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Ecologically Grown Agricultural Swards as Factor for the Biodiversity and SOC Increasing

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Abstract

Objective: To evaluate the content of soil organic carbon (SOC) under ecologically grown mono- and three- and four-component perennial legume swards.

Methods: The soil organic carbon under perennial swards grown for 5 years using ecological management was investigated.

Results: the study showed that the highest amount of SOC in the top layer of soil accumulated under organically grown multi-component swards, which consisted of a mixture of 3 and 4 components. The SOC content was 1.55%, accumulated in the 0-10 cm soil layer under four-component sward including mixture of *Galega orientalis* 40%, *Trifolium repens* 20%, *Onobrychis viciifolia* 20%, *Festulolium* 20%, in comparison to the mono-component Galega orientalis sward- 1.44%.

Conclusion: The multi-component swards exerted more considerable effect on SOC accumulation that mono-components ones.

Keywords: Long-Lived Swards; SOC; Ecological Growing

Introduction

Conversion of former agricultural land to grassland and forest ecosystems is a suggested option for mitigation of increased atmospheric CO_2 [1]. Understanding the impact of different land-use management on SOM content and composition is extremely important as soils may provide an immediate sink for atmospheric CO_2 with proper management [2]. Soil, which is a complex and continuously developing part of many ecosystems, including grassland, plays an especially important role in the protection of natural environment and use of its resources. Agricultural policies in the EU are enhancing the increase of biodiversity in all ecosystems [3]. One of the major sources of soil organic carbon (SOC) is plant residues, the highest content of which is left in the soil by perennial grasses, especially legumes [4]. In this study we researched SOC in ecologically grown mono- and multi-component swards.

Experiment Site and Conditions

The field Experiment compared the influence of long-term legume swards on soil SOC and humic substances in an *Epicalcari-Endohypogleic Cambisol* with clay content of 11.9%, silt 34.2% and sand 53.9% in Akademija, near Kedainiai, Lithuania. Field experiments were carried out in the central part of Lithuania (lat. 55º 24′ N, 23º 52′ E). The pure or mixtures of herb species were sown under barley in certified ecological area. The experiment was laid out as a randomized complete block with a plot size of 35 m^2. No mineral or organic fertilisers and pesticides were used. The swards were cut either two or three times per season. Before the experiment, plough-layers pH (KCl 1M, w/v 1:2.5) was 7.0; plant available phosphorus (P_2O_5) determined by Egner-Riem-Domingo (A-L) method: 128 mg kg^{-1}; and available potassium (K_2O) 211 mg kg^{-1}. SOC content determined according Tyurin method modified by Nikitin [5]. The soil of three field replicates was investigated in our Chemical Research laboratory. Perennial swards grown for 5 years under ecological management was investigated. No fertilizers or pesticides were used. The following long-lived swards and their mixtures were investigated:

i. *Galega orientalis;*

ii. *Galega/ Onobrychis/Festulolium;*

iii. *Galega/Medicago/T. Pratense/ Festulolium;*

iv. *Galega/T. Repens/Onobrychis/ Festulolium.*

The experiment was laid out as a randomised complete block with four field replications.

Results and Discussion

The study showed that according to indicators investigated, in the multi-component swards exerted more considerable effect on SOM accumulation that mono-components sward (Figure 1). In recent years the attention was given to estimate the influence of different swards on SOC accumulation and stabilization. We concluded, that by increasing biodiversity, choosing the right crops for the cultivating in agriculture, as well as their appropriate combinations, especially perennial grasslands, it is possible to achieve sufficiently good results in the preservation of SOM and SOC, stabilization of C in the soil, reducing CO_2 emissions, preserving soil richness and stability. We cannot have unrealistic goals to abandon anthropogenic activity and to turn all the earth's resources into wildlife, because the earth and vegetation feed the people. However, we can achieve that land uses are environmentally friendly, do not cause harm, but instead provide benefits. There are many tools for the sustainable use of natural resources, it is only important to use them correctly. We offer a somewhat innovative moderate solution to the problems mentioned. One of the right steps in this direction is to increase biodiversity in the agricultural sector by establishing organically grown multi-component long-lived swards.

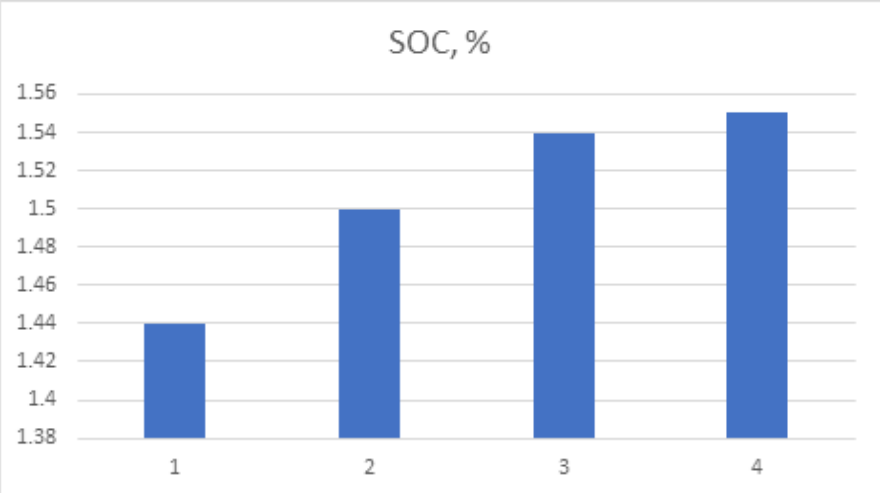

Figure 1: The influence of grass species on the content of SOC (%) in soil. Mean data from five years sward.
Note: 1. Galega orientalis 100%; 2. Galega orientalis 40%, Onobrychis viciifolia 40%, Festulolium 20%; 3. Galega orientalis 40%, Medicago sativa 20%, Trifolium pratense 20%, Festulolium 20%; 4. Galega orientalis 40%, Trifolium repens 20%, Onobrychis viciifolia 20%, Festulolium 20%.

Conflict of Interest

There are no conflicts of interest.

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