ORGANIC MATTER IN BANAT SOILS

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Abstract *Soil organic matter, in its usual sense,is the totality of organic components of the solid phase consisting of both non-humic substances and humus,other than the undecayed plant and animal residues. A typical agricultural soil may contain between 1 and 5% organic matter in the top 15 cm. The greatest content of humus , in the territory Sânandrei there are in the Gleysols (3.72%) Solonetz (3.63%) and Phaeozems (3.41%). A typical agricultural soil may contain between 1 and 5% organic matter in the top 15 cm. The dead plant material of lignocelluloses with an average composition of 15-60% cellulose,10-30% hemicelluloses,5-30% lignin and 12-50% protein. Almost 95% of total soil N is associated with soil organic matter. Humus is a mixture af dark-coloured amorphous and colloidal substances made up of strictly humic subtances, of products of the advanced decomposition of organic residues and of microbial biomass. The study is based on soil survey report effectuated by OPSA Timișoara or in doctorate thesis. The greates values for Humus and N content are in the Phaeozems, Vertisols and Chernozems. The C/N ratio determines the rates at which N and C are released and mineral N becomes available for plant uptake. In the case of Uivar territory the maximum value for humus content is at Vertisols (3.74%) and Phaeozems (3.72%) , and the minimum for Fluvisols (2.59%). It can be noticed that in soil types from plain region, like as Chernozems, Vertisols and Solonetz, prevails humic acids and the ration of NA/FA is over 1. In the soil type from the hilly region – Dealurile Lipovei and mountain region – Muntele Mic, prevails fluvic acids and the NA/FA ratio is under 1.*

Key words: *soil, organic matter, carbon, humus acids*

INTRODUCTION

Soil organic matter, in its usual sense,is the totality of organic components of the solid phase consisting of both non-humic substances and humus,other than the undecayed plant and animal residues. Part of the soil organic matter is free in soils,while part is baund as organo-mineral compounds.

The organic matter content of soils ranges from less than 1% in desert soils to close to 100% in organic soils.

A typical agricultural soil may contain between 1 and 5% organic matter in the top 15 cm. (CANARACHE,2006)

The term ,,organic matter'' refers to the sun total of all organic carbon-containing substances in soils.

Carbon is an essencial building block of life. It has always been transported from one farm or ecosystem to another as a basic part of natural processes. Examples include its transport, through soil erosion into aquatic ecosystems, or the undersea formation of limestone, the chief component of which is carbon. Much of the world's carbon is held in soils, another carbon pool is in the atmosphere, as carbon dioxide. Carbon dioxide is the largest single agent of climate change. Of the increase in atmosphere carbon over the last 150 years about a third is thought to have come from agriculture, and this has had adverse effects an sustainability as well as contributing to climate change.The use of agricultural soils in the developing world to requester soil organic carbon appears to be the strategy. The global pool of the soil organic carbon is about 1,550 PgC (1Pg=1,000 milion metric tons).Taken together with soil inorganic carbon at about 750-950 PgC, this is about three times the atmospherie carbon pool (Franzluebbers,2005).The net annual increase in the latter is thought to be about 3.3 PgC. The soil carbon pool is more than double that of atmosphere.

The primary sources of soil organic matter are dead plant in the form of leaves, straw, twigs, roots and other plant litter material.The dead plant material of lignocelluloses with an average composition of 15-60% cellulose,10-30% hemicelluloses,5-30% lignin and 12-50% protein. Menior components are phenols, sugars, amino acids and peptides,as well as numerous secondary metabolites (ROGOBETE,1994). Soils may contain several tons per hectare. Most of it can be only slowly degraded and metabolized by soil organisms.Their diversity and lack of regular polymeric structures do not favour efficient enzymatic degradation (HALDER,2005): microscopic and electromicroscopic evaluation gives direct acces to the origin and the degree of decomposition of soil organic matter within the different fraction. Mostly large undecomposed root and plant fragments exist in the 500-2000 µm aggregate fractions,wheares in the 10-100 µm aggregate more decomposed materials.The average turn over time for old carbon –derrived carbon is approximately 400 years for microaggregates compared with an average turnover time of 140 years for macroaggregates.

Most chemists partition the humic substances in three fractions:

1.Humic acid-HA that coagulates when the extract is acidified to pH

2.Fulvic acid-FA that fraction remains in solution when the alkaline extract is acidified, it is soluble in both alkaline and acid

3.Humin,which is that humic fraction that is insoluble in both alkaline and acid humic.

A more detailed analysis (Schnitzer,2005) shows that:

-HA contains ~10% more C, but 36% less O than the FA;

-there are smaller differences between the two materials in H, N and S contains;

-the total acidity and COOH content of the FA are higher than those of the HA;

-both materials contain concentration oh phenolic OH, alcoholic OH and Ketanic and quinanoid C= O groups;

-the HA is richer than the FA in C= O groups,while both contain few OCH_3groups;

-FA has lower molecular weight then the HA

Senesi (2005) estimates that metal ions in soil are rarely found in a free state, but mostly occur in interaction with other soil organic, inorganic and biological components in the liquid and solid phases;

-one COOH reacts with one metal ion to form an organic complex;

-one COOH and one adjacent OH react with the metal ion to a complex or chelate;

-two COOH interact with the metal ion to farm a bidentate chelate;

-the meatl ion M^{2+} linked to the HA or FA through a water molecule in its primary hydration shell to a C =O groups of the ligand.

Almost 95% of total soil N is associated with soil organic matter (Cayne,2005).This N occurs in the forms of amino acids, peptides, proteins, amino sugars, heterocylic N compounds and ammonia.The principal soluble inorganic N farms are NO_3, NO_2 and NH_4.The inorganic gaseous N farms in soil are N_2,N_2O,NO, and NH_3. The major organic and inorganic N transformation can be: mineralization, assimilation, nitrification, nitrate reduction and N_2 fixation.

The extend to which soil organic matter is humified is expressed as the ratis, multiplied by 100, between the sum of organic C found in HA and FA and the total organic C. (BALSER,2005).

Humus is a mixture af dark-coloured amorphous and colloidal substances made up of strictly humic subtances, of products of the advanced decomposition of organic residues and of microbial biomass.It is assumed that humus contains as an average, 58% organic C,and that the ratio C:N:S:P is of the order 100:10:1:1.The molecular formula of the HA is C_{308} C_{90} N_5 and its elemental analysis id 66.8% C, 6.0% H, 26.0% O and 1.3%N.

Organic soils have more than 12-18% organic C dpending on the clay content of the mineral fraction (Mokma,2005), and a commonly called peatlands. Highly acid organic soils are referred to as bags. Less acid organic soils are called fens or swamps.Marsh referens to wet mineral soils that are dominated by grasses and for sedges. More organic soils have forward since the end of the last ice age. In low latitude region the average rate of accumulation was about 1.4 mm year^{-1}. In the northen latitude the average rate was 0.55 mm year^{-1}. In Iceland was 0.39 mm year^{-1}. Organic soils compromise about 2% of the Earth's icefree land surface. In SRTS-2012 organic soils are called Histosol, soils having histic horizon,which extend from the soil surface to at 100 cm of the soil profile,with a thickness of minimum 50 cm.

MATERIALS AND METHODS

The main emphasis of this article is on the organic matter content in the representative soil types from Banat region and on their chemical structure, especially of the major component HA and FA.

The study is based on soil survey report effectuated by OPSA Timișoara or in doctorate thesis (ROGOBETE,1979). For a few soil types from low plaine we used the data from doctorate thesis OPRIȘ (1979), AND TUDOR (2007).

RESULTS AND DISCUSSIONS

In the following tables we present the average values for the soil types from the Low Plain Timiș, Low Plain Aranca, High Pain Vinga, and from Mountain Muntele Mic (in accordance with WRB) (Table 1).

Table 1

Analytical data Timișoara

Soil type	C%	Humus%	Nitrogen total %	C/N
Chernozems	1.87	3.21	0.143	13.05
Phaeozems	2.28	3.93	0.165	13.82
Cambisols	1.69	2.90	0.140	12.07
Haplic Luvisols	1.69	2.91	0.133	12.72
Albic Luvisols	1.35	2.32	0.108	12.50
Vertisols	2.29	3.94	0.152	15.07
Pellasols	1.96	3.37	0.141	13.90
Gleysols	1.91	3.29	0.128	14.94
Solonetio	1.69	2.91	0.154	10.99

The greates values for Humus and N content are in the Phaeozems, Vertisols and Chernozems. The C/N ratio determines the rates at which N and C are released and mineral N becomes available for plant uptake (Table 2).

In the case of Uivar territory (Table 3) the maximum value for humus content is at Vertisols (3.74%) and Phaeozems (3.72%) , and the minimum for Fluvisols (2.59%).

In the Foeni territory, the maximum content of humus is in Solonetz (5.09%) and Gleyosols (4.36%).

Table 2

Analytical data,Low Plain Timiş

Territory	Soil type	C%	Humus%	N total%	C/N
Uivar	Chernozems	2.05	3.52	0.182	11.24
	Phaeozems	2.16	3.72	0.192	11.26
	Cambisol	1.73	2.97	0.147	11.75
	Vertisols	2.17	3.74	0.181	12.01
	Gleysols	2.14	3.68	0.183	11.69
	Fluviols	1.50	2.59	0.131	11.49
	Solonetz	1.91	3.29	0.156	12.26
Foeni	Chernozems	2.03	3.49	0.171	11.86
	Phaeozems	1.82	3.14	0.174	10.49
	Cambisols	1.62	2.79	0.125	12.98
	Vertisols	2.15	3.70	0.190	11.32
	Gleysols	2.53	4.36	0.156	16.25
	Fluvisols	2.13	3.66	0.128	16.62
	Solonetz	2.96	5.09	0.159	18.61

It must be underline, for both territories, that the quality of the humus is inferrior comparatively with Chernozems and Phaeozems .

Table 3

Analytical data , High Plain Vinga

Territory	Soil type	C%	Humus %	Nitrogen total %	C/N
Sânandrei	Chernozems	1.60	2.76	0.148	10.81
	Phaeozems	2.00	3.41	0.168	11.90
	Cambisols	1.75	3.01	0.136	12.87
	Haplic Luvisols	1.67	2.88	0.154	10.84
	Luvisols	1.40	2.41	0.123	11.38
	Vertisols	1.78	3.08	0.143	12.45
	Glaysols	2.16	3.72	0.250	8.64
	Fluvisols	1.07	1.84	0.105	10.19
	Solonetz	2.11	3.63	0.192	11.00
Orţişoara	Chernozems	1.87	3.21	0.143	13.05
	Phaeozems	2.28	3.93	0.165	13.82
	Cambisols	1.69	2.90	0.140	12.07
	Haplic Luvisols	1.69	2.91	0.133	12.72
	Luvisols	1.35	2.32	0.108	12.50
	Vertisols	1.96	3.37	0.141	13.90
	Glaysols	2.29	3.94	0.152	15.07
	Fluvisols	1.91	3.29	0.128	14.94
	Solonetz	1.69	2.91	0.154	10.99

The greatest content of humus , in the territory Sânandrei there are in the Gleysols (3.72%) Solonetz (3.63%) and Phaeozems (3.41%).

For Orţişoara territory is a similary situation: Gleyosols have a great content of humus (3.94%) and Phaeozems (3.93%).

Unlike soils from plain region, in the mountain region the C/N ratia is much more, the values reacted 23.08, and the humus composition is dominated of FA (Table 4).

Table 4

Analytical data, mountain Muntele mic (0-18cm)

Soil type	C%	Humus %	Nitrogen total %	C/N
Distric Cambisols	5.77	9.92	0.250	23.08
Entic Podzols	8.71	14.99	0.513	16.98
Hapic Podzols	8.80	15.17	1.020	8.62

In order to know the humus quality for the main soil types we present the results of humus analysis (Rogobete . 1979) in the topsoil .

Table 5

Analytical data of humus in the region Banat

Soil type	Humus %	Humic acid HA	Fluvic acid FA	NA/FA
Chernozems Lovrin	3.51	0.746	0.267	2.79
Stagnic Luvisols Bencec	1.18	0.320	0.400	0.80
Stagni-Albic –Luvisols Rădmăneşti	3.14	0.200	1.190	0.17
Stagni-Albic –Luvisols Labaşinţ	2.12	0.200	0.770	0.25
Pellic-gleyic Vertisols Dudeştii Vechi	4.03	0.662	0.332	1.99
Hapic Solonetz Diniaş	3.04	0.575	0.295	1.94

It can be noticed that in soil types from plain region, like as Chernozems, Vertisols and Solonetz, prevails humic acids and the ration of NA/FA is over 1. The fraction of humic acid may be subdivided into brown-humic acids, grey- humic acids and hymatomelanic acids, with a wide numbres of functional groups.

In the soil type from the hilly region – Dealurile Lipovei and mountain region – Muntele Mic, prevails fluvic acids and the NA/FA ratio is under 1. Fulvic acids are light yellowish coloured, have a lower degree of polymerisation and a higher acidy compared to humic acids, and predominate in strongly acid soils of the Podzolic type.

Similar results presents Opriş (1979) from soil types from plain region.

CONCLUSIONS

Soil organic matter serves as a soil nutrient reservoir, substrate for microbial activity, and major determinant for agricultural productivity. Decomposition of organic residues in soil is an important ecological function whereby heterotrophic organisms consume various components and cycling of constituent elements. The major components of soil organic matter are humic substances, especially humic acids; other significant componemts are carbohydrates, proteinaceous materials and lipids. HA , FA, as well as humic, are not distinct chemical substances.

The humus content is higher in medium and fine-textured soils, like Phaeozems, Vertisols, Gleysols and Chernozems, in the plain region from Banat. It significantly decreases in sandy soils (Fluvisols) and in acid soils like Luvisols.

The humic acid fraction (HA) is predominantly in the soil types from plain region- Chernozems, Phaeozems , Vertisols, Gleyosols and Solonetz ; fluvic acids are predominantly in the hilly and mountainous regions – Luvisols, Podzols.

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