Fate of ^{15}n urea applied to a wheat crop as affected by stubble management

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Previous studies conducted at the Wongan Hills Research Station have indicated that the retention of wheat stubble can reduce the grain yield of the subsequent wheat crops by about 27% compared to treatments where stubble was burnt. The aim of the study reported here was to determine whether the lower grain yields were the result of reduced rates of mineralisation of soil N and higher rates of immobilisation of fertiliser N or an effect of stubble management on the loss of fertiliser N by either leaching or denitrification.

Methods

The study was conducted in a long-term stubble management trial which was established at the Wongan Hills Research Station, Western Australian Department of Agriculture, in 1978. ^{1}5N labelled urea (46 kg N ha') was broadcast and incorporated into soil within 0.24 m diameter 0.35 m long PVC tubes. These were installed 10 June 1988 where stubble had been (1) grazed over summer and autumn (grazed), (2) left ungrazed but the stubble burnt before opening winter rains, or (3) neither grazed nor burnt (unburnt/ungrazed). Soil was sampled in 0.1 m increments to 0.4 m depth every ten days after fertilisation in unplanted tubes, except after 105 days of sowing when soil was sampled to 1.6 m in 0.2 increments below 0.4 m. Plant samples were taken from planted tubes 70 and 105 days after fertiliser application. Soil was analysed for content of 15N in NH_{4+}, NO3- and organic pools.

Results and discussion

There were no significant differences in the total recovery of 'N between treatments in either planted or unplanted systems which indicated that previous stubble management did not affect the total recovery of fertiliser N. The total recovery of ^{15}N in plant systems was 20-35 percent higher than in unplanted systems at 70 and 105 days after fertilisation (data not presented). The difference in total recovery of 15N between planted and unplanted systems was attributed to plant uptake which reduced the losses of 15N, presumably due to leaching.

Fig.1 Total 15-N recovery in unplanted soil (0-400 mm) and rainfall

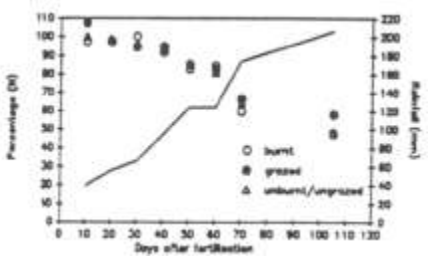
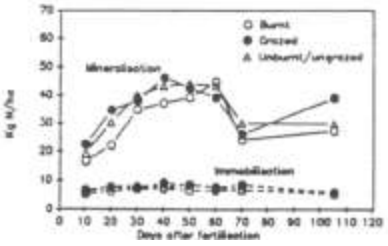


Fig.2 Soil mineralisation and immobilisation of fertilizer N. unplanted soil .



^{15}N dilution techniques showed that net mineralisation of soil organic nitrogen in burnt treatment in unplanted soil at 0-200 mm depth was significantly lower than in grazed and unburnt/ungrazed treatments up to 50 days after fertilisation (Fig. 2). Quantities of 15N immobilised into organic N in unplanted soil were similar between treatments (Fig. 2). The similar rates of loss of N, comparable rates of immobilisation and the apparent higher net mineralisation of soil organic nitrogen in ungrazed and unburnt treatments imply that the stubble retention did not reduce the availability of soil or fertiliser N and that low N availability was unlikely to be the cause of poor grain yields (1.6 t) in ungrazed/unburnt treatments compared to grazed (2.1 t) and burnt (2.2 t) treatments, in 1988.