

THE INFLUENCES OF THE SLOPE AND MATTRESSES ON EROSION IN THE FORMER BAUXITE QUARRY FROM THE PADUREA CRAIULUI MOUNTAIN

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Abstract

The researches were carried out in the former bauxite quarry from Zece Hotare, Bihor county during 2005 – 2007. The annual rainfall was of 815,8mm in 2005, 872,0mm in 2006 and 585,2 mm in 2007. The land losses were in direct correlation with hillside slope (5,2t/ha at 20%; 8,6t/ha at 31 % and 15,4t/ha at 44%) and degree of vegetation covering.

Absence of the mattresses on the hillside with 10% slope determined a loss of 100,6 t/ha in comparison with the loss of 3,9 t/ha registered on the hillside with mattresses.

Key words: slope, mattress, vegetation, erosion, former bauxite quarry

INTRODUCTION

Erosion is a natural process produced under the rainfall or wind influence consist of soil, land or rock detaching, their transport and sediment in other places (Budoï and Penescu, 1996; Domuta C.- 2006-2007). This phenomenon was observed by Pliniu the Old (Neamtu, 1996) but the researches were carried out at the begining of the XX century.

Erosion phenomenon affects the ploughed land from North Western Romania and determines big losses of soil, (4,5-70,8 t/ha/year in maize placed on hill to valley in Bihor country), humus (64110 t/year in Bihor country), fertilizers (4863,8t/years phosphorum and 4366,2 t /year potassium in Bihor country) and yields (10-52% in maize cropped from hill to valey in Bihor country), (Domuta, 2005).

Erosion affects the hillside of the former bauxite quarry, too. The paper studied this phenomenon on Padurea Craiului Mountain. (Brejea et al 2006, Brejea 2008).

MATERIAL AND METHODS

The researches were carried out at a bauxite quarry located in Zece Hotare, Bihor county. The exploitation of bauxite ended in 1998, and in 2004 and 2005 very large works for setting up, levelling and acacia tree planting on the levelled area as well as spruce tree on the slope area.

The acacia and spruce tree saplings were planted at 1 m distance on every row, and at 2 m distance between rows. The holes had 40 x 40 x 40

cm in dimension, and 6.0 kg of manure was used for each hole. In order to ensure a high rate of plant development, right after being put into the ground they were watered with 16.0 l water each. On the hillside of the quarry, mattress was made out of oak stakes and beech rods at meters distance in order to prevent soil erosion (figure 1).

Two experiments were made. The first was made on 4 hillside with slope of 20%, 31 % and 44 % with works against erosion consist of mattresses and planted with spruce tree. The second experiment was made on hillside without mattresses and planted with spruce tree, on the level curves, too

The covering degree of natural vegetation was established by counting. The data regarding the covering degree of were processed by variance analysis methods (Domuta, 2006).

RESULTS AND DISCUSSION

1. Erosion potential in the Zece Hotare area

The multiannual average of the rainfall in the Zece Hotare area is of 615,1 mm. The biggest monthly quantity of the rainfall is registered in June, usually ,84,7 mm. In the research period, the year with the biggest quantity of rainfall was 2006, 872,0 mm; 815,8 mm were registered in 2005 and the most droughty year was 2007, with 585,2 mm, only. (figure 2). The rainfall registered in 24 hours were used for emphasizing the rainfall aggressi velly under the hillside of the former bauxite quarry

Analysing the maximum values for every month of the year show the biggest quantity of rainfall felt in 24 hours from june. In the summer months, the biggest quantity of rainfall felt in 24 hours was registered 52,0 mm in average, in comparison with 40,0 the average value for spring, 39,7 the average value for autumn and 30,4 mm the average value for winter . (table 1).

In average on the year the biggest value of the rainfall felt in 24 hours were registered in 2005,20,31 mm ; in 2006 a quantity of 11,9 mm / 24 hours was registered and 11,46 mm /24 hours were registered in 24 hours in the year 2007. The biggest monthly quantity of rainfall felt in 24 hours was registered in August 2005, 35,4 mm.

In the years 2006 and 2007, the biggest quantity felt in 24 hours were registered in August,too,23,4 mm and 25,6 mm .



Figure. 1. Beech tree mattress after being set up (2004),
in the former bauxite quarry from Zece Hotare, Bihor

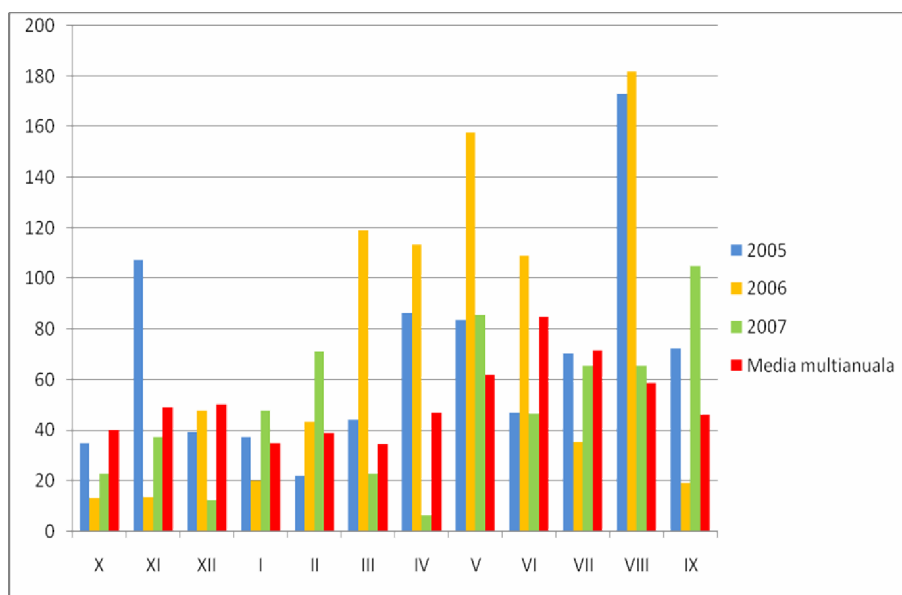


Figure 2 Monthly values (mm) of the rainfall registered in the area of the former bauxite quarry from
Zece Hotare 2005 - 2007

Table 1

Maximum rainfall (mm) registered in 24 hours in the area of the former bauxite quarry from Zece Hotare, Bihor 2005-2007

Specification		Month												Av era ge
		X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
Multionnual maximum value														
Value		58,0	29,0	28,0	37,0	26,3	29,2	45,8	45,0	61,3	49,6	45,1	32,1	40,53
Agricultural year 2005														
Value		12,8	19,2	4,8	12,9	17,9	18,7	25,8	28,2	31,2	19,2	36,4	16,6	20,31
Difference vs multianual average	m m	-45,2	-9,8	23,2	24,1	-8,4	40,5	20,0	16,8	30,1	30,4	-8,7	15,5	20,22
	%	-78	-34	-83	-66	-32	-36	-44	-33	-49	-63	-39	-49	-49
Agricultural year 2006														
Value		2,0	3,4	12,4	19,0	7,3	16,0	14,8	9,8	20,4	11,8	23,4	2,4	11,9
Difference vs multianual average	m m	-56,0	25,6	15,6	18,0	19,0	13,2	31,0	35,2	40,9	37,8	21,7	29,63	28,63
	%	-97	-89	-56	-49	-73	-46	-68	-79	-67	-76	-49	-93	-71
Agricultural year 2007														
Value		11,2	5,7	7,4	7,5	11,2	5,6	1,0	20,4	11,4	10,2	25,6	20,4	11,46
Difference vs multianual average	m m	-46,8	23,3	20,6	29,5	15,1	23,6	44,8	24,6	49,9	39,4	19,5	12,0	29,17
	%	-81	-80	-74	-80	-58	-81	-98	-55	-82	-79	-44	-47	-72

2. The slope influence on the erosion

The determination carried out in spring (April) of 2008 on the hillside of the former bauxite quarry with the following slopes : 20 % ; 31 % ; 44 % . In 2004 the mattresses were made on these hillside and spruce trees were planted. The determinations show that the natural vegetation (*Calamagrostis epigeios*, *Tussilago farfara*) cover 80 % from hillside surface with 20 % slope, 69 % from hillside surface with 31 % slope and 57 % from hillside surface with 44 % slope. (table 2) .

As consequence the erosions had different values in function of the slope. The smallest value of the erosion was registered on the 23 % slope, 5,2 t / ha. In the hillside with slope of 31 %,the erosion increased with 65,3 % (8,6 t /ha) and on the hillside with slope of 44 %,the erosion increased with 196,2 % in comparison with the hillside with 20 % slope. (table 3).

Table 2.

Influence of the slope on covering degree with natural vegetation on the hillsides of the former bauxite quarry from Zece Hotare, 2008

Hillside slope	Covering degree with natural vegetation		Difference		Statistically significant
	%	%	%	%	
20%	80	100	-	-	Control
31%	69	86,3	- 11	- 13,7	***
44%	57	71,3	- 23	- 28,7	***

LSD 5% 3,1
LSD 1 % 5,6
LSD 0,1 % 8,8

Table 3

Influence of the slope on the land losses from the hillsides of the former bauxite quarry from Zece Hotare, 2008

Hillside slope	Land losses		Difference	
	t/ha	%	t/ha	%
20%	5,2	100	-	-
31%	8,6	165,3	3,4	65,3
44%	15,4	296,2	10,2	196,2

3. The mattresses influence on erosion

There were determinations in the spring of 2008 on the hillside without mattresses but with spruce-trees planted on the level curves and on the hillside with mattresses. The hillside slope is 10 %. Determinations show a degree of the natural vegetation covering of 94 % on the hillside with mattresses ; the species were Calamagrostis epigeios, Tussilago farfara,, Cirsium arvense. A smaller degree of vegetation covering, 15 %, was determined on the hillside without mattresses and with spruce-tree planted on the level curves ; Tussilago farfara and Cirsium arvense were met and Calamagrostis epigrios was absent. The difference is very significant statistically. (table 4). As consequence, on the hillside with 10 % and with mattresses on the level curves ,the erosion was of 3,9 t /ha. On the hillside without the mattresses, the erosion (100,6 t/ ha) increased with 2479,5 % (table 5).

Table 4

Influence of the mattresses on covering degree with natural vegetation on the hillside from former bauxite quarry from Zece Hotare,2008

Variant	Covering degree with natural vegetation		Difference		Statistically significant
	%	%	%	%	
1. Hillside with 10 % slope and mattresses	94	100	-	-	Control
2. Hillside with 10 % slope and without mattresses	15	15,9	- 79	- 84,1	ooo

LSD 5% 3,9; LSD 1 % 7,2; LSD 0,1 % 13,8

Table 5

Influence of the mattresses on land losses of the hillside from
Former bauxite quarry from Zece Hotare ,2008

Variant	Land losses		Difference	
	t/ha	%	t/ha	%
1. Hillside with 10 % slope and mattresses	3,9	100	-	-
2. Hillside with 10 % slope and without mattresses	100,6	2579,3	96,7	2479,3

Aspects from the locations of the experiments are presented in the figure 3 and 4.

We can observe the land erosion and small degree of vegetation covering on the hillside without mattresses and high degree of vegetation covering and low erosion on the hillside wich was arranged with mattresses.

The experiment emphasized the big importance of the mattresses for hillsides of the former bauxite quarry from Zece Hotare .



Fig. 3 Aspect with erosion on the hillside with slope of 10 % without mattresses and with spur – tree planted



Fig. 4 Aspect with erosion on the hillside with slope of 10 % with mattresses and with spur – tree planted

CONCLUSIONS

The following conclusions were determined by the researches from former bauxite quarry from Zece Hotare, Bihor county:

- there is an erosion potential in the area of the former bauxite, quarry. The maximum values of the rainfall felt in 24 hours were registered in August : 36,4 mm in 2005 ; 23,4 mm in 2006 and 25,6 mm in 2007;
- the slope of the hillside influenced very much the land losses. The smallest losses were registered at the slope of 10 % , 5,2 t / ha. The increased of the slope to 31 % determined to increase the land losses with 65,3 % ; the biggest land losses, 15,4 t/ha ,were registered at the biggest slope, 44 %;
- the increase of the slope determined the decrease of the covering degree (%) with natural vegetation : 80 % at 20 % slope,69 % at 31 % slope,57 % at 44 % slope;
- the pressence of the mattresses on the hillside of 10 % slope determined on erosion of the 3,9 t /ha;
- the absence of the mattresses determined the increase of the erosion (100,6t/ha) with 2579,5 %;

- the absence of the mattresses on the hillside with 10 % slope determined an the covering degree with natural vegetation of 15% in comparison with 94% on the hillside with mattresses on the level curves;
- the results researches sustain the importance of the mattresses in the erosion control on the hillside of the former bauxite quarry from Zece Hotare, Piatra Craiului Mountains.

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