

## SOIL LOSSES THROUGH WATER EROSION AT THE PREAJBA GORJ RESEARCH STATION

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### ABSTRACT

*Experiments were made at Preajba Gorj Experimental Center in 2007 aiming to determine the soil losses through water erosion to the corn crop, sown grassland (in the second year of vegetation) and natural grassland. Within the experiments, there were studied: the influence of the climatic, anthropic and vegetation factors on the soil losses, and the indirect effect that fertilizers use have on soil erosion.*

### INTRODUCTION

Erosion is a very complex physical and physico-chemical process which consists in the decomposition of structural aggregates even to phases of elementary particles and their gravitational transportation or by water or wind (Dîrja M., si colab., 2002).

Depending on external dynamic agent which generates detachment, transportation and deposition of soil particles, there are two forms of erosion, namely water erosion (caused by water) and wind erosion (caused by wind). Depending on the intensity with which it manifests itself, and effects it leaves on soil, erosion can be surface erosion or depth erosion. (Lulea C., si colab., 2009).

Erosion manifests with higher intensity on sloping land - generally it happens when the slope exceeds 5%. Concurrently, erosion is also influenced by the covering degree with vegetation of the soils, in the sense that when soil has a reduced degree of vegetation cover, erosion manifests itself with a higher intensity. Erosion is also influenced a lot by anthropic factor, through negative actions (cultivation of lands with a very large slope, execution of works from hill to the valley or on the line of the largest slope, their plotting and their orientation with the long part on the direction of the largest slope or perpendicular to level curves, cultivation of hoes on lands with a very large slope, breaking up of grasslands, irrational forest cutting, etc.) it undertakes (Bălan M., si colab., 2010).

In Gorj county, water erosion is the most common form of soil degradation and affects an area of 139.027,95 ha which represents about 57,03% of total agricultural area, of which 134.940,26 ha surface erosion, and 4.087,69 ha depth erosion (O.S.P.A Gorj).

Therefore, it can be said that erosion caused by water is the most complex, serious and vast form of soil degradation in Gorj County, affecting strongly soil properties and its production capacity (Balan M. 2010).

Due to the surface erosion eliminating gradually the fertile layer from the bottom surface, the parent rock layer can be reached - which is without humus and fertilizing elements, fact which harms plant growth and development. Discharge of water on the versant leads in time to the appearance of erosions formations in depression (ditches, gullies, cloughs, gulches, floods), which reduce agricultural areas by land fragmentation (Motoc M., Sevastel M., 2002)

Concurrently, erosion affects environment in that erosion contributes to river, lake, water storage basin pollution, by the increase of solid alluvium percentage, respectively soil or rock particles, transported by surface discharges (Loch R.J., Pocknee C., 1995).

## MATERIAL AND METHOD

Experiments were located on Experimental Center Iuvic soil for Grassland Cultivation, which stands on the administrative territory of Tg.-Jiu city, in Preajba locality, on a slope between 11-12%. They were executed according to Perieni model and consisted in establishing 3 experiments to 3 crops (corn, natural grassland and sown grassland), with 3 variants and 3 repetitions, in order to determine the quantity of eroded soil.

The description of the experiment: the plots have had a rectangular shape, with the longer part of 25 m oriented on the length of the slope or perpendicular on the level lines (the direction of runoff) and the short part of 2,5 m, having a surface of 62,5 m<sup>2</sup>. In order to limit the runoffs there were mounted strips of plastic material in a slot between plots. Each plot tightens in the down side in order to collect the catchments (Hudson N.W., 1993). The runoff is collected for each plot by a pipe of plastic material in a cylindrical basin. In order to reduce the runoff, we have mounted a debit divisor that collects the 49<sup>th</sup> part of the runoff (Lulea C., Neagu I., 1999).

The three experimental variants from three crops were fertilized as follows: V<sub>1</sub> (PN, PS, PB) – remained unfertilized witness; V<sub>2</sub> (PN, PS, PB) – was fertilized with N<sub>60</sub>P<sub>60</sub>K<sub>60</sub> using complex fertilizer of type N<sub>15</sub>P<sub>15</sub>K<sub>15</sub> – 2.5 kg/plot; V<sub>3</sub> (PN, PS, PB) – was fertilized with N<sub>100</sub>P<sub>90</sub>K<sub>60</sub> using complex fertilizer of type N<sub>15</sub>P<sub>15</sub>K<sub>15</sub> – 3.75 kg/plot + NH<sub>4</sub>NO<sub>3</sub> - 0.206 kg/plot.

After every rain, from the collected water in each plot there was taken a sample of 1 liter, after stirring.

In the laboratory, the quantity of eroded soil was also determined after every rain as follows: the sample of one liter of water was filtered through a filter paper which has been dried and weighed previously; then, filter paper with eroded material was dried in oven at 105°C, after oven drying, it was weighed on the analytical balance, determining the quantity of eroded soil, adequate for one liter of water collected; then, the quantity of soil weighed was related to the amount of water discharged in the basin (taking into account that the 49<sup>th</sup> part of the amount of water discharged was taken), then it was related to the square mile and hectare.

## RESULTS AND DISCUSSIONS

Results obtained in 2007 are registered in table 1. In this table you can observe the following:

*In April*, no discharges of water and soil were recorded because the registered rainfall were very small - 2, 4 mm.

*In May*, the quantities of the rainfall were 122,8 mm, bringing discharges and together with them significant soil losses, under the corn crop being between 234,23-236,56 m<sup>3</sup>/ha, respectively 2,01-2,07 t/ha. Although the quantities of rainfall were significant, from a quantitative point of view, discharges of water and soil to natural grassland and sown grassland were relatively close because the sown grassland being in the second year of vegetation, the rich foliar mass on square mile reduces a lot the choc of rain drops, favoring water infiltration in soil.

*In June*, 86, 4 mm rainfall were registered, which led to the storage of amounts of water between 52, 74-101, 60 m<sup>3</sup>/ha and quantities of soil between 0,007-0, 67 t/ha. During this month, the largest amounts of water were discharged on corn 96, 95-101, 60 m<sup>3</sup>/ha and together with them eroded soil 0, 59-0, 67 t/ha. At the same time, approximately the same amounts of water and soil were discharged on natural grassland and sown grassland, which were between 52, 74-57, 40 m<sup>3</sup>/ha, respectively 0, 03-0,007 t/ha because of rich vegetal mass that both types of grasslands had.

*In July*, the rainfall were small - 19, 00 mm and determined very small water discharges and implicitly soil discharges. Because of this fact, soil losses in this month

were extremely small, namely 0, 0002-0, 0007 t/ha for natural grassland and sown grassland. Soil losses were also very small for corn, namely 0, 0343-0, 0259 t/ha.

*In August*, the large quantity of rainfall of 224,4 mm determined the greatest discharges of water this year and together with them the largest quantities of eroded soil for corn crop especially, and grasslands. Thus, discharges of water were between 273, 01-283, 10 m<sup>3</sup>/ha for corn, which called for significant quantities of eroded soil, namely 2, 08-2, 25 t/ha. The largest amounts of water, namely 193,13-197 m<sup>3</sup>/ha were discharged for natural grassland and sown grassland, which determined equally the greatest losses of soil this year, in comparison with the other months, losses which were between 0,23-0,29 t/ha.

*In September*, the recorded rainfall was 81, 6 mm, which determined the greatest discharges of water for corn, being between 135, 73-141, 94 m<sup>3</sup>/ha. These discharges determined soil losses between 0, 77-0, 84 t/ha. For natural grassland and sown grassland, the discharges of water between 77, 56 and 88, 42 m<sup>3</sup>/ha brought together with them quantities of soil between 0, 04-0, 07 t/ha.

### CONCLUSIONS

In 2007, the largest quantities of eroded soil were recorded under the corn crop (5, 54-5, 80 t/ha) in comparison with natural grassland (0, 38-0, 48 t/ha), namely 12, 08-14, 58 times more. In comparison with the natural grassland, where the quantity of eroded soil was between 0, 38-0, 48 t/ha this year, soil losses for corn crop were of 5, 54-5, 80 t/ha, namely 12, 08-14, 57 times more.

This can be explained by the fact that natural grassland and sown grassland (which was in the second year of vegetation this year), offered protection to the soil by large vegetal mass on one hand, and the corn being a hoeing plant, determined soil losses along with the discharges of water from rainfall on the other hand.

Regarding the fertilization, it can be observed that chemical fertilizers administered at the beginning of the period of vegetation, influenced the quantities of eroded soil.

The indirect effect of fertilizers on erosion is due to their influence on the increase of the vegetal mass of crops.

Thus, the greatest soil losses are recorded in unfertilized variants to all of the three crops, because the vegetal mass of these plants was less developed, offering a weaker protection to the soil.

Concurrently, the quantity of the eroded soil was influenced by the quantity of the rainfall. Thus, during the period of vegetation, April-September 2007, 536, 6 mm of precipitations were recorded. Because of the fact that these precipitations were distributed irregularly, the active range of 2007 was unfavorable to the productions, but favorable to erosion. Thus, it is obvious the fact that the greatest soil losses were recorded in May and August, months when the largest amounts of the water from the period of vegetation is registered.

### BIBLIOGRAPHY

- Bălan M.**, 2010. Starea de calitate a unor soluri erodate din Județul Gorj. Teză de doctorat, Facultatea de Agricultură a Universității din Craiova.
- Bălan M., Craioveanu Ghe., Carigoiu V.**, 2011 . Aspecte privind eroziunea solurilor din Județul Gorj. Editura Universitaria Craiova.
- Dîrja M., Budiu V., Păcurar I., Tripon D., Neag V.**, 2002. Eroziunea hidrică și impactul asupra mediului. Editura Risoprint, Cluj-Napoca.
- Florea N.**, 2004. Degradarea, protecția și ameliorarea solurilor și terenurilor. Ed. SNRSS, București.

**Hudson N.W.**, 1993. Field measurements of soil erosion and runoff. Silsoe Associates, Ampthill, Bedford, United Kingdom.

**Lulea C., Ileana Neagu**, 1999. Ghid pentru proiectarea și executarea unor lucrări antierozionale pe terenurile situate în pantă. Editura Universitaria, Craiova.

**Loch R.J., Pocknee C.**, 1995. Effects of aggregation on soil erodability: Australian experience. Journal of soil and water conservation.

**Moțoc M., Sevastel M.**, 2002. Evaluarea factorilor care determină riscul eroziunii hidrice de suprafață. Editura Bren, București.

\*\*\* O.S.P.A. Gorj, Tg.-Jiu. Inventarul terenurilor degradate în județul Gorj, 2001 Arhiva O.S.P.A. Gorj.

Table 1

## The water runoffs and soil losses under different crops in 2007

TRIAL	APRIL Rainfall.=2,4 mm		MAY Rainfall.=122,8 mm		JUNE Rainfall.=86,4 mm		JULY Rainfall.=19,0 mm		AUGUST Rainfall.=224,4 mm		SEPTEMBER Rainfall.=81,6 mm		TOTAL Rainfall.=536,6 mm	
	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha	Runoff m <sup>3</sup> /ha	Eroded soil t/ha
Com N <sub>0</sub> P <sub>0</sub> K <sub>0</sub> Mt			234,23	2,01	101,60	0,67	23,27	0,0343	283,10	2,25	141,94	0,84	784,14	5,80
Com N <sub>60</sub> P <sub>60</sub> K <sub>60</sub>			235,78	2,02	99,28	0,62	20,17	0,0297	278,44	2,17	139,61	0,81	773,28	5,65
Com N <sub>100</sub> P <sub>90</sub> K <sub>60</sub>			236,56	2,07	96,95	0,59	17,84	0,0259	273,01	2,08	135,73	0,77	760,09	5,54
Natural grassland N <sub>0</sub> P <sub>0</sub> K <sub>0</sub> Mt			124,87	0,11	57,40	0,02	14,74	0,0005	197,00	0,29	85,32	0,06	479,33	0,48
Natural grassland N <sub>60</sub> P <sub>60</sub> K <sub>60</sub>			121,77	0,11	56,62	0,009	13,19	0,0003	165,98	0,26	79,89	0,05	437,45	0,43
Natural grassland N <sub>100</sub> P <sub>90</sub> K <sub>60</sub>			116,34	0,10	53,52	0,007	11,63	0,0002	154,35	0,23	77,56	0,04	413,40	0,38
Sown grassland N <sub>0</sub> P <sub>0</sub> K <sub>0</sub> Mt			129,53	0,14	58,95	0,03	15,30	0,0007	199,33	0,29	88,42	0,07	494,84	0,53
Sown grassland N <sub>60</sub> P <sub>60</sub> K <sub>60</sub>			126,42	0,12	57,40	0,02	14,94	0,0063	195,45	0,28	79,79	0,06	472,35	0,49
Sown grassland N <sub>100</sub> P <sub>90</sub> K <sub>60</sub>			121,77	0,12	52,74	0,01	13,96	0,0047	193,13	0,28	78,03	0,04	450,63	0,45