

RATE OF HUMUS ACCUMULATION ON ANTHROPIC PROTOSOL
FROM THE CĂPUȘ-CLUJ DISTRICT

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A b s t r a c t. The paper presents data on the annual rate of humus accumulation after 10 and 20 years of a strict experimental routine carried out on sterile waste dumps (anthropic protosol) from Căpuș, cultivated with maize, oat and esparcet.

Basic dressing applied was the following: V₁ - unfertilized, V₂ - 40 t/ha manure, V₃ - 15 t/ha poultry manure, V₄ - 40 t/ha manure + N₁₀₀ P₆₀ K₄₀, V₅ - 15 t/ha poultry manure + N₁₀₀ P₆₀ K₄₀, V₆ - N₁₀₀ P₆₀ K₀, V₇ - N₁₀₀ P₆₀ K₄₀, V₈ - N₂₀₀ P₁₂₀ K₈₀, V₉ - N₃₀₀ P₁₈₀ K₁₂₀.

The results obtained revealed that the variant with 40 t/ha manure + N₁₀₀ P₆₀ K₄₀ (V₄) after 10 years accumulated 1.724% humus and after 20 years 4.100% humus. It means that the annual average rate was 0.115% and 0.176%, respectively, at a depth of 0-20 cm. The next variant is the variant with 15 t/ha poultry manure + N₁₀₀ P₆₀ K₄₀ (V₅) where 1.207% of humus was accumulated after 10 years and 3.760% of humus after 20 years; the annual average rate 0.055% and 0.155%, respectively.

K e y w o r d s: recultivation, humus accumulation rate, anthropic protosol.

INTRODUCTION

The rhythm of regaining fertility of anthropic protosols originating from surface mining, is in close relation with the technology of deposit exploitation, climate, type of rock, relief conditions, but especially with organic matter contribution brought above by utilisation (culture) and fertilization.

Synthetically, this rhythm of regaining fertility, especially over a long period of time, is expressed by the rate of humus accumulation.

Worldwide, Savici *et al.* [9], carried out research in this respect in 1973, 1985 and Ianoși [3], in 1974, 1981.

In our country, research in this field was undertaken by Nastea *et al.* [7], and by Blaga *et al.* [1,2], in 1993, 1997.

This paper aims at presenting the rate of humus accumulation during 10 and 20 years of experiment founded on waste dumps (anthropic protosol) resulting from scrape mining at Căpuș, the county of Cluj, Romania.

MATERIAL AND METHOD

An experiment with strict procedures was founded by the Institute of Pedology in 1976 on waste dumps from Căpuș after iron ore exploitation (mining). It included the following variants : V₁- unfertilized, V₂ - 40 t/ha manure. V₃ - 15 t/ha poultry manure, V₄ - 40 t/ha manure + N₁₀₀ P₆₀ K₄₀, V₅ - 15 t/ha poultry manure + N₁₀₀ P₆₀ K₄₀, V₆ - N₁₀₀ P₆₀ K₀, V₇ - N₁₀₀ P₆₀ K₄₀, V₈ - N₂₀₀ P₁₂₀ K₈₀, V₉ - N₃₀₀ P₁₈₀ K₁₂₀.

The bank on which the experimental field was placed, had a low humus level and was poor in the basic nutritive elements, except for potassium. It showed a low alkaline reaction with a loamy-clayey texture.

Soil samples were collected from the depth of 0-10 cm in the beginning of the experiment. Soil material consisted of a rock mixture (limestone, clay and marl) with a relatively uniform structure. After 10 years of cultivation with maize, oat and esparcet, when some morphological modifications appeared, samples were taken from 2 depths of 0-10 cm and 10-20 cm.

Unfermented manure and poultry manure were administered every 3 years, at the same date with basic ploughing. Mineral fertilizers were administered in autumn (superphosphate and potassium salt). In spring, ammonium nitrate in one dose from oat and maize and in stages (after each haymaking) for the esparcet crop.

Humus content was determined by the calculations based on the organic carbon content multiplied with the 1.724 factor.

All soil management treatments adequate for each culture were made by machines at the optimum time.

Analytical data are presented in Table 1.

RESULTS AND DISCUSSION

Field research and lab tests made after 10 and 20 years of cultivation and fertilization, show that in all 9 agricultural backgrounds, soil genetic processes, both

Table 1. Rate of humus accumulation on the waste dumps from Căpuș, district of Cluj

Variants	Depth	Humus (%)			Rate of humus accumulation		R ₁ - R ₂ **
		Initial*	After 10 years	Ater 20 years	After 10 years	After 20 years	
V ₁	0-10	0.679	0.900	1.470	0.022	0.060	0.033
	10-20		0.710	0.951	0.003	0.014	0.011
V ₂	0-10	0.603	1.224	3.325	0.062	0.136	0.074
	10-20		1.052	1.540	0.044	0.047	0.003
V ₃	0-10	0.689	1.224	0.053	0.110	2.981	0.057
	10-20		0.879	1.210	0.119	0.026	0.007
V ₄	0-10	0.568	1.724	4.100	0.115	0.176	0.061
	10-20		1.138	2.115	0.057	0.080	0.027
V ₅	0-10	0.655	1.207	3.760	0.055	0.155	0.100
	10-20		1.137	1.235	0.048	0.058	0.010
V ₆	0-10	0.724	1.017	1.950	0.029	0.061	0.032
	10-20		0.879	1.115	0.015	0.020	0.005
V ₇	0-10	0.776	0.995	1.985	0.022	0.060	0.045
	10-20		0.827	1.143	0.005	0.018	0.013
V ₈	0-10	0.810	1.121	2.000	0.031	0.084	0.053
	10-20		0.879	1.150	0.007	0.042	0.004
V ₉	0-10	0.758	1.129	2.135	0.037	0.068	0.031
	10-20		0.844	1.240	0.008	0.024	0.016

*the same value at the 0-20 cm depth; **difference between the rate of humus accumulation after 20 years (R₂) and 10 years (R₁).

in the morphological aspect, and, especially, in respect to humus content were observed. Annual medium value of the rate of humus accumulation was established.

Thus, the data from Table 1 show that, at a 0-10 cm depth, after the first 10 years of cultivation, the values of the mean rate of humus accumulation, in 9 agricultural backgrounds ranged from 0.022 % (V₁ and V₂) to 0.115% (V₄).

At the 0-10 cm depth, in the same period, the mean values of the humus accumulation rate are much smaller, respectively 0.003 % (V₁) and 0.057 % (V₄) which confirms the data obtained by other authors [4-6,10].

Analyzing organic agricultural backgrounds (V₂ and V₃) different from mineral agricultural backgrounds (V₆, V₇, V₈, V₉), we found out that at both depths, the mean rate of humus accumulation is much higher than in the organic agricultural backgrounds. Thus, in the agricultural background with 40 t/ha manure (V₂) the mean rate of humus accumulation at the 0-10 cm depth is 0.062 %. This value

is not exceeded even in the agricultural background with triple doses of mineral fertilizers (V₉), in which the mean rate of humus accumulation is 0.037 %. At the 10-20 cm depth, in the same period, the mean rate of humus accumulation is 0.044 % at V₂ as compared to only 0.008 % at V₉.

Agricultural backgrounds with organic fertilization, supplemented with low doses of mineral fertilizers (V₄ and V₅) show a much higher value of the mean rate of humus accumulation. Thus, at the 0-10 cm depth, these values are 0.057 % in V₄ and, respectively, 0.048 % in V₅. At the 10-20 cm depth, these values decrease to 0.057 % and 0.048 %, respectively.

Analyzing the data on the mean rate of humus accumulation after 20 years, we found out that in all agricultural backgrounds and at both depths, these values had a tendency to increase.

Agricultural backgrounds with organic fertilization (V₂ and V₃) showed the mean rate of humus accumulation of respectively 0.130 and 0.110 % at the 0-10 cm depth, and respectively 0.047 and 0.026 % at the 10-20 cm depth, which is, respectively 0.047 and 0.057 % more after 20 years than after 10 years, at the depth of 0-10 cm and 0.003 and 0.007 % at the 10-20 cm depth.

Values of the mean rate in the mineral agricultural backgrounds (V₆-V₉) at both depths are twice as high as the values of the mean annual rate from the first 10 years.

After 20 years, in the agricultural background with 40 t/ha manure + N₁₀₀ P₆₀ K₄₀ (V₄), i.e. the humus content of 4.100 % at the 0-10 cm depth and 2.115 % at the 10-20 cm depth, resulted in the mean rate of 0.176 % and 0.030 %, respectively.

These data confirm that in the waste dump conditions from Căpuș (anthropic protosols), fundamental soil management towards agricultural recultivation to stimulate pedogenetical processes, consists in the application of organic fertilization with manure supplemented with a N₁₀₀ P₆₀ K₄₀ dose.

CONCLUSIONS

1. Spoil banks (anthropic protosols) resulted from the scrape mining of iron ore from Căpuș, Cluj district that were levelled for agricultural recultivation had a very low humus content and poor content of nutritive elements.
2. The process of soil formation expressed in terms of humus content and the annual rate of humus accumulation is very long and depends on the environmental conditions and the soil management measures applied.

3. Administration of organic or organic-mineral fertilizers, accelerates pedogenetic processes, rising fertility and productivity of these "soils" which increases the prospects of re-introducing them to the economic system.

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