STUDY OF THE ECOPEDOLOGICAL CONDITIONS OF THE LANDS DEGRADED BY MINING EXPLOITATION WITHIN PERIMETER OF SUNCUIUS, BIHOR COUNTY

I.GAICA[1], ,Silvia PRUNAR[1], L. DANCEA[1] Madalina BORCA[1], D.DICU[1]
[1]Banat's University of Agricultural Sciences and Veterinary Medicine" King Michael I of Romania " from Timişoara, Romania
Corresponding author: ioangaica@usab-tm.ro

Abstract.*The perimeter studied is part of the Suncuius refractory clay deposit. The mining activity led to profound changes in the relief in the area, resulting in geomechanical changes (landslides, subsidence), qualitative and quantitative changes in water, changes in pedological, agrochemical and biological. In order to establish the features of the studied waste dumps, we sampled soil to be analysed in laboratory conditions with specific methods. We then analysed the soil samples from the point of view of their pH, humus content, total nitrogen, phosphorus, and potassium. The existing natural flora on the surfaces that were affected by the mining activities was completely destroyed. On these surfaces a new vegetation was installed for the most part, but in a different structure from the initial one. The investigated dumps are at the beginning of the colonization period with edaphic organisms and therefore we consider that, in the conditions of a natural evolution, the process of installing the biota with a decisive role in the incipient phases of pedogenesis, is a very long one. In the ecological reconstruction strategy it is important to know the factors making up the climate by comparing the specific features of the area and the different ways they have been influenced*

Keywords*: degraded lands, mining activity, ecopedological conditions, vegetation*

INTRODUCTION

Ecological reconstruction, applied on tailings dumps and on uncovered land, must operate with technical and biological methods to ensure ecogenesis starting from microbiota formation to colonization of the species and stabilization of interspecific relationships favorable to productivity and biocenotic balance of the new ecosystem.

We can say that succession that take place on newly formed surfaces lacking in soil, were named primary successions, whereas those that take place on surfaces that have no vegetation are called secondary successions (COSTE ET AL. 2001).

According to some authors (P. GUŞ, M. DUMITRU, 2002) the stages of elaboration of the concept of ecological reconstruction include: creation of the ecological product, diffusion, application (adaptation) and evaluation of the effects

The floras of the studied waste dumps. The values of the indicators used in the case of categories of bioforms, geoelements, and ecologic indicators are as indicated by SANDA ET AL. (1983).

Following the studies made by OPREA A. (2000) it was observed that on the mining tailings deposits there is a timid installation of vegetation, installation that starts at the base of the slope and continues towards the upper part of it, achieving reduced cover of the tailings layer..

As opposed to the ambiance and life-protective strategies, that are better organized and more efficiently controlled, the ecological reconstruction strategy requires large financial efforts and relatively high energy consumption.

The sterile waste dumps, once under the influence of external natural modulating factors, tend to create hydro-geological systems with specific shapes and dynamics that evolve more or less rapidly due to their particular characteristics, influencing the odds of foresting

activities. We should emphasize that the initial (construction) stability of the waste dumps is the most important factor in the rehabilitation process (ROŞU ET AL. 2002).

MATERIAL AND METHODS

For the study of the ecopedological conditions and of the flora installed on the degraded lands, a series of measurements and determinations were performed. For the physical, chemical, mineralogical, biological, micromorphological characterization, etc., soil samples were taken to be analyzed in the laboratory, by specific methods.

Quantitative determination of bacteria on agar media was performed using 0.1 ml of inoculum and then spread using the spreading rod. The work was done twice for each work variant. The seeded media were incubated in a thermostat, with the lid down at 22-250 ° C, and the readings were taken after 24 hours, repeating at 48 hours

RESULTS AND DISCUSSIONS

The tailings dumps were studied especially from a textural and agrochemical point of view. Based on the laboratory results, accompanied by those from the field, it was concluded that these surfaces consist of an inhomogeneous mixture of topsoil, sand, gravel, clay distributed inhomogeneously.

Sea buckthorn seedlings were planted on the slope and on the plateau on the improvement perimeter. On the amelioration perimeter we had a percentage of attachment of 56.8% in the first year with a higher vigor in the case of female plants

Physical and chemical characteristics were determined Following the results obtained, a low homogeneity was found. This situation leads to different installation of species.

Table 1

Soil texture on the studied degraded lands

Nr	Identification	Granulometric fractions (in mm) (% of the mass of the mineral part of the soil)											Simb subcls text
		Rough sand				Fine sand				Dust		Clay	
		2.0-0.2	2.0-1.0	1.0-0.5	0.5-0.2	0.2-0.02	0.2-0.1	0.1-0.05	0.05-0.02	0.02-0.002	<0.002	<0.01	
1	Not amended 0-10 cm	19.3	4.2	5.8	9.3	-	-	-	-	-	-	-	TN
2	Not amended 10-20 cm	24.9	5.2	7.2	12.5	-	-	-	-	-	-	-	TN
3	Amended 0-10 cm	29.4	7.9	6.9	14.6	-	-	-	-	-	-	-	LN
4	Amended 10-20 cm	31.9	6.8	8.1	17.0	-	-	-	-	-	-	-	LN
5	Hippophae rhamnoides plateau	5.0	2.4	0.9	1.7	-	-	-	-	-	-	-	TP
6	Hippophae rhamnoides versant	28.2	8.0	10.3	9.9	-	-	-	-	-	-	-	LN
7	External plateau	34.0	9.1	11.1	13.8	-	-	-	-	-	-	-	LN
8	Clay	31.9	8.8	8.1	15.0	-	-	-	-	-	-	-	SM

Table 2

Heavy metal contents on studied degraded lands

Nr proba	Identification	Cu mg/kg	Zn mg/kg	Pb mg/kg	Mn mg/kg	Co mg/kg	Ni mg/kg
1	Not amended 0-10 cm	11.6	36	15.1	32	5.4	5.7
2	Not amended 10-20 cm	12.3	39	16.7	37	7.4	5.8
3	Amended 0-10 cm	12.7	66	34.5	45	6.3	3.2
4	Amended 10-20 cm	14.3	51	23.5	52	6.7	6.3
5	Hippophae rhamnoides plateau	17.8	38	18.4	25	5.3	9.3
6	Hippophae rhamnoides versant	14.5	49	23.1	22	6.5	5.7
7	External plateau	14.5	49	23.1	22	6.5	7.7
8	Clay	15.8	34	24.0	12	5.3	9.3

The study of the vegetal coverage highlights a heterogeneous structure of the species installed on the degraded lands studied, dominating the species with reduced life demands. They manage to quickly fix the tailings dumps.

The horizontal structure is characterized on some dumps by the existence of scattered groups and individuals. From the point of view of phytocenogenesis, it corresponds to stages of colonization, aggregation to competition.

22 species were identified on the dump. The family Asteraceae (Compositaceae) with 9 species, is the most representative. The other families are represented by 1-3 species.

The dominant bioforms on this heap are hemicryptophytes (H 37.50%), followed by annual terophytes (Th 20.83%), and megaphanerophytes (MM 12.50%). The other categories are poorly represented.

To trigger phytocenogenesis, seedings were made with different herbaceous species and different doses of fertilizers and amendments were administered to correct the strong acidic pH.

The experimental field was established on the plateau taking into account the types of mixtures of grasses and legumes, fertilization of variants with different doses of fertilizers and application of amendment. and amendments to correct the strong acid pH.

The results obtained as a bacterial load on the ameliorating perimeter, highlight a significant increase in the number of colonies, up to 110 on the variants treated compared to the control with 16 colonies.

No bacteria / gr. dry soil = (no. bact. x 2) x 103x KU

The research carried out, the results of which are presented in the tables below, show that the soil with amendment benefits from the association of a more abundant bacterial population both in terms of quantity and quality.

There are also large differences in the bacterial load between the soil treated with amendment and fertilizer compared to the sterile soil and the 1-year tailings dump.

A maximum number of microorganisms was highlighted in the variant with amendment and complex fertilizers at a depth of 0-10 cm, while the minimum number was highlighted on the control variant at a depth of 0-10 cm.

Table 3

The colonies types on the studied variants

Soil	Variant	Nr. Colonies bacteria	Cultural character of the colony	Microscopic study
H	V1	74	Colony with irregular edge, rough appearance, milky white color	Sporulated bacilli, short, centrally arranged spore, G + (Bacillus cereus)
	V2	65	Glossy white colony, glassy appearance, smooth edge	Spores G +, gen. Bacillus
S	V1	25	Colony with irregular edge, rough appearance, milky white color	Sporulated bacilli, short, centrally arranged spore, G + (Bacillus cereus)
	V2	16	Glossy white colony, glassy appearance, smooth edge	Spores G+, gen. Bacillus
F	V1	60	Small colony with irregular and prominent edge, milky white color, rough appearance	Sporulated bacilli, short, centrally arranged spore, G + (Bacillus cereus)
	V2	48	Small colony with smooth edge and glossy white color, glassy appearance	Sporached, long, straight bacilli with angular arrangement, G + (Bacillus megaterium)
A	V1	110	Colony with irregular edge, rough appearance, milky white color	Spores bacilli, increase arranged centrally, short and arranged in a row, G +.....
	V2	63	Glossy white colony, glassy appearance, smooth edge	Short, non-sporulated, non-uniform bacilli with swollen heads, G +, (Arthrobacter globiformis- predominantly and A. simplex - very low)

CONCLUSIONS

The mining activity on the perimeter studied has a strong impact both through extraction and tailings deposits. Following the stripping, the soil layer and vegetation disappeared with relief changes. In some places, the piled material was permanently deposited on the surface of the pile and pushed towards its edges, the piles were not sloping in steps.
Stable, balanced and productive forest associations have been replaced by associations of very poor and sporadic ruderal herbaceous plants.

Following the establishment of the experimental field on which different types of fertilizers and amendments were administered in different doses, he noticed that the soil with amendment benefits from the association of a more abundant bacterial population both in terms of quantity and quality.

A colonization flora dominated by annual species was installed on the studied sterile dumps, the most frequent herbaceous species being Tussilago farfara and implicitly the species with high colonization capacity.

The wood species with a high capacity for colonization of sterile dumps, on eroded slopes, ensure the necessary premises for the forest vegetation to evolve into stable vegetation: *Salix capraea, Populus tremula, Betula verrucosa*.

BIBLIOGRAPHY

BAGHINA N, C STROIA, ISIDORA RADULOV, ADINA BERBECEA, GAICA I, F. CRISTA 2013- The Impact of Industrial Residues Dumps on Environment Curent Opinion In Biotechnology European Biotechnology Congress' 16-18 mai ,Bratislava,Slovakia

COSTE I, BORZA I, ARSENE G. 2001 – Ecologia şi protecţia mediului Ed. Orizonturi Universitare Timişoara.

DANCEA LUCRETIU, ANDREIANA ALEXANDRA – 2011 - A view at „green" energy in Romania - Environmental symposium for students ISBN 2548 – 1286, VOL.14, 2011, Novi Sad

DANCEA LURETIU, MAZARE VEACESLAV, GAICA IOAN, LUCIAN NITA, MERCE IULIANA - 2012 - What is Good Ecological Restoration? - Sesiunea de comunicari stiintifice cu participare internationala Bune practici in evaluarea si monitorizarea resurselor de apa, dedicata Zilei Mondiale a Apei, ed. IV, USAMV Cluj-Napoca 23 MARTIE 2012 Romania ISSN 1221-5279

DUMITRU M., BORZA I., 2006 – Evaluarea impactului ecologic. Ed Eurobit Timişoara

DUMITRU M.ŞI COL., 2000, Monitoringul stării de calitate a solurilor din România, Ed. GNP Bucureşti

GAICA I., DANCEA L, SAMFIRA I., 2009 - Natural succesions study on the steril dumps from Anina, Caras Severin county. Journal of Mountain Agriculture on the Balkans, volume 12, nr 4, Published Institute of Mountain Stockbreeding and Agriculture Troyan Bulgaria

GAICA, IOAN; BORZA, IACOB; IORDACHE, MĂDĂLINA, 2012- Study of the ecopedological conditions of the lands degraded by mining exploitation within perimeter of Rosia commune, Bihor county, Research Journal of Agricultural Science vol 44 (4) ISSN 2066-1843

GUŞ P., DUMITRU M., DÂRJA M., 2002 – Reconstrucţia ecologică a solurilor erodate din zona Cluj. Comunicările ştiinţifice a le Simp. " Reabilitarea terenurilor ocupate şi afectate de activitatea de extracţie a lignitului din bazinele miniere ale Olteniei. Targu-Jiu

NITA L., V. MIRCOV, CASIANA MIHUT, SIMONA NITA, L.DANCEA – 2011 - The soil coverage plain in relation with the environmental and anthropic factors- Research journal of Agricultural Science ISSN 2066-1843, Vol.42(3)1-908, 2011

OPREA A., MÂNZU C., 2000 – Refacerea comunităţilor vegetale pe haldele de steril din Obcina Mestecănişului, Buletinul Grădinii Botanice Iaşi Tomul 9, p. 125-130. Ed Univ. A I Cuza Iaşi

PRUNAR SILVIA, A DÎRLEA, R ŞUMĂLAN, L GHINEA, M FERICEAN, 2011-Features of mycorrizas type symbiosis at different plants families Research Journal of Agricultural Science 43 (2), 241-246

PRUNAR SILVIA, RENATA ŞUMĂLAN, LUCIAN GHINEA- LABORATORY 2007 - Studies concerning the microbial ghargie of the rhizosphere in the mineral relation of the plants Research Journal of Agricultural Science

ROSU C., UNTARU E., GEAMBAŞU N., DĂNESCU F., SURDU AURELIA, 2002 – Soluţii silviculturale privind reconstrucţia ecologică a haldelor provenite din exploatarea cărbunilor din zona Rovinari Comunicările ştiinţifice a le simp " Reabilitarea terenurilor ocupate şi afectate de activitatea de extracţie a lignitului din bazinele miniere ale Olteniei. Targu-Jiu

SANDA V., POPESCU A., DOLTU M., DONITA N., 1983 – Caracterizarea ecologică şi fitocenologică a speciilor spontane din flora României. Stud. şi com. Şt. nat.Muzeul Bruckenthal,supl., 25, Sibiu