DOC trial: diversity and metabolic efficiency of microbial communities in organic and conventional soils

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Introduction

Organic farming has often been shown to improve soil fertility by increasing soil organic matter and supporting the living organisms in the soil. Moreover it is a decisive aim of organic farming to enhance diversity in terms of time and space. Generally diversity is looked at as the number and abundance of plants and animals living in an area. Agricultural diversity also has a temporal feature in the form of a diverse crop rotation with a large number of crops fodder and intercrops in order to use the available resources to a large extent. The diversity of micro-organisms is largely neglected because of lack of methodology. Nowadays several methods are available to assess soil microbial diversity. This paper aims to evaluate the effect of farming systems on soil microbial diversity and how diversity affects functionality.

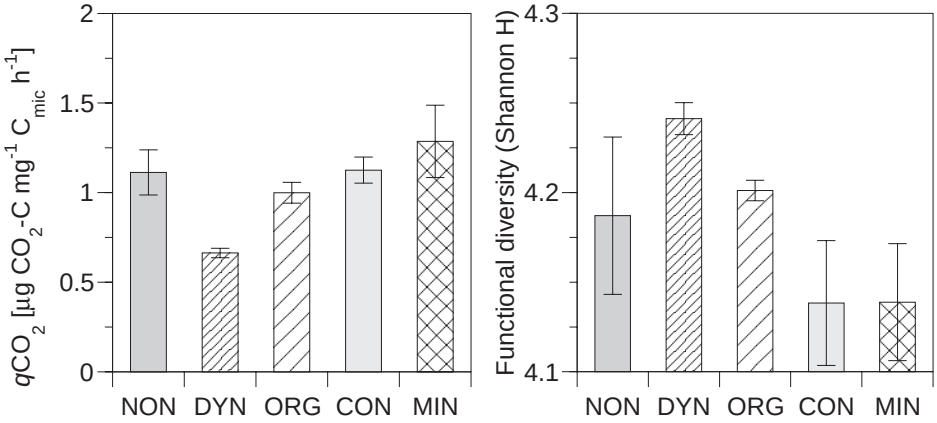
Material and Methods

Soils from the DOC trial were taken in early spring from the bio-dynamic, bio-organic and the conventional system as well as from the two unmanured control systems. Soil microbial biomass was estimated by fumigation extraction, soil respiration by CO_2 evolution and microbial diversity was assessed by a substrate utilization assay. The number and intensity of substrates used served as the base for a functional diversity estimate.

Results and Discussion

Soil microbial biomass was significantly affected by the farming systems, with high values in the organic systems and lower values in the unmanured systems. Soil respiration showed minor differences between the systems, but the ratio of soil respiration and microbial biomass (qCO_2) was significantly lower for the biodynamic systems and showed higher values for the unmanured conventional system (MIN) (Figure 1). We used this metabolic quotient as an indicator for the energy needed to maintain the microbial population.

The diversity of microbial functions, as shown in figure 2, was found to exert the highest value in the bio-dynamic soils, whilst the lowest values were found in the unmanured treatments. Even though these results need to be proven by other techniques they support the idea that energy use and diversity are functionally related.



Conclusions

Soil microbiota are favoured by organic farming systems. Moreover they were found to need less energy fore their maintenance. The diversity of microbial functions was also increased. Our results support the hypothesis that diverse populations make better use of the available resources.

References:

Flie§bach A., M der P. (1997) *Carbon source utilization by microbial communities in soils under organic and conventional farming practice*. In: Microbial Communities Functional versus Structural Approaches, eds H. Insam, A. Rangger, pp 109-120, Springer, Berlin