CONSIDERATIONS ABOUT THE HUMUS AND NITROGEN CONTENT IN THE LOW PLANE TIMIŞ-BEGA

CONSIDERAȚII ASUPRA CONȚINUTULUI DE HUMUS ŞI AZOT ÎN CÂMPIA JOASĂ TIMIŞ-BEGA

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***Abstract**:The paper has as objective the study of the humus and nitrogen content from the main types of soil from this area periodically affected by floods and also influenced by the phreatic waters and antropic factors. Regards are made about the nitrogen and humus reserves and are presented dates from the humus located in the construction materials of habitation near this area. A series of practical recommendations are made regarding fertilization and the lost of nitrogen, respectively avoiding the underground water pollution.*

***Rezumat**:Lucrarea are ca obiectiv studierea conținutului de humus şi azot din principalele tipuri de sol din acest areal afectat periodic de inundații şi aflat sub influența apelor pedofreatice şi a factorilor antropici. Se fac referiri asupra stării de aprovizionare cu azot şi asupra rezervelor de humus şi sunt prezentate date privind humusul existent în materialele pământoase folosite la construcția caselor din aşezările umane întemeiate prin secolele 18-19. Sunt stabilite şi o serie de recomandări privind compensarea pierderilor de azot şi humus, respectiv evitarea poluării cu nitrați a freaticului.*

***Key words:** soil, humus, nitrogen, nitrate, pollution.*
Cuvinte cheie: sol, humus, azot, nitrați, poluare.

INTRODUCTION

Nitrogen (N) is essential for life because it is a component of nucleic acid and amino acids and thus peptides and proteins. In soils, N is present predominantly in organic form and inorganic N is made available by the mineralization of organic N to ammonium (NH_4^+) and nitrate (NO_3^-).

Nitrogen can be readily last from terrestrial soils, leading to reduced fertility and surface – or groundwater contamination and several transformations give rise to intermediate or final products that can have negative environmental consequences.

The principal soluble inorganic N forms in soil are NO_3^-, NO_2^- and NH_4^+. The inorganic gaseous N forms in soil are N_2, N_2O NO and NH_3. Organic N takes many forms, such as amino acids, amino glucide, nucleoside, peptides, phospholipids, vitamins, etc.

The major organic and inorganic N transformations that occur in soil can be grouped into five pathways: mineralization (ammonification), assimilation, nitrification, nitrate reduction and N_2 fixation.

Mineralization is frequently referred to as ammonification:

$$R\text{-}NH_2 \rightarrow NH_3 \rightarrow NH_4^+$$

$$H_2O + NH_2CONH_2 \xrightarrow{\text{urease}} CO_2 + 2\ NH_3$$

Assimilation is the incorporation of inorganic N as NH_4^+, NO_3^-, NO_2^- into biomass.

Nitrification is an aerobic process, autotrophic or heterotrophic.

- autotrophic is a two-step process that is carried out by chemolitotrophic bacteria such as Nitromonas and Nitrobacter.

$$NH_4^- \underset{+H^+}{\overset{-H^+}{\rightleftarrows}} NH_3 \rightarrow NO_2^- \rightarrow NO_3^-$$

$$NH_3 + O_2 + 2H^+ \xrightarrow{\text{oxygenase}} NH_2OH + H_2O$$

$$NH_2OH + H_2O \xrightarrow{\text{reductase}} NO_2^- + 5\,H^+$$

$$H^+ + NO_2^- + H_2O \xrightarrow{\text{dehydrogenase}} NO_3^- + 3H^+$$

- heterotrophic

$$R\text{-}NH_2 \rightarrow RNHOH \rightarrow R\text{-}NO \rightarrow R\text{-}NO_3 \rightarrow NO_3^-$$

R-NO – nitroso-compound potential carcinogens

Nitrate Reduction or Denitrification is the major reductive fate of NO_3^- in anaerobic or waterlogged soils.

$$NO_3^- \xrightarrow{\text{Nitrate reductase}} NO_2^- \xrightarrow{\text{Nitrite reductase}} NO \xrightarrow{\text{Nitric reductase}} N_2O \xrightarrow{\text{Nitrous oxide reductase}} N_2$$

N_2 Fixation is an energy-demanding process by which prokaryotic bacteria reduce N_2 gas to NH_3, either independently or symbiosis with various leguminous and nonleguminous plant species.

$$N_2 + 16\text{ Mg-ATP} + 8H^+ \xrightarrow{\text{Nitrogenase}} 2NH_3 + H_2 + 16ADP + Pi + 16Mg^{2+}$$

The route of N loss can be (1):

- reductive losses, during denitrification, as N_2 a final product; the NH_4^+ formed can still be leached in soils with low cation exchange capacities or loss through erosion.
- volatilization. If NH_4^+ production is sufficiently rapid, aqueous NH_3 will be volatilized from soil and lost to the atmosphere as a gas.

In order to grow large yields of agricultural crops, nitrogen is required in large quantities. For example, winter wheat growing under UK conditions would typically take up about 200 kg N ha^{-1} and most agricultural crops take up between 100 and 200 kg N ha^{-1} (5).

Nitrate ions dissolved in soil water are lost by soil leaching – the vertical movement of water, and surface runoff – the horizontal movement.

In the European Union a limit of 50 $mg \cdot l^{-1}$ of nitrate has been imposed on any ground – or surface water to be used as a source of drinking water ad any surface water where eutrophication is considered to be a risk. In the USA the limit is 45 $mg \cdot l^{-1}$ (5).

The period immediately after N fertilizer application is a time of high risk of nitrate loss. About 17% of the applied N had been lost. There are many examples implying losses of 50% or sometimes even more (6).

One of the main drivers to decrease loses of nitrate has been the claim that nitrate in drinking water is a cause of two serious diseases. Medical research now indicates that it does not exist at all.

It was claimed that nitrate (NO_3^-) was reduced to nitrite (NO_2^-) by bacteria in the mouth when nitrite entered the stomach it could react with amines to form N-nitrosamines, which are known to be cancerigenic. Many studies have shown a negative correlation between nitrate and incident of stomach cancer. There is now no medical evidence to suggest any link between nitrate intake and stomach cancer.

Methemoglobina can kill infants less than 1 year old. Nitrite derived from the reduction of nitrate can react with haemoglobin and block the site that normally transports oxygen around the body. The condition only occurs when water is contaminated by gastroentiritic bacteria from sewage or manures heaps (3).

Recent medical research has indicated that nitrate can protect humus and animals from gastroenteritis. The proposed reaction between nitrite and amines in the stomach does not occur because the acid conditions in the stomach destroy nitrite and nitric oxide, NO is formed.

MATERIAL AND METHOD

The study is based on pedological mapping conducted in the period 2003-2007 in the territories Foeni, Giulvăz, Uivar, Peciu Nou and on a few special studies executed to establish the nitrogen content and nitrates in lots fertilized with tail waters from animal farms.

RESULTS AND DISCUSSION

Characterization of the agrarian fields regarding the organic matter is made by humus determination, after the decomposed rest are removed from the soil. The humus content and total nitrogen content from the tilled layer obey to the same rules.

For the main types of soil in Romania, Irina Vintilă (10) presents the following values:

Table 1

The humus content (%) and total nitrogen (%)from the tilled layer

Types of soil and area	Humus		N total	
	Limits	Media	Limits	Media
Typical chernozem				
Câmpia Română de Vest	2,2-3,1	2,75	0,121-0,197	0,160
Câmpia Română de Est	2,2-4,3	3,15	0,144-0,230	0,189
Moldova	2,6-5,4	3,69	0,146-0,260	0,189
Cambic chernozem				
Câmpia Română de Est	2,2-3,6	2,94	0,124-0,206	0,162
Moldova	2,6-5,4	3,57	0,130-0,260	0,175
Argic chernozem				
Câmpia Română de Vest	2,0-2,9	2,60	0,104-0,164	0,131
Phaeziom				
Moldova	2,7-4,5	4,17	0,198-0,260	0,218

The nitrogen supply of the cultures depends directly from the total nitrogen reserves, but even in the soils with the highest contents of nitrogen the quantity is not enough to make high productions.

The nitrates content in the tilled layer is usually smaller then 20 ppm in the unfertilized layers and is under the climatically changes and cultural practices. The level of displacement of the maximum content of nitrates is not higher then 50-60 cm only in the sandy soils. In the severely rainy years the nitrates war located in a Chernozem from Valul lui Traian under 90 cm (2).

The pedological study conducted in Foeni revealed the following values of the humus content and total nitrogen for the main types of soil.

Table 2

Analytical data, Foeni

Types of soil	N total %			N total %		
	Minimum	Maximum	Media	Minimum	Maximum	Media
CZ	2,70	4,21	3,49	0,147	0,210	0171
FZ	2,24	6,90	3,14	0,154	0,212	0,174
EC	1,98	3,70	2,79	0,120	0,131	0,125
GS	2,12	6,60	4,36	0,112	0,201	0,156
SN	2,17	12,12	5,09	0,119	0,199	0,159
PE,VS	3,42	3,90	3,70	0,185	0,195	0,190
AS	2,42	6,84	3,66	0,121	0,136	0,128

On the type of soil, the humus content is maximum in Solonetz (5.09%) and minimum in Cambisoils eutric (2.9%), the total nitrogen content is maximum at Vertisoils cambic (0.190%) and minimum at Cambisoils eutric (0.125%).

For the Uivar territory, the humus content and total content is presented in the table 3.

Table 3

Analytical data, Uivar

Types of soil	N total %			N total %		
	Minimum	Maximum	Media	Minimum	Maximum	Media
CZ	2,24	4,83	3,52	0,125	0,240	0,182
FZ	2,97	4,59	3,72	0,149	0,250	0,192
EC	2,73	3,47	2,97	0,135	0,171	0,147
GS	4,40	2,97	3,68	0,147	0,220	0,183
SN	2,17	5,10	3,29	0,106	0,209	0,156
PE,VS	2,42	5,95	3,74	0,121	0,232	0,181
AS	1,98	3,59	2,59	0,096	0,175	0,131

In the case of Uivar territory, the maximum value for humus is 3.74 % at Vertisols cambic and 3.72% at Phaeozems and the minimum value for the total nitrogen is for the Fluvisoils.

At Giulvăz, the data from the table 4 reveal for humus, the maximum value in Solonetz (3.72%) and minimum in at Cambisoils eutric (0.120%).

The total nitrogen has a maximum value in Vertisols cambic (0,191%) and minimum (0,134) in Cambisoils eutric.

The medium values for the types of soils from The Low Plane Timiş-Bega in the nitrates contents and ammonia are described in the table 5.

Table 4

Analytical data, Giulvăz

Types of soil	N total %			N total %		
	Minimum	Maximum	Media	Minimum	Maximum	Media
CZ	2,07	6,30	3,31	0,146	0,197	0,163
FZ	2,54	4,21	3,38	0,101	0,210	0,160
EC	1,08	4,67	2,5	0,120	0,148	0,134
SN	1,49	5,96	3,72	0,165	0,175	0,170
PE,VS	1,93	5,69	3,71	0,187	0,195	0,191

Table 5

Nitrates (NO_3^-) and ammonia (NH_4^+), ppm

Depths	0-30	30-60	60-90
CZ			
NO_3^-	31.2	25.2	11.4
NH_4^+	3.61	1.80	1.92
FZ			
NO_3^-	22.8	25.2	13.2
NH_4^+	1.8	1.5	3.6
EC			
NO_3^-	8.5	6.2	-
NH_4^+	7.0	3.1	-
GS			
NO_3^-	6.8	5.2	-
NH_4^+	3.4	1.4	-
SN			
NO_3^-	38.4	39.4	12.6
NH_4^+	12.0	1.8	1.68
PE,VS			
NO_3^-	34.8	12.6	7.8
NH_4^+	3.84	2.88	1.5
AS			
NO_3^-	6.0	2.8	-
NH_4^+	2.3	1.0	-

Just like in the case of humus and nitrogen we note that the soils with salts, natrium and clay are most rich in nitrates and ammonia (Vertisols cambic, Solonetz). The Chernozem has also high and very high values of nitrates.

CONCLUSIONS

The soils from the area of The Low Plane Timiş-Bega, total nitrogen, nitrate ammonia generally superior to the existent values in the soils from Romanian Plane and Moldavia.

As types of soils, the richest in humus, total nitrogen, nitrates and ammonia prove to be the Chernozem, Phaeozems, Solonetz and Vertisols cambic.

We cam appreciate after the recent medical research data that the dangerousness for human of the presence of nitrates in drinking eater is not confirmed. The negative effects are for water eutrophization.

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