

Management of high rainfall cropping to improve water quality and productivity

Lead Research Organisation:

DPI-PIRVic

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Introduction

The **Management of high rainfall cropping to improve water quality and productivity** project aims to determine the processes and pathways of nitrogen and phosphorus exports from 'on-the-flat' cropping systems and provide the scientific foundation for the development of economically sustainable cropping systems in the Victorian high rainfall zone (500-900 mm rainfall) with minimal off-site impact. The project is co-funded by the Grains Research and Development Corporation (GRDC).

Monitoring Sites

Two sites were selected in south-west Victoria, at Hamilton and Cressy (near Geelong), both of which drain a cropped area of at least 10 ha. Automated runoff monitoring equipment has been installed at these sites. Sample collection and analyses of data from the sites will provide information on the importance of nutrient exports. Drought conditions prevalent over the past two years have affected the collection of field data from both sites.

Right: Automated runoff flume and monitoring shed at Cressy, Victoria.



Colloid Study

Small amounts of N and P have a big impact on receiving waters. These nutrients can be in the dissolved (<0.45 micron, or the size of a virus) or particulate form. To find the size of the different dissolved and particulate forms a colloid separation technique was developed. The technique involved sequential filtration through filters with pore sizes of 3, 1.2, 0.8, 0.65 and 0.40 microns followed by ultrafiltration through 10,000 and 3,000 Nominal Molecular Weight Limit (NMWL) filters. This technique was applied to water extracts of soils taken from the monitoring sites at Hamilton and Cressy and will be applied to water samples taken from nearby streams for comparison.

Rainfall Simulator Study



Left: Rainfall simulator in operation at the long-term agro-ecological trial site at the Rutherglen Research Institute.

Soil samples were collected from the long-term cropping site at Rutherglen in February and August 2006 to determine nutrient stratification resulting from cropping practices, such as stubble retention and minimum tillage. The tillage practices in place are conventionally tilled with stubble burnt, direct drilled with stubble burnt and direct drilled with stubble retained. To determine possible nutrient exports from the site a rainfall simulation study was completed in August 2006.



Above: Inside the rainfall simulator whilst in operation at the long-term agro-ecological trial site at the Rutherglen Research Institute.

Grower Survey

A survey was conducted in South West Victoria in conjunction with Southern Farming Systems (SFS) to determine farmer perceptions, attitudes and practices towards nutrient management to protect off-site water quality. The survey has been approved for distribution by the GRDC. The results from this survey were presented at a Grower Workshop on September 26, 2006 and have raised the awareness of farmers in the region to the impacts of poor nutrient management. The survey and results are available on the SFS website at www.sfs.org.au/publications.html.

Preliminary Results

Results of soil tests and ultrafiltration indicate that:

- Cressy contained twice as much calcium chloride extractable P (1.32 mg/kg) and approximately three times as much nitrate N (95 mg/kg) than Hamilton (0.64 and 37 mg/kg, for P and N respectively),
- N and P concentrations in the soil water extracts from Cressy exceeded stream water quality criteria of no more than 1 mg N/L and 0.12 mg P/L.

Preliminary results of the rainfall simulator study indicate that:

- Nutrients were greatest in the surface 0-2 cm soil depth in all treatments,
- Total P and N was greatest in runoff from direct drill with stubble retention (0.61 mg P/L and 2.63 mg N/L), followed by direct drill with stubble burning (0.59 mg P/L and 1.62 mg N/L) and least in runoff from conventional cultivation with stubble burning (0.47 mg P/L and 1.25 mg N/L),
- However, runoff volumes were greatest from conventional cultivation with stubble burning, followed by direct drill with stubble burning and least from direct drill with stubble retained,
- When N and P concentrations were considered together with runoff volumes, dissolved reactive P, nitrate-N, total N and total P were always greatest from conventional cultivation with stubble burning.

Results of the grower survey indicated that:

- environmental awareness of nutrient management decisions had increased from 11% of farmers in 2004 to 21% in 2005,
- the timing and quantity of nutrient application were thought to be the most important practices influencing nutrient loss,
- the practices least adopted by farmers were water related issues such as management of surface runoff, application of fertiliser to wet soils and fertilising when rain was likely.

Although farmer perceptions of nutrient loss and environmental implications have increased, more work is needed to further raise the level of awareness and to reduce nutrient losses.

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