

Soil phosphorus evaluation: correlation between the Olsen and ammonium lactate extraction methods in Portuguese acid soils

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Most methods currently in use to quantify soil phosphorus (P) were developed for agronomic purposes, that is, with the aim of providing an estimate of the phytoavailable soil P. From an environmental standpoint it is well established that freshwater eutrophication is partly attributed to non-point source pollution from agricultural land, and the eutrophication risk is mainly correlated with soil P level. Currently, there are more than twenty methods of soil P extraction, of which about ten are in use in Europe. This makes it difficult to compare soil P levels between countries and even different regions within a country, and also to establish guide-lines in terms of common agronomic and environmental policies. In particular, the Ammonium Lactate (AL) method, which is the official one in Portugal, is seldom used in laboratories of other countries. However, replacing it for one of the commonly used methods is time consuming and costly. Previous work suggested that Olsen's method is suitable for Portuguese acid soils for both agronomic and environmental purposes. The main objective of this work was to compare the AL-P with the Olsen P values and propose an accurate model for predicting Olsen P from AL-P. For this purpose, forty-eight soil samples belonging to twelve different reference soil groups were used. Some soils were incubated with Gafsa phosphate rock (500 mg P kg^{-1}) for 120 days at 20°C . Following this incubation period, AL-P and Olsen-P were also measured. Despite their contrasting composition, both reagents extracted phosphate from the same sources (as previously evaluated from a sequential fractionation scheme), albeit in different proportion. Both Olsen P and AL-P were strongly correlated with resin-extractable and dilute electrolyte-desorbable P, which are respectively related to the soil contents in phytoavailable P and P that can be released to runoff or drainage water. Olsen-P and AL-P were strongly correlated ($R^2 = 0.870$), the correlation becoming stronger when three overfertilized soils were excluded (Olsen P = $2.35 + 0.45 \text{ AL-P}$; $R^2 = 0.908$; $P \leq 0.001$, $n = 45$). No correlation was observed for a group of soils recently fertilized with Gafsa phosphate probably because the acidic AL reagent dissolved residual calcium phosphate, thus overestimating the soil content in desorbable P.