THE INFLUENCE OF THE CROP TYPE ON PHYSICAL AND CHEMICAL PROPERTIES OF THE HAPLIC LUVISOL

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Abstract

The researches were carried out in 2012 and 2013 on the haplic luvisol cultivated in two variant such as: cropland cultivated in 2012 with wheat and in 2013 with maize. Soil samples were collected from plots of an experimental field localized at 10 kilometers from Oradea, on March and October. Some physical and chemical properties of the soil samples were determined: soil moisture, pH, organic, nitrate and ammonium concentration. The aim of this paper was to evaluate the differences between physical and chemical properties of the haplic luvisol from Crisurilor Plain in different croping systems conditions (wheat crop and maize crop). Under wheat crop the haplic luvisol presented a higher moisture content compared with the values registered under corn crop. The use of mineral fertilizers produced the haplic luvisol alkalinization. Under wheat crop the haplic luvisol showed lower values of pH. The content in ammonia nitrogen was higher in the crop year 2013 compared to the year crop 2012. The content in nitric nitrogen was found higher under the both crops.

Keywords: crop, soil, properties, season.

INTRODUCTION

Soils have a large number of essential functions, some of them for the environment (protection function) and others for human or animal nutrition (production function).

Most soil functions are significantly influenced by the quantity and quality of soil organic matter. This factor is essential for soil organisms and their diversity, plant nutrition, water holding capacity, aggregate stability and erosion control (Ellen Kandeler, 2005).

Soil microbiology traditionally deals with the study of microorganisms and their processes in soil. The interaction among organisms and their environments involves soil ecology (Paul 2007).

Most soils are classified on the basis of their chemical and physical properties. The reason for this is that soil chemical and physical properties are more readily defined and measured than their microbiological properties.

The degree to which soil properties variability affects microbial activity has implication for the understanding of ecosystem structure and the management of ecosystem resources.

MATERIAL AND METHODS

The researches were carried out in 2012 and 2013 on the haplic luvisol cultivated in two variant such as: cropland cultivated in 2012 with wheat and in 2013 with maize.

Soil samples were collected from plots of an experimental field localized at 10 kilometers from Oradea, on March and October.

The samples were mixed; stones, plant and animal residues were eliminated and they were sieved (mesh 2 mm). Soil samples were analysed immediately after adjusting.

Some physical and chemical properties of the soil samples were determined as follows: soil moisture using gravimetrically method by oven-drying fresh soil at 105^0C, pH in 1:2:5 soil water suspension by pH-meter, organic material by using Walkley-Black method, nitrate (NO_3-N) determination by colorimetric method and ammonium with Nessler reagent.

The results were analyzed with the ″Student″ statistics method to determine the significance or non-significance of the differences between the values.

RESULTS AND DISCUSSION

The most recently studies have shown that the treatments with pesticides and irrational application of fertilization can affect the soil properties. In croplands are always applied chemical fertilizers and treatment with pesticides.

The chemical properties of soil influence also the numerical presence of microorganisms. Dynamics of biological activity of soil and seasonal variation of soil microorganisms may be the results of the changes occurring in soil chemistry.

The aim of this paper is to evaluate the differences between physical and chemical properties of the haplic luvisol from Crisurilor Plain in different croping systems conditions (wheat crop and maize crop).

The main objectives of this research are:

1. determination of the physical and chemical properties of the haplic luvisol under wheat crop and maize crop;
2. differences among tested plots;
3. differences between spring and autumn seasons;

The results of physical and chemical properties of the studied cropland are presented in the following.

Table 1

Haplic luvisol moisture content (%)

The year of the study	Crop type	Vegetation period	Depth (cm)	Values
2012	Wheat crop	spring	0-20	18.50
			20-40	15.59
		autumn	0-20	15.20
			20-40	13.05
2013	Maize crop	spring	0-20	8.90
			20-40	17.93
		autumn	0-20	7.97
			20-40	9.47

Table 2

pH of the haplic luvisol

The year of the study	Crop type	Vegetation period	Depth (cm)	Values
2012	Wheat crop	spring	0-20	7.85
			20-40	7.88
		autumn	0-20	6.65
			20-40	6.80
2013	Maize crop	spring	0-20	7.80
			20-40	8.00
		autumn	0-20	7.80
			20-40	7.90

Table 3

Nitrates content (ppm) of the haplic luvisol

The year of the study	Crop type	Vegetation period	Depth (cm)	Values
2012	Wheat crop	spring	0-20	10.9
			20-40	11.1
		autumn	0-20	26.6
			20-40	13.3
2013	Maize crop	spring	0-20	9.3
			20-40	8.4
		autumn	0-20	20
			20-40	18.7

Table 4

Ammonia nitrogen content (ppm) of the haplic luvisol

The year of the study	Crop type	Vegetation period	Depth (cm)	Values
2012	Wheat crop	spring	0-20	0.6
			20-40	0
		autumn	0-20	0.8
			20-40	0.8
2013	Maize crop	spring	0-20	17.2
			20-40	5.3
		autumn	0-20	0.5
			20-40	0.4

Table 5

Humus content (%) of the haplic luvisol

The year of the study	Crop type	Vegetation period	Depth (cm)	Values
2012	Wheat crop	spring	0-20	2.93
			20-40	2.34
		autumn	0-20	2.68
			20-40	2.08
2013	Maize crop	spring	0-20	3.26
			20-40	3.15
		autumn	0-20	3.25
			20-40	2.63

The requirements of wheat concerning the humidity are moderate to high and varies over stages of vegetation. Corn is snobbish towards moisture but presenting resistance to drought. Under wheat crop the haplic luvisol presented a higher moisture content compared with the values registered under corn crop, but the differences were not significant. The vital activity of microorganisms derive in an aqueous medium, so that the presence of enough humidity is a necessary condition for their proper development in the soil.

Under the influence of the maize crop the use of mineral fertilizers produced the haplic luviosl alkalinization. The effects of alkalinization approves the worsening of physical and hydrophysical soil properties and of the soil argilization (increase of particle dispersion).

Under wheat crop the haplic luvisol showed lower values of pH (the wheat crop produce the soil acidification). Low values of pH changes the mobility and absorption of microelements favoring their transition in easily water soluble forms and their removal by precipitation water washout. The uptake of nutrients by microorganisms is also influenced by the soil reaction. Thus the nitrogen is assimilated more easily within the range of pH 6.0-6.8.

During the 2 years of study, there were significant differences in terms of content in ammonium nitrogen of the haplic luvisol, which is higher in the crop year 2013 compared to the year crop 2012 ($p<0,05$).

In the studied cropland, both under the wheat crop and the maize crop the nitric nitrogen content was higher and so, the use of mineral fertilizers has led to the increase of nitric nitrogen content.

The amount of nitrogen fertilizers increased nitrogen soil supply, either in the form of nitric nitrogen introduced, either by fixing in the adsorbtiv complex of the soil in the form of exchangeable ammonium, made available to plants through cation exchange reactions.

Nitrification activity is more intense in croplands than in pasture. In cultivated soils, soil aeration with the appropriate agrotechnical works contributing to a good ventilation and thus can increase considerably the degree of nitrification. The concentration of nitrates in the soil depends on: moisture, aeration, crop type, mineralization and immobilization capacity of the soil. Nitrification is done best at a slightly alkaline pH. Rarely the content of soil nitrate can be used as an index of soil mineral nitrogen needs. Nitrification has the maximum intensity in the summer months. The nitrification process is more active when the soil is cultivated for a long time with agricultural crops.

CONCLUSIONS

Under wheat crop the haplic luvisol presented a higher moisture content compared with the values registered under corn crop, but the differences were not significant.

Under the influence of the maize crop the use of mineral fertilizers produced the haplic luviosl alkalinization. Under wheat crop the haplic luvisol showed lower values of pH (the wheat crop produce the soil acidification).

The content in ammonia nitrogen was higher in the crop year 2013 compared to the year crop 2012. The content in nitric nitrogen was found higher in both crops.

In the wake of the results it was found that both form nitric nitrogen and ammonium nitrogen presented higher values in autumn compared to the spring, during the years of study. This may be due to high level of nitrogen fertilisers solubilization and of their levigation produced by the winter precipitation, in spring the soil containing very little nitrogen.

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REFERENCES

1. Ayers R.S. and Wescot D.W., 1989 – Water quality for agriculture. FAO. Irigation and Dreinage Paper, Rome.
2. Borlan Z., şi colab., 1994 – Fertilizarea şi fertilitatea solurilor (compendiu de agrochimie). Editura Ceres, Bucureşti.

3. Domuța C. şi colab., 1999 – Modifications in the Soil – Water – Plant System under the irrigation influence (1976 – 1998) in potato crop from Western Romania.Lucrările "Third International Symposium Irrigation of Horticultural Crops".Lisboa , Portugal.
4. Domuța C . şi colab., 1999 – Researches concerning the use of the neutron method (1985 – 1988) to determine the crop coefficient (Kc) in the Crişurilor Plain conditions. Debreceni Agrartudomány Egyetem.Agrokemiai es Talajtani.
5. Domuța C . şi colab., 2000 – Modifications in the soil – water – plant sistem under the irrigation influence in soy bean crop from Western Romania.Lucr. "Second Conference of Agricultural Research Institutes in Carpathian Region", Debrecen Hungary.
6. Domuța C. şi colab., 2001 – Researches regarding the water requirement in the main crop from Western Romania (1976-2000). Proceedings of "19th European Regional Conference, Sustainable use of land and water" 4 – 8 June Brno and Prague 2001.
7. Domuța C. şi colab., 2001 - Researches concerning the covering sources of the water consumption in the main crops from Crişurilor Plain during 1976 – 2000, University of Debrecen.
8. Nave, L., Vance, E., Swanston,C., and Curtis, P. (2009). Impacts of elevated N inputs on north temperate forest soil C storage, C/N and net N-mineralization J. Geoderma. 153: 231-240.
9. Kandeler E., 2007. Physiological and biochemical methods, In: Paul E.A. (ed.): Soil Microbiology. Ecology and Biochemistry, Vol. 3. Academic Press and Elsevier Inc., Burlington: 53–83.
10. Köteles N., Ana Cornelia Pereş, 2010, Air's temperature at surface of the soil (level 0 m), in the area of Oradea City, Analele Universității din Oradea, Fascicula Protecția Mediului, Vol. XV, Anul 15, Editura Universității din Oradea, 2010, ISSN 1224-6255, pag. 661-667
11. Matsumura, F., 1989. Biotic degradation of pollutants. Published by John Wiley –Sons Ltd.
12. Pereş Ana Cornelia, 2012, Meteorologie şi climatologie, Editura Universității din Oradea, ISBN 978-606-10-0962-6, nr. pag. 253.
13. Oneț A. 2010. Research on the influence of fertilizers and pesticides pollution on biological activity and other properties of soil in the plains Crisuri. PhD Thesis, University of Transilvania Brasov.
14. Oneț A., Oneț C., 2011. Numerical variation of the main groups of microorganisms monitored in haplic luvisol. University of Oradea Annals, Environmental Protection Section, vol. XVI, Year 16, University of Oradea Publishing House.
15. Oneț A., Oneț C, 2010. Study of biological activity of haplic luvisol. Natural Resources and Sustainable Development, University of Oradea Publishing House.
16. Onet C., Onet A., Domuta Cr., Vuscan A., 2012. Research regarding the effect of some pesticides on soil microorganism. A Bihar-hegység és a Nyirség talajvédelmi stratégiájának kidolgozása az EU direktivák alapján. Konferenciakötet, Debrecen: p. 504-507.
17. Paul E.A., 2007. Perspective in soil microbiology, ecology and biochemistry, In: Paul E.A. (ed.): Soil Microbiology, Ecology and Biochemistry, Vol. 3. Academic Press and Elsevier Inc., Burlington: 3–24.
18. Brady, N., and Weil, R. (2010). "Elements of the nature and properties of soils". Third Edition. Pearson Education Inc.
19. Buol, S., Southard, R., Graham, R., and McDaniel, P.(2003)."Soil Genesis and classification". 5th Edition. Blackwell Publishing Company.
20. Comerford, B. (2005). "Forest Soil. Encyclopedia of Soil Science", Second Edition.