The availability of early applied nitrogen for winter crops in Queensland

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During the past decade there has been a four-fold increase in the use of nitrogen for cereal crops in Queensland, which has created some problems with fertilizer distribution. Financial incentives are offered to growers to apply anhydrous ammonia, which comprises 80% of the nitrogen used on cereal crops outside the peak demand periods. The application of nitrogen in January or February for winter crops may be convenient for supplier and user but there is a chance that some of the applied nitrogen may be either tied up because of immobilization or lost if summer rains promote waterlogging. A field experiment has been conducted to measure the quantity of available nitrogen in the soil at planting with early application and with application at the conventional time (April or May).

Methods

Anhydrous ammonia was applied with a 25cm tine spacing at 90 kg N ha^{-1} to a black earth (Norillee) soil at Bongeen in January, March and May at a depth of 10cm. Applications were also made at a depth of 13cm in March and May. Urea was also applied in March. The site was previously cropped to barley and stubble was incorporated. It was maintained weed-free with cultivation during the fallow. In March, plots to which nitrogen was applied in January were sampled across two adjacent fertilizer bands at three positions in each plot to a depth of 0.4m (0-0.2 and 0.2-0.4m intervals). Plots were similarly sampled in June to a depth of 1.2m before planting wheat to determine soil water and mineral (NH_4, NO_3 and NO2) nitrogen contents.

Results and Discussion

In June the recovery of mineral nitrogen to 0.6m with January and March-applied anhydrous ammonia and with March-applied urea was 56, 65 and 55% respectively of that recovered from the profile with May application. An additional 18 and 15% was recovered from below 0.6m with January and March application respectively, whereas only 7% or less was recovered from below 0.6m with the urea treatment or anhydrous placed at 17cm in March.

The site was inundated on three occasions during the summer fallow; twice before and once after the March application. These wet periods could have promoted some leaching of applied nitrogen as well as some nitrogen loss during the ensuing periods of waterlogging. Soil sampling revealed that a high (91%) proportion of January-applied nitrogen could be recovered in the mineral form to a depth of 0.4m at March, which suggested little leaching or loss of applied nitrogen during the January-to-March period. Similarly the results of the June sampling indicate that most of the reduction in plant available nitrogen supply occurred in the post-March period, there being similar recoveries of mineral nitrogen with January and March applications. Immobilization during the fallow may have been responsible for some reduction in the quantity of mineral nitrogen available at planting. In a field study in 1978 (1) that proportion (25-57%) of nitrogen applied in February not recovered in either mineral or organic forms was assumed lost to the atmosphere. Similarly, some applied nitrogen may have been lost to the atmosphere in this experiment because of the prolonged inundation in early April.

Low apparent recoveries of nitrogen applied during this wet summer fallow contrast with results obtained in 1978 when early (February) applied nitrogen was recovered completely after a relatively dry summer fallow.

1. Saffigna, P. G., Strong, W. M. and Waring, S. A. 1980. Queensland Wheat Research Institute biennial report 1978-1980, 51-52.