

CHEMICAL AND PHYSICAL FEATURES OF CAMBIC CHERNOZEM IN THE DIDACTIC STATION OF TIMISOARA

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Abstract: *The major objective of this paper is to study the chemical proprieties of cambic chernozem, weakly gleyed from experimental field. The experimental field is situated in the Didactic Station of Timisoara. The chemical pointers taken under consideration in this project are the following, the reaction of soil solution (pH_{H_2O}), the carbonates content (%); the humus content (%); the total nitrogen content, the hidrolytic acidity - A_H (me/100 g sol); the total capacity of cationic exchange -CEC (me/100 g sol); the degree of base saturation -V (%). The field experiments are the stationary type. Each plot is subdivided in four repetitions which are linear positioned, one next to another. Each micro-plot has 10 x 3.5 m (35 m²) dimension. There are 32 micro-plots for wheat crop and also 32 micro-plots for maize crop. For the two crops taken under study we have used varieties and hybrids located in the west plain. We have chosen the Alex variety of wheat and, in this spring we will use one of the maize hybrids with the best features. The rational use of fertilizers and other chemical substances it is compulsory because we should remember that, one of the main objective of sustainable agriculture is to assure food security. The chemical substances increase harvest with approximately 40 % measure up to another technological methods. This is one issue that can not be neglected in the policy of food providing industry. Taken in consideration the dynamic of micro granulated chemical fertilizers nowadays, we can create a starting point for more ambitious studies. The interest in environment pollution has greatly increased lately for the entire population, and also for various institutions and organizations. Without soil there are no lives. The soil which is formed along millions of years can be destroyed by erosion within few days. The pollution prevention and reduction following the use of micro granulated fertilizers is one of the objectives founded in the regulations regarding the environment protections.*

Key-words: *micro granulated fertilizers, fertilization cambic chernozem, weakly gleyed*

INTRODUCTION

It is known that the long chemical fertilization has an influence over the chemical properties of the soil: pH, degree of base saturation, total cationic exchange capacity, hydrolytic acidity, total exchangeable bases, total and apparently density, total porosity and also porosity of aeration.

The application of larger nitrogen doses diminishes the quantity of cations adsorbed by soil, leading to a decrease of soil pH and degree of base saturation.

The research for present paper will be used in the experimental field situated in the Didactic Station of Banat University of Agricultural Science and Veterinary Medicine. The study will continue to develop in the Department of Soil Science and Plant Nutrition research labs. The major purpose is to scientifically investigate the issues involved in the increase of crop quality and quantity, soil fertility and the decrease of environment pollution in the case of the controlled use of chemical fertilizers. This will provide new information which will help the transactions from nowadays agriculture to the sustainable one.

MATERIAL AND METHODS

Will be used the chemical fertilizers, the time and the way of administration is

extremely important. We should establish in the correct manner the technique of administration for the chemical fertilizers in order to become more efficient. The nutritive substances should be situated as much as possible in the zone of active roots. From field experiments we will take soil and plant samples which will be analyzed in our labs to observe the changes that may appear following the chemical treatments.

Chemical and physical features of cambic chernozem are determined in the case of our experimental field cultivated with maize and wheat. For this research we have used two types of micro granulated fertilizers, one type of granulated fertilizers and also, one type of foliar fertilizer.

This paper is the preliminary one, further changes occurred in soil will be once again determinate after maize and wheat harvest.

The wheat was plant on 26.10.2010 according to the experimental field map. Two types of micro granulated fertilizers were used.

The autumn wheat variety (*Triticum aestivum*, ssp. *vulgare*) **Alex**.

From the geomorphological point of view the studied perimeter takes part in the lower plain. The minimum altitude of relief is between 85 and 86 m, in this case the phreatic level is situated near the surface.

The maximum altitude is 90 m on the plan shape or on the light beam shape. Toward Dudestii Noi place there are some beams higher then 92 m which are the erosion witness of the higher plain. Between those altitudinal odds, the relief and the phreatic water operate upon soil and give hydromorphic characters of various intensities.

The wheat crop is situated on the cambic mold weakly gleyed. This type of soil has the biggest share (84.90 %) in the Didactic Station of Timisoara.

The soil type was identified based on the major profile from the experimental field and physical and chemical characterized.

Soil morphological features

The soil profile performed in the experimental field shows an obvious differentiation for the horizons and sub-horizons. (4)The profile has a generous development on the 205 m length. The profile micro and macro morphological proprieties are the following:

Amp = 0-20 cm, clay loam, gray – black colored (10 y R 2/1) in the wet condition and light gray (10 y R 3/1) in the dry condition. The structure is grainy, friable, damaged by agricultural work, moderate wet, cohesive, weakly plastic in the wet condition, fine porous.

Amt = 20-35 cm, medium clay loam, is brown – black colored, (10 y R 2/1) in wet condition and light gray (10 y R 3/1) in dry conditions. The structure is lamellar nuciform, extremely compact, cohesive, weakly plastic, with fine pore, thin roots and rare coprolite and organic un-decomposed scrap.

ABy = 35-45 cm, clay loam, is brown black colored (10 y R 2/1) in wet conditions and dark gray (10 y R 3/1) in dry conditions. The structure is polyhedral well developed, with good mechanic and fluid stability, moderate cohesive, plastic, adherent, with fine pore, humus coprolite and seldom vegetal scraps.

A/B = 45-55 cm, clay loam, is brown black colored (10 y R 2/1) in wet conditions and dark gray (10 y R 3/1) in dry conditions. The structure is polyhedral with light ferruginous stains, compact, adhesive and moderate plasticity.

Bv = 55-75 cm, clay loam, is olive dark brown (7,5 y R 3/2) in wet conditions and dark gray (7,5 y R 4/4) in dry conditions with obvious ferruginous stains. The structure is polyhedral, wet, compact firm in dry conditions, with fine pore, plastic adhesive.

B/C = 75-95 cm, clay loam, is yellow –brown colored in wet conditions (7,5 y R 4/3) and dark yellow in dry conditions (7,5 y R 5/3). The structure is polyhedral subangular, poor developed, friable, with middle size pore, gradually crossing horizon.

CCa G01= 95-160 cm, clay loam, is light brown colored (10 y R 4/2) in wet conditions and yellow brown in dry conditions (10 y R 5/2). The structure is small, dusty, weakly developed, friable, and softly adhesive, with CaCO₃ micelles; makes strong effervescence.

Cca G02 = 160-205 cm, clay loam, is light brown colored (10 y R 4/2) in wet conditions and light yellow 5/4 in dry conditions. The structure is dusty, friable, weakly adhesive, with oxidation-reduction olive stains, with numerous CaCO₃ concretions, makes strong effervescence.

In order to characterize the cambic chernozem weakly gleyed the following features were determined:

- the reaction of soil solution (pH_{H2O})- with method potentiometric ;
- the carbonates content (%); with Richards method
- the humus content (%) – with Tiurin method;
- total nitrogen content -with Kjeldahl method;
- the hydrolytic acidity -A_H (me/100 g sol) -with method Kappen;
- the total cationic exchange capacity – CEC (me/100 g sol) and summ of exchangeable cations S_B (me/100 g sol) -with Kappen method;
- the degree of base saturation -V (%) – from calculation;

RESULTS AND DISCUSSIONS

The reaction of soil solution is weakly acid in the superior horizon pH=6,16 and weakly alkaline (pH=8,44) in the inferior horizons. This is strongly correlated with the carbonates content values. Following the massive loses of alkaline substances in the superior horizons, the carbonates were pushed down towards 160 cm.

The CaCO₃ content the Ca salts are completely carried off from the superior third of the soil profile. Taken under consideration the leaching process and also, the leaching depth of calcium salts, we may believe that the stage of the carrying down the alkaline substances it is happening now.

The humus content ranges between 1,83 % and 3,30%, which reflects a excellent supply with organic substances.

In the following table, one can easily observe the chemical proprieties of cambic chernozem weakly gleyed from Didactic Station Timisoara.

Table 1

The chemical properties of cambic chernozem weakly gleyed from S.D. Timisoara

Horizon	Depth cm	pH in water	Carbonates substances %	Humus %
Amp	0-20	6,16	-	3,30
Ant	20-35	6,46	-	2,91
AB _y	35-45	6,47	-	2,75
A/B	45-55	7,18	-	1,83
B _v	55-75	7,60	0,95	-
B/C	75-95	8,12	16,70	-
CcaGo1	95-160	8,42	15,70	-
CcaGo2	160-205	8,44	14,70	-

The total capacity of cationic exchange (CEC) is distinctive for well supplied soil with humus and clay. The values range between 30.35 and 29.60 me/100 g sol.

The degree of base saturation (V) is higher especially in the inferior horizons. In this region carbonates are present, the content is between 84.34 and 91.46%.

Table 2

The chemical features of cambic mold weakly gleyed from S.D. Timisoara

Horizon	A _H	S _B	CEC	V %
	me/100g sol			
Amp	4,75	25,60	30,35	84,34
Amt	4,21	26,06	30,27	86,09
ABy	2,84	26,80	29,64	90,41
A/B	2,62	26,98	29,60	91,46
Bv	-	-	-	-
B/C	-	-	-	-
CcaGo1	-	-	-	-
CcaGo2	-	-	-	-

The total nitrogen content fluctuates from 0,181 to 0,221 . It is highly dependent of humus content from soil. The mobile phosphorus supply is poor, varies from 4,1 and 23 ppm. This explains the necessity of phosphorus chemical fertilizers use.

Things are better in the situations of mobile potash content, this range between 120 to 138 ppm. Which means that the soil is medium supplied with this nutritive element.

Table 3

The total nitrogen content, the mobile phosphorus and potash content

Horizon	Ntotal %	P mobile ppm	K mobile ppm
Amp	0,221	23,0	138
Amt	0,193	18,5	120
ABy	0,181	12,6	124
A/B	0,120	4,1	120
Bv	-	-	-
B/C	-	-	-
CcaGo1	-	-	-
CcaGo2	-	-	-

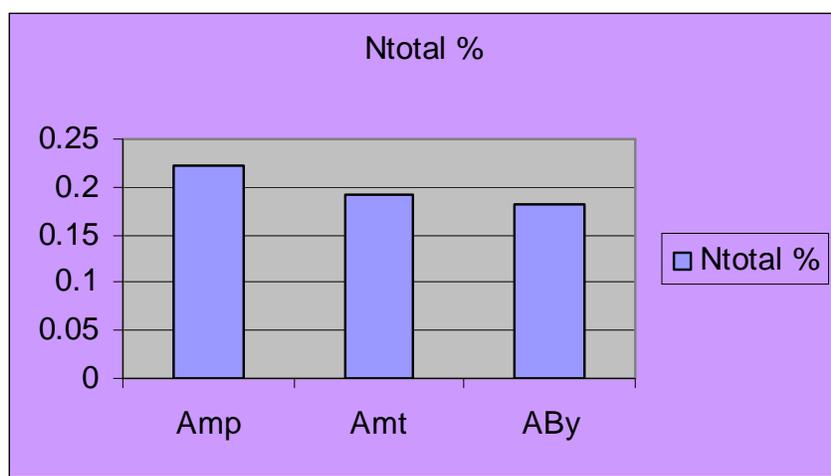


Figure 1 Total nitrogen content

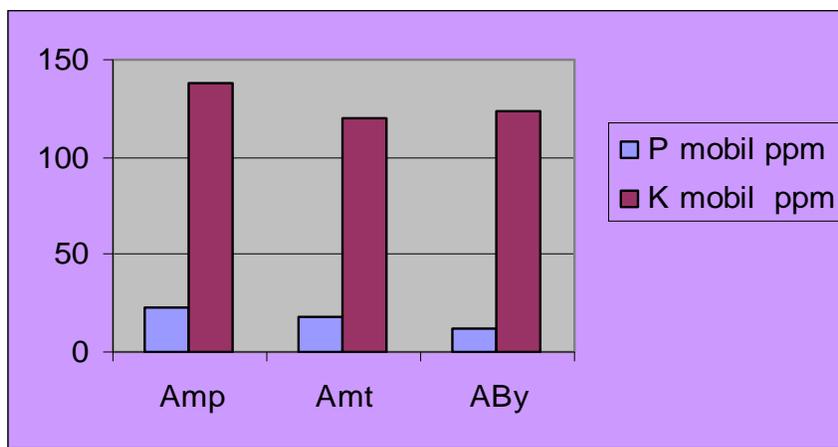


Figure 2 Mobile phosphorus and potash content

The density value of 2,45-2,73 g/cm³, founded in this case is high. This shows that we are dealing with an advanced mineralization process of organic matter.

The apparent density depends mainly of the degree of loosening of soil horizons. Higher values were found in the (Amp) horizon, 1,32 g/cm³. In the data interpretation we can consider two hypotheses. Soil samples were taken from dry soil which may lead to higher values. The second hypothesis is based on the accentuated damage of horizon structure occurred by multiple interventions or by intense mechanical processing.

Total porosity in this case has low and medium values (43-47%),

The porosity of aeration (PA) confirms the values of apparent density. The value is very small (12%), due to the non-capillary pores damaged.

Table 4

Physical features of cambic chernozem

Horizon	D g/cm ³	D.A. g/cm ³	P.T. %	P.A. %
Amp	2,45	1,32	47	16
Amt	2,58	1,44	45	14
ABy	2,60	1,46	45	13
A/B	2,73	1,58	43	12
Bv	-	-	-	-
B/C	-	-	-	-
CcaGo1	-	-	-	-
CcaGo2	-	-	-	-

CONCLUSIONS

In conclusion, we can appreciate that the type of soil taken under study presents numerous favorable chemical and physical features which grant a medium fertility. A series of agrochemical and agro-technical measure are imposed in order to improve the physical and chemical features of cambic chernozem weakly gleyed.

In the next research, the soil will be kept under observation from the point of view of proprieties changes following the micro granulated fertilizers, granulated and foliar fertilizers.

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