Comparing residual versus knockdown herbicides in sugarcane in the Mackay Whitsunday region

Background
The Reef Water Quality Protection Plan (Reef Plan), a joint initiative of the Australian and Queensland Governments, focuses on the threat posed by diffuse source agricultural pollution. It is designed to reduce the amount of pollutants flowing into waterways and the Great Barrier Reef in order to build the resilience of the reef to impacts of other stressors.

The Paddock to Reef Integrated Monitoring, Modelling and Reporting (Paddock to Reef) Program measures and reports on progress towards Reef Plan and Reef Rescue goals and targets. Funded jointly by the Australian and Queensland Governments, it is a collaboration involving governments, industry bodies, regional natural resource management bodies, landholders and research organisations.

Paddock monitoring and modelling are important components of the program. This work is funded by the Australian Government’s Reef Rescue initiative with significant support from the Queensland Government. The program conducts paddock trials in various regions in partnership with other organisations to assess the water quality benefits of different land management practices.

About this case study
Weeds are a major contributing factor to losses in both production and profits for the sugarcane industry. Minimum tillage and green cane trash blanketing is considered best practice management in cane. Herbicides are used to control weeds; however, there are concerns about chemicals including herbicides being transported to the Great Barrier Reef. The photosystem inhibiting (PSII) residual herbicides are of greatest concern due to their potential to affect algae, seagrasses and coral.

Reducing the use of PSII residual herbicides, such as atrazine, diuron, hexazinone and ametryn, and using alternatives such as knockdown herbicides as part of an integrated weed management strategy, is considered best practice (Rolfe et al. 2007). Band spray application is also suggested as an improved practice.

This project in the Mackay region measured the amount of herbicides moved in runoff from a standard rain storm applied with a rainfall simulator.

Methods
This study was undertaken on a sugarcane field with recently emerged ratoon cane. The site had a sandy soil (Sodosol), low slope and almost 100 per cent groundcover of trash and weeds.

Key findings
- The runoff of three residual herbicides was higher than for the knockdown herbicides. Residual herbicides also persist longer in the environment.
- Reducing the amount of herbicide applied will reduce the losses in runoff.

The study involved treating plots with:
- bromide (a mobile salt tracer)
- residual herbicides – diuron, hexazinone and metolachlor
- knockdown herbicides – glyphosate and 2,4-D amine.

The application treatments were:
- blanket coverage (100 per cent coverage)
- band spray coverage (20 per cent, 50 per cent and 70 per cent coverage)
- no coverage (0 per cent coverage).

Rainfall was applied at 80 millimetres per hour for 40 minutes, one to two days after herbicide application.

Two to four plots of each treatment had rainfall applied using a rainfall simulator. Runoff rate and sediment concentration (almost nil) were measured through time. Runoff was sampled seven to 14 times for chemical analysis. Soil and trash samples were taken before the rain and analysed for the chemicals.

Results
- Residual herbicides (diuron, hexazinone, metolachlor) runoff more than the knockdown herbicides glyphosate and 2,4-D due to their inherent properties. Over time, these differences will become even greater because the knockdowns decay more rapidly than the residuals.
  - Glyphosate and 2,4-D load in runoff was 40 per cent and 76 per cent less than the residuals for blanket spray respectively.
  - Glyphosate and 2,4-D load in runoff was 68 per cent and 71 per cent less than the residuals for band spray respectively.

These knockdown products have lower toxicity in receiving waters than the residual herbicides (ANZECC/ARMCANZ 2000).
## Other ways to reduce/prevent herbicide runoff

- Avoid spraying when rainfall is forecast. Spray earlier before the wet season or when risk of rainfall is lower (see First 20 days after herbicide application is critical for runoff in the Mackay Whitsunday region case study).
- Use precision spraying technology such as band spraying (see Precision application (band spray) of herbicides on sugarcane in the Burdekin case study).
- Retain cane trash (see Comparing runoff loss of knockdown and residual herbicides in the Herbert catchment and Sub-surface fertiliser application reduces runoff nutrient loss in the Herbert case studies).

## Authors

Mark Silburn and Samuel Rojas-Ponce (Queensland Government Department of Natural Resources and Mines), Emilie Fillols (BSES Limited, Mackay), Jack McHugh and Craig Baillie (National Centre for Engineering in Agriculture, University of Southern Queensland, Toowoomba).

## References


