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Net transformation of phosphorus forms applied as inorganic and organic amendments to a calcareous soil

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The forms of phosphorus (P) in animal manure composts are different from that of synthetic P fertilizers, and this could affect how soil P chemistry will be altered when they are used as P amendments. The objective of this study was to analyze the net changes in the nature and dynamics of plant available P forms applied either as inorganic P (KH2PO4) or turkey litter compost (TLC) in calcareous soil with and without plant growth. Forms of TLC-P were characterized by x-ray diffraction and solution 31P NMR spectroscopy techniques. The amounts of various P forms in soils were measured by a sequential fractionation method after 4, 8, 12 and 16 weeks incubation. Brushite (Ca-P) and newberyite (Mg-P) were the major forms of inorganic P, and phosphate monoester was the major form of organic P present in TLC. The addition of inorganic P fertilizer increased the labile/moderately labile P, whereas the compost increased the moderately labile P extractable with weak acid (pH 4.2). Even though the amount of the labile P fraction in the compost-treated soil was smaller than that in the fertilizer-treated soils, ryegrass growth and plant P uptake were greater. The net transformation of the labile/moderately labile P was slower in the compost-treated soil without plant growth, however it was faster with plant growth. This study showed that P applied either as an inorganic or an organic amendment was recovered in different P fractions in a calcareous soil, and therefore it is expected that the P source would affect soil P chemistry. A weak acid extractable inorganic P fraction should be considered as plant available P especially in the compost-treated soil, that is converted into plant available P through direct and/or indirect root-induced acidification in the rhizosphere.