THE INFLUENCE OF SEVERAL FIELD CROPS ON SOIL NUTRIENT LOSSES WITHIN HILLY ZONE OF MOLDAVIA

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Abstract: *Within the hilly zone of Moldavia, on sloppy soils, the erosion phenomenon determines the loss of nutrient and humus along with the runoff water. Through thoroughly experiments in a special experimental field with different crops and plots for determining the volume of the runoff water in covered basins there was researched the influence of several crops on nutrient losses from soil on a period of 16 years (1995-2010). The experimental plots have been worked conventionally as regard soil tillages, being cropped by: corn, winter wheat, bromus, bean, soybean, according with crop rotation principles. On the basis of water volume that was collected and its turbidity there were estimated the liquid and solid losses per hectare. From these researches there resulted that with cereal crops there is lost the lowest quantity of nutrients from the soil. This way, in comparison the control fallow treatment plot, with wide row crops (corn, soybean, bean) these losses have been of 13.07 – 28.65% while with cereals (bromus, winter wheat) they only reach 7.15%. As compared with the corn crop plot, these losses are of maximum 22.5% with cereals and of 66.4-89.9% with soybean and 3-5 times higher with the fallow control plot. In conclusion, good protective crops as regard the erosion are bromus and winter wheat; they reduce the impact of the rain drops upon the soil and reduce the possibility to disrupt and transport the soil particles. This way, a higher quantity of water enters into the soil and the nutrient and soil losses are much reduced as compared with fallow or corn.The most sensitive crops as regard nutrients are wide row crops and the most resistant, the cereals. The soil kept as permanent fallow records the highest transformations of the chemical features by losing nutrients. The developing status of the crops has an important role as regard the soil losses, water and nutrients. There is recommended to crop bromus on the slope protective strips.*

Key words**:** *slope, nutrient losses, nitrogen, humus, potassium, cereals, corn*

INTRODUCTION

Within hilly zone of Moldavia and Oltenia on slope land the soil nutrients are taken away by one of the following:

- by mean of eroded soil that determines the movement of the nutrient downward on the slope and their accumulation at the base of the slope or in lowlands in function of the transportation capacity of eroding agents;
- nutrient losses along with the runoff water; these losses are influenced by nutrient solubility and soil content of a certain nutrient;
- the movement of these nutrients on soil profile by mean of water that percolate the soil (PURNAVEL, 2002).

As a result of erosion there are moved important quantities of soil and nutrients from cropping land. The quantification of these losses both by eroded soil and runoff water is a permanent concern of the people that work in this domain (AGASII, 1995).

The transformation of the soil chemical features as a result of erosion processes is shown up more rapidly than with physical features. The most important transformations are related with: humus, nitrogen, phosphorus and potassium (JOHANNENSSEN, 2010). These losses

can be diminished by appropriate technologies yet, especially, by choosing a crop assortment that will better cover the land.

MATERIAL AND METHODS

Figure 1. Standard plot

Figure 2. Collecting device

With this respect, between 1995-2010 there was researched at CCDCES Perieni, District Vaslui, soil nutrient losses by mean of liquid and solid runoffs under several field crops. The experiments unfolded with standard plots regarding the control of runoff located in the lower basin of Valea Tarinei, District Vaslui. These plots allow the catching of the runoff water and soil in covered basins in order to avoid errors in the determination of the runoff water. Every plot is equipped with three basins of 1,000 liters, 200 and 50 liters; first basin is fitted with a device for reducing the runoff water volume by 1/5 (FILICHE, 2011).

The soil from the experimental plots has been conventionally cropped with different species: corn, winter wheat, bromus, bean and soybean respecting the crop rotation principles. On the basis of the collected water volume and turbidity there was estimated the liquid and solid losses per hectare. After the analyses for water and soil samples taken after rains there was established the level of nutrient losses per hectare. As control there was used a fallow plot.

RESULTS AND DISCUSSIONS

The nutrient losses by mean of liquid and solid runoff in the experimental plots within 1995-2010 period are presented in the table 1. Of these data there results that during 16 years of research there were lost the following nutrient quantities:

- with cereal crops (bromus and wheat) that are good protective against erosion, the losses are of maximum 176.62 kg/ha of humus, 10.877 kg/ha nitrogen, up to 2.341 kg/ha phosphorus, expressed as P_2O_5, while potassium quantities expressed as K_2O are 5,492 kg/ha;
- with pulses (bean, soybean) there are recorded losses of nutrients ranging between: 1,754 – 2164 kg/ha humus, 95-119 kg/ha nitrogen, 6.9-9.3 kg/ha P_2O_5 and 20.5-25.3 kg/ha K_2O;
- with the corn crop the movement of soil and nutrient are the following: 2,536 – 331 kg/ha humus, 132 kg/ha nitrogen, 10.5 kg/ha P2O5 and 28.2 kg/ha K2O;
- with the control variant there are recorded the following data: 13,421 kg/ha humus, 699 kg/ha nitrogen, 32.7 kg/ha phosphorus and 110.8 kg/ha potassium;

The percent distribution of nitrogen, phosphorus and potassium losses by eroded soil over total losses recorded within this period (table 2) emphasizes the fact that these values have values between: 76.79-97.92% for nitrogen, 24.84 – 85.87% for phosphorus and 10.64-80.90 with potassium.

Table 1

Nutrient losses within 1995-2010 period at Perieni

Crop	Humus	Nitrogen			K_2O			P_2O_5		
	Total	Water	Soil	Total	Water	Soil	Total	Water	Soil	Total
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
Bromus	64,827	1,864	6,169	8,034	2,071	0,247	2,318	0,365	0,395	0,760
Winter wheat	176,622	1,579	9,298	10,877	4,248	1,244	5,492	1,760	0,582	2,341
Soybean	2164,495	6,912	112,159	119,071	10,564	14,822	25,386	2,279	7,101	9,380
Bean	1754,628	5,540	90,210	95,749	8,815	11,717	20,532	1,923	5,065	6,989
Corn	2536,833	7,686	124,734	132,421	10,814	17,483	28,296	2,782	7,739	10,521
Fallow	13421,575	14,516	684,743	699,260	21,180	89,689	110,869	4,627	28,111	32,738

Table 2

Percent distribution of nutrient losses through water and soil,1995-2010, Perieni

	Humus	Nitrogen			K_2O			P_2O_5		
	SOIL	Water	Soil	Total	Water	Soil	Total	Water	Soil	Total
Crop	kg/ha	%	%	kg/ha	%	%	kg/ha	%	%	kg/ha
Bromus	64,827	23,21	76,79	8,034	89,36	10,64	2,318	48,02	51,98	0,760
Winter wheat	176,622	14,52	85,48	10,877	77,35	22,65	5,492	75,16	24,84	2,341
Soybean	2164,495	5,80	94,20	119,071	41,61	58,39	25,386	24,29	75,71	9,380
Bean	1754,628	5,79	94,21	95,749	42,93	57,07	20,532	27,52	72,48	6,989
Corn	2536,833	5,80	94,20	132,421	38,22	61,78	28,296	26,44	73,56	10,521
Fallow	13421,575	2,08	97,92	699,260	19,10	80,90	110,869	14,13	85,87	32,738

Within the third table there is presented a suggestive image of total nutrient losses as compared with the control plot which is permanent fallow.

Table 3

Nutrient losses reported to fallow

Crop	Humus	Nitrogen	K_2O	P_2O5
	%	%	%	%
Bromus	0.48	1.15	2.09	2.32
Winter wheat	1.32	1.56	4.95	7.15
Soybean	16.13	17.03	22.90	28.65
Bean	13.07	13.69	18.52	21.35
Corn	18.90	18.94	25.52	32.14
Fallow	100.00	100.00	100.00	100.00

There can be noticed that with wide row crops the nutrient and soil losses ranged between 13.07-28.65% and with cereals the losses are maximum 7.15% over the control treatment.

The importance of the role of the crops in diminishing the losses of nutrients by erosion are emphasized by data from fourth table that comprises the comparison of nutrient losses with the corn plot, the lowest protective plot. This fact is underlined by W. Chardon in 2007, too.

Table 4

Comparison of nutrient losses with the corn cropped plot

Crop	Humus	Nitrogen	K_2O	P_2O_5
	%	%	%	%
Bromus	2.56	6.07	8.19	7.22
Winter wheat	6.96	8.21	19.41	22.25
Soybean	85.32	89.92	89.71	89.16
Bean	69.17	72.31	72.56	66.43

From these data we can notice the following:

- with cereal crop the losses are of maximum 22.5%;
- with pulses there are oscillations between 66.4-89.9%;
- with permanent fallow the nutrient losses are 3-5 times higher than corn plot (BHRENDT, 2008);

Figures 3, 4, 5 and 6 present the annual losses of humus, nitrogen, K2O and P2O5. From these figures we can notice that the highest nutrient losses have been recorded in 1999, a year with high rains (9) in June, July and August. The highest rain was recorded at 22-23 June when there was a rain of 131.5 mm in four reprises. Also, there can be noticed that the annual nutrient losses with good protective crops (bromus, winter wheat), are much lower over the other crops.

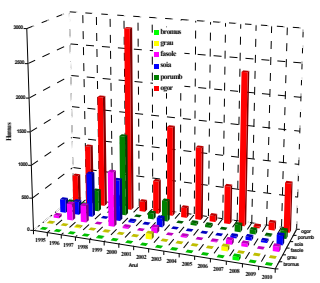

Figure 3. Annual humus losses

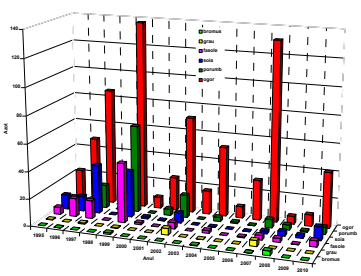

Figure 4. Annual nitrogen losses

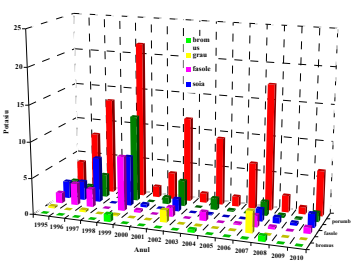

Figure 5. Annual potassium losses

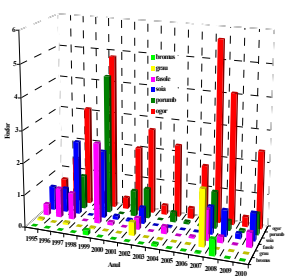

Figure 6. Annual phosphorus losses

CONCLUSIONS

- Text good protective crops as regard the erosion are bromus and winter wheat; they reduce the impact of the rain drops upon the soil and reduce the possibility to disrupt and transport the soil particles. This way, a higher quantity of water enters into the soil and the nutrient and soil losses are much reduced as compared with fallow or corn;
- the most sensitive crops as regard nutrients are wide row crops and the most resistant, the cereals;

- the soil kept as permanent fallow records the highest transformations of the chemical features by losing nutrients;

- the developing status of the crops has an important role as regard the soil losses, water and nutrients;

- there is recommended to crop bromus on the slope protective strips.

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