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Characterization of acid piedmont rice soils for phosphorus sorption and phosphorus saturation

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Abstract: The maximum phosphorus adsorption (S_{max}) and Phosphorous saturation index (P_{sat}) of a soil provide information for the proper management of the P fertilizer of the soil. The objective of this investigation was to determine S_{max} and develop a P_{sat} for 14 rice soils. Soil samples were analyzed for pH, clay content, dithionite extractable Fe (Fe_D), Mehlich-3 (M3) extractable P (PM3), and Fe (FeM3). The S_{max} value and P_{sat} based on M3 extractions were determined. The S_{max} value ranged from 110 to 625 mg kg^{-1}, and correlated with sand (r =-0.70, P>0.01), silt (r =0.70, P>0.01), clay (r =0.59, P>0.05) and Fe_D (r =0.71, P>0.01). Soil pH_{H2O} and organic carbon content were not correlated (P>0.05) with S_{max}, while pH_{KCl} was negatively correlated (r =-0.64, P>0.05) with S_{max}. Multiple regression found that the combination of pH_{KCl} and Fe_D were the two most important soil properties related to the S_{max} of the soils studied. Conventional adsorption equations, such as the Langmuir, Freundlich and Temkin equations, satisfactorily described the P sorption of the soils. The P sorption capacity of the studied soils varied from 80 to 316 mg kg^{-1}. The calculated energy of adsorption of the soils ranged from 0.18 to 1.56 mg L^{-1}, and there was apparently a negative correlation between the energy of adsorption (k) and the observed S_{max} values. Buffering capacity ranged from 14 to 69. Phosphorus saturation indices (P_{sat}) of the tested soils varied from 1.82 to 28.21%, and were correlated with sand (r =0.56, P>0.05) and silt (r =-0.59, P>0.05), but not with the other

soil properties we studied.

Keywords: Maximum adsorption capacity, phosphorus buffering capacity, energy of adsorption, Langmuir equation

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