ABSTRACT

The habilitation thesis entitled *The role of biodiversity in the soils conservation and the sustainability of agricultural systems*, presents a synthesis of the scientific research results carried out after obtaining my PhD degree in Agronomy, in 2009. The thesis is structured into three different chapters that present the academic activity carried out until now, the scientific activity and future perspectives on the academic career.

Obtaining the habilitation is an approach carried out in order to find, support and guide young people interested in scientific research in the field of Agronomy, in research sectors that concern the soil and its health or in assessing the sustainability of agricultural systems.

The first chapter of the thesis presents my education and professional development, but also the teaching, scientific, and publishing achievements obtained after getting my PhD title. During this period I worked at the current Department of Environmental Engineering and Protection at the Faculty of Agriculture, as a lecturer, respectively associate professor. The activities carried out meant holding courses and practical activities with the students studying Environmental Engineering, Biology, Agriculture and Montanology. The teaching courses during last years were General Ecology, Agroecology, and Soil Biology. In connection with these fields of study, I also carried out scientific research activities, being involved in 7 research projects, 5 of them as the director or the project coordinator. The publishing activity resulted in 5 books and 37 scientific papers.

Chapter 2 of the habilitation thesis briefly presents the scientific research activity carried out after obtaining the PhD title, being structured on two different research directions: soil biodiversity and its role in ensuring soil functions and the assessment of sustainability in agricultural systems.

The first part of this chapter deals with the role of soil biodiversity in ensuring its functions and presents data obtained in agricultural soils. General aspects regarding soil biodiversity and the ecosystem services provided by soil biota are discussed and a number of working methods and protocols used in the collection of the data and monitoring parameters in different projects carried out are presented. The presented results highlight the need to use common protocols for monitoring soil biodiversity, but also the need to develop a complex model for monitoring soil biodiversity in order to integrate a larger number of biological parameters to be used in the soil health assessment process.

The second part of the chapter presents the effects that agricultural practices have on soil biological parameters like: microbial biomass, soil respiration and the physiological profile of the microbial community. At the same time, results obtained from different experiments carried out in the laboratory or in the field are presented. Through such experiences, we tried to establish how different soil species combination mutually influence each other, the synergism or antagonism between them, and how these relationships can directly affect different processes and functions in agricultural soils. The obtained results showed the influence of the type of organic matter added to the soil on the microbial biomass and its mineralization process. Microbial biomass was higher in agricultural soils where organic matter was added, being dominated by bacterial biomass. In microcosm experiments, it was highlighted that the presence of enchytraeids can reduce microbial biomass as a result of its consumption by the enchytraeids. However, the presence of earthworms caused a significant increase in microbial biomass, the activity of earthworms being able to stimulate microbial activity in the soil.

The effect of conventional or minimum tillage practices on microbial biomass was minimal, with no significant differences in biomass between the two types of tillage systems. Tillage depth can influence soil microbial biomass to some extent.

Soil respiration was monitored in organic or mineral-fertilized soils, but the obtained results did not indicate significant differences between the two types of agricultural practices considered. Soil respiration was mainly influenced by the climatic season, with soil temperature and humidity having a key role to play in this regard. The highest values of soil respiration was recorded in the summer season.

The physiological profile of the soil microbial community is a parameter that measures the functional diversity of this community. This parameter has been evaluated in organic and mineral fertilized soils, but also in conventional or conservatively managed soils. The results obtained in the case of this parameter, revealed a beneficial effect of organic fertilization, compared to mineral fertilization. White mustard used as a green fertilizer had the most pronounced effect, regardless of the type of soil used in the experiment. The community level physiological profile was not influenced by the tillage system.

The experiments carried out to evaluate the influence of species communities on soil processes, highlighted the effects of different functional groups of edaphic organisms on the decomposition of available

organic resources, on the microbial biomass of the soil, but also on the control of some diseases that have as etiology, either organic matter in the soil or the soil itself.

The second direction of my research presented in the second chapter of the thesis is related to the assessment of the sustainability of agricultural systems. The thesis discusses the possibility of using the sustainability assessment method, called PG Tool, to measure the sustainability of some unconventional agricultural systems, which have a forestry part integrated into them. The methodology by which the PG Tool method can be adapted and improved for the use in these systems is presented. Following a consultation procedure of the target groups, it is presented how new indicators, considered relevant for the evaluated agricultural system can be selected and integrated into this evaluation method. The proposed new indicators were subsequently integrated into the evaluation procedure, and the method was applied to an agroforestry system in order to assess the sustainability of the system and to highlight the importance of the forestry component in the system. The results showed animal welfare, food security and biodiversity as the strengths of sustainability, while aspects regarding energy consumption, carbon sequestration and animal manure management as problematic aspects of the farm.

The last chapter of the paper presents the perspectives of my academic career, after obtaining the habilitation. From an academic perspective, I presented the necessity of improving the teaching methods, so that the skills and abilities acquired by the students to be of real use in their future professional activity. It is also discussed the needs to develop or re-edit teaching materials that are consistent with the topic courses, to be current and attractive for the students.

Regarding the scientific activity, I intend to continue the existing research directions within the coordinated research group and to find PhD students who are interested and can support the scientific research in the addressed fields. The major key elements that will be followed are: development of a participatory research through which the topics addressed are directly connected with the real problems in the studied sites (e.g.: farms); strengthening existing collaborations with our partners and establishing new partnerships with research teams from other national and international institutions; attracting funds for scientific research by participating in national and international competitions and improving scientific research activities; increasing the international visibility by increasing the number, but especially the quality of scientific publications.