Behavior of nitrogen applied to upland field in Thailand

In 1974 a field experiment using ^{15}N tracer technique was carried out in the Phraputtabat Agricultural Experiment Station to clarify the behavior of fertilizer nitrogen applied to the upland field in relation to rainfall. The soil of the experimental field was Reddish Brown Lateritic soil, with a clayey texture throughout the profile, containing mainly kaolinite minerals with a moderate content of montmorillonite.

The experimental field was divided into following four plots:

Plot A: No crop was planted. When the plot had received a total of 300 mm of rainfall after fertilizer application, soil samples were taken.

Plot B: No crop was planted. Soil samples were taken when the plot had received a total of 600 mm of rainfall after fertilizer application.

Plot C: No crop was planted. The plot was not exposed to rainfall by being covered by a roof after fertilizer application, and soil samples were taken at the same time as in Plot B.

Plot D: Corn (DMR No. 6) was planted. Fertilizers were applied in the same way as other three plots. Soil and plant samples were taken at the time of corn harvest, that coincided with the date of soil sampling of Plot B and C.

In each plot a small sub-plot with an area of 0.225 m^2 (0.3 × 0.75 m), enclosed with galvanized iron sheets was placed, and fertilizers (^{15}N enriched nitrogen, phosphate and potassium) were applied in a band with a width of 10 cm to a depth of 3 cm below soil surface in each sub-plot. Nitrogen was applied in the form of ^{15}N enriched ammonium sulphate at a rate of 2,250 mg N/sub-plot as a basal dressing. Soil samples were taken quantitatively from successive soil layers as shown in Fig. 1.

Distribution pattern of applied nitrogen in the Plot A, which had received 300 mm of rainfall after fertilizer application showed that nitrogen concentration was very high at the site of nitrogen application, but it decreased with the distance from the site of application both in vertical and horizontal directions. At the depth of 50 to 90 cm, no nitrogen was recovered.

In the Plot B, which received 600 mm of rainfall, the nitrogen distribution was nearly the same as that of Plot A, although it showed a deeper downward movement of nitrogen due to more rainfall than Plot A. However, no accummulation of nitrogen was observed at the 50 to 90 cm of depth.

In the Plot C, which had been kept under a roof, the movement of nitrogen was extremely limited, showing high concentrations in the surface layer of 0 to 10 cm depth, particularly at the site of fertilizer application and adjacent portions as given in Fig. 1.

It is worthy to note that 50 to 60% of the total nitrogen applied was lost from the soil within a short period of two or three months after the application in the above three plots. Since it is evident that there was no nitrogen loss caused by leaching and absorption by crop, the result suggests the nitrogen loss in the form of gas.

Nitrogen distribution pattern in the Plot D after the harvest of corn is shown in Fig. 1. Balance sheet of applied nitrogen is given

Table 1. Balance sheet of applied fertilizer nitrogen in corn plot (Nmg/area*)

Amount of applied N	Fertilizer N taken up by plants (A)	Residual fertilizer N in soil after harvest (B)	A+B	Loss from soil	% of recovery of N
2250	235.5	201.5	437.0	1813	19.4

* Sub-plot surrounded by galvanized iron sheets

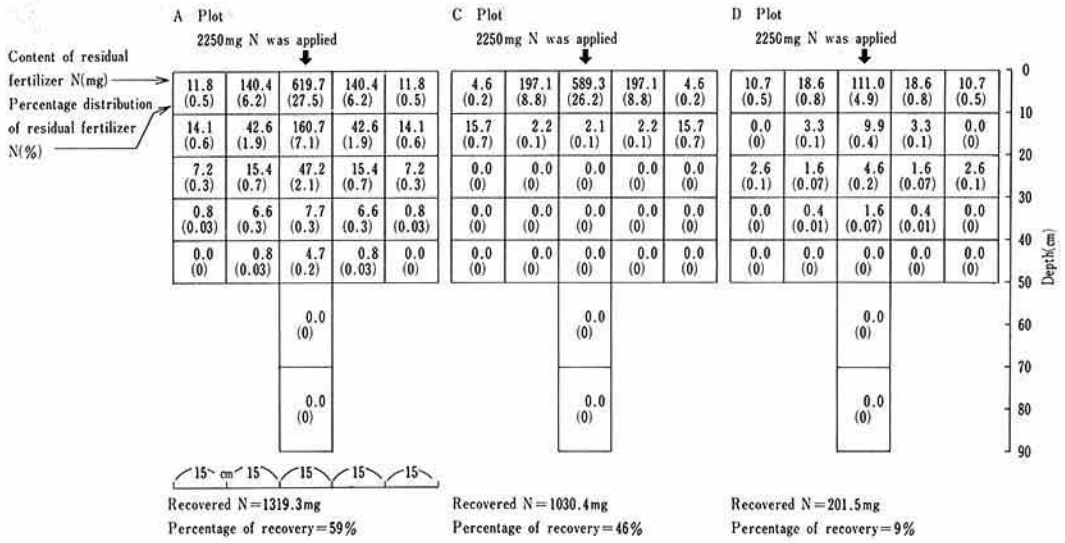

Fig. 1. Distribution of applied fertilizer nitrogen in soil layer

in Table 1, which indicates that about 10% of the total nitrogen applied was utilized by the crop, whereas residual nitrogen in the soil after the crop harvest was only 9%. This fact implies that as much as 81% of the total applied nitrogen was lost from the soil. This percentage of loss in the Plot D with crop culture was much higher than that of other plots without crop.

Further studies are needed to find out the mechanism of such nitrogen loss and methods to minimize it.

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