Effect of slurry acidification on phosphorous fractionation after soil application

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Animal slurry is commonly applied to soil as a source of organic matter and to supply nutrients to plants, namely nitrogen (N) and phosphorus (P). However, slurry management at farm and field scale led to high ammonia emissions and slurry acidification has been promoted as an efficient solution to decrease such emissions. Nevertheless, little is known about the effect of slurry acidification on P dynamics after soil application.In the present work, a laboratory incubation was performed to assess the effect of pig slurry acidification on P fractionation after soil application. Three treatments were considered: non acidified pig slurry (PS), acidified pig slurry (APS) and a control. Slurry was applied at a rate of 120 mg P kg^{-1} dry soil to a sandy soil. Soil samples were collected immediately after setting up the different treatments (T0) and at 182 days (T6). A modified version of the Hedley P fractionation scheme described by Roboredo (2007) was determined in each sample. The fractionation scheme included the extractions with cationic and anionic resin in the membrane form (CAEM-P), $NaHCO_3$, NaOH, NaOH plus ultrasound (u.s.) and HCl . Inorganic P was determined in all the extracts by the modified molybdenum blue method. Total P was also determined after a potassium persulphate digestion in the $NaHCO_3$, NaOH and NaOHu.s. extracts. Organic P (Po) was evaluated as the difference between total and inorganic P (Pi). Data was analyzed as the increases observed in the PS and APS treatments relative to the control and expressed as percentage. At the beginning of the incubation (T0), the Hedley fractionation revealed that the CAEM fraction represented the majority of the increase resulting from the slurry application. These increases were significantly ($P<0.05$) higher in the APS treatment, 87.4%, when compared to the PS treatment, 75.8%. Also, when comparing both treatments, it was observed that all the other Pi fractions ($NaHCO_3$ Pi, NaOH Pi, NaOHu.s. Pi and HCl) presented significantly ($P<0.05$) lower increases in the APS treatment. There were no significant differences between both treatments with respect to the organic P fractions. At the end of the incubation (T6) differences between treatments followed a similar trend, although the NaOH Po presented small but a significant ($P<0.05$) increase (0.14% and 0.36% in PS and APS treatments, respectively). When comparing data T0 and T6, PS treatment revealed that the NaOH and NaOHu.s. organic fractions showed significantly ($P<0.05$) lower increases at T6, when compared to T0 (8.09% and 0.57% for the NaOH Po + NaOHu.s. Po at T0 and T6, respectively). These variations were followed by significant ($P<0.05$) increases of the $NaHCO_3$ Po, NaOH Pi, and, particularly, the $NaHCO_3$ Pi fraction (4.30% and 9.92% at T0 and T6, respectively). The CAEM fraction remained constant with no significant alterations. The APS treatment followed a similar trend between T0 and T6 with the $NaHCO_3$ Pi presenting the highest increase (from 1.28% to 9.42%). Nevertheless, the CAEM fraction decreased significantly ($P<0.05$), from 87.4% to 82.6%. The results evidence that slurry acidification enhanced the increases in the most biologically available P fraction, the CAEM. Also, in both treatments, PS and APS, the incubation promoted the mineralization of occluded Po and the consequent increment of more labile and plant available fractions.

Roboredo, M. 2007. A aplicação directa de rochas fosfatadas ao solo. Comportamento químico e agronómico. Dissertação de Doutoramento, UTAD, 291 p.