SOIL AND NUTRIENT LOSSES LIMITATION ON SLOPE LANDS, WITH THE HELP OF *BROMUS INERMIS* LEYSS. SPECIES

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Abstract

Recently the soil erosion phenomenon, materialized by soil loss has been emphasized by climatic variations, namely the lack of precipitation over extended periods of time, the immediate effect being the diminution of the obtained yields. Bromus inermis Leyss. *species is a very well adapted to conditions of prolonged drought, it resembles high densities (1000-1100 plants per square meter) and is a species with high perenniality (it can hold over 10 years in the crop), and it can be used as a cultivated species to protect the soil from erosion. The solid leaks from the 4 monitoring plots were determined, ranging between 3.16 t·ha^{-1} at plot 2, cultivated with Bromus inermis* Leyss. *(100%) and 3.16 t·ha^{-1} at plot 1, the uncultivated control plot (2025-05-30) and between 3.16 t·ha^{-1} at plot 2, cultivated with Bromus inermis* Leyss. *(100%) and 3.16 t·ha^{-1} at plot 1, the uncultivated control plot (2025-07-20). In the plots where the species Bromus inermis* Leyss. *was sown, solid leaks determined were by 33.5-56.7% (2025-05-30) and 56.7-65.4% (2025-07-20) lower than in the control plot. The largest losses of hunus and soil nutrients were determined in plot 1 - control and plot 4 - Onobrychis vicifolia* Scop. *(100%), where adequate plants protection was not provided.*

Key words**: **soil lost percentage, humus, NPK, plants density, plants height

INTRODUCTION

In recent years, the soil erosion phenomenon, materialized by soil loss (whose essential components for plants are the content of organic matter and mineral nutrients), has been emphasized by climatic variations, namely the lack of precipitation over extended periods of time. Prolonged drought affects the growth and development of plants in agricultural crops or grasslands, the immediate effect being the diminution of the obtained yields (**Abdulle Y.A. et al, 2022**; **Chen Y. et al, 2023**). Thus, after such critical periods, the plant carpet no longer exerts the same anti-erosional protection on the soil, the plants being underdeveloped. Under these conditions, if torrential rains occur, significant amounts of soil are eroded, along with the organic matter and mineral elements contained in it (**Bonthagorla U. et al, 2022**; **Chiurciu I.-A. et al, 2022**; **Akhatov A. et al, 2024**; **Radu A.T. and Burcea M., 2024**; **Samarinas N. et al, 2024**).

Limitation of soil and nutrient losses through erosion fenomen under current climatic conditions can be done by three

methods: cultivation of species adapted to these conditions, cultivation of plants that resemble at higher times and cultivation of perennial species.

Bromus inermis Leyss. species it fits each of these three methods, being a very well adapted to conditions of prolonged drought, it resembles high densities (1000-1100 plants per square meter) and is a species with high perenniality (it can hold over 10 years in the crop).

The cultivation of this species together with the species *Onobrychis vicifolia* Scop., has advantages such as increasing the amount of nitrogen fixed in the soil and higher quality yields.

The researches carried out in the 2024-2025 agricultural year, within the Moara Grecilor location of the Research and Development Station for Meadows (RDSM), Vaslui, was represented by the analysis of the the influence of *Bromus inermis* Leyss. and *Onobrychis vicifolia* Scop. species, grown alone or in mixture, on solid spills on slopes under the conditions of Moldavian Forest Steppe.

MATERIALS AND METHODS

The purpose of the study was to investigate the influence of Bromus inermis Leyss. species and Onobrychis vicifolia Scop., grown alone or mixed, on solid spills on slopes under the conditions of Moldavian Forest Steppe, through liquid and solid surface leak control plots.

The objectives pursued were solid leakage analysis, determination of nutrient losses from eroded soil (loss of humus, nitrogen phosphorus and potassium), as well as analysis of morphoproductive indicators (number of shoots/m^2, plant height) in plants in the first year of vegetation (starting year of the crop).

Four erosion control plots were placed:

- plot 1 - control: 150 m^2 (4 m × 37.5 m), maintained uncultivated;
- plot 2 - a_1: 100 m^2 (4 m × 25 m), cultivated with *Bromus inermis* Leyss. (100%);
- plot 3 - a_2: 100 m^2 (4 m × 25 m), cultivated with *Bromus inermis* Leyss. (50%) and *Onobrychis viciifolia* Scop. (50%);
- plot 4 - a_3: 100 m^2 (4 m × 25 m), cultivated with *Onobrychis viciifolia* Scop. (100%);

As a biological material it was used at *Bromus inermis* Leyss. MIHAELA variety and Onobrychis vicifolia Scop. ANAMARIA variety, varieties created by RDSM Vaslui.

In general, the agricultural year 2024-2025 was rainy, with precipitation in large quantities in some periods, but also with periods of water stress, the vegetation conditions being not ideal (figure 1).

During the agricultural period 2025-04-01 - 2025-10-07, at the weather station of RDSM Vaslui (Station I - Moara Grecilor locality), torrential precipitation was recorded, which produced liquid and solid surface leaks.

Table 1 presents situations where rainfall exceeded 3 mm over one hour.

The date of 2025-05-26, time interval 18-19:00:00, when 9 mm precipitation fell, causing surface leaks, liquids and solids.

Table 1. Liquid precipitation exceeding 3 mm within one hour at the RDSM Vaslui weather station

No.	date and time	mm
1	2025-05-26 01:00:00	3.8
2	2025-05-26 18:00:00	3.2
3	2025-05-26 19:00:00	9.0
4	2025-05-26 20:00:00	4.8
5	2025-05-27 20:00:00	4.2
6	2025-05-27 21:00:00	6.6
7	2025-05-28 01:00:00	3.2
8	2025-05-28 02:00:00	3.8
9	2025-07-18 00:00:00	6.2
10	2025-07-18 04:00:00	8.2

Source: Own data

Standards used to determine humus and nutrients in the lost soil:

- STAS 7184/21-82 for humus content;
- STAS 7184/2-85 for nitrogen content;
- STAS 7184/19-82 for phosphorus content;
- STAS 7184/18-80 for potassium content.

The analyses were performed at National Institute for Research and Development in Pedology, Agrochemistry and Environmental Protection - ICPA Bucharest, Bucharest

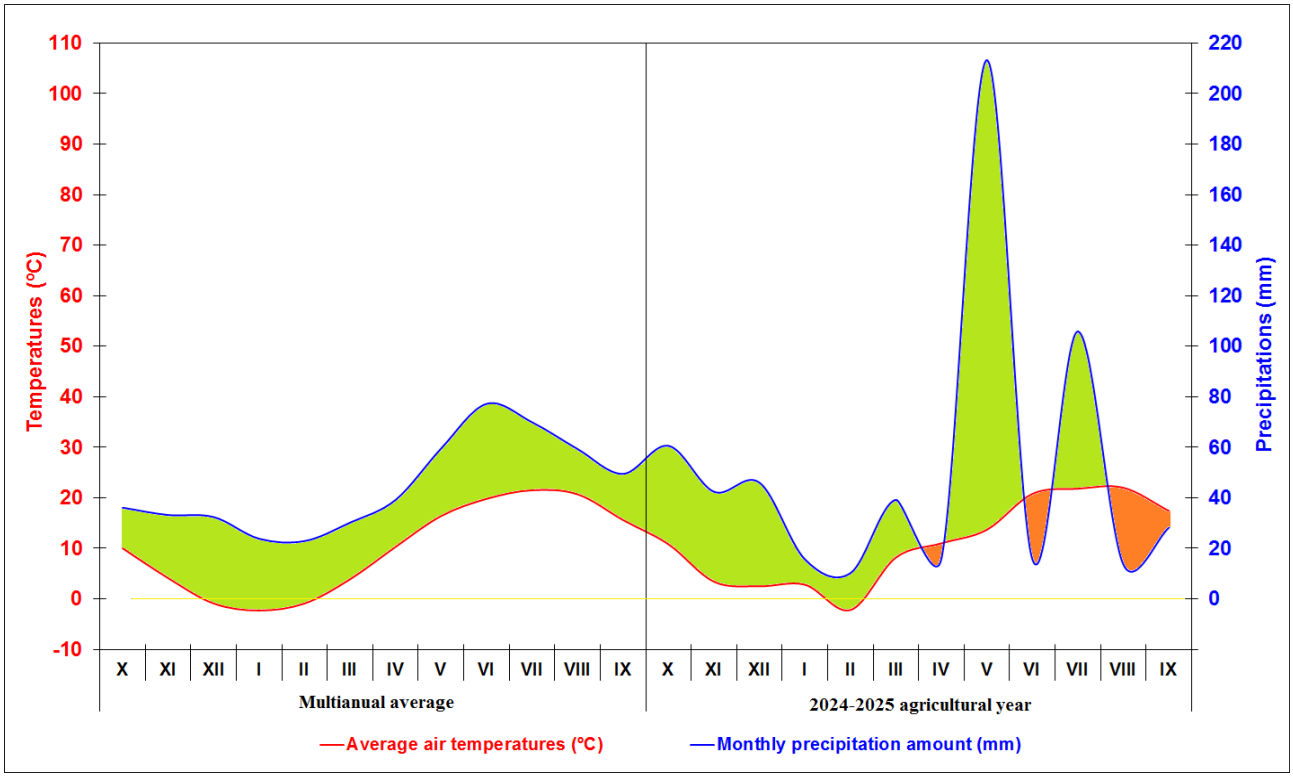

Figure 1. Climate conditions from the 2024-2025 agricultural year
Source: Own data, taken from from RDSM Vaslui weather station (Station I - Moara Grecilor locality)

RESULTS AND DISCUSSIONS

On 2025-05-30, the solid leaks from the 4 monitoring plots were determined, ranging between 3.16 t·ha^{-1} at plot 2, cultivated with *Bromus inermis* Leyss. (100%) and 7.29 t·ha^{-1} at plot 1, the uncultivated control plot.

It can be noted that in the plots where the species *Bromus inermis* Leyss. was sown, solid leaks determined were by 33.5-56.7% lower than in the control plot (table 2). The species *Bromus inermis* Leyss. is a stoloniferous species, which since year 1 of vegetation develops stolons and fixes the surface layer of the soil, limiting water erosion. These aspects were also noted for the solid leaks determined on 2025-07-20, when values determined were with 56.7-65.4% lower than in the control plot (table 3).

Table 2. Solid leaks measured at 2025-05-30

Plot No.	Plot surface (m^2)	Culture	Total solid leakage (t·ha^{-1})	Difference	
				t·ha^{-1}	%
1 (Control)	150	Uncultivated	7.29	Control	100
2	100	a_1 - *Bromus inermis* Leyss. (100%)	3.16	-4.13	43.3
3	100	a_2 - *Bromus inermis* Leyss. (50%) and *Onobrychis viciifolia* Scop. (50%)	4.84	-2.45	66.5
4	100	a_3 - *Onobrychis viciifolia* Scop. (100%)	6.81	-0.48	93.4

Source: Own data

Table 3. Solid leaks measured at 2025-07-20

Plot No.	Plot surface (m^2)	Culture	Total solid leakage (t·ha^{-1})	Difference	
				t·ha^{-1}	%
1 (Control)	150	Uncultivated	0.24	Control	100
2	100	a_1 - *Bromus inermis* Leyss. (100%)	0.08	-0.16	34.6
3	100	a_2 - *Bromus inermis* Leyss. (50%) and *Onobrychis viciifolia* Scop. (50%)	0.11	-0.14	43.3
4	100	a_3 - *Onobrychis viciifolia* Scop. (100%)	0.20	-0.04	82.7

Source: Own data

Physicochemical analyses were also carried out in soil samples determined on 2025-05-30 (table 4.) on the basis of which loss of humus and nutrients were calculated (table 5.).
The greatest losses of hunus and soil nutrients were determined in plot 1 - control and plot 4 - *Onobrychis vicifolia* Scop. (100%), where adequate protection was not provided, through a dense vegetation obtained by seeded culture.

Table 4. Analysis of solid leakage measured at 2025-05-30

Identification	pH (pH units)	Chemical analysis			
RDSM Vaslui - Moara Grecilor experimental field		Humus (%)	Total N (%)	P_{AL}	K_{AL}
				($mg \cdot kg^{-1}$)	
Plot 1 (Control)	6.91	1.75	0.204	31	278
Plot 2 - a_1	6.28	2.60	0.115	16	179
Plot 3 - a_2	5.88	3.02	0.175	19	227
Plot 4 - a_3	6.76	2.99	0.201	18	229

Source: Own data

Table 5. Calculation of the loss of humus and nutrients from solid leaks measured at 2025-05-30

Plot	Humus	N	P	K	Lost soil	Lost Humus	Lost mineral elements		
							N	P	K
	%				$t \cdot ha^{-1}$	$kg \cdot ha^{-1}$			
Plot 1 (Control)	1.75	0.2040	0.0031	0.0278	7.29	127.6	14.9	0.23	2.03
Plot 2 - a_1	2.60	0.1150	0.0016	0.0179	3.16	82.1	3.6	0.05	0.57
Plot 3 - a_2	3.02	0.1750	0.0019	0.0227	4.84	146.3	8.5	0.09	1.10
Plot 4 - a_3	2.99	0.2010	0.0018	0.0229	6.81	203.5	13.7	0.12	1.56

Source: Own data

The number of shoots determined at first cut ranged from 489 shoots·m^2 at *Onobrychis vicifolia* Scop. (100%) variant and 1612 shoots·m^2 at *Bromus inermis* Leyss. (100%) variant and at the second cut between 461 shoots·m^2 at *Onobrychis vicifolia* Scop. variant (100%) and 1549 shoots·m^2 at *Bromus inermis* Leyss. (100%) variant (table 6).
In the given climatic conditions, *Bromus inermis* Leyss. species had a better emergence.
Also, in the vegetation the *Bromus inermis* Leyss. species plants had a better development. Thus, the plant height varied between 16.9 cm at *Onobrychis vicifolia* Scop. (100%) variant and 26.4 cm at *Bromus inermis* Leyss. (100%) variant, at first cut and at the second cut varied between 14.6 cm at *Onobrychis viciiifolia* Scop. (100%) variant and 17.9 cm at *Bromus inermis* Leyss. (100%) variant (table 7).
The crops were highly riddled and the cleaning cuts made were carried out before weeds formed seeds or put the crop at risk.

Table 6. Determination of the number of shoots·m^2

Culture		First cut - 2025-06-15	Second cut -.2025-07-29
		Number of shoots·m^2	
Uncultivated		-	-
a_1 - *Bromus inermis* Leyss. (100%)		1612**	1549***
a_2 - *Bromus inermis* Leyss. (50%) and *Onobrychis viciifolia* Scop. (50%)		1089	1016
a_3 - *Onobrychis viciifolia* Scop. (100%)		489^{oo}	461^{ooo}
Average (Control)		1063^{Mt}	1009^{Mt}
LSD	*0.5*	*336*	*171*
	0.1	*471*	*239*
	0.01	*665*	*338*

Source: Own data

Table 7. Plants height (cm) measurement

Culture		First cut - 2025-06-15	Second cut -.2025-07-29
		Plants height (cm)	
Uncultivated		-	-
a_1 - *Bromus inermis* Leyss. (100%)		26.4**	17.9**
a_2 - *Bromus inermis* Leyss. (50%) and *Onobrychis viciifolia* Scop. (50%)		25.6*	17.2**
a_3 - *Onobrychis viciifolia* Scop. (100%)		16.9^{ooo}	8.6^{ooo}
Average (Control)		23.0^{Mt}	14.6^{Mt}
LSD	*0.5*	*2.1*	*1.8*
	0.1	*2.9*	*2.5*
	0.01	*4.1*	*3.5*

Source: Own data

In figure 2 there are presented aspects from the experimental field (field preparation, seeding and aspects from the vegetation period).

Figure 2. Aspects from the experimental field
Source: Own foto

CONCLUSIONS

On 2025-05-30, the solid leaks from the 4 monitoring plots were determined, ranging between 3.16 t·ha^{-1} at plot 2, cultivated with *Bromus inermis* Leyss. (100%) and 7.29 t·ha^{-1} at plot 1, the uncultivated control plot and on 2025-07-20 the solid leaks ranged between 0.08 t·ha^{-1} at plot 2, cultivated with *Bromus inermis* Leyss. (100%) and 0.24 t·ha^{-1} at plot 1, the uncultivated control plot.

In the plots where the species *Bromus inermis* Leyss. was sown, solid leaks determined were by 33.5-56.7% (2025-05-30) and 56.7-65.4% (2025-07-20) lower than in the control plot;

The largest losses of hunus and soil nutrients were determined in plot 1 -

control and plot 4 - *Onobrychis vicifolia* Scop. (100%), where adequate plants protection was not provided.

The number of shoots determined at first cut ranged from 489 shoots·m^2 at *Onobrychis vicifolia* Scop. (100%) variant and 1612 shoots·m^2 at *Bromus inermis* Leyss. (100%) variant and at the second cut between 461 shoots·m^2 at *Onobrychis vicifolia* Scop. variant (100%) and 1549 shoots·m^2 at *Bromus inermis* Leyss. (100%) variant because, in the given climatic conditions, *Bromus inermis* Leyss. species had a better emergence.

In the vegetation the *Bromus inermis* Leyss. species plants had a better development and the plant height varied between 16.9 cm at *Onobrychis vicifolia* Scop. (100%) variant and 26.4 cm at *Bromus inermis* Leyss. (100%)variant, at first cut and at the second cut varied between 14.6 cm at *Onobrychis viciiifolia* Scop. (100%) variant and 17.9 cm at *Bromus inermis* Leyss. (100%) variant.

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