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Regenerative agriculture practices improve soil health in phosphorus deficient soils in western Kenya

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Abstract

Regenerative agriculture practices are key in promoting soil health, consequently enhancing soil and crop productivity. Assessment of how different regenerative agriculture practices influence key soil health indicators is imperative in broadening our understanding on soil health and quality; and informing the potential for policy advocacy. We assessed the influences of select regenerative agriculture practices (in an 18-year long-term trial) in western Kenya on four key soil health indices namely; i) Nutrient and soil organic carbon (SOC) availability; ii) Activities of 4 extracellular enzymes involved in nutrient cycling, comprising alkaline phosphatase (ALP), acid phosphatase (ACP), beta glucosidase (GLU) and beta-glucosaminidase (NAG), responsible for phosphorus (P), carbon (C) and nitrogen (N) cycling, respectively; iii) Enzyme stoichiometry ratios; and iv) Soil nutrient-enzyme activity relationships. This study was conducted in phosphorus deficient soils in Western Kenya; and was analysed using high-throughput calorimetry measurements. Results showed that regenerative agriculture practices integrating organic inputs (farmyard manure) increased the soil nutrient and SOC availability; elevated activities of the 4 extracellular enzymes involved in C, N and P cycling in the range of 22 % to 144%; enhanced the enzyme stoichiometry ratios and soil nutrient-enzyme activity relationships. Both enzymatic C:N and N:P ratios were significantly enhanced under regenerative practices involving application of farmyard manure. Sole addition of P fertiliser significantly reduced enzymatic C:N ratios whereas enzymatic C:P and N:P ratios were lowest under no input systems. Key extracellular enzyme activities, their stichometry ratios, vector angles and lengths significantly correlated with different parameters involving soil pH, SOC, soil N, ACP, ALP, soil N:P and soil C:P.

These results broaden our understanding of the potential soil health benefits associated with sustainable agroecological regenerative practices, calling for more research for scaling and policy advocacy.

Keywords: Agroecological, enzyme activities, enzyme stoichiometry ratios, nutrient cycling, regenerative agriculture, soil health

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