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Characteristic and influence of biologically-based phosphorus fractions in the farmland soil

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A suitable fractionation method of phosphorus (P) is a key to effectively assess soil P componential features. Here we used a new biologically-based P (BBP) method to evaluate the P fractions in the upland and paddy soils across large-scale in China. We divided the soil P into four components: (1) soluble or interception of rhizosphere (CaCl2-P), (2) inorganic combined, organic acid complexation (Citrate-P), (3) enzyme mineralization of organic P (Enzyme-P), (4) potential activation of inorganic P (HCl-P). We investigated the relationships between biologically-based P fractions and standard Olsen-P, and identified driving factors of P fractions. The results showed that P content were in order of HCl-P > Citrate-P > Enzyme-P > CaCl2-P. All P components of upland soil displayed a higher level than that of paddy soil. Moreover, the P components were highly positive correlated with the Olsen-P, suggesting that each P component was contributed to soil P availability. However, we found that Olsen-P was most highly correlated with CaCl2-P and Enzyme-P (R2 = 0.359; R2 = 0.386) in upland soil, while Olsen-P was most highly with Citrate-P (R2 = 0.788) in paddy soil. This result indicated that available P of upland soil was mainly from organic P mineralization and soluble P, and available P in paddy soil was mainly from inorganic P activation. Redundancy analysis (RDA) showed that the P components were mainly affected by soil pH and silt content, which suggested that it could enhance the P availability via regulating soil pH in the agricultural activities.