

## SOIL LOSSES PRODUCED BY EROSION IN THE CONDITIONS FROM NORTH WESTERN PART OF ROMANIA

Dirja Marcel\*, Pantiş Ionuţ\*

\*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048, Oradea, Romania, e-mail: [pantis\\_ionut@yahoo.ro](mailto:pantis_ionut@yahoo.ro)

### **Abstract**

*The researches were carried out during 2009-2011 in the Agricultural Research and Development Station Oradea, on the hill with 10% slope, in the plots for check flow. The soil losses were determined every year. The erosion was present in each of the three years studied, measured determined in leakage plot with a slope of 10% showed that the highest soil losses were recorded in the variant with black fallow (20.3 t/ha/year in 2016, 41.38 t / ha / year in 2015 and 52.68 t / ha / year in 2014). In variant cultivated with maize from the top to the valley soil losses exceeded the losses caused by maize sown on the level curves direction in all three years studied.*

**Key words:** erosion, soil, slope, maize, wheat, pasture, black fallow

### **INTRODUCTION**

Erosion is the detachment process of soil particles (rock), the transport of them to the place of origin and deposited elsewhere.

This phenomenon was noticed in antiquity by Pliniu cel Batrân; even though it is recommended that land with slopes to be worked transverse (Neamţu, 1996). The real attention on this phenomenon so complex effects and damaging was fired by American researchers in the early twentieth century. They found that major rivers that cross the Americas and deposited in the oceans carrying millions of tons of soil. Q.C. Azres, A.F. Gustafson, H.H. Bennet (quoted by Domuţa, 2006) believe that only in the US, with soil washing, lost 43 million tons of nutrients. Gradually, the phenomenon was studied more in all the areas of erosion.

Nationally, the great agronomist Gheorghe Ionescu Şişeşti, in 1925, in paper "The phenomenon of destruction and reconstruction of the soil" was the first to draw attention on damages caused by erosion to Romanian agriculture. The main research regarding the soil erosion in Romania was made Motoc, 1959 in Transylvania, Popa, 1965, 1966, 1973 for soils of Moldova, Luca 1961, soils in Dobrogea, Domuţa, 2001, 2003, for soils of Bihor (Domuţa, 1987-2016).

M. Motoc, 1975 believes that in Romania is lost annually 28.0 million tons of soil from agricultural use. As a result, physical, chemical and biological properties of soil are degraded. As a result, crop production decreases substantially (Popa, Popa, 1976; Neamţu, 1996; Domuţa, 2005, 2006; Domuţa et al., 2003, 2007, 2008, 2012 etc.).

Approximately 2/3 of Romania's territory and 45% of arable land are located on slopes and exposed to erosion. In our country, land degradation through erosion began with the irrational deforestation of large areas of forests in hill and mountain areas and the irrational exploitation of land by agricultural works on the hill in the valley (Budoï, Penescu, 1996).

Types of erosion: a) after it conducted and factors who causes: geological erosion, accelerated erosion; b) after how water acts on land: erosion by drops, surface erosion, erosion runoff, erosion through ravine; c) by the effect on land configuration: surface erosion, depth erosion (Brejea, 2010, 2014; Brejea, Domuța, 2011).

Erosion creates difficulties in arable, increases the frequency and severity of floods, droughts are more pronounced, and the environment is polluted (Budoï, Penescu, 1996; Gus et al., 1998).

The importance and peculiarities fertilization on slopes were highlighted by published works of Moțoc M. 1963, Costache et al. 1961, Popa A. 1977, Dumitrescu N. 1979, Doina Nistor et al. 1979, Colibaș I., 2000, Domuța C. 1988, Ailincăi C. et al., 1990, Domuța C., 2001, 2003 (Brejea, 2014).

## **MATERIAL AND METHOD**

The research carried out in the Agricultural Research and Development Station Oradea, town located a at 45<sup>0</sup>03' north latitude and on 21<sup>0</sup>56' east longitude. Field research is situated on a land with a slope of 10%.

The soil from research field is a preluvosoil with the following profile: Ap = 0-24 cm, El = 24-34 cm; BT<sub>1</sub> = 34-54 cm; Bt<sub>2</sub> = 54-78 cm; Bt / c = 78-95 cm, C = 95-145 cm. It is noted that migration of colloidal clay causes the apparition of horizon El with 31.6% colloidal clay and two horizons of colloidal clay accumulation with BT<sub>1</sub> and Bt<sub>2</sub> with 39,8% and 39,3% colloidal clay.

On sown field was determine available mineral nitrogen content (N-NH + NO<sub>3</sub>) of 3.86 ppm, 6.0 ppm, and 88.5 ppm phosphorus content, potassium mobile content, pH value is 5,5. Wilting point had a medium value on 0-75 cm depth and a great value below this depth. Field capacity is medium on the entire depth and water use capacity is high on depth of 0-50 cm and medium on depth of 50-150 cm.

### **Variants studied were:**

- V<sub>1</sub>: cereal
- V<sub>2</sub>: maize seeded from top to valley
- V<sub>3</sub>: maize seeded on the level curves direction
- V<sub>4</sub>: pasture
- V<sub>5</sub>: black fallow

A plot of leakage has dimensions of 45 x 3.5 m and delimitation was done by metal panels and dikes based on sloping ground.

## RESULTS AND DISSCUSION

### Soil losses produced by erosion in 2014

The values of maximum rainfall registered in 24 hours it was high throughout the period from April to September, in August exceeding the maximum multianual value 36.4 mm 24 hours compared with 27.9 mm / 24 hours (Table 1).

*Table 1*  
Maximum rainfall registered in 24 hours in agricultural year 2014 in the conditions from Oradea

Specification	Month												Average
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
2014	12,8	19,2	4,8	12,9	17,9	18,7	25,8	28,2	1,2	19,2	36,4	16,6	20,31
Value of maximum mulatianual	21,6	39,0	28,1	38,5	44,2	85,8	61,0	49,5	41,8	36,0	27,9	36,4	42,48

In these circumstances soil losses were considerable. Highest soil losses was registered in the variant with black fallow, 52.68 t/ha/year. In terms of location of maize from top to the valley, soil losses was 34.72 t/ha/year. Compared to this variant, by placing maize on the level curves direction soil losses was reduced by 4.82 times, situated close to the allowable limit of 4-6 t/ha/year. At wheat crop the losses of soil was 4.96 t/ha/year and in variant with pasture was registered the lowest soil losses, 3.14 t / ha /year (Table 2).

*Table 2*  
Soil losses registered at different crops from leakage plot, Oradea 2014

Crop	Soil losses					
	t/ha	%	%	%	%	%
1. Pasture	3,14	100	9,0	43,6	63,3	6,0
2. Maize seeded from top to valley	34,72	1105,7	100	482,2	700,0	65,9
3. Maize on the level curves direction	7,20	229,3	20,7	100	145,2	13,7
4. Wheat	4,96	157,9	14,3	68,9	100	9,4
5. Black fallow	52,68	1677,7	151,7	731,6	1062,1	100

### Soil losses produced by erosion in 2015

The values of maximum rainfall registered in 24 hours it was high throughout the period from June and March (Table 3).

*Table 3*

Maximum rainfall registered in 24 hours in agricultural year 2015 in the conditions from Oradea

Specification	Month												Average
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	
2015	2,0	3,4	12,4	19,0	7,3	16,0	14,8	9,8	20,4	11,8	23,4	2,4	11,9
Value maximum multianual	21,6	39,0	28,1	38,5	44,2	85,8	61,0	49,5	41,8	36,0	27,9	36,4	42,48

The biggest soil losses were registered in the variant with black fallow, 41.38 t/ha/year. In the variant with maize cropped from top to valley, the soil losses was 21.32 t/ha/year. Compared to this variant, by placing maize on the level curves direction soil losses was reduced by 3.52 times, situated close to the allowable limit of 4-6 t/ha/year. At wheat crop the losses of soil was 3.76 t/ha/year and pasture variant was registered the lowest losses of soil, 2.10 t / ha / year (Table 4).

*Table 4*

Soil losses registered at different crops from leakage plot, Oradea 2015

Crop system	Soil losses					
	t/ha	%	%	%	%	%
1. Pasture	2,1	100	10	35	56	5
2. Maize seeded from top to valley	21,32	1015	100	352	567	52
3. Maize on the level curves direction	6,04	288	28	100	161	15
4. Wheat	3,76	179	18	62	100	9
5. Black fallow	41,38	1970	194	194	1100	100

### Soil losses produced by erosion in 2016

In 2016 until the end of June rainfall recorded in Oradea determined an erosion lower than usual. The smallest quantity of eroded soil was registered in the variant with pasture 0.2 t /ha, and the highest in the variant version with black fallow, 20.3 t/ha. In the variant with maize sown from top to the valley soil losses exceeded soil losses registered in the maize on the level curves direction with 219.1% (Tables 5-6).

*Table 5*

Maximum rainfall registered in 24 hours in agricultural year 2016 in the conditions from Oradea

Specification	Luna											
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
Agric. year 2016	11,2	5,7	7,4	7,5	11,2	5,6	1,0	20,4	11,4	10,2	25,6	20,4
Value maximum multianual	36,0	27,9	36,4	21,6	39,0	28,1	38,5	44,2	85,8	36,0	27,9	36,4

Table 6

Soil losses registered at different crops from leakage plot, Oradea 2016

Crop system	Soil losses					
	t/ha	%	%	%	%	%
1. Pasture	0,2	100	2,3	7,4	10,5	1,0
2. Maize seeded from top to valley	8,6	4300	100	319,1	45,3	42,4
3. Maize on the level curves direction	2,7	1300	31,3	100	142,1	13,3
4. Wheat	1,9	950	22,1	70,3	100	9,3
5. Black fallow	20,3	6770	236,0	752	9,3	100

## CONCLUSIONS

The research was conducted during 2014-2016 in Agricultural Research and Development Station of Oradea.

The erosion was present in each of the three years studied, measured determined in leakage plot with a slope of 10% showed that the highest soil losses were recorded in the variant with black fallow (20.3 t/ha/year in 2016, 41.38 t / ha / year in 2015 and 52.68 t / ha / year in 2014).

In variant cultivated with maize from the top to the valley soil losses exceeded the losses caused by maize grown on the level curves direction in all three years studied.

Soil losses recorded in the wheat crop were lower than soil losses registered in maize crop.

The lowest soil losses (0.2 t/ha/year in 2016, 2.1 t / ha / year in 2015 and 3.14 t / ha / year in 2014) were registered in variant with pasture.

Research shows the importance of an adequate structure of cultures that should not be missed perennial crops because it provides the highest degree of protection against erosion. Crops straw provides a good degree of protection against soil erosion and maize will practice only in terms of the level curves direction as sowing from top to the valley causes soil losses over the allowable limit in the years characterized generally as drought.

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