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Extraction Methods in Soil Phosphorus Characterisation

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Extraction methods are widely used to assess the bioavailability of P and to characterise soil P reserves. Even though new and more sophisticated methods to characterise soil P are constantly developed the use of extraction methods is not likely to be replaced because of the relatively simple analytical equipment needed for the analysis. However, the large variety of extractants, pre-treatments and sample preparation procedures complicate the comparison of published results. In order to improve our understanding of the behaviour and cycling of P in soil, it is important to know the role of extracted P in the soil P cycle. The knowledge of the factors affecting the analytical outcome is a prerequisite for justified interpretation of the results.

In this study, the effect of sample pre-treatment and properties of the used extractant on extractable molybdate-reactive phosphorus (MRP) and molybdate-unreactive phosphorus (MUP) was studied. Furthermore, the effect of sample preparation procedures prior the analysis on measured MRP and MUP was studied. Two widely used sequential extraction procedures were compared on their ability to show management induced differences on soil P.

These results revealed that pre-treatments changed soil properties and air-drying was found to affect soil P, particularly extractable MUP, thought to represent organic P, by disrupting organic matter. This was evidenced by an increase in the water-extractable small-sized (<0.2 μm) P that, at least partly, took place at the expense of the large-sized (>0.2 μm) P. In addition to the effects of sample pre-treatment, the results showed that extractable organic P was sensitive to the chemical nature of the used extractant and to the sample preparation procedures employed prior to P analysis, including centrifugation and filtering of soil suspensions. Filtering may remove a major proportion of extractable MUP; therefore filtering cannot be recommended in the characterisation of solubilised MUP. However, extractants having high ionic strength may cause the organic molecules to collapse during centrifugation and thus affect the recovered concentration of MUP. These findings highlight the importance of characterising the nature of the MUP extracted with different extractants and acknowledging the sensitivity of MUP to analytical procedures when comparing published results.

Widely used sequential fractionation procedures proved to be able to detect land-use -derived differences in the distribution of P among fractions of different solubilities. The results of this study demonstrate that, although the extraction methods do not reveal the biogeochemical function of a given P pool in soil, the extraction methods can be used to detect changes in soil P pools with different solubilities. To obtain the most benefit from extraction methods, we need a better understanding of the biological availability of P and the role of extracted P fraction in the P cycle in soils from different environments (climatic and weather) and land-uses.