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P and C dynamics in planted soils under combined use of Poultry manure and inorganic fertilizers

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Phosphorus (P) is one of the major limiting nutrients for plant growth in many agroecosystems, and continuous application of phosphate fertilizer is required to support agricultural production. Alternative sources of P fertilizers need to be found in the near future due to exhaustion of mineral phosphate rock reserves. Nowadays poultry meat production is increasing worldwide, with a high amount of P-rich residues in form of manure. Composted poultry manure application in soils, as source of nutrients particularly P, is a common practice for organic farmers with meat and milk production systems based on pasture management. The repeated applications of composted poultry manure amendment increase pasture production, soil available P, and carbon (C) content consequently soil aggregate size. It is unclear whether this was a direct effect due to increased microbial activity following the application of C-rich manure or an indirect effect due to improved plant growth and root C input. We combined soil fractionation with isotope analyses to examine soil organic carbon (SOC) and P dynamics in planted soils under composted poultry manure and phosphate rock fertilization. The experiment was carry on during seven weeks in a growth chamber under controlled conditions. Two soils and three treatments (composted poultry manure, phosphate rock and their combination) were fractionated in different aggregates sizes (>2000 μm, 2000-250 μm, 250-50 μm and >50 μm) and three density fractions: free light fraction (LF), intra-aggregate particulate organic matter (iPOM), and mineral-associated organic matter (mSOM). We hypothesized that composted poultry manure application will change the distribution of P fractions among aggregate-size classes and; the application of phosphate rock, composted poultry manure and their combination will have contrasting effects on soil aggregation, plant-derived C input, and soil phosphorus forms.