ELS2014 –The Earth Living Skin: Soil, Life and Climate Changes
EGU – SSS Conference
Bari | Italy | 22 – 25 September 2014
ELS2014-124-1

The effect of good agricultural management practices on soil biological quality indicators in a European context

Tommy D'Hose (1), Leendert Molendijk (2), Wim Van den Berg (2), Hans Hoek (2), Willemien Runia (2), Greet Ruysschaert (1), Laura Zavattaro (3), Chiara Costamagna (3), Luca Bechini (4), Carlo Grignani (3), Adelheid Spiegel (5), Taru Lehtinen (5), Gema Guzmán (6), Janine Krüger (7), Alicja Pecio (8), Frits van Evert (9), and Hein Ten Berge (9)

(1) Institute for Agricultural and Fisheries Research (ILVO), Merelbeke, Belgium, (2) Applied Plant Research (PPO), Lelystad, the Netherlands, (3) Department of Agricultural, Forest and Food Sciences of the University of Torino (DISAFA), Torino, Italy, (4) Department of Plant Production, University of Milano (DIPROVE), Milano, Italy, (5) Austrian Agency for Health and Food Safety (AGES), Vienna, Austria, (6) Department of Agronomy, University of Cordoba (UCO), Cordoba, Spain, (7) Leibniz Institute of Vegetable and Ornamental Crops (IGZ), Grossbeeren, Germany, (8) Institute of Soil Science and Plant Cultivation (IUNG), Pulawy, Poland, (9) Plant Research International (PRI), Wageningen, the Netherlands

Maintaining and improving soil quality is crucial if agricultural production and environmental quality are to be sustained for future generations. After all, due to legal constraints shortcomings in soil quality cannot be easily compensated anymore by large rates of mineral and/or organic fertilizers and pesticides. Possible tools for maintenance and improvement of soil quality include non-inversion tillage systems, crop rotations and cover crops and the use of compost. Traditionally, soil quality research has focused primarily on soil chemical and physical characteristics but more recently soil biology has been increasingly recognized as an indicator of soil quality. After all, soil biota play a major role in mineralization of nutrients by degradation of organic matter and in creating and maintaining a good soil structure. Furthermore, biological soil properties quickly change in response to a change in soil and crop management practices that affect soil quality and processes. Hence, biological indicators are critical when characterizing soil quality.

In the framework of an EU-funded project, Catch-C (www.catch-c.eu), a large scale literature survey on the effects of good agricultural management practices on biological soil quality was performed. Experimental data on earthworm and nematode abundance, microbial biomass carbon and bacterial and fungal communities from more than 65 European long-term field experiments (LTEs) were extracted from peer reviewed scientific literature and national reports. The effects of management practices on the selected biological soil indicators were analyzed and through a subset regression it was evaluated whether climatic zone, soil texture and duration of practice influence these effects. The agricultural management practices that were considered in our study were the use of crop rotations (vs. monoculture), application of no- and non-inversion tillage (vs. ploughing), organic fertilization with farmyard manure, animal slurry or compost (vs. mineral fertilizer) and crop residue incorporation (vs. removal). Only for tillage and organic fertilization a sufficient amount of data was collected which allowed a thorough statistical analysis.

Overall, farmyard manure and compost amendment emerged as the best management practices for increasing soil biological quality. Apparently, soil biota benefit more from organic materials added to the soil, which serve as a food source, than from reduced soil disturbance and consequently a more stable habitat. Further, the effect of a given management practice on soil biological quality was rarely influenced by climatic zone, soil texture or duration of practice. Amongst the biological indicators, earthworm abundance and microbial biomass carbon are frequently monitored in European LTEs and they tend to respond well to a change in crop and soil management. Data on the nematode, bacterial and fungal community are still rather scarce. In this study their response to management changes proved to be more difficult to interpret as we rather observed a shift in the community structure instead of a clear increase or decrease of a given species. However, because of the presence of nematodes in all trophical levels of the soil food web, nematode community indices still are likely candidates to become indicators of soil quality.

This research has received funding from the European Community's Seventh Framework Programme under grant agreement No. 289782 (Catch-C)