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# Exploring the potential of the permanganate oxidation method as a tool to monitor soil quality in agricultural upland systems of Southeast Asia

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The transition to more intensified upland systems is having an impact on the soil quality, defined as the ability of a soil to both provide and maintain essential services to an ecosystem. As many tropical upland soils are inherently low in quality, it is essential that impacts be monitored.
Soil quality is assessed by using a combination of parameters that serve as indicators and cover the soil chemical, biological and physical properties. An ideal indicator should be sensitive to changes in the environment and management practices and should be widely accessible, meaning low resource requirement (i.e. time and equipment). Total organic carbon (TOC) content is a commonly used indicator of soil quality as it is linked to many soil functions and processes; however analysis is costly and requires access to advanced instrumental facilities, rendering it unsuited for many developing countries. An alternative indicator is the soil fraction dominated by easily decomposable carbon; this may be measured by treating soil samples with 0.2M potassium permanganate (KMnO4), an oxidizing agent which is thought to mimic the enzymes released by the soil microbial community. The advantage of this method is that it is accessible: it is fast, requires little resource input and is field appropriate. There is no consensus however as to which soil carbon fraction the method targets. Furthermore Skjemstad et al. (2006) has indicated that KMnO4 may oxidise charcoal, a component of the non-labile carbon pool; this has implications for the suitability of the method when used for soils of shifting cultivation systems.
The purpose of this study was to investigate the potential of permanganate oxidizable carbon (Pox C) as a reliable indicator of soil quality in agricultural upland systems in Northern Lao PDR. Focus was placed on the relations between Pox C and other soil quality parameters (bulk density, pH, CEC, TOC, total N, exchangeable K, plant available P) and upland rice yields. The ability of KMnO4 to oxidize charcoal was also a focus however, as the study is still in its initial stage, no results can be discussed. Volumetric soil samples (at the surface and at 10 cm) and upland rice yield measurements were taken from three fields with three plots that were previously left fallow for five years (n=9; soil n=81). Pearson's Correlation test and Stepwise Regression analysis was done using SPSS v 16.0 for Windows.
Results show that Pox C is significantly correlated to the measured soil parameters in a manner similar to TOC. Both are positively correlated to the soil nutrients: Total N %, P Avail and K Exch; Pox C however had a stronger correlation to K Exch than TOC. This affirms the important role of Pox C in soil processes in the biological, chemical and physical spheres. Furthermore, the regression analysis identified Pox C as an influencing factor for the variations seen in upland rice yields. It is concluded that Pox C is a suitable indicator for soil quality and may be useful in monitoring changes in the soil quality of agricultural upland systems.