate percentage of chemicals lost in run-off are based on one sampler due to equipment error. The information is provided as a guide for comparison between treatments at this site only.

This trial aimed to compare different chemical options using the Dual Herbicide Sprayer (DHS). The DHS allows knockdown chemicals such as glyphosate and Basta (glufosinate ammonium) to be used in the interrow, whilst different products can be applied to the cane row at the same time, for example Bobcat i-MAXX (hexazinone and imazapic).

No paraquat or diquat was detected in any sample from any treatment. Very small detections of glufosinate ammonium (Basta) were detected in the first irrigation event on some treatments. Small detections of glyphosate were detected in the glyphosate treatment (Treatment 4). However, glyphosate was also detected in the control treatment (Treatment 6 - no glyphosate applied). It is likely that the glyphosate detected entered the control treatment through irrigation water and possibly small residual amount from applications in previous years. Analysis of irrigation water did detect glyphosate, see graphs.

Hexazinone and imazapic graphs show that Treatment 5 (highest application of Bobcat i-MAXX) has the highest concentrations in run-off compared to Treatment 1 (example treatment without Bobcat i-MAXX applied to the interrow), and the control treatment (lowest losses). 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 Herbicide Risk Matrix)). This suggests that APPLICATION RATE is the major influence on losses. Losses for hexazinone and imazapic are roughly in line with this research. However, imidacloprid losses were far smaller than 13%, this indicates a positive outcome for imidacloprid at this site.

The results show that significant reductions in pre-emergent herbicides can be achieved with the DHS. Weed counts, cane growth measurements and yield measurements will also be compared between treatments. These will be shared once available.

DIN losses at this site only exceeded the Mackay Whitsunday Water Quality Plan's DIN 2021 Event Target in one event. FRP losses do not exceed the FRP 2021 Event target significantly. It is expected that paddock scale run-off would be of higher concentration than in-creek concentrations due to scale and dilution. Whilst paddock scale run-off cannot be directly compared, this indicates a positive result.

REFERENCES/FURTHER INFORMATION

The Herbicide 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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