THE IMPACT OF NUTRIENT LOSSES FROM AGRICULTURE ON THE ENVIRONMENT. CASE STUDY IN VALEA ȚĂRNII, PERIENI, VASLUI COUNTY

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ARTICLE

Abstract
Soil erosion is an important environmental problem that causes climate changes, changes in the hydrology of an area and when it can no longer be controlled, it causes sinister events like those recorded in 2024, in Bârlad Plateau, Romania. The purpose of this study is to quantify nutrient losses from agriculture on the environment, in the Perieni experimental point. For this, two pedological profiles were made, one downstream and the other upstream of the standard runoff control plots.

Keywords: climate changes, *nutrient losses*
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INTRODUCTION

Erosion is one of the most important environmental problem, the decrease in soil fertility over large areas when it could not be controlled, it can determine the appearance of sinister phenomena similar to those recorded in the Bârlad Plateau, Romania, in 2024 (Voicu et al., 2022).

In Romania, a threat, as presented in the PSN, is represented by the low level of access to risk management tools: in the period 2012-2020; soil drought affected 1,344,759.18 ha; floods 154,844.93 ha and the soil phenomenon erosion over 260,000 ha (Chiurciu et al, 2022, 2023).

The agricultural sector is under pressure to respond energy, food security and greenhouse effect reduction challenges gas emissions. At the same time, climate change and an increasing demand for food products can intensify the pressure on agricultural production (Ruosteenoja et al, 2011; Rosegrant et al, 2013; Dana et al, 2023).

In Norway but also globally, agricultural production is one of the main sources of increased nutrient concentrations in bodies of water (Ulén et al, 2007, 2011; Villa et al, 2015; Giri and Qiu 2016). Nutrient and soil losses cause climate changes and affects agricultural production systems and hydrology (Bechmann et al, 2008, 2014; Deelstra et al, 2011; Andersen et al, 2016; Withers et al, 2003).

MATERIAL AND METHOD

The Bârlad depression (Figure 1), an area of strong tectonic subsidence, represents a depression that was formed by the sinking of the southern edge of the Moldova Platform and the northern part of the northern Dobrogea promontory. It is a unit with a mixed foundation, of Podolian origin to the north of the Bacău-Bârlad-Murgeni locality line and of Hercynian, North-Dobrogea origin, to the south. From a lithological point of view, in the foundation of this unit, metamorphic rocks (gneisses and amphibolites) pierced by eruptive rocks, Paleozoic formations, over which lie Triassic deposits consisting of sandstone conglomerates, limestones, dolomites, sandstones and clay shale pierced of porphyry.

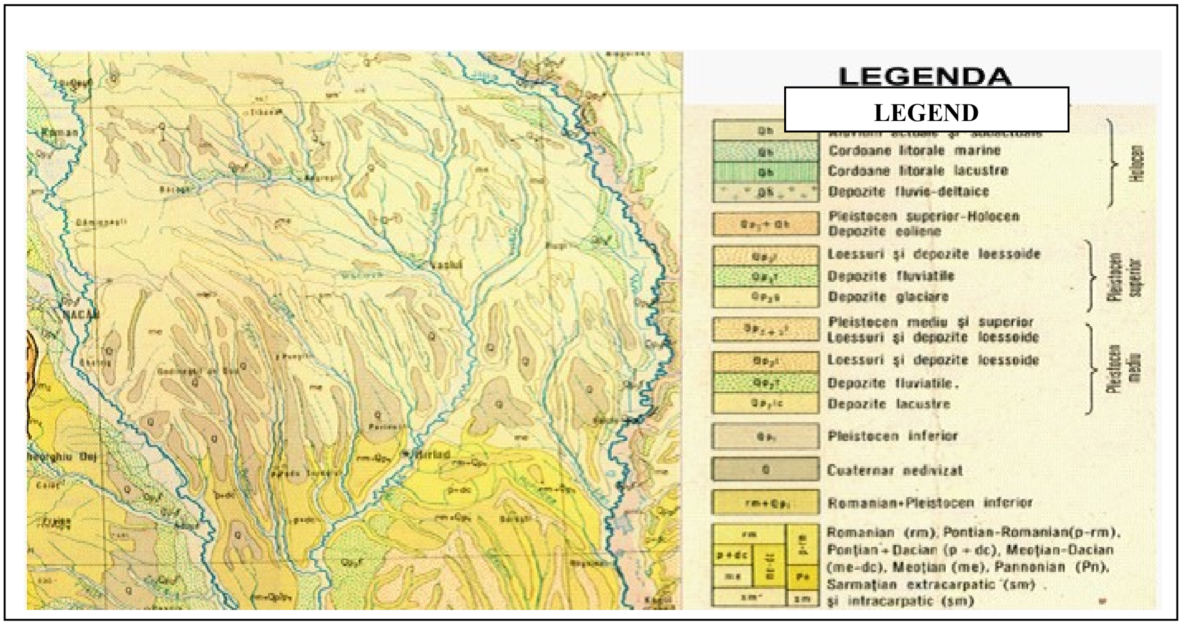

Figure 1 **Geological map of the Bârlad Plateau (PENSOL Project)**

Man's intervention, especially in the last two centuries, through the clearing of once-extensive forests, the clearing of meadows and the rudimentary agricultural techniques of the past, have obviously disturbed the natural balance favoring accelerated erosion.

The most important role in the appearance and development of erosion processes is played by high humidity, water from direct precipitation - from melting snow, from long-lasting rains, more frequent in the transitional seasons, or in the form of summer showers - as well as the sources underground phreatic, or cantoned in deeper, Sarmatian and Pliocene strata, sectioned by slopes.

In order to quantify the impact of nutrient losses from agriculture on the environment, two pedological profiles were made at the Perieni experimental point, one downstream and the other upstream of standard plots for runoff control. To establish the level of nutrient supply, soil samples were taken from the upstream and downstream of the standard plots to control nutrient leakage (Figures 2-4). Methodology for Elaboration of Pedological Studies, 1987, was used to characterize soil resources.

Profile 1 Perieni valley, Valea Ţărnii

Name and general training conditions of profile1 Perieni, Valley of Tărnii

Soil name: Moderately eroded cambic chernozem, LP/LP, on loessoid deposits

Location: Perieni Communal Territory, Valley of Tărnii

Relief: Bârlad Plateau, Slope 5 - 6%

Parent rock: loessoid deposits

Ground water depth: > 10 m;

Characteristic vegetation: Grassy xerophytic vegetation.

Profile 2 Perieni, hill, Valley of Tărnii

The name and general conditions of formation of the profile 2 Perieni, Valley of Tărnii

Soil name: moderately-strongly eroded cambic chernozem LP/LP, on loessoid deposits

Location: Perieni Communal Territory, Valley of Tărnii

General training conditions:

Relief: Bârlad Plateau, Slope 5 - 6%

Parent rock: loessoid deposits

Ground water depth: > 10 m;

Characteristic vegetation: Grassy xerophytic vegetation

Figure 2 **Standard plots for leakage control at SCDCES-MM Perieni, in Valley of Tărnii (PENSOL Project)**

Figure 3 **System of anti-erosion works at SCDCES-MM Perieni, in Valley of Tărnii (PENSOL Project)**

Figure 4 **Cambic Chernozem soil profile, in Valley of Tărnii (PENSOL Project)**

RESULTS AND DISCUSSIONS

Agrochemical characterization of Profile 1 Perieni, valley, Valea Tărnii

The soil is medium (0.14 - 0.24%) supplied with total nitrogen throughout the profile (Figure 5). The total phosphorus content is low and very low in the surface horizons (7.33 - 12.92 ppm), extremely low (3.14 - 3.66 ppm) in the Am and AB horizons respectively and very low - low (5 .9 - 25.15 ppm) in the Bv horizon.

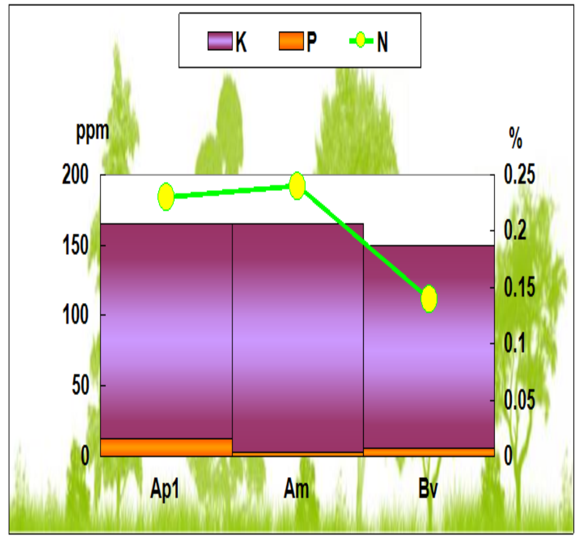

Figure 5 **The soil content in N, P, K, Profile 1, Perieni, valley, Valley of Tărnii (PENSOL Project)**

Mobile potassium has a medium content (150.00 - 163.33 ppm) in almost the entire horizon and low content in the horizons at the base (105.00 - 126.60 ppm).

The content of trace elements is extremely low (0.18 - 0.25 ppm) in Ap and Bv respectively, at very low (0.42 - 0.79 ppm) for zinc, while for copper the values are very low throughout profile (0.61 - 0.96 ppm), exceeding the susceptibility limit of 0.2 ppm. The manganese content gradually decreases on the profile, from medium-high values (28.58 - 58.76 ppm) in the upper part to low values (15.66 - 22.66 ppm) at the bottom of the profile, exceeding the threshold of susceptibility to 4-5 ppm, and iron is in the optimal range of values, being greater than 4.5 ppm, in all horizons of the profile (Table 1). In the case of applying irrigation, small - medium and frequent watering norms are recommended to prevent the rapid infiltration of water on the soil profile and the formation of the crust.

Since the soil is located on a slope, erosion can be prevented by plowing on the level curve, by choosing the appropriate assortment of crops and by grass strips. In this case, agricultural terraces and grassy lanes are used.

Table 1

Analytical data regarding the microelement content of profile 1, from the downstream area of the standard plots for the control of nutrient runoff, Perieni (PENSOL Project)

Horizon	Cu ppm	Zn ppm	Fe ppm	Mn ppm
Ap1 0-10 cm	0.96	0.71	80.34	58.76
Ap 2 10-26 cm	0.89	0.62	37.90	45.24
Am 26-40 cm	0.86	0.18	16.73	28.58
AB 40-52 cm	0.75	0.42	15.22	22.66
Bv1 52-73 cm	0.80	0.25	17.03	18.64
Bv2 73-90 cm	0.63	0.79	15.35	15.66
Cca 90-103 cm	0.61	0.19	12.87	6.92

Agrochemical characterization of Profile 2 Perieni, hill, Valley of Tărnii

The soil is well (0.21 - 0.45%) to medium (0.16 - 0.18%) supplied with total nitrogen (Figure 6). The total phosphorus content gradually decreases along the profile, from high (42.09 ppm) in the surface horizon, to low (11.00 ppm) and very low (4.19 - 6.46 ppm) towards the base of the profile.

The mobile potassium content is high (256.60 - 340.00 ppm) in the first two surface horizons and medium (128.33 - 160.60 ppm) in the base horizons.

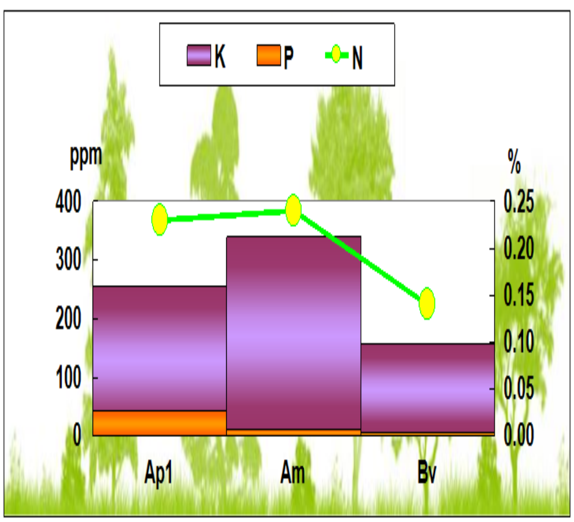

Figure 6 **The soil content in N, P, K, Profile 2, Perieni, hill, Valley of Tărnii (PENSOL Project)**

The microelement content of this profile is generally similar to that of the first profile (Table 2). The zinc content is extremely low - very low (0.18 - 0.53 ppm) throughout the profile, except for the surface horizon where this content is high (2.34 ppm). Regarding copper, its values are very low in almost the entire profile (0.46 - 0.98 ppm) and low (1.19 ppm) in the surface, exceeding the susceptibility level of 0.2 ppm.

The content of manganese gradually decreases along the profile, from high values (62.98 ppm) in the surface to medium values (31.32 - 45.02 ppm) and very low values (7.72 - 24.32 ppm) in the rest profile, exceeding the susceptibility level of 4-5 ppm, while iron is in the range of optimal values (53.66 ppm) in the surface and in the other horizons (42.52 - 4.92 ppm).

This profile does not raise particular problems either, but, in the case of carrying out agricultural works in conditions of inadequate humidity, a thick layer of hardpan may appear, which can be destroyed by plowing with variable depths. In the case of using irrigation, low-medium and frequent watering norms are recommended to prevent the rapid infiltration of water on the soil profile and crust formation.

Since the soil is located on a slope, erosion can be prevented by plowing on the level curve, by choosing the appropriate assortment of crops and by grass strips. In this case, agricultural terraces and grassy lanes are used.

Soil erosion and soil nutrient losses

The amount of soil eroded in different experimental plots, with various soil maintenance methods, varied between 0.015 tons/ha and 6.851 tons/ha (Figure 7).

The amounts of macronutrients lost with the eroded soil are shown in figures 8-10.

Table 2

Analytical data regarding the content of trace elements of profile 2, from the upstream area of the standard plots for the control of nutrient runoff, Perieni (PENSOL Project)

Horizon	Cu ppm	Zn ppm	Fe ppm	Mn ppm
Ap 0-2 cm	1.19	2.34	53.66	62.98
Am 2-35 cm	0.98	0.53	42.52	45.02
AB 35-44 cm	0.62	0.18	8.01	31.32
Bv 44-62 cm	0.61	0.23	6.65	24.32
Cca 62-72 cm	0.46	0.39	4.92	7.72

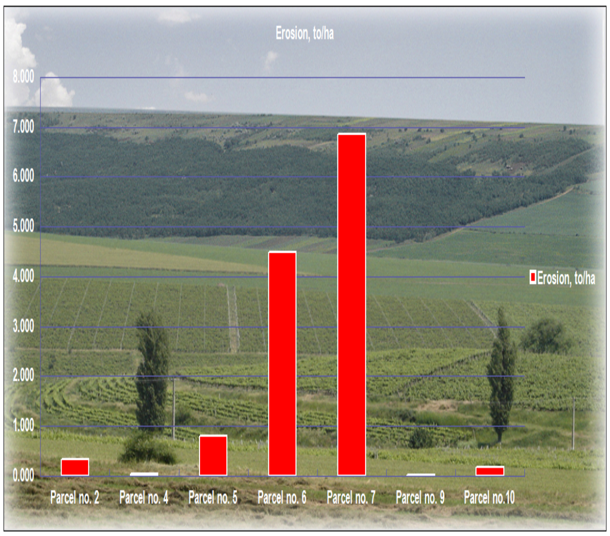

Figure 7 **The amount of soil eroded in the experimental plots, Valley of Tărnii (PENSOL Project)**

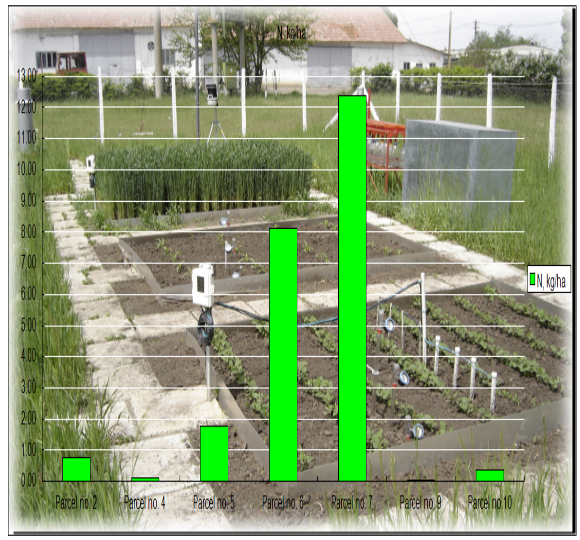

Figure 8 **Nitrogen losses with the amount of eroded soil in the experimental plots, Valley of Tărnii (PENSOL Project)**

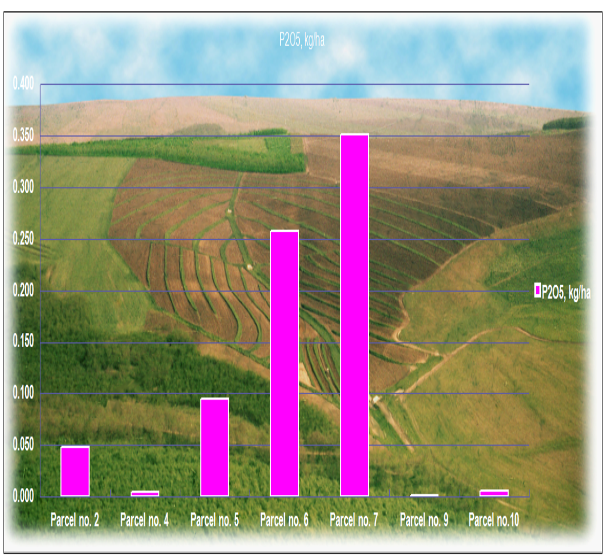

Figure 9 **Phosphorus losses with the amount of eroded soil in the experimental plots, Valley of Tărnii (PENSOL Project)**

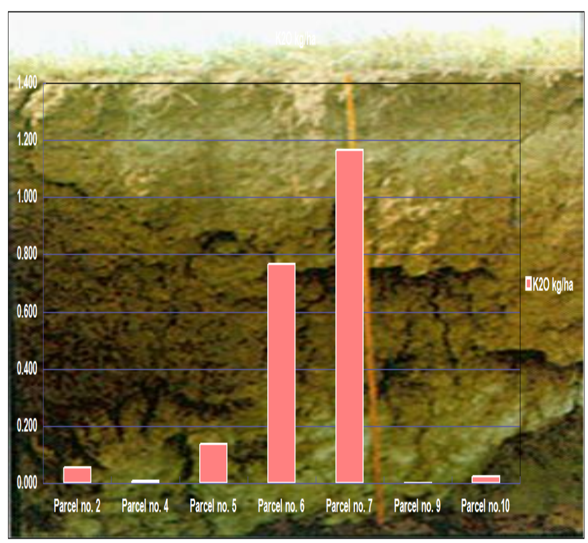

Figure 10 **Potassium losses with the amount of eroded soil in the experimental plots, Valley of Tărnii (PENSOL Project)**

CONCLUSIONS

The soil profile is located in Perieni Communal Territory, Valley of Tărnii and the Cambic Chernozem has the following profile: Ap/Am/AB/Bv/Cca.

As a result of the erosion processes, the amount of soil lost varied between 0.015 and 6.851 tons/ha, annual data.

Losses of macronutrients with eroded soil were for nitrogen 0.101-12.379 kg/ha, for phosphorus 0.004-0.352 kg/ha, and for potassium 0.007-1.166 kg/ha.

The data obtained indicate a high probability of repeating the sinister events in the Bârlad Plateau, such as those in 2024, if sustainable measures are not taken to combat the phenomenon of erosion in the area.

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