WATER BALANCE AND DRAINAGE IN DUPLEX SOILS

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The water balance equation can be presented as $P = ET + I + L + D + \Delta\theta$, where P is total precipitation, ET is evapotranspiration, I is canopy interception storage, L is net lateral water flow, D is deep drainage, and $\Delta\theta$ is change in soil water storage. Therefore, water use by crops and pastures is important information, as it affects deep drainage, which can lead to salinity problems. Deep drainage is often quantified using a water balance approach, but ET and lateral flow are difficult water balance components to measure. $\Delta\theta$ is usually calculated from weekly or fortnightly soil moisture readings, but this is often not frequent enough for accurate calculations.

MATERIALS AND METHODS

An area of approximately 2.25 ha between two reverse interceptor drains (approximately 100 m apart) in a sloping (3?) paddock sown to sub-clover pasture near Narrogin, WA, was chosen as the experimental site. The soil is 20-30 cm sandy loam abruptly changing to medium clay. V-notch weirs were placed along the lower drain to measure both interflow (lateral flow at the sand/clay interface) and surface runoff. A Bowen ratio (energy balance) apparatus was positioned in the centre of the area to measure ET, and time-domain reflectometry (TDR) probes were installed at various depths in the soil to measure volumetric water contents at 20 minute intervals. Rainfall was measured hourly, and deep drainage (beyond 50 cm) was calculated from the water balance equation.

RESULTS AND DISCUSSION

Significant deep drainage was calculated only for the period 8-17 August 1994 (Table 1), which coincided with the only period for which severe waterlogging was observed. For other rainfall events, calculated drainage was usually negative, possibly due to systematic errors in calculating the change in soil water storage. When the topsoil is waterlogged, water flow through macropores in the subsoil becomes possible, and so the risk of deep drainage in duplex soils is greatest under waterlogged conditions.

Table 1. Components of the water balance (mm) for various periods in 1994.

Period in 1994	Rainfall	ET	Lateral	$\Delta\theta$	Drainage
1 May - 21 December	348.9	335.6	24.4	0.0	-11.1
19-23 June	31.6	6.4	1.1	31.3	-7.2
3-5 August	29.2	5.3	1.0	30.4	-7.5
8-17 August	50.5	20.3	9.2	7.5	13.5

The ability to choose the periods of calculation from intensive data collection instead of weekly or fortnightly measurements (the advantage of TDR over the neutron probe) was critical in reducing errors in the measurements, allowing more confidence in the calculation of deep drainage.

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