



Integrating biological indicators in a Soil Monitoring Network to improve soil quality diagnosis – a study case in Southern Belgium (Wallonia)

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Soil organisms and their activities are essential for soil ecosystem functioning and are thus pertinent indicators of soil quality. Recent efforts have been undertaken to include biological indicators of soil quality into regional/national monitoring networks. The aim of this study was to establish baseline values for six biological indicators and two eco-physiological quotients for agricultural soils in the CARBIOSOL network and to assess small scale spatial and seasonal variability.

Potential respiration, microbial biomass carbon and nitrogen, net nitrogen mineralization, metabolic diversity of soil bacteria, earthworm abundance, microbial quotient and metabolic quotient were measured at 60 sites across contrasting agricultural regions (different soil types and climate) and land use types (grasslands and croplands). Eleven additional cropland sites, the same biological indicators were measured at four sampling points within the same farm plot at four dates during the vegetation period (April, June, August, October of 2016) to assess temporal variability and small-scale spatial variability.

Four of the six selected biological indicators (potential respiration, microbial biomass carbon and nitrogen as well as metabolic diversity of soil bacteria) were significantly higher under grassland than under cropland. Ranges of values were generally wider under grasslands than under croplands. Agricultural region did not significantly influence the biological indicators tested. Date of sampling had a significant effect on five of the six selected biological indicators (potential respiration, microbial nitrogen, metabolic diversity of soil bacteria, and net nitrogen mineralization). Temporal variability within one year was slightly higher than variability within one farm plot, with the biological indicators having the highest seasonal variability also showing the highest small-scale spatial variability.

This study defined baseline values for agricultural soils at the scale of the region (Southern Belgium) classified by land use (grassland and cropland), laying the foundation for a monitoring network of biological soil quality.