# HUMUS CONTENT IN PSEUDOGLEY SOIL DEPENDING ON LAND USE

# SADRŽAJ HUMUSA U PSEUDOGLEJNOM ZEMLJIŠTU U ZAVISNOSTI OD NAČINA ISKORIŠĆAVANJA

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***Abstract:*** *The paper presents data on humus contents in 109 profiles of pseudogley soils in Kraljevo environs under three different forms of land use: arable land, meadow and forest. Soil analysis showed that forest pseudogley soils had the highest content of humus in the humus horizon, 5.99% on the average, while meadow soils followed with 3.37% and arable land with the lowest average humus content of 3.31%. The high content of humus and a tendency of its increase in forest pseudogley soils indicate deteriorating conditions regarding the mineralization of organic matter, which leads to intensification of its accumulation in soil. Well aerated arable land was found to undergo more intensive mineralization of organic matter and more intensive utilization, which decreases the content of humus. In the subhumus horizon, humus content was considerably lower, 1.99% on the average in forest soils, 1.27% in arable land and 1.15% in meadow soils. Humus contents were also found to vary considerably, their values in the humus horizon ranging from 2.85% to 9.68% in forest soils, from 2.01 to 6.03% in meadow soils and from 2.02 to 4.63% in arable land soils. In the subhumus layer of the profile, the most evident vatriation was registered in the arable land variant (0.44-4.01) of pseudogley (0.24-2.04). This high variation of humus contents in the pseudogley soils examined, especially forest soils, indicate very different amounts of organic residues as well as different conditions of their degradation, accumulation and humification*

***Key words*****:** *humus, pseudogley soil, land use*

***Apstrakt:*** *U radu su prikazani rezultati određivanja sadržaja humusa Kraljevačkog pseudogleja u 109 profila koji je korišćen na tri različita načina i to pod njivom, livadom i šumom. Analizom ispitivanih zemljišta ustanovljen je najveći sadržaj humusa u pseudogleju šumskog varijeteta sa prosečnim sadržajem humusa u humusnom horizontu od 5,99%, zatim livadskog sa 3,37%, dok je kod njivskog varijeteta sadržaj humusa imao najmanju prosečnu vrednost od 3,31%. Visok sadržaj humusa sa tendencijom njegovog daljeg rasta u šumskim varijetetima pseudogleja, ukazuje na pogoršanje uslova za mineralizaciju organske materije što dovodi da pojačanja njegove akumulacije u zemljištu. Njivski varijeteti u uslovima bolje aeracije imaju pojačanu mineralizaciju organske materije i intenzivnije iskorišćavanje, što dovodi do smanjenja sadržaja humusa. Sadržaj humusa u podhumusnom horizontu je bio znatno niži sa prosečnim vrednostima 1,99% kod šumskih, 1,27% kod njivskih i 1,15% kod livadskih varijeteta. Takođe, sadržaj humusa je pokazivao izuzetno veliko variranje, koje se u humusnom horizontu šumskih zemljišta kretalo između 2,85 i 9,68%, livadskih od 2,01 do 6,03% i njivskih od 2,02 do 4,63% dok je u podhumusnom delu profila najveće variranje zabeleženo u njivskim varijetetima (0,44-4,01) a najmanje u livadskom varijetetu pseudogleja (0,24-2,04). Prisustvo velikog variranja sadržaja humusa u zemljištima pseudogleja, naročito šumskog varijeteta govori o veoma različitim količinama organskih ostataka i uslovima u kojima se odvija njihovo razlaganje i akumulacija, odnosno humifikacija.*

***Ključne reči****: humusa, pseudoglejnom*

## INTRODUCTION

Humus content is an important indicator of soil fertility. Soils with low humus contents normally have a deficit of some biogenic elements, primarily nitrogen. The content and quality of humus formed in different soil types under different land use variants depend on the conditions of its formation.

Some of the factors most affecting humification includes climatic conditions, amount and type of plant residues in soil and application of mineral and organic fertilizers (Lass et al., 1994; Chander et al., 1997; Raun et al., 1998).

Fertilization with nitrogen and calcium fertilizers, and especially their mixed application with manure, has had positive effect on humus contents in soil (Rutkowska et al., 2004; Zivanovic-Katic S., 2004).

This study aimed to determine the effect of different forms of land use on humus content and its distribution in pseudogley soils at different sites.

## MATERIAL AND METHOD

Pseudogley (epygley) soils were tested at sites in the Čačak-Kraljevo basin. A total of 109 soil profiles were opened, of which 60 on arable land, 30 on meadows and 19 profiles in forest pseudogleys.

Soil samples were collected from two profile depths: the humus horizon (0-20 cm) and subhumus horizon (30-50 cm). Sampling was performed manually by opening profiles with a pedological knife.

The samples were air dried and pounded in a porcelain mortar to obtain 1 mm particle size. Humus content was determined using the standard Kotzmann method. The analysis produced average values and statistically processed by the standard deviation method.

## RESULTS AND DISCUSSION

Humus content was found to vary considerably in the pseudogley soils analysed depending on the form of land use and profile depth (Table 1). A high variation of humus content was found in the humus layer (0-20 cm). The lowest amount of humus was detected in the humus (tilth) layer of pseudogley soil in the arable land variant (3.31%).

The forest variant had the highest average content of humus (5.99%) and an exceptional variation of content from a minimum 2.85% to maximum 9.68%.

High content of humus and a tendency of its further increase in forest pseudogley soils are indicative of deteriorating conditions in terms of mineralization of organic matter, which leads to its further accumulation in soil.

Low humus content in the humus horizon of arable land indicates that conditions for mineralization of organic matter are better there than in forest humus, and that its adsorption complex is improved. Similar findings have been reported by Grubisic and Dugalic, 2004.

*Table 1*

Humus content in pseudogley profiles examined (x ± Sd and interval) (%)

| Horizon (depth, cm) | Land use | | |
|---|---|---|---|
| | Arable land (n =60) | Meadow (n=30) | Forest (n=19) |
| Humus (0-20 cm) | 3.31±0.60<br>2.02-4.63 | 3.75±1.09<br>2.01-6.03 | 5.99±2.06<br>2.85-9.68 |
| Subhumus (20-40 cm) | 1.27±0.62<br>0.44-4.01 | 1.15±0.46<br>0.25-2.04 | 1.99±0.67<br>0.74-3.04 |

Average humus content in the humus horizon of meadow pseudogley was 3.75% with values ranging between 2.01 and 6.03%. Deeper subhumus layers of soil (20-40 cm) had a lower content of humus, around 2.97%.

The highest average humus content in the subhumus horizon (1.99%) was found in the forest pseudogley soil. These differences between the humus and subhumus horizons are evident from the ratios of humus contents in the two horizons (Tab. 2).

The ratios of humus contents in humus and subhumus soil horizons of arable and forest pseudogleys were similar (3.12 and 3.14), while the meadow variant of land use showed the highest average ratio of 3.85.

As a consequence, meadow soil had a more evident accumulation of humus in the surface humus profile, compared to the deeper subhumus layers in the profile.

*Table 2*

Ratios of humus contents in the humus and subhu
mus horizons of pseudogley profiles examined

| Horizon (depth) | Land use | | |
|---|---|---|---|
| | Arable land (n=60) | Meadow (n=30) | Forest (n=19) |
| Humus/subhumus (0-20/20-40) | 3.12±0.72<br>1.04-6.85 | 3.85±2.27<br>1.99-14.80 | 3.14±0.86<br>1.64-5.26 |

This variant of land use also demonstrated an exceptional ratio variation, having the maximum ratio value of 14.80. Different contents and distribution of humus in the pseudogley variants examined are the result of specific conditions in which humus had been formed.

Pronounced differentiation of soil profiles and frequent alternation of reduction and oxidation processes in the presence of different amounts of heterogeneous organic residues lead to accumulation of different amounts and qualities of humus matter.

Similar findings have been reported in other studies (Lass et al., 1994; Raun et al., 1998; Verhayen et al., 1999; Kristiansen, 2001; Kristiansen and Greve, 2003).

## CONCLUSIONS

The data obtained in this study of effects of land use on humus contents in pseudogley soils suggest the following conclusions:

The highest average content of humus in the humus horizon was found in forest pseudogley soil (5.99%), while it was lower in meadow (3.37%) and lowest in arable land psoudogley soils (3.31%).

Humus content in the subhumus horizon was considerably lower and had the average value of 1.99% under forest, 1.27% under arable land and 1.15% under meadow form of land use. Humus content also showed exceptionally high variation: 2.85-9.68% in the humus horizon of the forest variant of land use, and 2.01-6.03% in the meadow and 2.02-4.63% in the arable land variant, while the highest variation in the subhumus profile section was found under arable land (0.44-4.01) and lowest in the meadow variant of pseudogley soil (0.24-2.04).

The ratios of humus contents in the humus and subhumus horizons of arable land and forest were similar (3.12 and 3.14), while its average ratio in the meadow variant was 3.85. The meadow variant of land use is therefore characterized by higher accumulation of humus in the top humus layer than in the deeper subhumus layers of soil profile.

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