Nitrogen accumulation from late applications of 15 N labelled fertilizer

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Irrigated wheat is achieving increasing importance on red-brown earths and related soils of south-eastern Australia. Potential yield of irrigated wheat is large, but quality is generally poor in the absence of fertilizer N. The present study was undertaken to determine the fate of late applications of ¹⁵_N and their contribution to grain nitrogen.

Materials and Methods

Rectangular microplots (30 cm x 28 cm) were inserted to 30 cm depth in a field experiment sown to Condor which otherwise received no application of N fertilizer (1). The plots were managed under rainfed conditions (dryland) or irrigated on a 7-day cycle. Irrigations commenced on October 12, 120 days after sowing (DAS 120). Applications of ¹⁵N (2.3 g N m⁻² at 16.495 atom % ¹⁵N) were applied to randomly selected microplots when the crop was at tillering (Sept. 14), earlyboot (Oct. 5) and heading (Oct. 22). Microplots were harvested at maturity. N contents and isotope ratios were determined.

Results and discussion

Percent recovery of ¹⁵N topdressings is summarized in Table 1.

Table 1. Percent recovery of ¹⁵N-labelled fertilizer applied at tillering, early boot and heading.

Growth stage at 15 N application	Rainfed			Irrigation		
	Grain	Plant #	Soil	Grain	Plant *	Soil
Tillering	39	54	12	40	49	16
Earlyboot	41	52	13	42	50	14
Heading	30	33	42	39	46	16

#Plant = grain + stem + leaf

Uptake of the N topdressing into the plant and its redistribution to the grain were not affected by delaying application from tillering to heading and approximately ¹40% of the ¹N applied was recovered in the grain under irrigated conditions. However, under rainfed conditions, lower recoveries were measured in grain and plant when the ¹⁵N topdressings were delayed until heading (P<0.05). Residual ¹⁵N in the soil increased to ¹42%. The nitrogen harvest index of all treatments was high, although topdressing at heading under rainfed conditions resulted in low plant assimilation and inefficient use of the fertilizer N.

Late uptake of N is significant when adequate moisture is maintained with irrigation. This N was efficiently incorporated into the grain and consequently should be effective in increasing protein content of the grain. By contrast, N application later than earlyboot, under rainfed conditions, tended to be less effective because the crop was relying on soil moisture reserves. The risk of not obtaining a positive response is increased and the N is likely to remain in the soil rather than being incorporated into the grain.

1. (1) Whitfield, D.M., Smith, C.J. and Gyles, O.A. 1987. These proceedings.