

## Relative importance of soil and fertilizer nitrogen to rice

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The apparent recovery of N applied to rice crops grown in S.E. Australia can exceed 90%. In addition unfertilized crops frequently take up around 100 kg N ha<sup>-1</sup>. These results conflict with those of many overseas workers and suggest that the mechanisms influencing availability of soil and fertilizer N in Australia may be considerably different to those in overseas rice fields. In the experiments below <sup>15</sup>N labelled fertilizer was used to determine the recovery of soil and fertilizer N for a range of application times.

### Methods

A rice crop (var. Inga) was sown in October following rice harvest the previous Autumn. Polythene pipes, 15cm I.D. and 33cm long, were driven into the soil within a large rice bay. <sup>15</sup>N labelled NH<sub>4</sub>SO<sub>4</sub> at 60 kg N ha<sup>-1</sup> was applied to the soil within the pipes at one of three times - sowing, permanent flood (P.F.) or panicle elongation (P.E.). There were 4 replicates of each treatment including unfertilized control pipes.

### Results and Discussion

Around 3% of <sup>15</sup>N applied at sowing was in the crop at harvest. The low recovery from plots fertilized at sowing reflect losses due to sequences of nitrification denitrification during flood irrigations prior to permanent flood. Delaying nitrogen until P.F. resulted in a 1.4 t ha<sup>-1</sup> increase in grain and a five fold increase in % <sup>15</sup>N recovery. Nitrogen application at P.F. more than doubled yield compared with unfertilized plots and 43% of the applied <sup>15</sup>N was found in the plant tops.

Table 1. Effect of applying 60 kg <sup>15</sup>N ha<sup>-1</sup> at various times on rice crop performance

		Fertilization time			
		Zero N	Sow	P.F.	P.E.
Grain Yield	t ha <sup>-1</sup>	3.5	4.8	6.2	7.4
<sup>15</sup> N Uptake	kg ha <sup>-1</sup>	-	2	9	26
Soil N Uptake	kg ha <sup>-1</sup>	50	64	77	83
Total N Uptake	kg ha <sup>-1</sup>	50	66	86	109
Apparent Recovery	% (1)	-	27	60	98
Actual <sup>15</sup> N recovery	%	-	3	15	43

(1) Apparent Recovery =  $\frac{(\text{total N uptake} - \text{N uptake on zero N plot})}{\text{Fertilizer application rate}}$

Fertilizer applications stimulated uptake of soil N. For instance 60 kg <sup>15</sup>N ha<sup>-1</sup> at sowing resulted in an extra 14 kg ha<sup>-1</sup> of soil N being recovered. Delaying <sup>15</sup>N application until R.E. increased the "priming" effect to 33 kg ha<sup>-1</sup>, with an apparent recovery of 98%. This priming effect reflects better root growth, and consequently more effective exploitation of available soil N. There was also evidence that the fertilizer stimulated turnover of native soil and that some of this was taken up by the rice crop. The amount of soil N taken up was strongly correlated with crop yield (R<sup>2</sup> - .87), and while fertilization did not result in a high percentage recovery of <sup>15</sup>N, it was vital in determining the supply of soil N. and consequently crop yield. The data presented above shows that between 76 and 97% of rice N came from the soil. Delaying N application until P.E. substantially increased uptake of both soil and fertilizer N. Further work is being undertaken to follow the fate of the 55 to 97% of applied N not being absorbed during crop growth.