Nitrogen fertilizer balance of irrigated wheat grown on a red-brown earth

C.J. Smith, D.M. Whitfield and O.A. Gyles

Institute for Irrigation and Salinity Research, Tatura Vic. 3616

Fertilizer nitrogen should be used as efficiently as possible for economic and energy reasons. On red-brown earths which have low permeability to water (rainfall or irrigation) the potential for N loss is high. However few data are available which deal with the fate of fertilizer N on irrigated cereal crops in south-eastern Australia.

Materials and Methods

Condor wheat was sown at 150 kg ha^{-1} on Lemnos loam in June and small circular microplots (180 cm^2) were inserted to a depth of 35 cm in plots which otherwise received no applications of nitrogen fertilizer. Uptake and a ^{15}N balance were determined. The microplots were fertilized at sowing with the equivalent of 150 kg N ha^{-1} at an isotopic enrichment of 4.786 atom % ^{15}N. Three replicates were used. Data were collected on 5 occasions from 85 days after planting (DAS 85) to maturity. Irrigation commenced on October 12 (DAS 120).

Results and discussion

Percentage recovery of labelled fertilizer N in the plant increased after DAS 85 ($P < 0.05$) to a mean of 40% (Table 1). Residual fertilizer in soil, including roots, decreased with time ($P<0.001$). Between 16 and 20% of the applied N was recovered in the surface 10 cm (data not presented). Fertilizer movement to depth was limited and less than 1% of ^{15}N was recovered in the 20-35 cm zone. The small ^{15}N recovery at this depth, and the lack of influence of irrigation on the distribution of residual N suggest that loss of N by leaching is minor on irrigated red-brown earths.

Table 1. Total recovery of fertilizer in plant and soil.

	Recovery of ^{15}N fertilizer				
Time (DAS)	85	100	121	149	175
	----------	----------	-%-	----------	----------
Plant	28	40	43	38	39
Soil	33	25	20	20	19
Total	61	65	63	58	59

Total recovery of fertilizer N in plant and soil was not affected by time or irrigation. Average total recovery was 60% suggesting that [1]40% of the fertilizer was lost during the initial 85 days from sowing. The losses occurred early in the growing season when crop N uptake was small and soil NO^-_3 content was high. Rain during the early part of the season probably causes denitrification.