

## Nitrogen economy in a crop sequence study on the Darling Downs

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Nitrogen recoveries in wheat crops in 1977 and 1978 have been studied following crops of eighteen legumes, oilseeds, and cereals grown on a black earth soil of the Darling Downs, Queensland in 1976. Nitrogen ( $\text{kg ha}^{-1}$ ) removed in grain and stubble was measured as well as available soil N following each crop.

Also, on an adjacent site in 1977, nitrogen recoveries of wheat with successive 10 kg ha increments of N fertilizer, up to 90  $\text{kg ha}^{-1}$  were measured. However the comparison of legume N with fertilizer N was hampered by exceptionally dry seasonal growing conditions which rendered fertilizer essentially unavailable. In contrast, residual soil nitrogen following legumes was available to wheat and resulted in increased wheat yield and improved wheat quality. Because of the low availability of fertilizer in 1977, legume and fertilizer N were compared again in 1978. Again more wheat was produced with a higher concentration of protein following legumes than following cereals. Unused fertilizer from 1977 also added to wheat yield and increased grain protein content.

Nitrogen removed in grain by the two wheat crops was 22-47  $\text{kg ha}^{-1}$  more following a legume than following a cereal. If the quantity of N in the stubble of the two wheat crops is added to this, the total N uptake following legumes is even greater.

For some prostrate legumes (e.g. field peas and lathyrus) the additional N removed could have been due to an inefficient N removal in the legume crop as a result of the wet harvest of 1976. Lupins, however, presented no harvesting problems and so the additional N removed (23-35  $\text{kg ha}^{-1}$ ) following that crop represents a net N gain. Combined removal of fertilizer N in grain of the two wheat crops, averaged across all application rates, was 35% of that applied. Thus, additional N removed in 1977 and 1978 wheat crops following legumes would represent, in terms of fertilizer N, an application in 1977 of more than 80  $\text{kg ha}^{-1}$ .

An increase in the availability of N following legume crops was also reflected in soil mineral N ( $\text{NO}_3\text{N}$ ) measurements. After a six month fallow more (46 - 124  $\text{kg ha}^{-1}$ ) mineral N was present to a depth of 120 cm following legumes than following cereals. Although not as large (22 - 90  $\text{kg ha}^{-1}$ ), the difference was still evident following the 1977 wheat crop but had disappeared following the 1978 crop.