

## Nitrogen economy of lupin - wheat rotations

A.D. Doyle and D.F. Herridge

Agricultural Research Centre, Tamworth, N.S.W. 3340

Nitrogen deficient soils in the North West region of New South Wales, especially the lighter, coarse-textured soils of the Pilliga Scrub, constitute a major limitation to expanded cereal production. Grain legumes fix nitrogen and as such can improve the N status of soils in which they grow. They are also valuable grain crops. It is in this context that a research programme was initiated to evaluate the benefits of grain legumes when grown in rotation with cereals. Data presented refers to some of our work with the narrow leaf lupin (Lupinus angustifolius) and wheat.

In the first year (1978) 50 m x 30 m blocks of wheat and lupins were sown in a randomized block design with 4 replications near Coonabarabran, N.S.W. Nitrogen fixation by the lupins was quantified using the acetylene reduction technique as well as tissue analyses of dry matter for total and nitrate nitrogen (Herridge, unpublished). Wheat was sown over the whole area in the second year (1979) with different rates of nitrogen fertilizer (0, 30, 40, 60, 80 and 100 kg N/ha as urea) superimposed as sub-plots to provide empirical data on the benefits, if any, of the rotation.

Total assimilation of nitrogen by the lupin crop was 350 kg N/ha with an estimated 0-30 kg N/ha derived from the soil. In other words 93-100% of N assimilated by the lupins was fixed by their root nodules. Nitrogen taken off with the harvested grain was equivalent to 90 kg/ha with 160 kg N/ha remaining in above-and below-ground crop residues. The value of residual nitrogen was \$80/ha.

In the second year, maximum dry matter of wheat following lupins was obtained at the N fertilizer rate of 40 kg/ha (Table I). Maximum yield following wheat was obtained at 80 kg N/ha. At zero N the yield of wheat after lupins was 35% higher than after wheat.

**TABLE 1. Dry matter of wheat at heading, 131 d after sowing (1979) (kg/ha)**

	Rate of N fertilizer (kg/ha)					
	0	20	40	60	80	100
Following - lupins (1978)	4760	5440	5860	6040	6090	5610
wheat (1978)	3530	4420	5030	5150	6080	6020

Lupins have provided a substantial amount of nitrogen to the following wheat crop. In this experiment wheat grown after lupins responded to additional nitrogen fertilizer, probably reflecting the partial mineralization of organic nitrogen bound into the lupin residues. Soil analyses (not yet completed) may provide more information on this aspect of the experiment.