Leaching and the plant availability of organic nitrogen

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To determine optimum levels of nitrogen for application to crops it is necessary to know the fertilizer nitrogen equivalents of soil nitrogen, including the inputs of residues from past crops and pastures. Plant availability of nitrogen reflects rates of mineralization and nitrification in closed systems, but in open (leaching) systems plant availability also reflects the residence time of mineral nitrogen in the root zone of the crop.

Methods

In this project, various combinations of residue organic nitrogen sources (clover seedlings (6.9%N),lupin seedlings (6.3), clover seed (5.7), lupin seed (4.8), lupin leaves (3.8), weathered clover tops (2.4) and mixtures of ground dehulled lupin seed (6.7) with ground wheat straw (0.4)) were applied as fertilizers to wheat in undrained pots, drained leaching columns and at three field sites. Dry matter production, and nitrogen uptake were used as measures of nitrogen availability.

Results and discussion

The effectiveness for plant growth, of residue nitrogen relative to nitrate applied at seeding (RE) was measured and found to vary markedly with an index of leaching intensity (Fig.1). Figure l. The plant effectiveness of organic nitrogen sources relative to nitrate applied at seeding for a range of leaching intensities (Total leaching rain (mm)/gravimetric water content (%). Numbers on lines refer to nitrogen composition (%) of source materials.

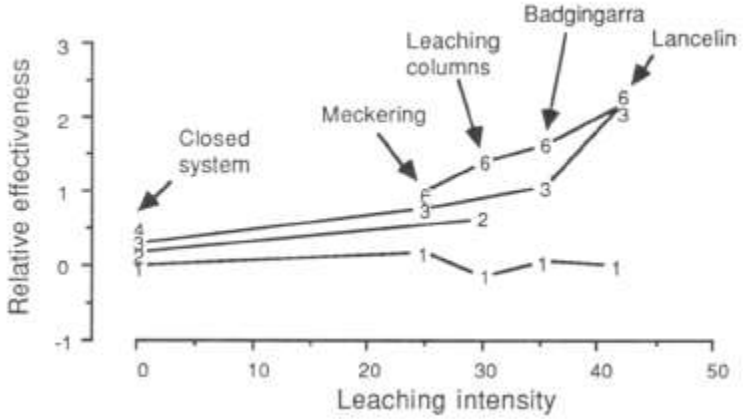

Figure 1. The plant effectiveness of organic nitrogen sources relative to nitrate applied at seeding for a range of leaching intensities (Total leaching rain (mm)/gravimetric water content (%)). Numbers on lines refer to nitrogen composition (%) of source materials.

Organic nitrogen sources of high nitrogen percentage mineralize more rapidly than low nitrogen sources but are still not as available as the nitrate source, as indicated by the REs for the closed system. The rate of nitrification is still low enough to reduce losses in the leaching environments where REs are greater than one.

Mixtures of high and low nitrogen sources have similar REs to the natural materials of similar nitrogen percentage except at high leaching intensities, where the mixtures seem to be more effective (Table 1, poster).