THE GREEN MANURE AND MANURE INFLUENCE ON THE MAIN PHYSICAL PROPERTIES OF THE EROSIONED SOIL FROM NORTH-WESTERN ROMANIA

Domuța Cornel*, Șandor Maria, Borza Ioana, Brejea Radu, Bara Vasile, Ciobanu Gheorghe, Bara Camelia, Bara Lucian, Sabău Nicu Cornel, Samuel Alina Dora, Vuşcan Adrian, Moza Ana, Koteles Nandor

**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: domuta_cornel@yahoo.com*

Abstract

The paper based on the researched obtained in 2010 in an experiment placed in 2000 in Oradea on a hill with 10% slope. The mixtures of green manure lupin+oat+rape and lupin+oat determined a better values of the structure, bulk density, total porosity, penetration rezistance and hydraulic conductivity than lupin like pure crop and than the mixture vetch+oat and ryegrass. The manure 25 t/ha and especially manure 50 t/ha determined the best values of the studied physical properties than green manure. The results researches sustain the opportunity of the green manure like mixture (lupin+oat+rape, lupin+oat) and of the manure for improve of the physical parameters of the erosioned soils.

Keywords: green manure, manure, structure, bulk density, penetration rezistance, hydraulic conductivity

INTRODUCTION

One of the components of the sustainable agriculture is the organic fertilization. (Ailincăi et al., 1990; Brejea et al, 2001, Budoi, Penescu, 1996; Guş et al., 1998, Neamțu T., 1996) Among the type of the organic fertilizer, the green manure occupied a distinct place, very important. (Flaig et al.,1975, Samuel A. et al., 2006)

During the time, many researches (Broadbent and Norman, 1947; Hallam and Bartholomew, 1953, Flaig et al, 1975 etc., referenced by Eliade et al, 1983) established that the green manure of Lupinus sp. in pure crops, due the small C/N report, does not improve the soil's humus content. The biological school from Western Europe solved this problem using leguminous (vetch) with gramineous (rye, oat, ryegrass) mixture (Roger, 1976, referenced by Eliade et al, 1983); this mixture has an optimum report monosaharide (cellulose) nitrogen. In Romania, the vetch is known only as a fodder and to recommend it for green manure would not be successful. Lupinus sp. was and is known as a green manure. The use of the green manure on the erosioned soil is very important possibility to improve the soil parameters and to increase the yields (Neamtu, 1996, Pintilie et al, 1980). Domuța, was made the research regarding the use of the mixture with Lupinus sp. and gramineous starting 1988 on erosined soil from Pocola, Bihor county (Domuța, 1999, 2003, 2006; Domuța et al., 2003, Domuța et al., 2003).

MATERIAL AND METHODS

The research started in 2000 and were carried out at Agricultural Researches and Development Station Oradea on a preluvosoil with 10% slop. The soil is characterized by a humus content of 2.1% în Ap (0-20 cm) horizon, pH of 6.3, phosphorus of 31.5, bulk

density of 1.44 g/cm^3 and total porosity is of 47%. Field capacity (24.3%) and wilting point (9.1%) have the median values.

The experiments had two factors: organic fertilization and annual fertilization. Organic fertilization included the variants: control, *Lupinus angustifolius*; vetch +oat+ryegrass; *Lupinus angustifolius* + oat; *Lupinus angustifolius*+oat+rape; rape; rape+oat; manure 25 t/hectare and manure 50 t/hectare. Annual fertilization included the graduations: N_0P_0, $N_{120}P_{90}$. Number of repetition used: 4; the plot surface: 100 m^2; the experiments surface: 7200 m^2.

The green manures, were sowed like 2nd crop in the 15th July. The seed rates used were: *Lupinus angustifolius* in pure crop, 200 kg/hectare; *Lupinus angustifolius* in mixture, 100 kg/hectare; vetch, 40 kg/hectare; oat, 80 kg/hectare; ryegrass, 10 kg/hectare; rape 20 kg/hectare in pure crop and 10 kg/hectare in mixture crop.

Green manures harvesting were manure at the flowering of the *Lupinus angustifolius*; the green manures were maintained on the soil surface 15 days and after that a plough land was made.

Crop rotation used: wheat-maize. Soil sample was prelevated in 2010 on 0-30 cm depth in four repetition from wheat. Soil structure were determined by Cseratzki method and bulk density, penetration rezistance and hydraulic conductivity were determined by usually method in the laboratory of the Agricultural Research and Development Station Oradea.

RESULTS AND DISCUSSIONS

Green manure and manure influence on soil structure

Macrostructure hydrostability included the aggregates with diameter bigger than 0.25 mm. The total structure degree in the control was of 55.8%. In the variants with mixture of green manure the total structure degree increased in comparison with the control with 2.3% (rape+oat), 6.7% (vetch+oat+rape), 7.6% (lupin+oat+rape) but the differences are unsignificant statistically; a few increase was registered in the variant with rape and in the variant with lupin like pure crop a few smaller value of the total structure degree was registered (55.72%) in comparison with manure (15.3% and 22.4%) are significant and distingue significant statistically. (table1)

Table 1

Green manure and manure influence on macroagregates hydrostability of the erosioned soil from Oradea, 2010

Variant	Diameter of aggregates, mm				Total > 0.25 mm	
	> 5	3.1 – 5.0	1.1 – 5.0	0.25 – 1.0	%	%
Control	4.28	7.20	7.40	36.9	55.80	100
Lupin	4.02	6.65	7.55	37.5	55.72	99.8
Vetch+oat+ryegrass	5.80	7.90	8.02	37.8	59.52	106.7
Lupin+oat	5.82	8.00	7.30	38.9	60.02	107.6
Lupin+oat+rape	5.90	8.02	7.20	39.5	60.62	108.6
Rape	4.30	6.70	7.25	38.6	56.85	101.9
Rape+oat	4.36	7.15	7.40	38.2	57.11	102.3
Manure 25 t/ha	7.93	10.65	8.24	37.9	64.32	115.3
Manure 50 t/ha	9.71	9.53	10.31	38.19	68.30	122.4
	LSD $_{5\%}$	**1.50**	**1.60**	**1.90**	**1.70**	**7.8**
	LSD $_{1\%}$	**2.30**	**2.90**	**3.30**	**2.60**	**11.6**
	LSD $_{0.1\%}$	**3.80**	**4.35**	**5.10**	**4.20**	**19.6**

Green manure and manure influence on bulk density and total porosity

The soil from the research field has a colloid clay content in the Ap horizon of 32.0% and a value of bulk density bigger than 1.47 g/cm^3 characterizes a very settled soil and a very big value of the bulk density. All the organic fertilizers used determined the improve of the bulk density. The differences in comparison with the control were significant statistically and included the values of the bulk density in the class "big" with the soils "moderate settled". The differences registered in the variants with manure are distingue significant but the value determined in the variant with 50 t/ha belongs "the median" class with the soils a "few settled" . (table 2)

Table 2

Green manure and manure influence on buk density (BD) of the erosioned soil from Oradea, 2010

Variant	BD		Difference %	Statistically significant %
	g/cm^3	%		
Control	1.53	100	-	Control
Lupin	1.41	92.1	-7.9	o
Vetch+oat+ryegrass	1.40	91.5	-8.5	o
Lupin+oat	1.39	90.8	-9.2	o
Lupin+oat+rape	1.38	90.1	-9.9	o
Rape	1.43	93.5	-6.5	o
Rape+oat	1.42	92.8	-7,2	o
Manure 25 t/ha	1.36	88.9	-11.1	oo
Manure 50 t/ha	1.34	87.6	-12.4	oo

LSD $_{5\%}$= 0.10; LSD $_{1\%}$= 0.16; LSD $_{0.1\%}$= 0.30

The total porosity in the control (43%) is very small. Lupin pure crop and the mixture vetch+oate+ryegrass determined the increases significant statistically of the total porosity. The increases from variants with lupin+oat+rape, lupin+oat and manure 25 t/ha were distingue significant (12% and 13%); the increase from variant with manure 50 t/ha was very significant statistically only. (table 3)

Table 3

Green manure and manure influence on total porosity (TP) of the erosioned soil from Oradea, 2010

Variant	TP		Difference %	Statistically significant %
	%	%		
Control	43	100	-	Control
Lupin	47	109	9	x
Vetch+oat+ryegrass	47	109	9	x
Lupin+oat	48	112	12	xx
Lupin+oat+rape	48	112	12	xx
Rape	46	107	7	-
Rape+oat	46	107	7	-
Manure 25 t/ha	49	113	13	xx
Manure 50 t/ha	50	116	16	xxx

LSD $_{5\%}$= 7; LSD $_{1\%}$= 10; LSD $_{0.1\%}$= 15

Green manure and manure influence on penetration rezistance

The values of the penetration rezistance determined in the studied variant include the soil in the class with small "values of the penetration rezistance". In the variant with lupin, rape and rape+oat the values of the penetration rezistance decreased significant in comparison with the value (25.6 kgf/cm^2) determined in the control. The decreases were distingue significant in the variant with manure 25 t/ha, lupin+rape+oat and

vetch+oat+ryegrass and very significant statistically in the variant with manure 25 t/ha. (table 4)

Table 4

Green manure and manure influence on penetration rezisance (PR) of the erosioned soil from Oradea, 2010

Variant	PR		Difference %	Statistically significant %
	Kgf/cm^2	%		
Control	25.6	100	-	Control
Lupin	20.6	80.4	-19.6	oo
Vetch+oat+ryegrass	20.1	78.5	-21.5	oo
Lupin+oat	20.5	79.9	-20.1	oo
Lupin+oat+rape	19.5	76.0	-24.0	o
Rape	21.7	84.7	-15.3	o
Rape+oat	21.5	83.9	-16.1	-
Manure 25 t/ha	17.6	68.6	-31.7	oo
Manure 50 t/ha	15.8	61.7	-38.3	ooo

LSD $_{5\%}$= 3.02; LSD $_{1\%}$= 5.01; LSD $_{0.1\%}$= 9.7

Green manure and manure influence on hydraulic conductivity

In comparison with hydraulic conductivity of the soil from the control in the all studia variant were determined the bigger values. The values of the hydraulic conductivity registered in the all variants indicate a soil with a big hydraulic conductivity. The differences in comparison with the value (13.89 mm/h) from the control variant were unsignificant statistically in the variants with rape and rape+oat, significant statistically in the other variant with green manure, distingue significant in the variant with manure 25 t/ha and very significant statistically in the variant with manure 50 t/ha. (table 5)

Table 5

Green manure and manure influence on hydraulic conductivity (K) of the erosioned soil from Oradea, 2010

Variant	K		Difference %	Statistically significant %
	mm/h	%		
Control	13.89	100	-	Control
Lupin	15.97	114.9	14.9	x
Vetch+oat+ryegrass	16.19	116.5	116.5	x
Lupin+oat	16.91	121.7	21.7	x
Lupin+oat+rape	16.57	119.3	19.3	x
Rape	14.32	103.1	3.1	-
Rape+oat	14.36	103.4	3.4	-
Manure 25 t/ha	18.61	133.9	33.9	xx
Manure 50 t/ha	20.61	148.3	48.3	xxx

LSD $_{5\%}$= 2.0; LSD $_{1\%}$= 3.9; LSD $_{0.1\%}$= 5.02

CONCLUSIONS

The researches were carried out in an experiment placed in the year 2000 on an erosioned soil from Agricultural Research Development Station Oradea. The conclusions of the researches are the following:

- Soil structure was improved statistically assured in the variant with manure 25 t/ha and 50 t/ha. The pure crop for green manure of lupin didn't determined the increase of the

total structure degree. The mixture lupin+oat+rape, lupin+oat and vetch+oat+rygrass determined the increases of 8.6%, 7.6% and 6.7% but unsignificant statistically; the mixture rape+oat determined a smaller difference (2.3%).

- All the variants with green manure determined the decrease of the bulk density values and the increase of the total porosity in comparison with the values (1.56 g/cm^3; 43%) determined in the control. The biggest differences in comparison with the control were registered in the variant with the manure 50 t/ha (12.4%; 16%).
- The penetration rezistance decreased in comparison with the control significant statistically in the variant with lupin, rape and rape+oat, distingue significant in the variant with manure 25 t/ha, lupin+oat+rape, lupin+oat, vetch+oat+ryegrass and very significant statistically in the variant with manure 50 t/ha.
- In comparison with hydraulic conductivity from control (13.89 mm/h) in the variant with rape and rape+oat a bigger value was determined but the differences are not significant statistically. In the other green manure variant the differences are significant statistically; in the variant with green manure the difference (33.9%) is significant statistically and in the variant with manure 50 t/ha, the difference (48.3%) is very significant statistically.

The results research emphasized the need of the green manure and manure for improve of the physical properties of te erosioned soils and the use of the mixture lupin+oat+rape, lupin+oat like green manure..

REFERENCES

1. Ailincăi C. Şi col., 1990, Influenţa lucrărilor antierozionale asupra eroziunii şi producţiei agricole. Cereale şi plante tehnice nr.1
2. Brejea R., Domuţa C., Sabău N.C., Şandor M., 2001, Modificările însuşirilor fizice şi chimice ale solului sub influenţa eroziunii în condiţiile zonei Beiuşului. Analele Universităţii din Oradea
3. Budoi Gh., Penescu A., 1996 , Agrotehnica, Editura Ceres, 1996, 290-340.
4. Domuţa C., 1999, Ameliorarea fertilităţii solurilor erodate pe terenurile în pantă din vestul ţării. Cereale şi plante tehnice nr. 7/1999.
5. Domuţa C. şi colab. 2003, Agricultura durabilă pe terenurile arabile din Bihor. Editura Universităţii din Oradea
6. Domuţa C., 2005, Agrotehnica terenurilor în pantă din nord – vestul României. Editura Universităţii din Oradea, 96-117.
7. Domuţa C., 2006, Agrotehnica diferenţiată. Editura Universităţii din Oradea, 377-442.
8. Domuţa C., 2006, Tehnică experimentală, Ed. Universităţii Oradea
9. Eliade Gh., Ghinea L., Ştefanic Gh., 1983, Bazele biologice ale fertilităţii solului. Editura Ceres, pag. 127-130.
10. Flaig W. şi colab., 1975, Soil components. Springer –Verlag. New York
11. Guş P., Lăzureanu A., Săndoiu D., Jităreanu G., Stancu I., 1998, Agrotehnica. Editura Risoprint, 496-499.
12. Neamţu T., 1996, Ecologie, eroziune şi agrotehnică antierozională. Ed. Ceres Bucureşti, 17-28; 127-155
13. Samuel A.D., Drăgan – Bularda M., Domuţa C., 2006, The effect of green manure on enzymatic activities in a brown luvic soil. Studia Universitas Babeş – Bolyai, Biologia, L I, 83-93.