CONSEQUENCES OF FLUORINE (F) ACCUMULATION IN ALLOPHANIC SOIL

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Fluorine (F) is a significant contaminant in most phosphate fertilisers, the continuous application of which significantly contributes to F accumulation in agricultural soil. Accumulated soil F may have the potential to alter soil properties, and thus may require changes to future land use and management practices.

Allophanic soil is one of the most productive soil orders in New Zealand. It is characterised by a high phosphate retention capacity requiring high application rates of phosphate fertiliser, resulting in high F accumulation rates in these soils. The objective of this study was to quantify the effect of added F on selected Allophanic soil properties.

A bulk soil sample (478 mg/kg total F) was collected from a dairy farm near Hawera in Taranaki. Pot experiments were conducted under glasshouse conditions, with treatments being amended with NaF to deliver spiked F concentrations of 0, 77, 154, 231, 308, and 385 mg F/kg of soil. These soil F concentrations are estimated to be equivalent to 0, 10, 20, 30, 40 and 50 years of F accumulation respectively, *via* the continuous application of phosphate fertiliser. Each treatment was replicated 6 times.

After 14 months, soil pH, Dissolved Organic Carbon (DOC), $CaCl_2$-extractable, and water-extractable F concentrations were measured. These analyses showed that soil pH significantly ($p<0.05$) increased from 5.18 to 5.53 with increased F addition. Dissolved organic carbon ranged from 270.5 to 331.3 mg/kg and significantly increased ($p<0.05$) with increased F addition. $CaCl_2$-extractable and water-extractable F values ranged from 4.95 to 12.67, and from 2.57 to 5.11 mg/kg soil respectively. These increases correlated significantly ($p<0.05$) with increasing F addition to the soil.

On average, F extracted by water and 0.01 M $CaCl_2$ was 0.37 % and 1.49 % of the added F respectively, and suggests that the major fraction of F added as NaF was immobilised by Allophanic soil. Immobilisation resulted in an increase in soil solution pH and an increase in DOC concentration by 0.4 unit and 60.8 mg/kg, respectively.

Editor's Note: An extended manuscript has not been submitted for this presentation.