

Fig. 30. Vertical distributions of exchangeable Ca and Al at 3 years after lime application.

grown. Thus, it is recommended that for Ultisols (Typi Paleudult) or for Ultisols with similar mineralogy and texture, annual rates of 200-400 kg/ha should suffice to maintain maize and cowpea yield. Under such circumstances, lime could be regarded as a form of fertilizer rather than a major soil amendment.

Leaching of nitrate under maize.

An experiment was established at Onne in 1980 to study the pattern of nitrate leaching under field conditions. Maize was planted in the first season and upland rice in the second season. Three methods of N application were used, 1 application at planting, 2 split applications: one-half at planting and one-half at 4 weeks after planting and 3 split applications: one-third at planting, one-third at 4 weeks after planting and one-third at 8 weeks after planting. A N rate of 150 kg/ha as calcium ammonium nitrate was used. A bare fallow treatment was included. The experiment was a split-plot design with 4 replications. Lime and unlimed treatments were the main plot.

Downward movement of inorganic N ($\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$) in the soil was monitored periodically up to a 120 cm depth (Fig. 31). At the end of 4 weeks (129 mm rainfall), the pattern of nitrate movement when all N was applied at planting in the unlimed plots was similar to the bare fallow and the crop plots. The peak concentration occurred between 30-60 cm. At the end of 8 weeks (477 mm rainfall), the nitrate peak in the cropped plots occurred at a depth of 60-90 cm, but the nitrate peak in the bare fallow plots was considerably deeper and broader, indicating greater leaching. At the end of the first season (940 mm rainfall), the nitrate peak moved to a depth of 105-120 cm. Liming increased the rate of nitrate leaching in both bare fallow and cropped plots. When N was split into 2 applications, nitrate peaks occurred in the upper layer between 0-30 cm both at 4 and 8 weeks after planting, indicating less leaching.

Splitting N into 2 applications significantly increased grain yield and N-uptake by the plant (Table 40), but fur-

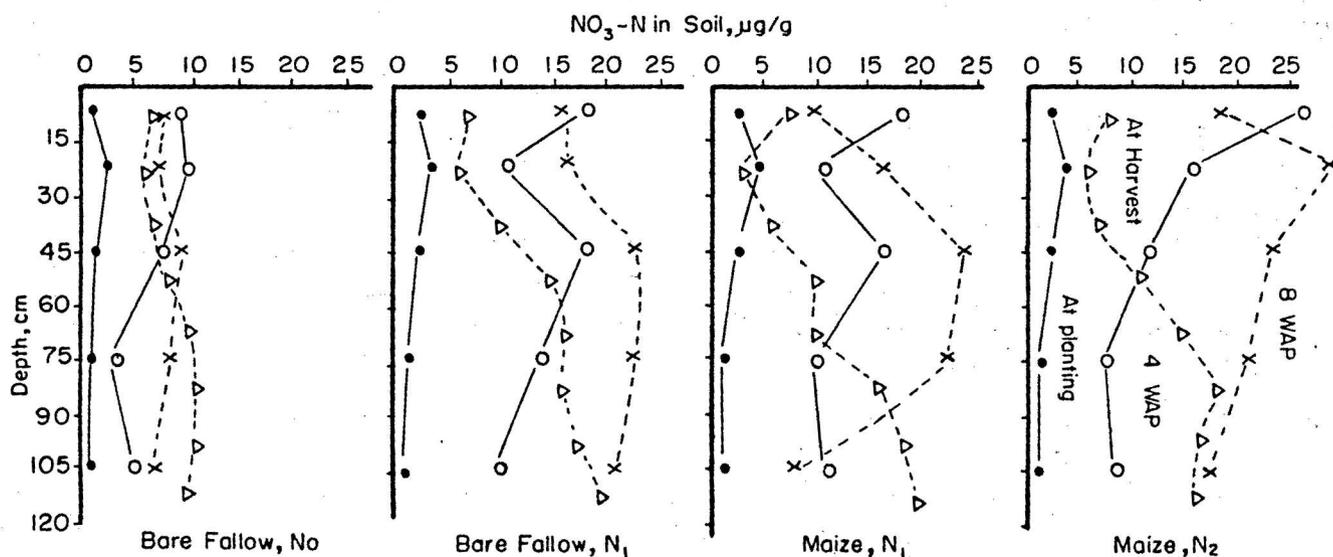


Fig. 31. Leaching of nitrate in unlimed plots under cropping and bare fallow. (No- no N applied, N₁-150 kg N/ha applied at planting, N₂-150 kg N/ha split application, one-half at planting, one-half at 4 weeks after planting.)