Effect of different fertilization managements on the changes of soil nitrogen and phosphorus fractions under two rotation systems after sixteen years

Chou, E. T.[1], S. F. Tai[2], and R. S. Chung[1]

Abstract

Nitrogen (N) and phosphorus (P) are the most common limiting nutrient in the growth and yield of crops. There are many factors that influence the availability and transformation of N and P in the soils. The objective of this study was to evaluate the effects of different fertilization managements on the different fractions of soil N and P under two different cropping systems after treating for 16 years. There were three fertilization treatemtns, including: 1. Apply chemical fertilizer only (Chem-F); 2. Apply organic fertilizer only (Org-F), and 3. Apply half-compost N plus half-chemical N fertilizer (Inter-F). The methods proposed by Bremner and Sui and Thompson were used to fractionate N and P, respectively, into different fractions. The results indicated that the concentrations of different fractions of soil N decreased in the order Org-F > Inter-F > Chem-F. In Rot-1, application of organic fertilizer resulted in decrease the proportion of unidentified hydrolyzable N and total hydrolyzable NH_4-N, however, increase the proportion of nonhydrolyzable N and unidentified hydrolysable N. The same was not true in Rot-2. There was significantly linear regression relationship between the amout of P fertilizer applied and total soil P concentration. There were also significantly linear regression relationships between the total soil P concentration and $NaHCO_3$ extractable inorganic P, HCl-P and residual-P, respectively. This indicated that the P applied preferentially transformed into these fractions, especially HCl-P being the most predominant. Different phosphorus fractions decreased in the order HCl-P >$NaHCO^3$-IP ≈ NaOH-IP > Residual P > NaHCO3-OIP ≈ NaOH-OP> H_2O-P. Long-term fertilization changed the concentrations and proportions of different fractions of N and P and did not change the order.

Key words: hydrolyzable nitrogen, nonhydrolyzable nitrogen, sodium bicarbonate extractable phosphorus, hydrochloric acid extractable phosphorus.

[1] Former master student and Professor, Department of Agricultural Chemistry, National Taiwan University

[2] Researcher and deputy director, Kaohsiung District Agricultural Research and Extension Station