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PODZOLISED ACID BROWN SOIL IN FOREST ECOSYSTEMS IN SERBIA

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The systematized data on the existence, properties, genesis and distribution of podzolised acid brown soils in Serbia are very few. In the Soil Classification (ŠKORIĆ *et al.*, 1985) this soil is defined as the subtype of acid brown soil.

The genesis, as well as the formation of the profile morphology, is performed under the effect of the corresponding constellation of site factors. Acid siliceous rocks, very much dissected relief, steep slopes, scanty vegetation and often the sunny exposures, water and wind erosion, specific microclimate, are the main agents of this soil formation.

Podzolised acid brown soil in acidophilous forests of beech (suballiance: *Luzulo-Fagenion moesiacae* B. Jov. 1976) and in the communities of acidophilous forests of sessile oak occurs in fragments over small areas throughout Serbia. The main characteristics of this soil, i.e. small depth, very acid or extremely acid soil pH, transition of sesquioxides, specific group-fraction composition of humus, are the properties that approach to brunipodzols and podzols.

In harmony with the modern approach to forestry development, the degraded and devastated areas of the coeno-ecological group of acidophilous beech forests (*Luzulo-Fagenion moesiacae* B. Jov. 1976) and acidophilous forests of sessile oak and sweet chestnut (alliance: *Quercion robori-petraeae*) on podzolised acid brown soil, on very steep slopes, should be designated as special management units and a special management treatment should be

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applied. Such units occur in beech forests throughout Serbia and their total area is not at all to be disregarded.

Key words: podzolised acid brown soil, ecological conditions, acidophilous forest

INTRODUCTION

Podzolised acid brown soils are insufficiently studied soil formations. In Serbian pedological literature, there are practically no systematised data on the existence, characteristics, genesis and distribution of this soil type in the area of Serbia. ANTIĆ and BUNUŠEVAC (1952) reported on the fragmentary presence of "highly acid brown soils, of poor characteristics" in acidophilous forests of beech with mosses throughout Serbia. JOVANOVIĆ (1953) emphasises that "the association *Fageto-Muscetum* B. Jov. 1953 is related to the soils with the podzolisation process", and the process itself is explained by "the relief, always siliceous bedrock, the altitude, as well as by the vegetation growing on it". FILIPOVSKI and ĆIRIĆ (1963) report the "highly acid brown soils" formed on quartz sandstones, hornfels and quartzites at the lower altitudes (below 900 m), and brown podzolic soils alternate with podzols at the higher altitudes on the same bedrocks.

The "extremely acid brown soil of specific morphology and chemical properties" was described on the slopes of the mountain Gučevo (VUKIĆEVIĆ and AVDALOVIĆ, 1972), in the acidophilous forest of beech with mosses, at the altitude of 300-400 m, on northern aspects

HARTMANN (1974) describes a great number of associations in the wider area of Central Europe, among them also *Luzulo-Fagetum montanum* obd. subas. with *Leucobryum glaucum*, on the "dry, especially quartz soils, and the soil type corresponds to highly podzolised brown soil". AVDALOVIĆ (1975) reports that podzolised acid brown soil has its typical morphology and its own evolution. According to ĆIRIĆ (1982) and BURLICA (1982), podzolised soils have very limited elementary ranges and they most often occur in combination with dystric brown soils, as series or mosaic series.

The extremely acid brown soil was described in the beech forest with blueberry (*Vaccinio-Fagetum moesiacae* Fukarek 1969), on western, northwestern and northern aspects and on steep slopes (20-35°) in the forest management unit "Crni Vrh-Kupinovo-Bor" (JOVIĆ and KNEŽEVIĆ, 1990).

The podzolic subtype of dystric brown soil was studied in beech forests in the area of the mountain Kukavica (TOMIĆ *et al.*, 2000). The formation of "podzolic brown soil" is linked to acidophilous forests of beech with woodrush (*Luzulo-Fagetum moesiacae montanum* Jov. 1976), which occurs on southern, warm slopes, or on prominent ridges and peaks, i.e. "at places where there are conditions for faster soil degradation", at the altitudes of 870-1170 m.

KNEŽEVIĆ and KOŠANIN (2005) report that podzolised acid brown soils as well as the eroded, shallow to medium deep acid brown soils, occur in acidophilous beech communities on steep and narrow ridges of the hilly and mountainous regions in Serbia, which are often exposed to soil loss processes. Podzolised acid brown soil was studied in the acidophilous forest of beech with moss on Veliki Jastrebac (MILOŠEVIĆ, 2006), and also in the area of the mountain Čemernik (ĆIRKOVIĆ, 2006).

Podzolised acid brown soil, according to Soil Classification criteria by ŠKORIĆ *et al.* (1985), is defined as a subtype of acid brown soil. The main reason of insufficient study of podzolised acid brown soil is in the fact that previous study was focused primarily on the soils of the most important forest ecosystems. Podzolised acid brown soil, as the soil in "uninteresting" acidophilous stands, from the forest-economic aspect, occupying relatively small areas within the large forest complexes, was the subject of only partial researches.

MATERIAL AND METHODS

The planned research programme was realised by field and laboratory methods adopted and defined by the Yugoslav Soil Science Society. The field survey was performed in all major forest ecosystems in Serbia (Kopaonik, Boranja, Cer, Gučevo, Goč, Stara Planina, Veliki Jastrebac, NP "Đerdap", Crni Vrh near Bor, Golija), in acidophilous forests of beech (sub-alliance: *Luzulo-Fagenion moesiacae* B. Jov. 1976) and in the communities of acidophilous forests of sessile oak. The soil samples were taken in the disturbed state, and the following was determined: standard physical and chemical characteristics of the soil, group-fraction composition of humus, and the sesquioxide dynamics, as diagnostic indicators of podzolisation.

The vegetation was studied in detail in the phase of field study, as it is most logical that forest soil should be studied in relation to vegetation. The vegetation was studied on phyto-coenological releves by *Braun-Blanquet* method.

Laboratory research included a set of standard physico-chemical analyses adopted and accepted by Society of Soil Science of Serbia. Special attention was focused to quantitative and qualitative characteristics of humus. Humus study included the following determinations:

1. Percentages of humus and carbon (%) by *Tjurin I. V.* (1960) method modified by *Simakov*;

2. Group-fraction composition of humus by *Ponomareva, V. V.* (1957) method after *Škorić, A.* and *Racz, Z.* (1966):

- Determination of the percentage of organic substances bound to R_2O_3;
- Determination of the percentage of organic substances bound to calcium;

- Determination of groups of the most mobile organic substances soluble in 0.05 *M* H_2SO_4 during soil decalcification (*Ponomareva, V. V.* 1957) - fulvic acids fraction 1a, after *Tjurin*;
- Simultaneous with the determination of organic carbon in the acid solution, we also determined the bases of iron and aluminium readily soluble or extracted from the adsorptive state. The content of mobile Fe_2O_3 was determined complexometrically (*Škorić, A.* and *Sertić, V.* 1963), and the content of Al_2O_3 was calculated from the difference of R_2O_3 content, determined gravimetrically by deposition with ammonia by *Ponomareva, V. V.* (1957) method, and the content of Fe_2O_3;
- Calculation of the ratio R_2O_3/Fk, where R_2O_3 is the total quantity of mobile sesquioxides, and Fk - fulvic acid fraction 1a. The value of Fk is obtained by multiplying the percentage of carbon fulvic acid fraction 1a by two, i.e. it is taken that the percentage of carbon in this fraction is 50% (*Martinez, F. M.* 1965);
- Calculation of the ratio of mobile Al_2O_3/Fe_2O_3.

3. The content of free, mobile (amorphous) forms of iron and aluminium in the oxalate extract was determined by *Tamm's* method (1934). In this, total sesquioxides were determined after the deposition of ammonia, and the mobile forms of Fe_2O_3 from the extract were determined complexometrically.

The study data were processed by statistical methods. The mean value, minimum and maximum values were calculated using the descriptive statistics. The analysis of variance showed the degree and the significance of variation and the differences between the horizons of the classification unit (podzolised acid brown soil), and also between the horizons of different classification units (podzolised acid brown soil, acid brown soil, and podzol). The differences were tested with probability 95%, i.e. 5% risk, using Duncan's test. The differences between the horizons were analysed for the identified physical and chemical soil characteristics. Based on the differences in the horizon characteristics in both cases, it can be concluded which processes are underway in the soil and the direction in which the soil evolution progresses. Finally, cluster analysis was applied in the grouping of profiles by the identified properties.

RESULTS AND DISCUSSION

GERASIMOV (2004) reduces the soil formation, or soil genesis, to the following three-member formula: soil properties←processes of soil genesis←factors of soil genesis. The genesis and the properties of the formed soil depend on the constellation of pedogenetic factors: relief, altitude, aspect, slope, climate, parent rock, and vegetation. For this reason, special attention in this paper is focused on site conditions.

In the hilly belt of Serbia, in the communities of submontane forests of beech (*Fagetum submontanum*), occurring up to the altitude of 600 m in its northeastern part, i.e. 800 m in other regions, the climate is temperate to mild continental. The climate-regional belt of beech montane forests (*Fagetum moesiacae montanum Jov.*) which in north-eastern Serbia occurs at the altitude of 600 - 1100 m, i.e. from 800 to 1300 m in western Serbia and south-eastern Serbia, and from 800 to 1500 m on Kopaonik, is characterised by humid to perhumid climate.

A very significant role in the genesis of podzolised acid brown soil is assigned to highly dissected relief and steep slopes. At lower altitudes, in the zone of submontane beech forests (*Fagenion moesiacae submontanum* Jov. 1976), podzolised acid brown soils are mainly formed fragmentarily on steep slopes at colder and moister aspects. In the belt of montane beech forests (*Fagenion moesiacae montanum* Jov. 1976), on the majority of mountains in Serbia, podzolised acid brown soils occupy the southern, warmer slopes or the high ridges, where soil degradation is faster, while acid brown soils remain in the valleys and on the cooler aspects.

Podzolised acid brown soils in Serbia are formed on siliceous bedrocks composed of acid rocks: granodiorites, granites, schists, gneisses, mica schists, conglomerates, phyllites, cornites, etc. Bedrock disintegration is performed by the processes of physical and chemical weathering, which cause essential changes in bedrock and mineral composition. By the weathering of acid siliceous rocks, coarse sandy material is released, predominantly of loamy-sandy particle-size composition, which enables a good aeration and water permeability to these soils. The main characteristic of acid siliceous rocks is that they are poor in bases, or their relatively low content of bases which are rather readily washed (K, Ca, Mg, On). Thanks to the substrate properties, already the first soil development phases are poor in bases and they are acid.

The communities on podzolised acid brown soils mostly belong to the sub-alliance of acidophilous forests of moesian beech *Luzulo-Fagenion moesiacae* Jov. 1976, more exactly they are formed in the following associations: submontane forest of beech with woodrush (*Luzulo-Fagetum moesiacae submontanum* Jov.1976), montane forest of beech with woodrush (*Luzulo-Fagetum moesiacae montanum* Miš et Pop.1976), acidophilous forest of beech with mosses (*Musco-Fagetum* Jov.1953), acidophilous forest of beech with white moss (*Leucobryo-fagetum montanum* Jov.1979), acidophilous forest of beech with blueberry (*Vaccinio-Fagetum moesiacae Fuk. 1969*), acidophilous forest of beech and hard fern (*Blechno-Fagetum moesiacae montanum* Tat. Et Atan.1977), acidophilous forest of beech and fir with woodrushes (*Luzulo-Abieti-Fagetum*), acidophilous forest of beech and fir with blueberry (*Vaccinio myrtilli-Fago-Abietetum* Jov.1979).

Acidophilous beech forests are mainly represented by the stands with low heights and broken canopy, with curved, thin, branchy beech stems without major technical value. The characteristic species in the sub-alliance are: *Vaccinium myrtillus, Luzula luzuloides, Luzula sylvatica, Luzula pilosa, Veronica officinalis, Pyrola rotundifolia* and numerous mosses - *Musci spp.*

Also, podzolised acid brown soils in Serbia are formed in the communities of the alliance of acidophilous forests of sessile oak and sweet chestnut (*Quercion robori-petraeae*) in the area of Kosovo and Metohija. The floristic composition of the communities includes a substantial number of Atlantic floral-geographic elements, as well as the differential acidophilous species: *Luzula albida, Vaccinium myrtillus, Calluna vulgaris, Pteridium aquilinum, Genista pilosa, Genista germenica, Leucobrium glaucum, Juniperus communis,* etc.

Profile morphology of podzolised acid brown soil is characterised by some specificities. The most frequent profile structure of podzolised acid brown soil is: OhA–(B)–(B)C–C. Humus accumulation horizon is a combination of raw humus and the humus eluvial horizon. The colour of OhA horizon is usually grey-brown and clearly differs morphologically from the rusty brown (B) horizon. Namely, cambic horizon retained all the morphological characteristics of acid brown soil (B)-horizon, the colour and the depth.

The depth of podzolised acid brown soil mainly ranges from 30 to 90 cm, average 54.44 cm, i.e. it is in the category of shallow to medium deep soils. The depth is conditioned by the type of parent rock and the slope. On most parent rocks, the depth is increased for the depth of the transitional (B) C horizon ranging from 25-44 cm, average 32.80 cm. The depth of OhA horizon in podzolised acid brown soil ranges from 3.00 to 14.00 cm, average 7.00 cm, and the depth of (B) horizon ranges from 27.00 to 84.00 cm, average 48.29 cm.

As acid siliceous rocks are subject to the processes of intensive physical decomposition, podzolised acid brown soils inherit the lighter particle-size composition, mainly sandy-loamy to silty-loamy. These soils, also often contain a high percentage of skeletal material, the content of which usually increases with depth.

Regardless of the bedrock type, the highest percentage is mainly that of the fraction of fine sand, and the percentage of silt fraction is also rather high, which cannot be considered as a favourable property. The content of fine sand fraction in OhA horizon in podzolised acid brown soil ranges from 25.59 to 48.84%, average 38.25%, and in (B) horizon, the percentage ranges from 23.89 to 50.25%, average 37.58%. The content of coarse sand fraction in OhA horizon in podzolised acid brown soil ranges from 2.95 to 37.4%, average 19.57%, and in (B) horizon, it ranges from 2.94 to 36.21%, average 19.00%. The analysis of variance shows that the content of fine sand and coarse sand fraction is rather uniform throughout the depth of the profile in podzolised acid brown soils and that it does not differ from the contents found in the horizons of dystric brown soil.

Podzolised acid brown soils, taking into account the particle-size composition, are characterised by good aeration and excellent water permeability. The exception is, to some extent, the soil formed on phyllites, with somewhat more clayey variants.

The coarse-grain system of these soils affects their liability to podzolisation processes, i.e., causes the easier migration of the colloid fraction, as well as the migration of organomineral compounds from the higher to the lower parts of the soil.

Chemical characteristics of podzolised acid brown soil are characterised, primarily by high acidity. pH in water in OhA horizon of podzolised acid brown soil ranges from 3.38 to 4.80, average 4.13, so this horizon has an extremely acid reaction. In (B) horizon, pH value in water ranges from 3.85 to 5.62, average 4.60, i.e. it is characterised by a very strong acid reaction. OhA horizon has a lower pH-value on average compared to (B) horizon, i.e. its reaction is more acid.

The content of humus in OhA horizon of podzolised acid brown soil ranges from 2.18-33.64%, average 16.39% and it is very rich in humus, while in cambic horizon, it ranges from 0.39 to 4.58%, average 2.00%, i.e. it is poor in humus.

However, regardless of the high content of humus, the content of nitrogen is relatively low. The C:N ratio in OhA-horizon is relatively wide and ranges from 9.70 to 49.10, average 17.92. This ratio points to the formation of dystrophic moder humus. In (B) horizon, the values range from 6.90 to 16.00, average 10.64.

The high content of humus results also in the high total capacity of adsorption for cations and it ranges up to 109.98 cmol/kg. The degree of soil saturation with bases (V%) in OhA horizon of podzolised acid brown soil ranges from 0.00-16.19%, average 7.88%, and in (B) horizon it ranges from 0.00-35.18%, average 9.83%.

Podzolised acid brown soil is characterised by strong acidification in surface OhA horizon, where on average the degree of soil saturation with bases is below 10%, which according to JOVIĆ (1965, 1966) indicates the formation of raw humus and the presence of podzolisation. According to the same author, in podzol, the degree of soil saturation with bases is below 10% throughout the profile depth, and in brown podzolic soil the same values account for 10-20%.

The hydrolytic acidity is in harmony with soil pH, as well as the total amount of acid cations. In OhA-horizon, podzolised acid brown soil hydrolytic acidity is even up to four times higher than that in acid brown soil, and it ranges up to 162.83 ccm n/10 NaOH. The supply of readily available phosphorus in podzolised acid brown soil is low, and the supply of potassium is medium to high in OhA-horizon. With depth, all these values decrease and approach the values of the contents in the cambic horizon of acid brown soil.

The group-fraction composition of humus of the podzolised acid brown soil in acidophilous beech forest with mosses is distinguished by the ratio Ch:Cf<1. Surface horizon has all characteristics of podzol with the ratio 0.26 to 1.01, average 0.53, and in (B) horizon, the ratio ranges from 0.10 to 0.61, average 0.28 and retains all the characteristics of acid brown soils.

The analysis of variance (Duncan's test) shows that there are no statistically significant differences in the ratio Ch:Cf between OhA horizon of podzolised acid brown soil and Ofh/A and E horizons of podzol, i.e. that there are significant differences between (B) horizon of podzolised acid brown soil and B horizon of podzol. There are no statistically significant differences between (B) horizon of podzolised acid brown soil and (B) horizon of dystric brown soil.

Fulvic acids, i.e. fraction 1, are dominant among humus components. In OhA-horizon, the content of fulvic acid fraction 1 accounts for 13.83-26.09% of the total carbon. The content of this fraction mainly decreases with depth and accounts for 3.40-11.76% (exceptionally 29.25%).

The content of fulvic acid fraction 1a is found immediately after the fraction 1. The content of fulvic acid fraction 1a in podzolised acid brown soil in OhA horizon ranges from 2.52 to 13.5%, average 5.16%, and in (B) horizon, it ranges from 3.49 to 25.58%, average 12.30%.

The analysis of variance shows that there are statistically significant differences in the content of fulvic acid fraction 1a between OhA horizon of podzolised acid brown soil and Ofh/A horizon of podzol, i.e. that there are no differences between OhA horizon of podzolised acid brown soil and E horizon of podzol. Also, (B) horizon of podzolised acid brown soil and B horizon of podzol differ in the content of fulvic acids fraction 1a. There are no statistically significant differences between (B) horizon of podzolised acid brown soil and (B) horizon of acid brown soil.

In the solution of genetic and classification tasks, soil scientists traditionally select the determination of the quantity of free compounds of iron (ВОДЯНИЦКИЙ, 2004). According to ZOON (1982), iron capacity of changing the valence (Fe^{+3}, Fe^{+2}) is of special significance for soil genesis. Iron can migrate in the soil only in its ionic, colloid and complex-chelate states.

Total quantity of released iron and aluminium greatly depends on the content of these oxides in the bedrock, and their percentage increases from sandstones, through granites to basalt (ДЮШОФУР, 1964). According to AVDALOVIĆ (1971), the soils formed on granodiorites, phyllites and especially on cornites, differ from the soils formed on mica schists, rhyolites and gneisses, by the contents of iron and aluminium oxides. The quantity of iron oxides is not so significant in the genesis of podzolised acid brown soil, its dynamics in the profile is more significant.

The migration of iron and aluminium oxides is significant for the soils with podzolisation processes. As opposed to acid brown soils, in podzolised soils aluminium oxides migrate to the substantially deeper parts of the profile. Table 1 presents the contents of free forms of iron and aluminium bound to the mineral part of the soil - clay, which were obtained by oxalate method after TAMM (1934) from the samples of the representative profiles of podzolised acid brown soil formed in the community *Musco-Fagetum*.

The analysis of variance of the horizons of podzolised acid brown soil shows statistically significant differences in the contents of Al_2O_3 from the extra. Its highest percentages were found in the upper part of (B) horizon (0.83%), which points to the presence of leaching. In podzolised acid brown soil, there are no statistically significant differences in the content of free Al_2O_3 in the profile compared to dystric brown soil.

Table 1. - Contents of free iron and aluminium oxides in % (in the extract after Tamm) from the samples of podzolised acid brown soil

Locality and profile number	Depth (cm)	Horizon	% in soil sample			Fe B/Fe A	Al B/Al A
			Fe_2O_3	Al_2O_3	R_2O_3		
CER 13/05 Musco-Fagetum	0 - 5	OhA	0.27	0.83	1.10		
Altitude: Aspect: NW	5 - 27	Bal	0.32	1.23	1.55	1.19	1.48
Slope: 20° Bedrock: granite	27 - 50	Bal	0.36	1.39	1.75	1.33	1.68
N.P.ĐERDAP 22a/02	0 - 5	OhA	0.36	0.56	0.92		
Musco-Fagetum Altitude: 430 m	5 - 10	(B)	0.41	0.70	1.11	1.14	1.25
Aspect: NW Slope: wide ridge Bedrock: gneiss	10 - 40	(B)C	0.20	0.63	0.83		
GOČ 8/00 Musco-Fagetum	0 - 10	OhA	0.62	0.33	0.95		
Altitude: 950 m Aspect: ridge Slope:20-25° Bedrock: phyllite	10 - 45	(B)	0.76	0.83	1.59	1.23	2.52

In podzolised acid brown soil, there are no statistically significant differences in the content of iron from the extract, bit its percentages are the highest in the upper part of (B) horizon (0.33%), which indicates its very poor migration. The statistically significant differences between the horizons of podzolised acid brown soil point to the migration of free Fe_2O_3 from the surface OhA horizon to the upper parts of (B) horizon, where the percentages are the highest.

The migration and accumulation of free oxides Fe_2O_3 indicates the presence of podzolisation in podzolised acid brown soil. This is also proved by the results of cluster analysis which also confirm and agree with the Classification by ŠKORIĆ *et al.* (1985).

Based on the cluster analysis, the soils are grouped depending on the content of free Fe_2O_3 in surface horizons (acid brown soil and its subtypes: podzolised soil and humus, brown podzolic soil and podzol) in three clusters (Diagram 1). The first cluster consists of two subclusters. The first subcluster at the shortest distance comprises E and Ofh/A horizons of podzol. OhA horizon of podzolised acid brown soil is at a distance from them. The second cluster also consists of two subclusters. A horizon of dystric brown soil and Ofh/A horizon of brown podzolic soil are found at the shortest distance, and at a somewhat larger distance they are joined with A/E horizon of brown podzolic soil. These two clusters at a great distance are joined with OAh horizon of humus-rich dystric brown soil. The formed cluster clearly points out the similarity of podzolised acid brown soil and podzol in the zone of surface horizons, based on the content of free Fe_2O_3.

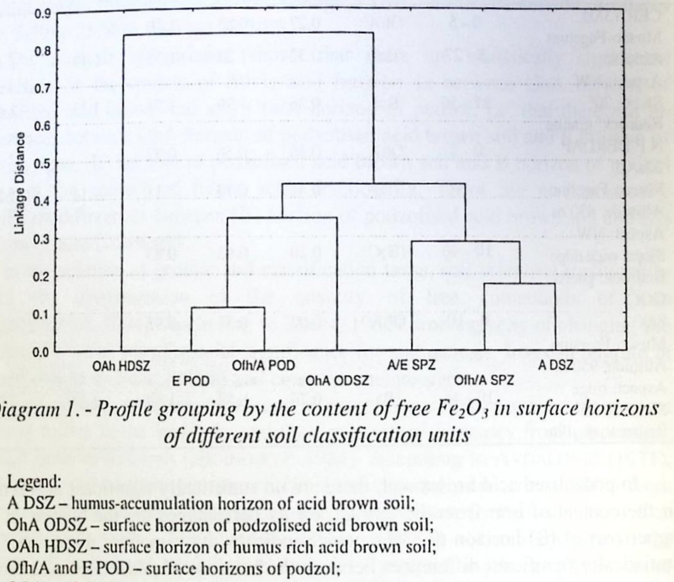

Diagram 1. - Profile grouping by the content of free Fe_2O_3 in surface horizons of different soil classification units

Legend:
A DSZ – humus-accumulation horizon of acid brown soil;
OhA ODSZ – surface horizon of podzolised acid brown soil;
OAh HDSZ – surface horizon of humus rich acid brown soil;
Ofh/A and E POD – surface horizons of podzol;
Ofh/A and A/E SPZ – surface horizons of brown podzolic soil;

In the zone of cambic horizons, in the same soil classification unit, the profiles are grouped in three clusters based on the content of free Fe_2O_3. The first cluster consists of (B) horizon of podzolised acid brown soil and (B) horizon of acid brown soil. They are joined with the cluster consisting of B horizon of brown podzolic soil and (B) horizon of humus acid brown soil, and at a great distance they are linked with a special cluster consisting of B horizon of podzol. The calculated data indicate the similarity of podzolised acid brown soil and acid brown soil regarding the content of free Fe_2O_3 in the zone of cambic horizons.

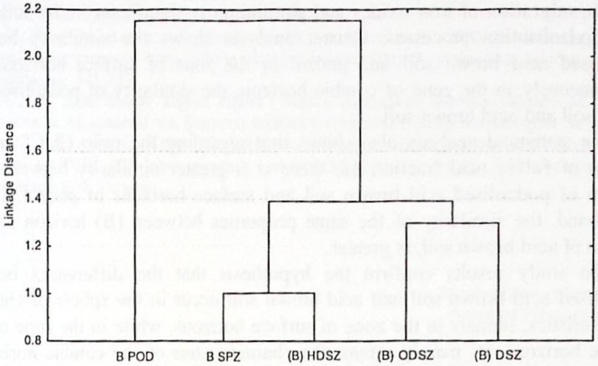

Diagram 2. - Profile grouping by the content of free Fe_2O_3 in the sub-surface horizons of different soil classification units

The similarity in the zone of surface horizons of podzolised acid brown soil and podzol is explained by a low content of free Fe_2O_3. The low content of sesquioxides and fulvic acid fraction 1a is a common characteristic of Ofh/A and E horizons of podzol and OhA horizon of podzolised acid brown soil, which occurs as the consequence of leaching i.e. the podzolisation process.

However, there are differences in the zone of sub-surface horizons. In podzol, there is a sharp transition, i.e. a high increase in the content of sesquioxides, especially of free Fe_2O_3 in the transition from surface horizon to B horizon, reaching its maximum in the lower parts of the illuvial horizon. In podzolised acid brown soil, the transition is gradual and the maximum occurs in the transition from OhA horizon in the upper parts of (B) horizon, because of which profile grouping in the zone of sub-surface horizons is performed in a different way.

CONCLUSIONS

In the Soil Classification (ŠKORIĆ *et al.*, 1985), podzolised acid brown soil is defined as a subtype of acid brown soil.

It is characterised by a simple profile structure: OhA – (B) – (B)C – C, and compared to the acid brown soil, the differences occur within the surface horizon which is simultaneously the horizon of accumulation of the dystrophic form of humus and it has some characteristics of the eluvial horizon.

The extremity of this soil, which nears it to brown podzolic soils and podzols, are primarily the high acidity, low degree of base saturation of the adsorptive complex, formation of moder humus, domination of fulvic acids over humic acids (Ch:Cf<1).

The migration of iron oxides and aluminium is significant in the soils with the podzolisation processes. Cluster analysis shows the similarity between podzolised acid brown soil and podzol in the zone of surface horizons, and simultaneously in the zone of cambic horizon, the similarity of podzolised acid brown soil and acid brown soil.

The statistical analysis also shows that regarding the ratio Ch:Cf and the content of fulvic acid fraction Ia, there is a greater similarity between OhA horizon of podzolised acid brown soil and surface horizons of podzol. On the other hand, the similarity of the same properties between (B) horizon and (B) horizon of acid brown soil, is greater.

The study results confirm the hypothesis that the differences between podzolised acid brown soil and acid brown soil occur in the sphere of chemical characteristics, namely in the zone of surface horizons, while in the zone of subsurface horizons, it mainly retains the characteristics of the cambic horizon of acid brown soils.

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OPODZOLJENA KISELA SMEĐA ZEMLJIŠTA U SRBIJI

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Izvod

Sistematizovanih podataka o postojanju, osobinama, genezi i rasprostranjenju opodzoljenog kiselog smeđeg zemljišta na području Srbije, ima veoma malo. U okviru Klasifikacije zemljišta (ŠKORIĆ et al., 1985) ovo zemljište se definiše kao podtip kiselog smeđeg zemljišta.

Geneza, kao i formiranje morfološke slike profila, vrši se pod uticajem odgovarajuće konstelacije stanišnih faktora. Kisele silikatne stene, veoma kupiran reljef, veliki nagibi, oskudna vegetacija i često izloženost terena suncu, eroziji vodom i vetrom, specifična mikroklima, su glavni uzročnici obrazovanja ovog zemljišta.

Opodzoljeno kiselo smeđe zemljište u acidofilnim šumama bukve (podsveza: *Luzulo-Fagenion moesiacae* B. Jov. 1976) i u zajednicama acidofilnih šuma hrasta kitnjaka fragmentarno se javlja na malim površinama u celoj Srbiji. Osnovne karakteristike ovog zemljišta: mala dubina, jako kisela ili ekstremno kisela reakcija zemljišta, premeštanje seskvioksida, specifičan grupno-frakcioni sastav humusa, su svojstva koja ga približavaju smeđim podzolastim zemljištima i podzolima.

U skladu sa savremenim pristupom razvoju šumarstva neophodno je degradirane i devastirane površine ceno-ekološke grupe acidofilnih šuma bukve (*Luzulo-Fagenion moesiacae* B. Jov. 1976) i acidofilnih šuma hrasta kitnjaka i pitomog kestena (sveza: *Quercion robori-petraeae*) na opodzoljenom kiselom smeđem zemljištu, na jako velikim nagibima, izdvojiti u posebne gazdinske celine i na njih primenjivati poseban gazdinski tretman. Ovakve celine javljaju se na području cele Srbije i njihova ukupna površina svakako nije zanemarljiva.

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