

THE EVALUATION OF THE HUMUS AND NUTRIENTS LOSSES THROUGH WATER EROSION IN 2007

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ABSTRACT

Trials have been established in 2007 at the Experimental Centre for fodder crops Preajba (Gorj department) according to the Perieni model, for 3 crops (corn, natural and seeded pasture). The trials had 3 variants and 3 repetitions in order to determine the soil loss through water erosion along with the humus and nutrients loss.

The highest soil losses through water erosion were registered at the corn standard trial – 5, 8 t/ha/year, and the lowest at the natural meadow fertilized with N₁₀₀P₉₀K₆₀ trial – 0, 38 t/ha/year. Low result for the soil loss was obtained for the seeded meadow, fertilized as well with N₁₀₀P₉₀K₆₀ – 0, 45 t/ha/year. The humus, N, P, and K losses are varying accordingly.

The soil losses are almost insesizable through analytical analysis in 2007, but we have to mention the fact that the effects are cumulative in time, the soil loss determining important effects on the soil structure and fertility.

INTRODUCTION

Due to the water erosion, soil losses are registered, affecting the soil's physical, chemical and biological properties. Erosion eliminates the finest particles from the soil's surface modifying its texture and removing the fertile layers from the surface - rich in humus and nutrients (Fliche E., Purnavel Ghe., Popa N., 2000).

The availability of nutrients has a high importance for the plant's growth and development, being a limitative factor for the soil's quality, especially due to the fact that important nutrients from the soil's reserve are found under inaccessible compounds (Florea N., 2004). The provisioning status of the soils with nutrients available for the plants varies yearly, according to the applied nutrients and the yields (Bălan M., 2010)

Erosion is modifying the chemical properties of the soil, with a higher impact than on the physical properties. The most important changes are on the soil's content in nutrients available for the plants: humus, nitrogen, phosphorus and potassium (Ulen, 2005).

Due to the change of the chemical and physical properties through erosion, a decrease in the microorganism's activity is registered, with effect the decrease of the soil's fertility and yields (Staubmann, Katie Tedd, cited by Mocanu R. et al, 2011).

The soils from the Gorj department have a low to very low content in available nutrients (Balan Mihaela, și colab., 2010).

MATERIALS AND METHODS

The trials have been established at the Experimental centre for fodder crops Preajba – Gorj using the Perieni model, on a luvic soil with a slope between 11-12%. There were established 3 trials for three crops (corn, natural and seeded meadow - the last one being in the second year of trial), in 3 variants.

In order to avoid rainfall to get in or out from the experimental plots, each of the plot was isolated with PVC strips introduced 10 cm below the soil's surface. Down the slope, each plot has a base made of concrete in triangular shape, allowing the drained

water carrying soil and nutrients to enter in a plastic pipe and then in the collecting basin. Between the collecting basin and the plastic pipe a debit divisor was installed, collecting the 49th part of the drained water.

After each of the rainfalls, the water from the collecting basin was homogenized and a 1 liter sample was then collected, filtered and analyzed –the filter paper and the soil from each sample was dried and weighted. The results were then reported at the plot’s surface and respectively to the hectare.

For each one of the soil samples collected after the rainfalls, there were determined: the humus content, the nitrogen, phosphorus and potassium content.

Based on the results, the annual losses were determined using the formulas (Bălan M., 2010):

$\text{Kg/ha/year Humus, Nitrogen} = 10 \times m \times H, (\text{N})$

$\text{Kg/ha/year P, K} = 0,001 \times m \times P, (\text{K})$ where:

H, N – humus and nitrogen in %,

m – the eroded soil, in t/ha,

P, K – soil’s concentration in mobile phosphorus and potassium, in ppm.

The width of the eroded soil layer can be determined from the experimental data. By noting with “d” – soil’s apparent density on 10 cm depth ($d = 1, 25 \text{ t/m}^3$), with “S” – soil’s surface/ha ($S = 10.000 \text{ m}^2$) and with “m”- the quantity of the eroded soil (in t/ha), the width of the eroded layer is: $h = m/12, 5 \text{ (mm)}$ (Bălan M., 2010). Results are presented in table 2.

RESULTS AND DISCUSSIONS

To evaluate the humus and nutrients losses through water erosion, there were analytically determined their concentration in the eroded soil, soil collected and separated through filtration from the water drained from the experimental plots. Results are presented in table 1.

Table 1

**Humus and nutrients concentration in the eroded soil
from the experimental plots in 2007**

Variant	Humus %	Nt %	P _{AL} ppm	K _{AL} ppm
Corn N ₀ P ₀ K ₀ Mt	4,18	0,165	10,52	79
Corn N ₆₀ P ₆₀ K ₆₀	4,12	0,167	9,38	75
Corn N ₁₀₀ P ₉₀ K ₆₀	4,10	0,167	10,26	82
Natural meadow N ₀ P ₀ K ₀ Mt	3,35	0,141	12,10	87
Natural meadow N ₆₀ P ₆₀ K ₆₀	3,27	0,128	10,72	88
Natural meadow N ₁₀₀ P ₉₀ K ₆₀	3,40	0,126	11,38	85
Seeded meadow N ₀ P ₀ K ₀ Mt	3,67	0,141	9,67	77
Seeded meadow N ₆₀ P ₆₀ K ₆₀	3,51	0,139	8,33	81
Seeded meadow N ₁₀₀ P ₉₀ K ₆₀	3,27	0,126	10,10	79

The width of the eroded soil layer is low, being, in average: 0, 45 mm/year for the corn crop, 0,038 mm/year for the seeded meadow and 0,034 mm/year for the natural meadow (Table 2). For all the trials, the eroded soil is varying according to the volume of the drained water. As well, for all the trials, the eroded soil is decreasing from the unfertilized standard trial to the crop fertilized by N₆₀P₆₀K₆₀ and to the one fertilized by cu N₁₀₀P₉₀K₆₀.

Table 2

Soil's nutrients losses due to erosion in 2007

Variant	Drained water m ³ /ha	Eroded soil t/ha	Width of the eroded soil mm	Nutrient losses kg/ha/year (total values)			
				H	N	P	K
Corn Mt	784,14	5,80	0,464	242,44	9,576	0,061	0,458
Corn N ₆₀ P ₆₀ K ₆₀	773,28	5,65	0,452	232,78	9,427	0,052	0,423
Corn N ₁₀₀ P ₉₀ K ₆₀	760,09	5,54	0,443	227,14	9,244	0,056	0,454
Natural meadow Mt	479,33	0,48	0,038	16,10	0,676	0,004	0,041
Natural meadow N ₆₀ P ₆₀ K ₆₀	437,45	0,43	0,034	14,10	0,550	0,005	0,037
Natural meadow N ₁₀₀ P ₉₀ K ₆₀	413,40	0,38	0,030	12,90	0,478	0,004	0,032
Seeded meadow Mt	494,84	0,53	0,042	19,50	0,747	0,006	0,040
Seeded meadow N ₆₀ P ₆₀ K ₆₀	472,35	0,49	0,039	17,20	0,681	0,004	0,039
Seeded meadow N ₁₀₀ P ₉₀ K ₆₀	450,63	0,45	0,036	14,70	0,567	0,004	0,035

It can be explained by an increase of the density and of the vegetative mass of the crops and accordingly of the surface covered with vegetation, lowering the quantity of the soil loss by water on the slope soils.

In straight correlation with the soil losses were the humus and nutrients losses. The highest humus losses were registered at the corn crop trial not fertilized, compared to the natural meadow trial fertilized by N₁₀₀P₉₀K₆₀

The nitrogen losses were between 0,478 and 9,576 kg/ha/year, the highest values being registered at the standard corn trial, the lowest being registered for the natural meadow trial, fertilized with N₁₀₀P₉₀K₆₀, due to the vigorous growth of the plants.

The phosphorus and potassium losses are lower compared with the nitrogen ones.

CONCLUSION

The highest soil losses through water erosion were registered at the corn standard trial – 5, 8 t/ha/year, and the lowest at the natural meadow fertilized with N₁₀₀P₉₀K₆₀ trial – 0, 38 t/ha/year. Low result for the soil loss was obtained for the seeded meadow, fertilized as well with N₁₀₀P₉₀K₆₀ – 0, 45 t/ha/year. The humus, N, P, and K losses are varying accordingly. The fact can be explained through a better density and area coverage of the natural meadow. The higher the density and coverage, the lower the soil and nutrient losses.

It has to be mentioned the fact that the losses are cumulative on long term with very important effects over the soil's structure and fertility.

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