

Environmental management perspectives of soil fluorine in New Zealand's agricultural soils

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The prolonged use of superphosphate fertilisers has inherited an accumulation of F in topsoils and it is considered to be building up in most of New Zealand's agricultural soils. NZ research into soil F has been hampered by the lack of a reliable and simple test for soil F. The accuracy of different methods to quantify the presence of F in analytical preparations is dependent on interfering elements such as aluminium (Al). The conventional methodology of NaOH fusion is considered to be time consuming, expensive and very dependent on the abilities of the operating technician, thus it is not ideal for environmental monitoring. A study conducted at FLRC, Massey University to assess the accuracy of alternative techniques relative to the standard fusion protocol found that simple extraction of soil with NaOH (4M) consistently reported 80% of the total soil F for Allophanic soils which generally represents the greatest history of build-up of soil F from superphosphate application. This initial work was further examined to confirm the repeatability of the NaOH extraction technique to quantify soil F, with specific focus on the relative accuracy of this technique between different soil orders. In order to have a representative wide range of soil orders and long term fertiliser application background, a study was conducted to perform the NaOH extraction technique on 13 different New Zealand soil types to determine the distribution of total soil F. This technique was further validated by analysing in both New Zealand and Australian laboratories. Variability between soils was assessed as a function of soil properties. Using this method, a controlled laboratory study was then performed to assess the impacts of elevated F on soil microbial activity. This presentation proposes the environmental guidelines to reliably measure and manage the elevated F issues in the New Zealand agricultural system.