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THE INFLUENCE OF CONVENTIONAL AND BIOLOGICAL SYSTEMS CULTIVATION OF PLANTS ON EDAFIC BIODIVERSITY

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Abstract

One of the main goals of biological agriculture is to maintain the agro-eco-systemic balance, mitigation of negative impacts and improve environmental qualities. The realization of this objective is associated with agronomic aspects of soil fertility management, the dynamics of organic matter and the presence of edaphic fauna in the sub-soil layer. The keeping of a good level of soil fertility, which supports long-term productivity of agro-eco-system, depends on the choice of cultural techniques. Dynamics of organic matter in soil is influenced by many factors, among which the presence of micro-flora and micro-fauna of the land. The diversity of species of micro-organisms present in the soil performs important keys functions in the eco-systemic recycling organic matter, transformation of nutrients and environmental qualities of agro-eco-systems. The diversity of microorganisms presents in soil depending on the system of cultivation, the type of soil, plant species and other organisms present in agro-eco-system. Conventional agriculture, through cultural techniques used, poor soil biodiversity, in particular that rhizospherical, changes structural balance of microbial populations. The study analyzes the levels of terrestrial biodiversity in the two types of agro-eco-systems (biological and conventional), planted with the same crops, through the study of the connections between plants, soil and microorganisms, in order to define the differences between them and impact on fertility of soil and biological diversity.
Key-words: soil biodiversity, micro-fauna, edaphic fauna, agro-eco-system

Introduction

The soil in agricultural systems represents the natural irreplaceable resource, which through its physic and chemical qualities and especially biological characteristics, accomplishes a range of fundamental functions, not just from the production point of view but moreover from the environmental point of view. Fundamental functions like biomass production, nutrients recycling, maintaining of fertility and filtering of different chemical pollutants could not be accomplished without an acceptable level of soil biodiversity (edaphic fauna). The choice of cropping system is fundamental to maintain this biodiversity and its functions. The density of present microorganisms in soil and their biomasses vary according to the soil and plants type and according to the cropping techniques applied. The diversity of microorganisms inside of an ecosystem is so a key element to maintain a healthy situation of agricultural soil (Borneman, 1996).

Setting of suitable equilibrium of soil biodiversity is reflected on environmental qualities of a cropping system. Conventional cropping systems based on monoculture and use of pesticide and herbicide, can impact the soil biodiversity and especially the biodiversity of rhizospheric ecosystem, changing the structural equilibriums of soil microorganisms communities (Bolton et al., 1985; Doran, 1980; Ramsay et al., 1986).

The composition and structure of soil communities is dependant not just from interaction among presented species and plants but from the chemical and physical nature of soil (soil structure, moisture, pH, temperature and nutrients), which impact the microbial life and select the most suitable microorganisms (Garbeva et al., 2004). Different studies have identified existing linkages

between soil biodiversity and its functions (Nannipieri et al., 2003). Though the environmental factors and soil typology impact the microbial diversity of soil (Girvan et al., 2003), frequently it is the typology of cropping practices used or the type of treatments applied that could determine obvious changes of biodiversity (Gomez et al., 2006), with consequences that are difficult if not impossible, to be recovered (Mocali et al., 2008).

Materials and method

This study analyses two cropping systems (biological and conventional) planted with corn (Zea mays) in Shijak, near Durresi, accomplished during 2011, on an area of 0.5 ha. In biological cropping area 90.2 ha) compost is used as nutrient. Another area (0.3 ha) close to the first one is managed with conventional practices. Fertilizers (ammonium nitrate) and pesticides are used in this area. The indicator chosen to evaluate the soil is the community of edaphic fauna. Biological analysis of soil through the study of micro fauna community serves as argument to verify differences between two types of agro ecosystems (Parisi, 2001). The level of diversity for samples taken is analyzed through the indicator QBS (Parisi, 2001).
In each plot samples are taken according to the standard methodology taking soil from both cropping systems. In these soil samples the presence of micro arthropods is analyzed through Berlese-Tüllgren selector. The samples are analyzed in laboratory to identify the respective classes according to the cropping system. The biological quality of soil is evaluated through QBS indicator (Parisi et al., 2005; Menta et al., 2008). The differences of biodiversity values (based on the calculation of Shannon-Wiener diversity indicator -H') are evaluated through the analysis of variance (Anderson, 2001; Anderson, 2005).

Results and discussion

The analysis of micro arthropods populations, in both cropping systems, evidences the presence of different groups of them in the underground strata. In the plot managed biologically and where manuring is used, a higher presence of these groups compared to conventional cropping is identified. Higher values of QBS indicator are identified also, based on the evaluation of the diversity indicators Shannon-Wiener -H'.

Table 1. The evaluation of diversity indicators of edaphic fauna

Cropping system	Indicators			
	No. of biological groups	Density (individuals/ m^2)	QBS	Shannon-Wiener -H'.
Biological cropping	14	33700	88	1.7
Conventional cropping	10	23200	43	1.1
Loss of diversity	4	10500	51 %	61.7 %

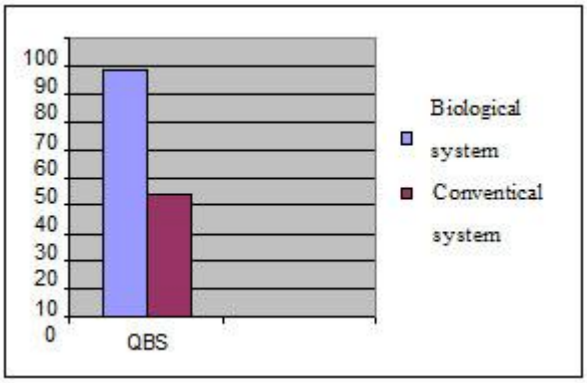

Figure 1. Values of QBS for both cropping systems in different treatments

From the above shown data it can be seen that there are high values of QBS indicator for corn crop in biological system of cultivation. A higher presence of systemic groups of arthropods in the biological system is due to the fact of manure application with quantities around 20-40 t/ha and leaving of after harvesting plants residues in field. They being transformed by micro organisms, increase the quantity of organic matter. In the plot where fertilizers were applied a lower number of micro organisms are seen. This situation is closely related to pesticide use and taking of almost all crop biomass as livestock feed also in this plot.

Conclusions

The analysis of different biodiversity indicators that give clear evidence of higher presence of soil microorganisms in the plot of biological system sustained by standard manuring and other sustainable practices like green manure, leaving plant residues in field after harvesting, minimal tillage etc. tells us for the sustainability of this system and the decrease of negative impacts. The indicator of soil biological qualities (QBS) which is higher for the biological system confirms the positive effects of this system.

Low values of QBS in the conventional system (51% lower compared to biological system) show that this system through management practices used brings negative impacts regarding soil microorganisms and soil biological qualities.

The data offered by this study are useful because they evidence the fact that sustainable practices used by biological agriculture bring positive impacts in sustaining soil resources and inner functional equilibriums of the system.

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