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Changes in Inorganic and Microbial P Fractions Over Time Following Goat Manure and Inorganic Phosphate Addition to a High P Fixing Soil

Elias Gichangi[1], Pearson Mnkeni[1], Phil Brookes[2]

[1] *University of Fort Hare, Department of Agronomy, South Africa*
[2] *Rothamsted Research, Agriculture and Environment, United Kingdom*

Abstract

Phosphorus transformations in untreated and manure treated soils at varying inorganic P application rates were assessed in controlled laboratory incubation experiments using a sequential fractionation procedure. Phosphorus was added at rates of 0, 45, 90, 135 and 180 mg P kg^{-1} as triple super phosphate with or without 20 t ha^{-1} of goat manure (dry weight) and incubated moist for 12 weeks. Resin P, soil microbial biomass P, 0.5 M NaHCO3 extractable inorganic P (NaHCO3-Pi) and 0.1 M NaOH extractable inorganic P (NaOH-Pi) concentrations were determined on days 1, 7, 14, 28, 56 and 84. Addition of inorganic P increased all P fractions but the increases were greater when goat manure was co-applied. The control treatments had only 17.2 and 27.5 mg P kg^{-1} of resin extractable P in the un-amended and manure amended treatments, respectively which increased to 118.2 and 122.7 mg P kg^{-1} at the highest rate of P application (180 mg P kg^{-1}) on day 28 of incubation. NaOH-Pi was the largest extractable Pi fraction and ranged from 144 to 251 mg P kg^{-1} and 108 to 213 mg P kg^{-1} in the unamended and manure amended treatments, respectively. Inorganic P addition increased the microbial biomass P concentration from 17 to 44 mg P kg^{-1} in P alone treatments but the fraction was greatly enhanced with manure addition, increasing it from 32.6 to 97.7 mg P kg^{-1}. The largest improvement in microbial biomass P due to manure occurred at low rates of added P indicating the potential of goat manure to enhance the fertiliser use efficiency of low doses of P fertilisers. This increase in microbial biomass P following goat manure addition implies that the presence of goat manure increased the proportion of added P immobilised in microbial cells that would be subsequently released into the soil solution and be available for plant uptake following microbial turnover.

Keywords: P fractionation, goat manure, microbial biomass, resin-P

Contact Address: Elias Gichangi, University of Fort Hare, Department of Agronomy, 5700 Alice, South Africa, e-mail: gichangim@yahoo.com