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# Analysis of biological qualities of land in traditional and conventional agro-ecosystems

EUGEN SKURA ALBERT KOPALI

Department of Agro-environment and Ecology, Agricultural University of Tirana, Albania

**Abstract**

Land constitutes the most important natural resource from the perspective of environmental and human life, for many ecological functions and socio-economical performs. The provision of continuous recycling of nutrients for plants, water retention, storage of carbon reserves, filtering many potential pollutant substances, are some of the key ecological functions of soil. Production of biomass, the supply of food for man and animals, production of fibers for industry, the plant for agro-industrial use of those medical, constitute social functions - economic land which affect the welfare of everyday human life. These important ecological and economic functions not depend only on land use, but also its qualities, and in particular the biological qualities. Biological qualities of the land, which determine the level of fertility, primarily depend on management practices of agricultural systems. In conventional systems of agriculture, unlike traditional systems, soil fertility is really threatened, due to the accumulation of pollutant substances used and their impact on soil micro-flora. Protecting biological qualities of land remains a perennial target of agricultural systems more to ensure its functioning for a long period of time, to support life on earth.

**Key-words**: micro-flora, micro-fauna, biological quality, agro-ecosystem

## 1. Introduction

In agricultural systems terrestrial environment realizes a basic set of functions, not just manufacturing but especially environmental perspective. Land is the primary means of food production, about 99% of the people's food supply comes from agriculture [1]. But many other ecological functions such as nutrient recycling elements, preservation of fertility, purification of water, filtering the degradation of contaminants carried in the terrestrial system, under the action of the breakdown process carried out by soil biodiversity. All these ecological processes and their intensity depend on the choice of the system of cultivation of plants which is essential for the conservation of terrestrial biodiversity and its functions. Chemical analysis of soil are not an adequate instrument to assess biodiversity and ecological functions of soil, therefore it is necessary to use biological indicators. Estimates of biological qualities of lands through bio-monitoring are proposed by researchers at the international level [2]. The density of microorganisms present in the soil and their biomass change as the type of soil, the type of plant and the cultural techniques implemented. A square meter of land usually contains a population of about 200 000 arthropods and billions of microbial organisms. One hectare of land of good quality containing an average of 1 300 kg of worms, 1 000 kg arthropods, 3 000 kg bacterium, 4 000 kg mushrooms and a high biomass of microorganisms [3]. Different organisms that live together in riso-sphere (part near the roots of plants) as fungus, bacteria, nematodes and protozoa, perform specific functions in different but coordinated their complex, supporting the growth and development of plants [4, 5]. The diversity of microorganisms inside an ecosystem is a keys element of the maintaining a quality health condition of agricultural land [6]. Soil microorganisms (pedo-fauna) interact and are dependent on terrestrial environment and can be used to assess the qualities of this environment. Separation of soil microorganisms in micro, meso and macro-networks [7, 8], helps in the assessment. Meso-networks (meso-fauna, size 2 to 0.2mm) acharie, colembula, dipters and coleopters, enchitreide, pseudo scorpions, some miriapodes, etc., are considered suitable for this assessment. Among the methodologies used and recommended by the literature, the use indicators of Quality Biological Status (QBS), which is based on the presence of micro-arthropods populations present and describing the functions and level of present biodiversity [9] is adequate and widely used. Establishing an appropriate balance of soil biodiversity is reflected on the environmental qualities of the agricultural system. Simplification of agricultural systems of human activity, inevitably brings a qualitative and quantitative reduction of edafic fauna, consequence of

Correspondence: Eugen Skura, Agricultural University of Tirana; Email: eugenskura@yahoo.com
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microbial activity, by which means many activities carried out by soil microorganisms, while biological activity includes the functions performed by other organisms of land, including plant roots [10]. Conventional farming systems which are based on monoculture and the use of pesticides and herbicides, may affect soil biodiversity, in particular riso-sphere ecosystem biodiversity, changing the structural balance of the communities of soil microorganisms [11, 12, 13]. Composition and community structure in soil depend not only on the interactions between species present and herbs, but also by physical and chemical nature of soil (soil structure, moisture, pH, temperature and nutrients present), affecting microbial life and carry out selection of suitable organisms [14]. Several studies have shown links between existing soil biodiversity and its functions [10]. Although environmental factors and soil typology affect soil microbial diversity [15], often is the typology of agricultural practices used or the type of treatment carried out that can determine the apparent changes of biodiversity [16], consequences sometimes difficult, if not impossible, to be recovered [17].

## 2. Material and methods

The study analyzed two spaces in a traditional farm type in the area of Durres (Romanat), in which is an orchard with pear (0.1 ha) with traditional-style treatments and in its vicinity is increased from 4 years with another pear orchard (Palm type, specialized orchard) (0.3 ha) treated with conventional cultivation techniques where pesticides are applied chemical treatments and is mounted a drip irrigation plant. The study was conducted during the years 2011 - 2012 (the period from April to June), in order to compare the impact of different cultivation practices on edafic communities of fauna. Analysis of biological soil through the study of indicators diversity [18] and entomological target species richness (carbide) [19], and the level of diversity of the pedo-fauna communities (micro-arthropods) for samples taken, which is analyzed by means of indicators QBS (Quality Biological Status) [9], serves as proof to verify the change of biological qualities both two types of orchard. In each plot were taken entomological samples for target species (arthropod) through the fall traps placed in three diagonal points every 10 m; species have been identified in laboratory seizures and according to standard methodology samples were taken (soil samples) in both systems, which is analyzed by the presence of micro-arthropods through Berlese-Tüllgren selector. Samples were analyzed in the laboratory to identify their (respective classes) and are calculated for both cultivation systems. Biological soil quality was evaluated by using QBS indicators [20, 21]. Differences of biodiversity values (calculation based on the values of diversity indices, Shannon-Wiener H '), were evaluated using analysis of variance [22, 23].

## 3.Results and discussion

Analysis of the impact of different farming systems on species richness and diversity of target entomological on the orchard with pear in the traditional and conventional systems shows a real and greater variability in the traditional system.

**Table 1:** The values of indicators of entomological species richness and structural diversity of Shannon in two cultivation systems

| *Cultivation system of fruit trees* | *Year 2011* | | ***Year 2012*** | |
|---|---|---|---|---|
| | Indicator species richness (no.) (Optimal value X> 25) | The Shannon diversity index (Optimal value X> 2) | Indicator species richness (no.) (Optimal value X> 25) | The Shannon diversity index (Optimal value X> 2) |
| Traditional cultivation | 33 | 2.1 | 38 | 2.4 |
| Conventional cultivation | 13 | 1.1 | 16 | 1.5 |
| **The loss of diversity** | 20 | 51% | 22 | 43% |

Cultivation practices implemented in the traditional system a much lower intensity interventions through work, but also traditional treatments, apparently favor a greater presence and a greater variability in the level order / family to different groups of target species entomological, as seen from the data, where the values of species richness and diversity indices of Shannon, optimal values exceed the threshold.

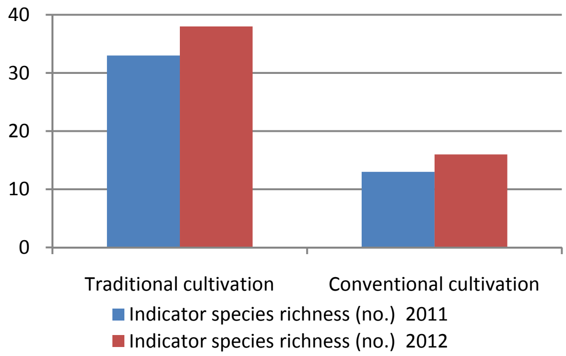


**Figure 1:** Indicator values of entomological richness species in traditional and conventional systems of cultivation

A greater presence of these groups and their variability during 2012 appears to be affected by the adverse weather conditions this year (a higher level of precipitation in the period of reference), no statistically proven link. From the analysis of micro-arthropods populations in both cultivation systems (traditional and conventional orchard), evidenced the presence of different groups of their underground layer. We managed orchard with traditional practices noticed a higher presence of these groups than in conventional breeding.

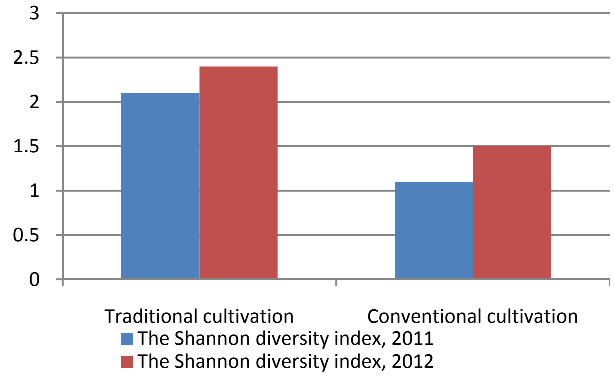


**Figure 2:** Indicator values of structural diversity of Shannon of entomological species in traditional and conventional systems of cultivation

Traditional practices and the presence of association increase the amount of organic matter in soil, consequently seen a greater presence of biological groups. So the highest observed value of QBS, based on assessment of indicators of diversity Shannon-Wiener-H '[18]. Noticed a small difference between the two systems in 2012.

Table 2: Indicator values the diversity of micro-fauna of the soil

| *Cultivation system of fruit trees* | *Indicators (2011)* | | | | ***Indicators (2012)*** | | | |
|---|---|---|---|---|---|---|---|---|
| | The number of biological groups | Density (individual/m2) | QBS | Shannon-Wiener - H'. | The number of biological groups | Density (individual/m2) | QBS | Shannon-Wiener - H'. |
| Traditional cultivation | 18 | 34 500 | 89 | 2.1 | 22 | 36 500 | 92 | 2.3 |
| Conventional cultivation | 12 | 21 300 | 41 | 1.3 | 15 | 25 000 | 47 | 1.4 |
| **The loss of diversity** | 6 | 13 300 | 53 % | 59.2 % | 7 | 11 500 | 51% | 47% |

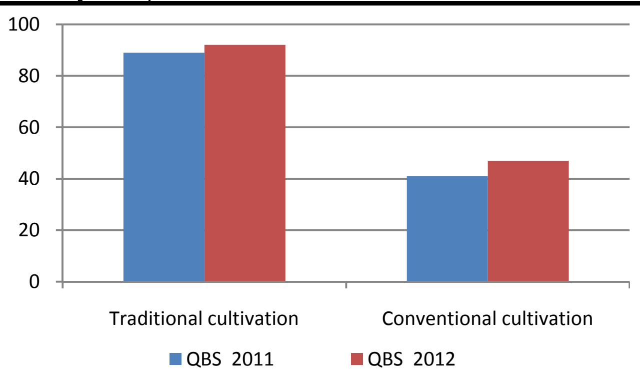


**Figure 3:** Indicator values the diversity of QBS (Quality Biological Status) in traditional and conventional systems of cultivation

From the analysis we have seen that the highest values for indicators QBS of orchard in traditional breeding system. The presence of higher systemic groups of micro-arthropods for cultivation traditions system due to the fact the use of composting organic waste and leaving the field after harvest by which microorganisms break through the soil increase the amount of organic matter. We plot the intensively treated (conventional) with chemical fertilizers and animal manure and pesticide treatments especially for plant protection noticed a smaller number of systemic groups edafic fauna.

## 4. Conclusions

Analysis of the above indicators, which identifies a higher presence of soil microorganisms and their activity traditionally cultivated plot associated with organic fertilizers and animal manure and other sustainable practices as flows, the green manure, leaving the waste in the shallow area of work shows the stability of the system and reduce the negative impacts.

Biological indicator of soil qualities QBS, which results in higher values for the traditional confirms the positive effects of the traditional system.

Lower values of indicators QBS in the conventional system with 53% less in 2011 and 51% in 2012, show that this system, through management practices that bring negative impacts applies with regard to soil microorganisms and its biological qualities.

Recent studies have proven that the administration of land, as flows, work, treatments with pesticides and chemical fertilizers, use of compost and irrigation significantly affect microbial parameters [24, 25].

The data obtained from this study are useful as evidence the fact that sustainable practices used in traditional agriculture bring to preserve the land resource, the biological qualities of its internal balances and agro-ecosystem functioning.

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