THE INFLUENCE OF THE CROP SYSTEM ON SOIL AND YIELD LOSSES IN THE CONDITIONS OF THE EROSIONED SOILS FROM BIHOR

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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 biggest soil losses were registered in the variant with clean fallow, followed by the variants with maize seeded from top to valley, maize seeded on the level curves, wheat and pasture. The soil erosion had a bigger effect in the variant with maize seeded from top to valley in comparison with the variant with maize seeded on the level curves. The soil losses registered in the variant with maize seeded from top to valley were bigger than the soil losses registered in the variant with maize seeded on the level curves direction. As consequence, the bigger differences of the yields determined in the base and top of the hill every year studied.

Key words: *check flow plots, erosioned soil, maize, wheat, pasture, clean fallow*

INTRODUCTION

Bihor County occupies an important part of the North-Western Romania. Bihor County, an area of 200,000 ha (38 % from the agricultural land), has lands with slopes bigger than 5 %, where erosion is possible. The researches regarding the erosion in this area were started in Hidişelu de Sus and Pocola in 1983 by Colibaş and Mihuţ who also conducted researches regarding the soil management against erosion. After 1986 Domuţa started the researches in Pocola; during 1990-1994 the researches were carried out in Beiuş and then in Oradea; the researches regarding the soil erosion determinations using the control plot and the soil management (crop rotation, green manure, chemical fertilization) were conducted in Oradea, as well (Domuţa, 1999, 2005, 2006).

MATERIAL AND METHOD

The researches were carried out during 2009-2011 in Oradea on a hill with 10% slope (Fig.1). The plots for the soil erosion measurement were placed in the year 2000 in the following variants: clean fallow, maize from top to valley, maize on the level curve direction, wheat, pasture. The plots dimensions were 45x3.5 m and metal panels were placed at the base of the plots as well as soil dams between the plots on the hill.

Four sequences were harvested in every variant with maize in the top and at the base of the hill. The yield data were calculated by variance analysis methods. The rainfall registered in the studied period was of 501.4 mm in 2009, 869.0 mm in 2010 and of 569.7 mm in 2011.

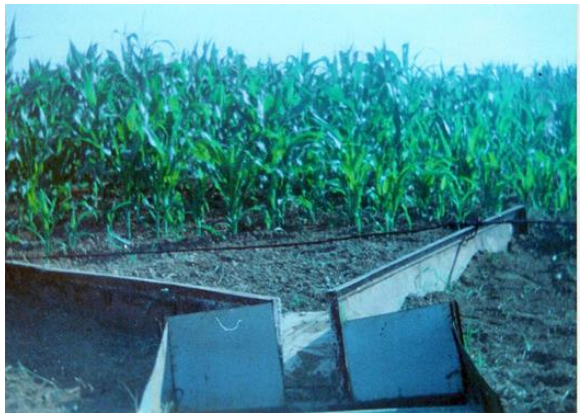

Fig.1 Plots for checking the flow of the erosion soil in Oradea

RESULTS AND DISSCUSIONS

In the drought year 2009, the soil losses exceeded the allowed limits (4-6 t/ha/year) in the variant with clean fallow and with maize seeded from the top to the valley of the hill. (tabel 1)

Table 1

Soil losses registered in different crops, Oradea 2009

Crop	Soil losses					
	t/ha	%	%	%	%	%
2009						
1. Pasture	0.2	100	2,3	7.4	10.5	1.0
2. Maize from top to valley	8.6	4300	100	319.1	45.3	42.4
3. Maize on the level curves	2.7	1300	313	100	142.1	13.3
4. Wheat	1.9	950	22.1	70.3	100	9.3
5. Clean fallow	20.3	6770	236.0	752	9.3	100

In the year 2010, the smallest soil losses were registered in the variant with pasture, 2.1 t/ha/year. The highest level of soil losses, 41.38 t/ha/year, was registered in the variant with clean fallow, 1870% bigger than in the variant with pasture. In the variant with maize seeded from top to the valley, the determined soil losses, 21.38 t/ha/year, were smaller than the soil losses determined in the variant with clean fallow; however, they were bigger than the soil losses (6.04 t/ha/year) determined in the variant with maize seeded on the level curves direction, in the variant with wheat (3.76 t/ha/year) and in the variant with pasture (2.1 t/ha/year). (tabel 2)

Table 2

Soil losses registered in different crops, Oradea 2010

Crop	Soil losses					
	t/ha	%	%	%	%	%
2010						
1. Pasture	2.1	100	10	35	56	5
2. Maize from top to valley	21.32	1015	100	352	567	52
3. Maize on the level curves	6.04	288	28	100	161	15
4. Wheat	3.76	179	18	62	100	9
5. Clean fallow	41.38	1970	194	194	1100	100

In the year 2011, soil losses exceeding the allowed limits were registred in the variant with clean fallow (29.6 t/ha/year) and with maize seeded on the level curves direction (12.3 t/ha/year). The yield losses were 54% smaller in the maize seeded on the level curves direction than the yield losses in the variant with maize seeded from top to valley of the hill. The yield soil losses registered in wheat were of 3.76 t/ha/year; the smallest soil losses, 1.7 t/ha/year, were registered in the variant with pasture. (tabel 3)

Table 3

Soil losses registered in different crops, Oradea 2011

Crop	Soil losses					
	t/ha	%	%	%	%	%
1. Pasture	1.7	100	14	30	47	6
2. Maize from top to valley	12.3	723	100	215	342	42
3. Maize on the level curves	5.7	335	46	100	158	19
4. Wheat	3.6	212	63	63	100	12
5. Clean fallow	29.6	1741	519	519	822	100

On average, the biggest soil losses were registered in the variant with clean fallow, 30.42t/ha/year, during the studied period. The soil losses in the other studied variants were of 14.07 t/ha/year in the variant with maize seeded from top to valley, of 4.81 t/ha/year in the variant with maize seeded on the level curves, of 3.08 t/ha/year in the variant with wheat and of 1.33 t/ha/year in the variant with pasture. (Tabel 4)

Table 4

Soil losses registered in different crops, Oradea 2009-2011

Crop	Soil losses					
	t/ha	%	%	%	%	%
1. Pasture	1.33	100	9	27	43	4
2. Maize from top to valley	14.07	1057	100	292	456	46
3. Maize on the level curves	4.81	361	34	100	156	15
4. Wheat	3.08	231	21	64	100	10
5. Clean fallow	30.42	2287	216	632	988	100

In the year 2009, the differences between the yield registered at the base of the hill and the one registered at the top of the hill were of 43% in the variant with maize seeded from top to valley and of 20% in the variant with maize seeded on the level curves direction. The differences were very statistically significant. (tabel 5)

Table 5

Yield maize registered at the top and base of the plots for check flow, Oradea 2009

Variant	Position on the hill	Yield kg/ha	Difference		Statistically significant
			kg/ha	%	
From top to valley	Top	3020	-	-	Control
	Base	4320	1320	43	xxx
$LSD_{5\%}$ 210; $LSD_{1\%}$ 390; $LSD_{0.1\%}$ 540					
On the level curves	Top	4250	-	-	Control
	Base	5110	860	20	xxx
$LSD_{5\%}$ 190; $LSD_{1\%}$ 330; $LSD_{0.1\%}$ 524					

Yields were registered in the variant with maize seeded on the level curves direction and from top to valley, both at the top of the hill and the foot of the hill. The differences between foot of the hill and top of the hill were of 40% in the variant with maize seeded from top to valley and of 16% in the variant with maize seeded on the level curves direction. (table 6)

Table 6

Yield maize registered in the top and base of the plots for check flow, Oradea 2010

Variant	Position on the hill	Yield kg/ha	Difference		Statistically significant
			kg/ha	%	
From top to valley	Top	5410	-	-	Control
	Base	7574	2164	40	xxx
$LSD_{5\%}$ 210		$LSD_{1\%}$ 390		$LSD_{0.1\%}$ 610	
On the level curves	Top	6800	-	-	Control
	Base	7890	1090	16	xxx
$LSD_{5\%}$ 170		$LSD_{1\%}$ 290		$LSD_{0.1\%}$ 574	

The differences between the yield from base of the hill and from top of the hill registered in 2011 were of 52% in the variant with maize seeded from top to valley and of 12% in variant with maize seeded on the level curves direction. (tabel 7)

Table 7

Yield maize registered at the top and base of the plots for check flow, Oradea 2011

Variant	Position on the hill	Yield kg/ha	Difference		Statistically significant
			kg/ha	%	
From top to valley	Top	4010	-	-	Control
	Base	6100	2090	52	xxx
		$LSD_{5\%}$ 180	$LSD_{1\%}$ 310		$LSD_{0.1\%}$ 580
On the level curves	Top	5370	-	-	Control
	Base	6020	650	12	xxx
		$LSD_{5\%}$ 190	$LSD_{1\%}$ 330		$LSD_{0.1\%}$ 660

On average, during the studied period, the differences of the yield maize registered at the foot of the hill and at the top of the hill were of 45% in the variant with maize seeded from top to valley and of 16% in the variant with maize seeded on the level curves direction. (tabel 8)

Table 8

Yield maize registered in the top and base of the plots for check flow, Oradea 2009-2011

Variant	Position on the hill	Yield kg/ha	Difference		Statistically significant
			kg/ha	%	
From top to valley	Top	4146	-	-	Control
	Base	5998	1852	145	xxx
		$LSD_{5\%}$ 210	$LSD_{1\%}$ 450		$LSD_{0.1\%}$ 680
On the level curves	Top	5473	-	-	Control
	Base	6337	864	16	xxx
		$LSD_{5\%}$ 195	$LSD_{1\%}$ 310		$LSD_{0.1\%}$ 460

CONCLUSIONS

The researches carried out during 2009-2011 at the Agricultural Research and Development Station Oradea in the plots for flow check placed on the hill with 10% slope determined the following conclusions:

- The soil losses were determined every year in the all variants: clean fallow, maize seeded from top to valley, maize seeded on the level curves, wheat and pasture. The biggest soil losses were registered in the clean fallow variant followed by the maize seeded from top to valley, maize seeded on the level curves, wheat and pasture. The soil losses from clean fallow and maize seeded from top to valley exceeded the allowed limits.
- In all the studied variants, the biggest quatity of the soil losses were registered in the year 2010, the year with the biggest quantity of the annual rainfall, 869.0 mm.
- The seeding of the maize from top to valley determined the biggest differences between the yields obtained at the top of the hill and those obtained at the base of the hill in comparison to the yields obtained at the top of the hill and the base of the hill from the variant with maize seeded on the level curves.

- In the variant with maize seeded on the level curves the yields were bigger than the yields obtained in the variant with maize seeded from top to valley both at the top and at the base of the hill.

The research findings emphasized the importance of the crop choice for the land with slope and the need for the maize seeding on the level curves.

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