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RESEARCH REGARDING THE IMPACT OF CHEMICAL FERTILIZERS UPON THE SOIL

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ABSTRACT

Chemical fertilizers need to be used according to the natural fertility of the soil, to the ecological conditions and the cultivation requirements for nourishing elements. Keeping this in mind, they will not have any negative effects over the surrounding environment. But if the optimal doses are not respected the soil will be polluted. Regarding this matter a study has been made that showed that if the correct dosage is not respected this could lead to the acidification of the soil to such a level that it won't be suitable for agricultural purposes. Even if excess usage of fertilizers does not cause any changes in the soils texture, it can still contribute to its pure quality. If the correct dosage and the period of administration is respected than the soil will be improved with nourishing elements, this leading to a better agricultural production.

Keywords: chemical fertilizers, fertility, soil pollution, acidification, dosage.

1. Introduction

The degradation of the environment can be caused by natural phenomenon, as well as by human intervention. f the effects of this natural phenomenon like hurricanes, earthquakes, volcanic eruptions, happen at certain times and last for short periods, the anthropic factors manifest themselves all the time so the negative effects are worst, threatening with global disasters.

An important factor of the anthropogenic impact over the soil and its eco-systems is the irrational usage of synthesis fertilizers. The agricultural production is obtained through the accumulation in the biomass of the plants of biogenic elements that have been taken from the soil. Because of the fact that after the crops have been harvested only a part of the biogenic elements that have been extracted by the plant are returned, there can be problems in keeping the soils ecosystems. It is known that not all the quantity of fertilizers that is found in the soil get to the plants, but a large quantity is lost and gets in the aquatic basins.

The surplus of fertilizers from the soil has a negative effect over it. For example, the surplus of nitrogen in the soil accumulates, normally, under the form of nitrates. Because the soil does not absorb the nitrogen under this form, it is easily washed by the water from the soil and around 20% to 40 % gets in the underground waters and the nearby pounds.

Even with all this arguments there are few countries in the world that are preoccupied with the protection of the agricultural lands with the firmness and severity that are imposed by the urgency of action. There are still a lot of people that think that the earth can take a lot, but the soil as any natural body has a limit over which we cannot pass without the danger of degradations. Unlike water and air, were that toxic chemicals are diluted as they are assimilated, in the soil this toxic chemicals can be concentrated because of the fact that the circulation is very slow.

2. Experimental procedures

On a soil from Valea Larga Mures County, this soil belonging to the mol soil class, on 5 square meters, a different dosage of fertilizers has been administered. These doses have been calculated for soils were vegetables are cultivated. The doses were doubled from the normal quantity, so the pollution was on porpoise.

The fertilizers were administered as follows:

- Parcel 1 – amendment (CaCO3)
- Parcel 2 – ammonium nitrate (NH4NO3)
- Parcel 3 – complex fertilizers (N:P:K 15:15:15)
- Parcel 4 – witness probe.

The soils samples were taken on dry weather. For this porpoise the shallow layer of the soil has been removed up to 10cm in depth. From each parcel were taken several samples with the help of a probe, samples that were taken in clean and dry recipients. In the lab the samples were mixed, and from the total quantity 500 g of soil was

retained, representing the medium sample for each parcel.

To observe how the properties of the soil were influenced in the given situations in comparison with the taken sample, unfertilized, the harvest was made after 4 months from the administration of the chemical fertilizer.

The following researches were done:

- To determine the mobile phosphorus(P) in ppm
- To determine the mobile potassium(K) in ppm
- To determine the total nitrate in %
- To determine the humus content of the soil in %
- To determine the SH – change of total acidity in mech/100g
- To determine the SB – the sum of cationic change in mech/100h
- To determine the T - the total capacity of cationic change
- To determine the V – the saturation level in basic cationic change in %
- To determine the CaCO3.

2.1. Methods used in determining

The analyses were done at the "Oficiul de Studii Pedologice and Agrochimice", Mureş and at the Laboratory of Environment of "Petru Maior" University from Tirgu-Mures. The samples were transported in clean polyetilene bags, ermetically sealed and labeled accordingly.

The granulometric ingredients are determined on air dried samples, that are homogenized, and that have passed through the 0,2 – 2,0 mm diameter sieve.

For the ph analyses two comparative methods were adopted:

- The colorimetric method of the ph(with etalon paper bands)
- Digital meter ph (the meter ph used for the determinations was Hanna instruments HI 113 that can be found in the laboratory; the determination was made in saline solution)

For the analyses of the conductibility of the soil the digital conduct-meter Accumet AB 30 was used, which is a specially conceived instrument to respond the necessity of correct and fast conductibility measurements of the soil and the liquids, this instrument measures the conductibility of the soil EC (mS/CM), as well as the saline activity (g/L).

For determining the nitrate concentration from the soil the Kjeldahl Method was adopted. This method is based on the wet oxidation procedure (mineralization) of the organic nitrogen compounds from the soil.

The phosphates are extracted from the soil sample with a ammonium acetate-lactate solution for ph=3, 75.

The organic carbon from the humus was determined through the titrimetric oxidations and dosage.

3. Results and discussions

3.1. The granulometric analyses

Table 1

Results obtained through the granulometric analyses

No. Lab.	Sample Name	Sample		Granulometric Analyses				
		Horizon	Depth [cm]	Sand		Dust		Clay
				Grosier [%]	Fin [%]	I [%]	II [%]	%
1	Reference Sample	A	10 cm	22,9	7,3	9,4	18,7	41,7
2	Amendment Sample	A	10 cm	27,5	5,6	9,4	12,5	45,0
3	NPK Sample(15:15:15)	A	10 cm	25,2	4,8	9,4	16,7	43,9
4	NH_4NO_3	A	10 cm	24,7	7,4	9,4	14,6	43,9

The fallowing aspects were observed after the analyses:

- Even if the chemical fertilizers were applied in excess, the texture of the soil was not affected in comparison with the reference sample;
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- There are insignificant differences between the reference sample and the other samples, the most significant being that there was a difference with the amendment sample up to 5% against the reference sample.

3.2. The pH analyses

For the pH analyses two comparative methods were adopted that were mentioned at 2.1 paragraphs:

Fig. 1. *Digital pH meter Hanna HI 113*

After determining the pH the following results were obtained (table 2):

Table 2

The pH determination results

No. Lab	Sample name	Sample		pH reference bands	pH Digital pH meter
		Horizon	Depth [cm]		
1	Reference Sample	A	5-10 cm	5	4,90
2	Amendment Sample	A	5-10 cm	7	7,50
3	NPK Sample	A	5-10 cm	6	6,60
4	Sample NH_4NO_3	A	5-10 cm	6	6,48

The results from this index show that from a high acid pH (as the reference sample is) a slightly acid to neutral pH was obtained.

3.3 The conductivity analyses of the soil

Table 3

Results of the conductivity analyses of the soil

Nr. Lab.	Sample Name	Sample		Conductivity $[mS]$ Saline Solution
		Horizon	Depth [cm]	
1	Reference Sample	A	5-10 cm	-22,6
2	Amendment Sample	A	5-10 cm	-17,85
3	NPK Sample	A	5-10 cm	- 95,14
4	NH4NO3 Sample	A	5-10 cm	-100,8

Looking at the ammonium nitrate samples and the chemical fertilizers there are big differences to the reference sample. This explaining the excess presence of the nitrogen in the soil.

The values are higher because from the soil solution calcium was not removed. For a close to reality determination the calcium must be removed from the soil sample; the highest values in sample 4 were a result of the presence of H ions that were absorbed in the colloidal complex of the soil.

Table 4

The results of N, P, K determination analyses

No. Lab.	Sample Name	Sample		P mob. [ppm]	K mob. [ppm]	N total [%]
		Horizon	Depth [cm]			
1	Reference sample	A	5-10 cm	19	133	0,108
2	Amendment sample	A	5-10 cm	68	125	0,112
3	NPK Sample	A	5-10 cm	240	332	0,268
4	NH4NO3 Sample	A	5-10 cm	205	125	0,277

After the mobile potassium, mobile phosphorous and nitrogen analyses we can deduce that the nitrogen considerably exceeds the limits with the NH4NO3 sample, this excess of nitrogen in the soil leading to its pollution.

The analyses of the humus concentration in the soil

Looking at the date from 3.54 index we can observe that the reference sample and the amendment sample are characterized with a medium humus content (the imposed limit values by Office of Pathology are of 2,03). The other two samples with the complex and nitrogen characterized the soil with good humus content.

Table 5

The humus content of the soil

Nr. Lab.	Sample Name	Sample		Humus (%)
		Horizon	Depth [cm]	
1	Reference Sample	A	10 cm	2.20
2	Amendment Sample	A	10 cm	2.28
3	NPK Sample	A	10 cm	5.42
4	NH4NO3 Sample	A	10 cm	5.60

4. Conclusions

The analyses that we conducted allowed us to come to this conclusions:

- The harvested samples have a medium texture, as they are clayey soils
- Applying chemical fertilizers, even in excess, did not affect the texture of the soil in comparison with the reference sample
- The dosage that is applied changes the pH of the soil, but we must keep in mind the levitation of the soil as well
- The relation between the electro-conductivity of the soil and the productivity can be used for splitting the surfaces with a higher productivity level
- At the NPK and NH4NO3 samples, the soil is over saturated in phosphorus, exceeding 2 times the normal level for the NPK sample
- The N content considerably exceeds the limits for NH4NO3, this excess in nitrogen in the soil leading to its pollution. The plants do not need such a high level of nitrogen.

As a result, for keeping the quality and fertility of the soils, and for avoiding pollution it is absolutely necessary to respect the dosage of chemical fertilizers and the right time for using them.

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