

The influence of stubble management and nitrogen fertiliser on nitrogen fixation in chickpea

J.A. Doughton¹, P.G. Saffigna² and I. Vallis³

¹QDPI, Roma Research Station, Roma, Qld 4455

²Griffith University, Nathan, Qld, 4111

³CSIRO, Division of Tropical Crops and Pastures, St Lucia, Qld, 4067

In Queensland and northern New South Wales substantial areas of chickpea are sown in rotation with both summer and winter cereals and improve the nitrogen nutrition and yields of those crops. Nitrogen fixed symbiotically by chickpea can also provide additional nitrogen to the soil-plant system and can assist in arresting nitrogen fertility decline of cropping lands.

This paper describes results from an experiment designed to quantify nitrogen fixation by chickpea and to determine whether nitrogen fertiliser (or soil nitrate-N) and management of previous crop residues could influence nitrogen fixation. The experiment was carried out on a Darling Downs black earth (Ug 5.15) (1) located 10 km west of Toowoomba.

Methods

Residues (7.1 t/ha) from a grain sorghum crop were either a) removed by forage harvester and the soil cultivated, b) incorporated by cultivation or c) left on the soil surface and slashed (zero tillage). Ammonium nitrate fertiliser was sprayed onto plots at rates of 0, 50 and 100 kg/ha and leached into the soil by rainfall within 24 hours. The above combinations provided a 3 X 3 factorial with four replicates. Planting of chickpea (cv. Reselected Tyson) and barley as split plots was carried out 12 days after nitrogen fertiliser application.

Quadrat cuts of chickpea and barley were taken 130 days from planting and used to estimate chickpea nitrogen fixation by the ¹⁵N natural abundance Method (2).

Results and discussion

Soil nitrate-N under the various plots at planting of chickpea ranged from 10 to 130 kg N/ha (0-120 cm depth). Table 1 shows quantities of nitrogen fixed in chickpea tops. These exceeded nitrogen removed in grain (56 to 68 kg N/ha) in all but two cases indicating that chickpea is capable of providing a net nitrogen input to the soil plant system after grain removal.

Table 1. Nitrogen fixed in chickpea tops (kg N/ha) 130 days from planting for various nitrogen fertiliser and prior stubble management treatments.

Sorghum stubble management	Nitrogen applied (kg N/ha)		
	0	50	100
stubble removed	75	71	44
stubble incorporated	97	86	65
stubble surface retained	102	66	87

LSD (P=0.05) = 39

Treatment combinations that resulted in low soil nitrate at planting due to nitrate immobilisation by stubble and absence of applied fertiliser produced high nitrogen fixation, however differences from other treatment were not always significant

1. Northcote, K.H. (1979). A factual key for the recognition of Australian soils. Rellim Technical Publications, Adelaide.

2. La Rue, T.A. and Patterson, T.G. (1981). Advances in agronomy 34, 15-38.

