

# Book of Abstracts

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## Linking sustainable management to soil functions: physico-chemical and biological dynamics in a differentially managed wheat field

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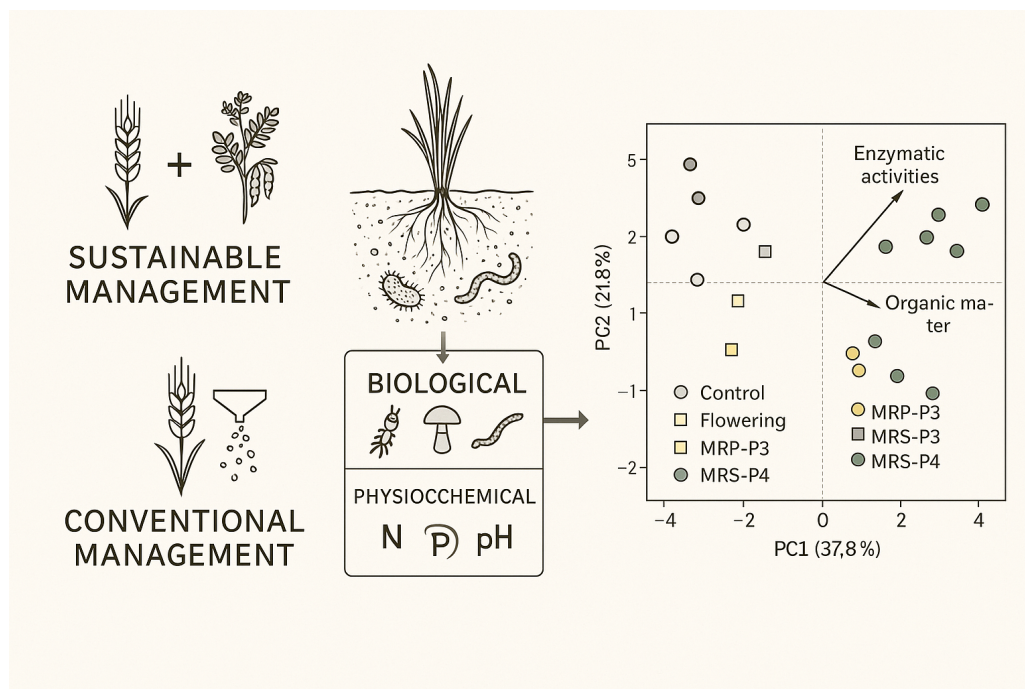
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Among today's global challenges, soil degradation demands urgent and effective solutions. Investigating soil ecological dynamics and comparing farming practices can offer critical insights into soil health and support the design of resilient agroecosystems. This study evaluated the effects of different management practices on soil biological and physicochemical properties through a two-year field experiment featuring a wheat–chickpea rotation and pollinator-friendly plant mixes aligned with EU Common Agricultural Policy ecoschemes. The experiment was conducted in Caselle in Pittari (Salerno, Italy), using three replicates across six treatments: wheat (*Triticum aestivum* L. cv Ardito) under sustainable management with organic amendment (P1); chickpea (*Cicer arietinum* L.) in rotation with P1 (P2); wheat under conventional management with mineral fertilizer (NPK) (P3); O.P. RUSTICO mix (P4); O.P. ECO-5 PLUS mix (P5); and native spontaneous vegetation (P6). Soil samples were collected before sowing (control) and at flowering (F), and analyzed in the first year for bulk physicochemical parameters and enzymatic activities in rhizosphere (MRP) and rhizosheath (MRS) compartments, following protocols of the Italian Ministry of Agriculture. Principal Component Analysis (PCA) accounted for 59% of the total data variance, with PC1 (37%) driven by biological activity and organic matter, and PC2 (22%) reflecting soil textural and chemical traits. Sustainable management (P1) aligned with vectors of biological indicators ( $\beta$ -GLU, DHA, URE, organic C), whereas conventional management (P3) samples appeared more dispersed and oriented toward mineralogical variables. Control samples distinctly differed from flowering samples. Notably, F-MRP-P3 and F-MRS-P3 clustered in a PCA region opposite to enzymatic activity and organic nutrient indicators, suggesting a mineral-dominated soil with reduced biological function under conventional practices. In contrast, F-MRP-P4 and F-MRS-P4 diverged from other treatments, influenced by clay content, cation exchange capacity (CEC), magnesium, and pH, indicating an improvement in mineral nutrition. These PCA outcomes were corroborated by cluster analysis and chi-square testing, which demonstrated a statistically significant association between treatment type and cluster grouping ( $p = 0.041$ ). Overall, these preliminary results underscore that sustainable farming practices measurably enhance soil quality by fostering both biological activity and chemical balance.

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