



Determination of soil organic phosphorus exchange sensitivity

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Soils contain both organic and inorganic phosphorus (P) species in varying proportions. Studies have shown that many soils contain substantial amounts of inositol hexaphosphate (IHP) and there is much interest worldwide in developing strategies to make some use of this recalcitrant resource for plant growth to reduce P fertilizer inputs. Little is known about the preference of ion exchange processes in the solubilisation of organic vs inorganic P forms in soils, an important first step in making P forms bioavailable. Although they do not possess biotic functions, resins provides a simple means to deplete P forms in soil allowing investigation of exchange selectivity between inorganic and organic P forms. The aim of our work was to determine new understanding of exchange selectivity in soils and provide insight into potential depletion and plant uptake of soil phosphorus, with emphasis on organic forms such as IHP.

For our study we used a Cambisol sampled from an agricultural area (Tayport) near Dundee in Scotland. The soil had a high Olsen (0.5 M sodium bicarbonate at pH 8.5) extractable P status (84 mg P/kg) and P-31 nuclear magnetic resonance analysis of its NaOH/EDTA extract showed it contained a substantial proportion of IHP (21 % of total extractable P). For resin extraction we used anion exchange resin sheets (4.17 cm each side) in bicarbonate form to minimise pH related solubilisation effects. We used 3.5 g of soil in 75 ml of water and added 1, 2 or 3 resin squares. After equilibration the resin squares were removed and replaced with fresh resin squares a further 3 times. Phosphorus was recovered from the resin sheets by elution with 0.25 M sulphuric acid and analysed by inductively coupled plasma spectroscopy to determine total P, and colorimetrically with malachite green to determine inorganic P with the remainder assigned to organic P.

The data showed that the resin preferentially removed inorganic P and even after four sequential extractions little or no organic P (< 9 %) was found on the resin, despite the high charge density of IHP. The amount of total P extracted over the sequential extractions with 1, 2 or 3 resin squares decreased in an exponential manner.

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