COMPARATIVE STUDY BETWEEN THE NATURAL SOILS AND SOILS DEGRADED BY MINING FROM GORJ DISTRICT

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The Gorj District has a 250,268 ha.Of all this surface, 7.6% which means 19,140 ha is affected by mining activity as follows: 6,861.2 ha quarries (35.85%); 440.8 ha micro quarries (2.3%); 7,971 ha sterile dumps (41.65%); 3,867 ha underground mines (20.2%).

Within the not affected soils by the surface mining activity predominates typical eutricambisoils and within the affected soils by mining activity there are mostly spodic typical entiatrosoil. Between these two soil types there are the following differences: the texture is silty with typical entiatrosoil and very heterogeneous from sandy to clayey – silty yet predominates materials with sandy silty texture, silty or silty clayey (60%) on spodic typical entiatrosoil.

The organic matter content is between 1.80 and 2.48% on typical eutricambosoil and it is 0.16 and 6.04% on spolic entiantrosoil (the higher values are influenced by the silt content or coal crumbles from the soil mass).

The available phosphorus has low values on typical eutricambosoil, between 6.5 – 10.0 ppm and higher, between 3.2 and 49.0 ppm on spolic entiantrosoil.

The availabele potash has lower values on the typical eutricambosoil, between 46 and 66 ppm and higher, between 22 and 172 ppm on spolic entiantrosoil.

The exchangeable bases sum is between 13.9 and 20.9 me/100 g soil with the typical eutricambosoil and 7.2 and 39.5 me/100 g soil with the spolic entiantrosoil.

The typical entricambosoil has the average evaluation mark of 82 being enclosed within the first class and the spolic entiantrosoil has the evaluation mark of 73 being enclosed within the third quality class.

Key words: *eutricambosoil, spolic entricambosoil, evaluation mark, quality class*

The Gorj District is located in the south western part of our country and it has an arable surface of 250,268 ha that is distributed as usage as follows:

- arable = 103,409 ha
- vineyards and vine nurseries = 4,035 ha
- orchards and trees nurseries = 5,985 ha

- lawns and pastures = 136,839 ha

Of this surface, 7.6% which means 19,140 ha is affected by mining activity as follows:

- quarries = 6,861.2 ha (35.85%)
- micro quarries = 440.8 ha (2.3%)
- sterile dumps = 7,971 ha (41.65%)
- underground mines = 3,867 ha (20.20%)

The surface mine of the coal (lignite) is the most aggressive form of soil destruction (Craioveanu I., 1995). After surface mining, by excavation processes and deposition of the sterile material, the soil impact is harsh the soil factor disappearing. The place of the initial soils that occupy the surface before lignite extraction there have been brought to surface diverse lithological materials of different geological ages in this manner appearing the sterile dumps (Mostea, I. 1980). They have different chemical and physical features over the soil they were transformed of being named anthroposoils or entriantrosoils (Negrea I., 2009).

A comparison between the natural soils from Gorj District and the anthropic soils resulted after coal extraction is quite necessary in order to establish the fertility degree and the ecological rehabilitation measures.

MATERIAL AND METHOD

In order to establish the fertility degree of entriatrosoils there was made a comparison between them and the predominant soils from Gorj District namely typical entricambosoil and the stagnic luvisoil that occupy 67.74% of the District surface (Rauta I., 1983). For this reason there were analysed two characteristic soil profiles of the two soils in comparison with the soil type predominant in the sterile dumps, spolic entriantrosoil.

The analysis of these three soil types have consisted of evaluation of the following physical, chemical and evaluation indicators:

- size analysis: texture, soil reaction, lime content, organic matter content, available phosphorus and potash, bases sum, saturation bases degree, evaluation mark, quality class, yielding capacity.

RESULTS AND DISCUSSIONS

1. The physical and chemical features

The typical eutricambosoil occupies 27.08% of the agricultural surface of the District.

There can be observed the silty texture, a thick sand content between 10.2 and 25.7 %, fine sand between 29.8 and 36.9%, silt between 21.0 and 29.9% and a high clay content, between 35.7 and 40.1%.

- the soil reaction is low acid, neutral shown by the sum of the bases, between 13.8 and 20.9 me/100 g soil and the bases saturation degree, between 77.0 and 88.1%.

- the organic matter content is middle, 2.48%, the supplying degree of phosphorus and potash is low (Dumitru M., 1999).

The stagnic luvosoil occupy 40.6% of the agricultural land of the district.

Table 1

The physical and chemical features of the typical eutricambosoil

Horizon Depth cm	pH	Lime	H %	P ppm	K ppm	SB me/100g soil	V%	Size analysis					T
								TS	FS	S	FC	CC	
Ao 0-22	6.33	-	2.48	10	66	13.8	77	19.2	29.8	26.5	40.1	24.5	SS
Bv1 22-48	6.9	-	1.80	6.7	54	15.6	84	20.4	31.5	22.0	39.2	26.1	SS
Bv2 48-80	7.1	-	1.40	7.1	50	15.3	84	25.7	30.2	21.0	35.7	23.1	SS
Bv3 80-105	7.1	-	1.35	6.5	46	20.9	88	10.2	36.9	29.9	42.7	28.0	SS

Legend: TS – thick sand; FS – fine sand; S – silt; FC – physical clay; CC – colloidal clay; SS – silty silt; T - texture

Table 2

The physical and chemical features of the stagnic luvosoil

Horizon Depth cm	pH	Lime	H %	P ppm	K ppm	SB me/100g soil	V%	Size analysis					T
								TS	FS	S	FC	CC	
Ao 0-27	5.6	-	1.79	26	92	9.5	66.4	10.7	42.4	27.0	21.8	19.9	SSa
El 27-50	6.0	-	0.93	30	88	14.5	84.8	10.1	35.6	33.2	42.8	21.2	SS
Bt1(w) 50-75	6.4	-	0.58	8	52	20.6	92.4	3.6	39.2	19.3	50.5	37.9	SC
Bt2(w) 75-100	6.7	-	-	5	48	22.5	94.9	4.6	26.9	33.6	53.6	34.9	SC

Legend: TS – thick sand; FS – fine sand; S – silt; FC – physical clay; CC – colloidal clay; SS – silty silt; SSa – silty sandy, SC – silty clayey; T - texture

Of the enclosed data there result the following issues:

- the soil texture is from silt – sand at the surface to silt clay in the depth, the content of the physical clay increases to the depth from 29.8 to 53.6% and the fine sand decreases from 42.4 to 26.9%;

- the soil reaction is low acid (pH between 5.6 and 6.7) that is shown by the SB, between 9.5 and 22.5 me/100 g soil and V%, between 66.4 and 94.9%;

- the organic matter content is low, the phosphorus and potassium supplying degree are low.

The spolic entriantrosoil occupies 3.68% of the agricultural land of the district.

Table 3

The physical and chemical features of the spolic entriantrosoil

Horizon Depth cm	pH	Lime	H %	P ppm	K ppm	Size analysis					Texture
						TS	FS	S	FC	CC	
S1 0-28	6.3	-	0.28	18	36	22.4	47.3	19.0	23.0	11.3	SaS
S2 25-58	6.6	-	2.92	5.9	30	22.1	44.5	20.4	24.2	13.0	Sas
S3 58-83	6.6	-	0.04	14.1	24	25.0	44.6	19.5	21.9	10.9	Sa SaS
S4 83-110	6.7	-	0.14	13.0	32	14.0	52.0	22.4	23.8	11.4	SaS
S5110-160	6.7	-	0.20	13.9	30	23.1	72.2	17.0	21.1	10.8	Sa Sa S

Legend: TS – thick sand; FS – fine sand; S – silt; FC – physical clay; CC – colloidal clay; Sa – sandy; S- silty.

On the basis of the data from the upward table this soil can be characterized as follows:

- the texture is sandy silty and sandy sandy silty having the thick sand content between 14.0-23.1% and the fine one between 44.6 and 72.2% and the one of physical clay is reduced, between 21.9 and 24.2%;
- the soil reaction is low acid, shown by the values of Sb and V%;
- the organic matter content is very low, 0.04 – 0.28% when S2 layer appears, 2.92% are lignite particles, the phosphorus supplying degree is low to middle and the potash one is low.

The evaluation marks and the quality classes of the natural and anthropic soil are enclosed in the *forth table.*

Table 4

Yielding and ecopedological indicators of the natural and anthropic soils from Gorj District

Soil type	Yielding and ecopedological indicators	Main crops			
		Barley	Wheat	Corn	Potato
Typical eutricambosoil	Evaluation mark	90	90	81	73
	Favorability class	II	II	II	III
	Average evaluation mark			82	
	Quality class			I	
	Yieldind capacity Kg/ha	5,400	5,400	6,480	32,850
Stagnic luvosoil	Evaluation mark	52	52	47	30
	Favorability class	V	V	VI	VIII
	Average evaluation mark	45			
	Quality class				III
	Yieldind capacity Kg/ha	3,120	3,120	3,760	13,500
Spolic entriantrosoil	Evaluation mark	34	30	42	38
	Favorability class	VIII	VIII	V	VII
	Average evaluation mark	36			
	Quality class	IV			
	Yieldind capacity Kg/ha	2,200	2,150	2,650	13,500

CONCLUSIONS

The comparative study between the natural and mining degraded soils in the Gorj District emphasizes the following aspects:

- the natural soils: typical entricambosoil and stagnic luvosoil have silty texture, silty sandy while the anthropic soil stagnic entriantrosoil has a sandy silty sandy texture;
- the reaction of the natural soils is low acid and neutral and the reaction of the anthropic soil is low acid to low alkaline;
- the natural soils have a low to middle organic matter content while the anthropic soils have very low content of organic matter;
- the phosphorus and potassium supplying degree is low to middle on the natural soils and low on the anthropic soils;

- the average evaluation mark is 82, first quality class with typical entricambosoil and 45, third quality class with stagnic luvosoil and with the anthropic soil spolic entriantrosoil, 38 points as evaluation mark and the fourth quality class, that shows the fact that the anthropic soils are not favorable for crops being needed special measures for increasing the organic matter content and nutrients.

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