Reef Rescue
Research & Development - Project Factsheet

**RRRD038 Tebuthiuron management in grazing lands (Subproject 2)**

**Project Background**
The mean annual load of photosystem-II herbicides entering the Great Barrier Reef (GBR) has been estimated to be 30,000 kg/yr (Kroon et al. 2012 Mar. Poll. Bull. 65: 167-181). This load includes tebuthiuron which is registered for use in grazing. Grazing accounts for 96% (26.2 Mha) of the area within the Fitzroy, Burdekin and Burnett-Mary Basins. In Queensland, tebuthiuron is the main herbicide used to control regrowth of brisalow (Acacia harpophylla), tea tree (Melaleuca spp.) and other problem woody weeds on grazing lands (Figure 1). However, despite the regular detection of tebuthiuron in the GBR, there is limited information on how this herbicide behaves in the Australian environment. Thus, the objective of this study was to provide preliminary data on tebuthiuron dynamics in an Australian grazing system. This was achieved by the completion of three trials at the Brigalow Catchment Study which is located near Theodore in central Queensland:

1. Determine the persistence of tebuthiuron in Vertosol (clay) and Sodosol (duplex) soils at the plot scale (1.7 m²) to a depth of 40 cm and at intervals up to 314 days after application under natural rainfall conditions.

2. Compare tebuthiuron loads exported in runoff from different formulations (granular and dry flowable) and soil types (Vertosol and Sodosol) at the plot scale (1.7 m²) under simulated rainfall conditions.

3. Quantify tebuthiuron loads exported in runoff at the paddock scale (12.7 ha) under natural rainfall conditions.

**Key Findings**
**Movement in soil at the plot scale under natural rainfall**
- Tebuthiuron showed an overall trend of declining mass over time, but this was more evident within the 0 to 2.5 cm layer than deeper in the soil profile (Figures 2 and 3).

Figure 1. Photos from the Brigalow Catchment Study grass pasture catchment that had an aerial application of tebuthiuron in November 2011.

Figure 2: Tebuthiuron mass (g/ha) in the 0 to 40 cm profile of Vertosol (A) and Sodosol (B) soil at 1, 16, 30, 55 and 104 days after application to the soil surface. Cumulative rainfall at day 1 was 0 mm, day 16 was 26 mm, day 30 was 53 mm, day 55 was 165 mm, and day 104 was 175 mm. Tebuthiuron was applied at a rate of 3,000 g a.i./ha in October 2012.
Tebuthiuron was highly mobile in both Vertosol and Sodosol soils with redistribution at depth observed after rainfall.

Tebuthiuron half-lives in soil to a depth of 40 cm were two to six months, which was considerably shorter than the one year half-life reported in the international literature (Weed Science Society of America Herbicide Handbook 1989).

Movement in runoff at the plot scale under simulated rainfall
- More tebuthiuron was lost from Vertosols compared to Sodosols (Figure 4). Similar runoff volumes were recorded from the two soil types which indicate that tebuthiuron interacts with the physical and chemical properties of the two soil types differently.
- Vertosols lost more granular than dry flowable tebuthiuron. NB. Dry flowable tebuthiuron was applied as a spray over the entire surface of the plot. This formulation is not currently available for commercial use in Australia, but it was used to compare with granular tebuthiuron which can export entire pellets in runoff and thus substantially inflate loads calculated at the plot scale.

Movement in runoff at the paddock scale under natural rainfall
- Event mean concentration (EMC) of tebuthiuron showed a trend of exponential decay with the greatest decline observed between the first two events; 100 and 224 days after application (Figure 5).
- At 472 days after tebuthiuron application, a total of 1239 mm of rainfall had occurred and a total of 1.03% of the applied tebuthiuron had been exported in runoff.
- Tebuthiuron loss during each event was less than 0.45% (mean 0.20%) of the total applied to the paddock.
- No relationship was detected between tebuthiuron and total suspended sediment EMCs which indicates that tebuthiuron in runoff was transported in a dissolved form rather than adsorbed to soil.
- Mean annual rainfall for the 2011/12 hydrological year was 786 mm and for the 2012/13 hydrological year was 682 mm. These were both higher than the long-term average of 654 mm (1965 to 2012) and additional data is required to determine if the trends observed in these unusually wet years are reflected over the long-term.

Management Recommendations
- Half-lives in soil suggest a reduced risk to water quality 60 to 180 days after application. Decay curves of tebuthiuron in runoff also support this trend. Thus, it is important for application to occur during the dry season to minimise tebuthiuron lost from the paddock in runoff over the wet season.
- Management practices that reduce runoff will also reduce tebuthiuron loss. For example, high plant cover will minimise runoff.
- Limit application to only areas where tebuthiuron is required to minimise the amount of product used.
- Opportunities exist to replicate the plot scale investigations on additional soil types in other reef catchments, to continue water quality monitoring at the paddock scale, and to further investigate formulation technologies.

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