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FEBRUARY 2006 PRIMEFACT 36 MASTER — MANAGING ACID SOILS THROUGH EFFICIENT ROTATIONS

MASTER — Nitrate leaching and deep drainage on acid soils

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Summary

This Primefact reports nitrate leaching and deep drainage on acid soils. In the wetter years, perennial pastures can reduce nitrate leaching by up to 12 kg N/ha, and reduce runoff and deep drainage by up to 40 mm compared with the annual pastures.

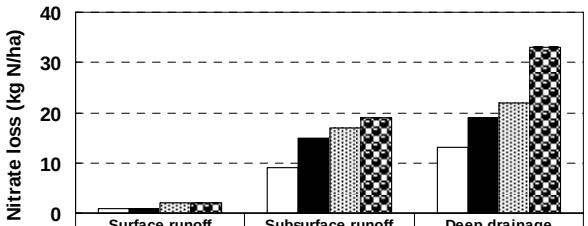
Background

- There are large amounts of mineral nitrogen (NO_3^- and NH_4^+) accumulated in the profile at 0–120 cm by the end of each summer (70–135 kg N/ha), most of which is concentrated at 0–30 cm soil depth. Much of this nitrogen can be taken up by the pastures, mainly during the following spring, but substantial amounts are also lost by leaching in lateral and deep drainage, especially in the winter.
- Nitrate leaching is the primary factor to make soil acidic in the recharge area. Deep drainage, on the other hand, raises the water table and contributes to dryland salinity in the discharge area.

Tipping buckets for water runoff measurements

Nitrate leaching

- Nitrate leaching was substantial on limed and unlimed treatments in the wetter years, e.g. 1995 (Fig. 1), but there were no nitrogen losses in the dry years, e.g. 1994.
- Perennial pastures reduced nitrate leaching by up to 12 kg/ha in deep drainage compared with the annual pastures in a wetter year.



	Surface runoff	Subsurface runoff	Deep drainage
PP-	1	9	13
PP+	1	15	19
AP-	2	17	22
AP+	2	19	33

Fig. 1. Nitrate losses from annual pasture (AP) and perennial pasture (PP) with (+) and without (-) lime in 1995.

- The acid added to a soil from leaching 12 kg nitrate-N/ha would need 45 kg lime/ha to be neutralised.

Deep drainage

- In a wetter year, up to 62 mm of soil water was lost through deep drainage.
- However, perennial pastures reduced runoff and deep drainage by up to 40 mm compared with annual pastures.
- There was no surface runoff, subsurface flow or deep drainage in the dry years

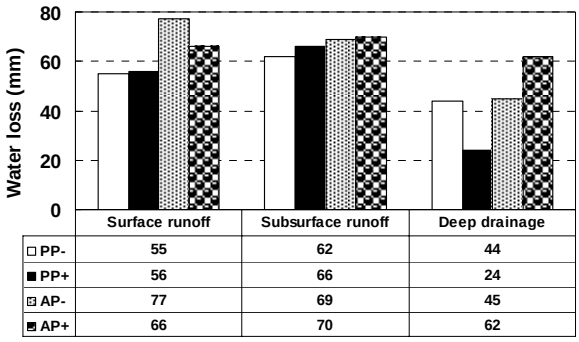


Fig. 2 Water losses from annual pasture (AP) and perennial pasture (PP) with (+) and without (-) lime in 1995.

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Further information

- Heng, LK, White, RE, Helyar, KR, Fisher, R, Chen, D 2001, 'Seasonal differences in the soil water balance under perennial and annual pastures on an acid Sodosol in southeastern Australia', *European Journal of Soil Science* **52**, 227–36.
- Ridley, AM, White, RE, Helyar, KR, Morrison, GR, Heng, LK and Fisher, R 2001, 'Nitrate leaching loss under annual and perennial pastures with and without lime on a duplex (texture contrast) soil in humid southeastern Australia', *European Journal of Soil Science* **52**, 237–52.

- Primefact 31, *MASTER — Experimental design*
- Primefact 32, *MASTER — Soil acidity and lime responses*
- Primefact 33, *MASTER — Crop responses to lime*
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