

CHANGES IN NITROGEN AND ORGANIC CARBON IN A MYWYBILLA CLAY FOLLOWING APPLICATIONS OF N FERTILISER RATES TO NINE CROPS

C.W. Dowling

Incitec Fertilizers, PO Box 623, Toowoomba, Qld 4350

The economic and biological sustainability of cropping, using fertiliser nitrogen as the sole nitrogen input to the soil system, has been questioned in recent times. However, in large areas of cropping land the use of pasture leys is not feasible and the success of grain legumes has been limited, so fertiliser nitrogen has remained the primary nitrogen source.

MATERIALS AND METHODS

A sorghum/barley rotation was established with five rates of fertiliser N and P applied in each crop. After nine crops in ten years, soil nitrate-N samples were taken from the five rates of N with both 0 and 20 kg/ha of P. Each core was taken to a depth of 300 cm and divided into ten 30 cm segments. Samples were taken from the 0-10 cm and 10-20 cm for total N and organic carbon (% OC). The effect of P on accumulation of OC and total N was not considered in this study. The preparation of the samples, extraction and analysis were conducted at QWRI, Toowoomba, according to the procedures described by Standley (1).

RESULTS AND DISCUSSION

Soil nitrate

In the plots where had nitrogen been applied annually, significant increases in soil nitrate-N were found. The amount of nitrate-N equated to 56, 66, 130, 168 and 304 kg/ha N available in the top 150 cm of soil for the 0, 40, 80, 120 and 160 kg/ha N treatments respectively. The most significant increase in soil nitrate-N concentration was with 120 and 160 kg/ha N, where the fertiliser inputs greatly exceeded the N removed in the grain. Most of the N was found at 0-90 cm, within reach of the root systems of most crops. In the soil layers below 90 cm the nitrate-N concentration was significantly lower than those above.

Soil organic carbon

There was no measureable change in % OC in samples taken at sowing from the zero N plot prior to sowing of each of the nine crops. No significant change in % OC was found as a result of the addition of the 5 rates of N. This suggests that change in % OC is parallel across all N treatments or the accumulation/decline of carbon is limited by a factor other than N. It has been suggested that the rate of decline in % OC is more closely related to water availability for dry matter production than N availability *per se*. (M. Foale, pers. commun.).

Soil total nitrogen

The rate of applied N was found to have a significant ($P=0.09$) effect on the total N content of the soil. The mean annual increase in soil total N was 0.13%, 0.4%, 0.8% and 0.6% for the 40, 80, 120 and 160 kg/ha N rates, respectively. The majority of the accumulation of nitrogen in the soil appeared to be in the form of nitrate-N not N incorporated in organic matter. The apparent low proportion of applied N in the organic form may be related to the lack of significant increase of organic matter as indicated by the % OC.

REFERENCES

1. Standley, J. 1993. Analytical Note No. 4, QWRI, Toowoomba, Queensland. 15 pp.