



Soil organic matter quality in intensive maize-based forage systems

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An experiment designed and managed as a long-term platform and aimed at studying the dynamics of soil organic matter (SOM) in 38 forage systems based on maize was started in 1992 on a deep calcareous loam soil. The treatments are typical of intensive livestock farms in the Po plain, NW Italy. The experimental design is a plot-scale, set up in 3 randomized blocks.

Various techniques were combined to evaluate the N use efficiency and mineralization rates of different fresh organic material added to the soil: cattle slurry, farmyard manure (c. 230 and 350 kg ha⁻¹ of N), maize stalks, roots or grass ley residues. The techniques concerning soil organic matter turnover included C and N annual budgets based on SOM content, in-situ incubations (net mineralization in buried bags), lab incubations (soil respiration, potentially mineralizable N PMN, soil microbial biomass SMB). The environmental impact of C and N cycle on groundwater and air quality was assessed through monitoring the soil and soil solution mineral N content, and the CO₂, N₂O and CH₄ in-situ emissions using the closed chamber technique.

While the crop yield and N uptake did not respond to types and levels of manures, the SOM amount and quality were modified by fertilization: treatments which received repeated applications of the different fresh organic materials increased SOM content and soil total N, but also the N supplying capacity, soil respiration and SMB when compared with soil that received no N fertilizer or urea. More in detail, farmyard manure additions in combination with the incorporation of maize stalks was the practice that mostly increased the total SOM content (C and N) and showed the maximum C sequestration potential (46% of C added as manure was retained in the soil), but fertilization with liquid slurry also exerted a potential in augmenting the soil C and N (26% of added C was retained), and the fraction of easily-mineralizable organic N.

The residual effect of manures applied repeatedly in the past years strongly dominated the soil response, whereas fresh applications of farmyard manure or slurry did not cause any significant difference on the timing and extent of net N mineralization in the weeks that followed fertilization. This evidence stresses one more the difference, in aim and results, that long-term agronomical studies exert with regards to those lasting few years.