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# Microbiological Characteristics of Luvisols of a Midfield Shelterbelt and Cultivated Field

**Renata Jaskulska***

*Department of Environmental Chemistry, Institute for Agricultural and Forest Environment of Polish Academy of Sciences, Poland*

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***Corresponding author:** Renata Jaskulska, Department of Environmental Chemistry, Institute for Agricultural and Forest Environment of Polish Academy of Sciences, Poznan, Poland

**Abstract**

Multifunctionality of landscape structure is important for environmental protection. In 2018, preliminary research was carried out in a Landscape Park (Poland). The research was conducted in two ways and included areas of a midfield shelterbelt and a neighboring cultivated field. The aim of the study was to [1] compare the number of microorganisms inhabiting the Luvisols of the shelterbelt and neighboring cultivated field; [2] determine selected chemical properties and their impact on soil microbiological characteristics. The studies revealed significant differences in the number of microorganisms in the Luvisols of the midfield shelterbelt and cultivated field. A higher number of bacteria (65.42 x $10^5$ cfu/g) and actinomycetes (48.11 x $10^5$ cfu/g) was observed in the soil of the cultivated field compared to the midfield shelterbelt soil (34.07 x $10^5$ cfu/g) and (4.78 x $10^5$ cfu/g), respectively. In addition, the study indicated that the number of fungi found in the soil of the cultivated field (6.33 x $10^4$ cfu/g) was lower than in the shelterbelt soil (7.17 x $10^4$ cfu/g). The reaction and soil organic carbon content of the studied soils varied significantly. The soil of the cultivated field was slightly acidic (pH = 6.31) and the content of soil organic carbon was 0.94%. In contrast, the soil under the shelterbelt was characterized by a very acidic reaction (pH = 3.63) with higher content of soil organic carbon 4.57%.

**Keywords:** Luvisols; Shelterbelt; Cultivated field; Microorganisms; Soil pH; Soil organic carbon

## Mini Review

Midfield shelterbelts are an important element of traditional agriculture. They play a key role in protecting soils which supply plants with water and nutrients. Soil is a natural environment for microorganisms, which together with vegetation, determine the direction and nature of biochemical changes. The activity of microorganisms contributes to maintaining the balance in the soil environment [3,4]. They are also responsible for transforming large amounts of organic and mineral substances. According to Nannipieri, et al. [2] & Paul et al. [3] microorganisms also have an effect on the enrichment of arable soils with biogenic elements, growth substances and other biologically active substances. Among the chemical properties, the pH and the content of soil organic carbon influence the microbiological characteristics to the greatest extent. The pH value is one of the most important soil properties; it is not only a measure of acidity, but also a feature that determines the course of many soil processes.

The research was carried out in a Landscape Park, during the growing season of 2018. Soil samples were taken from the 0 -15 cm layer in the old 200-year old tree stand (Poland 52°04'19"N and 16°82'19"E) and from the neighboring cultivated field (Poland 52°04'20"N and 16°82'67"E). The soils in the studied area are Luvisols. The arable field was used for cultivation of winter triticale. In fresh soil samples, the total number of bacteria, actinomycetes, and fungi was determined using Koch plates [1]. In air-dry soil samples sifted through a 2-mm sieve, the pH was determined in 1M KCl (1:2.5) by the potentiometric method. The soil organic carbon was measured using the 5000A TOC analyser (Shimadzu, Japan). All tests were repeated three times.

The performed analyses demonstrated a large diversity of chemical properties of soils of the midfield shelterbelt and cultivated field. Soils of the old shelterbelt indicated a very acidic reaction (pHKCL = 3.63), unfavorable for the development of most microorganisms. The content of soil organic carbon was 4.57%. In contrast, the soil of the cultivated field showed a slightly acidic reaction (pHKCL = 6.31, with low content of organic carbon (0.94%). Bacteria (65.42 x $10^5$ cfu/g) and *actinomycetes* (48.11 x $10^5$ cfu/g) were most abundant in the soil of the cultivated field. Relatively low number of bacteria (34.07 x $10^5$ cfu/g) and *actinomycetes* (4.78 x $10^5$ cfu/g) with the lowest pH values were recorded for the soil under the shelterbelt compared to the soil of the cultivated field.

The highest overall number of fungi was found in the soil under the shelterbelt (7.17 x $10^4$ cfu/g), which was characterized

by a strongly acidic reaction (pHKCL=3.63). The results of the tests are presented in Table 1. The results indicate that soil reaction is the factor that impacts the number of bacteria, actinomycetes and fungi the most.

**Table 1:** The number of microorganisms depending on the reaction and content of soil organic carbon.

| Variable | pHKCl | Soil Organic Carbon (%) | Bacteria (x10$^5$) | *Actinomycetes* (x10$^5$) | Fungi (x10$^4$) |
|---|---|---|---|---|---|
| Shelterbelt | 3.63 | 4.57 | 34.07 | 4.78 | 7.17 |
| Cultivated field | 6.31 | 0.94 | 65.42 | 48.11 | 6.33 |

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