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FACTORS AFFECTING GROUND WATER POLLUTION IN THE MEADOW OF BORCEA ARM

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Abstract

This paper aims to study the factors leading to water pollution by nitrates in the Meadow of Borcea arm, mainly derived from agricultural sources. mIn oder to model the amount of nitrate nitrogen in the soil, which can be partially used by plants or leached into the ground water, research was made on alluvial soil in the Meadow of Borcea arm. I tried to study in the laboratory the influence of three factors of nitrate nitrogen pollution of ground water: soil type, environmental conditions (temperature and humidity) and the amount of mineral fertilizers incorporated. The resulting amount of nitrate nitrogen resulted with nitrogen fertilizer dose, and the temperature and it was affected by humidity especially 40-80% of field capacity.

Key words*: aluviosol, ammonium nitrate, nitrate, pollution*

INTRODUCTION

Nitrogen is the second element, after the carbon, of importance in the development of the vital processes. It is the vital plant mineral element, accounting for crop productivity. The yield depends on both carbon and on nitrogen mineralization processes that occur in organic compounds in the soil. It is about the soil organic subtance mineralization, plant and animal remains.

The mineral fertilizers have risen over time problems, especially the processes of mineralization and nitrification of soil nitrogen.

The fertilization with organic and mineral fertilizers are an important way of increasing the content and quality of soil organic substance [10].

In conditions where the soil organic substance may provide the plant through mineralization processes large amounts of nitrogen, it increasingly requires further research on finding ways to optimize nitrogen regime to ensure a greater efficiency of the mineral fertilization.

Conversion of nitrogen compounds in the soil is effected by means of soil population [9].

The nitric form of nitrogen used by plants through passive consumption, is soluble in water, with its leaching risk, with the possibility of contamination of ground water, where it can remain for a long time - years.

The problem of correspondence between the intensity of organic nitrogen mineralization and the period in which it is necessary to the plant nutrition is of great importance in agriculture. It is known that the activity of micro-organisms capable of decomposing the organic substance of the soil is typically the maximum period in which the crop plants do not show its maximum absorption. As a result, in the soil large quantities of nitrate nitrogen eliminated where in the conditions of rainfall they can be easily moved by water into the soil [6].

Due to the low stability of soluble nitrogen compounds in the soil, a significant part of the nitrogen applied in excess of plant needs can not be assimilated by them and subject to transformation in the soil to ground water or the atmosphere, they pollute. The risk for pollution is linked mainly to the oxidation of the nitrogen compounds.

Nitrates and nitrites, with the negative charge can not be adsorbed by the soil colloidal complex and remain in the soil solution from which, some are absorbed and metabolized in higher plants or in micro-organisms biomass, and another part is leached in soil [6].

MATERIALS AND METHODS

The sources of pollution of ground water with minerals containing nitrogen (ammonium, nitrite, nitrate) are nitrogen mineral fertilizers, humic substances, especially animal waste, municipal and communal waste.

Nitrogen pollution of ground water with nitrates resulted from the soil depends on the environmental conditions (temperature and humidity), soil type and quantity of mineral fertilizers incorporated [7].

The nitrate content reflects the best conditions of ensuring nitrogen to the plants for the moment on cultivated soils.

The nitrates are the only natural source of nitrogen available for soils with relatively neutral p_H in Calarasi [5]. The optimal conditions for nitrifying flora, ammonia and organic mineral fertilizers into the soil is rapidly converted to nitrate.

The soil studied was an aluviosol, proxicalcaric and was taken from Roseţi locality, so from the Meadow of Borcea arm. The ground water is at a depth of 2-3 m surface. The appearance of land surface is of flat meadow and the vegetation in this area is of the Danube steppe.

As regards the chemical characteristics of the soil: the first 20 cm pH is of 7.6; carbonate are in a ratio of 1%, 3.1% humus. In the wet state is small-grained structure, moderately developed. The soil texture is clay loam in the top 35 cm depth.

In order to model the amount of nitrate nitrogen from the studied soil, which can be used by plant or partially leached, researches were made on soil samples taken from the horizon Amp (0-20 cm), the three repetitions of the field and have been mixed in an average sample of the experimental variant.

The dose of nitrogen fertilizer used was NH_4NO_3 (N active) and had graduations:N_0, N_{80}, N_{150}, N_{250}.

The samples were prepared from three extreme temperatures regimes (50 ° C - as is the case early spring 20^0C - spring 30^0C - summer) and humidity (40%, 80%, 100% of field capacity), the greater forming a nitrification process.

From soil samples subject to conditions above and incubated for 15 days, the amount of nitric spectrophotometer method was determined [8].

The nitrate extraction was done with a solution of K_2SO_4. Nitrate dosing was phenol-disulphuric acid, by which nitrates are bound to nitro-acid phenol-disulphuric, coloured in yellow in alkaline medium. The colour intensity obtained depended on the concentration of nitrates. The maximum extinction was at 410 nm.

The content expressed in ppm nitrate N in soil was calculated using the formula:

$$N\ (ppm) = \frac{C \times V_e}{m \times a_e}$$

where:

C = N content of the sample, in micrograms;
V_e = volume in ml of extract soil;
m = mass of soil taken into consideration, in g;
a_e = volume of aliquot part of the extract in ml.

RESULTS AND DISCUSSIONS

The results obtained from the analysis are presented in the tables and figure below.

Table 1. Influence of incubation temperature (5°C) the soil samples according to moisture and chemical fertilizers with nitrogen on nitrification potential

Temp. (°C)	C.C.A (%)	Dose nitrogen (Nkg/ha)	NO_3^- (ppm)	
			Initial	Final
5°C	40%	0	1,50	2,36
		80	1,74	4,80
		150	2,06	6,25
		250	2,55	4,79
	80%	0	1,50	4,01
		80	1,74	7,45
		150	2,06	7,18
		250	2,55	9,10
	100%	0	1,50	5,19
		80	1,74	7,81
		150	2,06	7,05
		250	2,55	10,65

We can see from the data obtained that the amount of nitrogen fertilizer influenced the nitrification potential.

Table 2. Influence of incubation temperature (20°C) the soil samples according to moisture and chemical fertilizers with nitrogen on nitrification potential.

Temp. (^oC)	C.C.A (%)	Dose nitrogen (Nkg/ha)	NO_3^- (ppm)	
			Initial	Final
20^oC	40%	0	1,50	4,44
		80	1,74	5,55
		150	2,06	8,26
		250	2,55	9,33
	80%	0	1,50	4,48
		80	1,74	6,04
		150	2,06	7,36
		250	2,55	6,24
	100%	0	1,50	6,04
		80	1,74	6,78
		150	2,06	8,66
		250	2,55	9,41

Table 3. Influence of incubation temperature (30°C) the soil samples according to moisture and chemical fertilizers with nitrogen on nitrification potential.

Temp (^oC)	C.C.A (%)	Dose nitrogen (Nkg/ha)	NO_3^- (ppm)	
			Initial	Final
30^oC	40%	0	1,50	4,80
		80	1,74	6,84
		150	2,06	9,02
		250	2,55	12,84
	80%	0	1,50	6,23
		80	1,74	7,42
		150	2,06	10,79
		250	2,55	9,45
	100%	0	1,50	5,21
		80	1,74	8,28
		150	2,06	7,22
		250	2,55	4,06

The amount of nitrate increased with dose of nitrogen fertilizer. The correlation is particularly close to 100% of field water capacity. These findings confirm numerous previous data [3] and they have provided the basis of the observation that in fact the ability of mineralization-nitrification is the most faithful index to assess the crop nitrogen need [1].

From the data obtained, it was found that moisture differentially influenced the nitrification process. Humidity between 40 and 80% of field capacity has most influenced the amount of nitrates, probably because optimal conditions for aeration and humidity, condition so necessary to this process.

From Fig.1. it can be seen that the capacity for mineralization-nitrification at 20^0C, is somewhat higher, although the correlation coefficient is low.

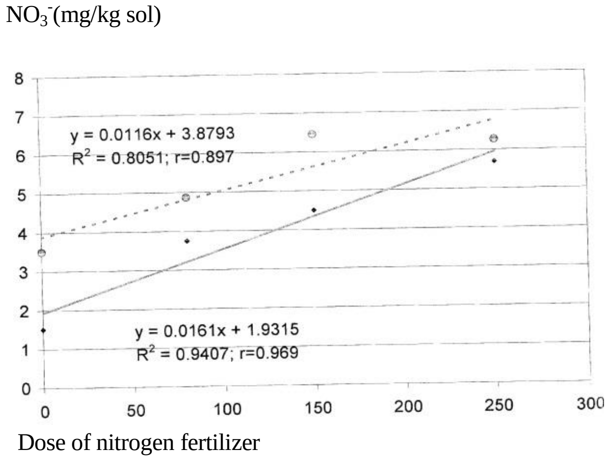

Fig.1. Mineralization-nitrification capacity in Calarasi alluvial soil, incubated at 40% humidity and 5^0C ( ) and 20^0C (-------)

The positive influence of incubation temperature on the nitrification process of the nitrogen was present in all doses that were administered.

The influence of temperature increased the amount of nitrate found in the soil sample with increasing incubation temperature. Increasing the temperature has proved to be favourable to the process of nitrification, especially in the fertilizer and soil fertilized with 150 kg N / ha of active substance.

CONCLUSIONS

The possible influence of soil nitrate ion administered as agricultural fertilizer on soil nitrification capacity.

The nitrates resulting from the oxidation of ammonia in the soil and added to the same mineral fertilizer, is on the one hand, the nutrition elements for other organisms, as well as a process for nitrification of waste. Under anaerobic conditions produced in the version of reaching the ceiling of 100% of field capacity for soil water, soil nitrates or existing products can be a source of oxygen for respiration anaerobic of the micro flora, known as nitrate reduction and de-nitrification.

As we saw, there were no anaerobic conditions or lasted very little, because there is an increase of nitrate content with increasing field water capacity, which probably facilitated the development of various species of soil micro flora and it released into the environment easily assimilated organic substances.

From the experimental data, we observe that at the humidity of 100%, the nitrification was stimulated even when the blank, which has not received the ammonium nitrate. Such observation may underlie the finding that in irrigated fields, organic matter mineralization processes are always high, especially at high doses of mineral fertilizer.

From our data we can see that the system has a great influence on fertilizer nitrogen in soil nitrification.

The crop is the main factor depleting soil mineral nitrogen solution [4].

Considering the soil organic substance as a carrier of potential fertility features (the chemical elements required storage plants, improving water retention properties of soil by soil structure, etc.) that mineral nitrogen product is a measure of the potential loss of fertility.

Increasing doses of nitrogen exerts a stimulatory effect on nitrification.

As we observed in our study the bacteria develop and nitrify best when the humidity is between 60-80% of field capacity.

Depending on the local environmental conditions, the nitrification processes are subject to seasonal dynamics. The shredded waste is accumulated into the ground at the end of the growing season are only partially decomposed due to the low temperature of the soil in the season. The disintegration processes are reduced in the winter months. Only at the beginning of the growing season it may be expected an increase in nitrification. The process culminates in early summer, being interrupted only during periods of drought. Land works have a key influence on this dynamics.

The nitrification is most intense in autumn (when there are favourable conditions of temperature and humidity) and there is also an increased risk of water pollution by nitrates. In countering this phenomenon, the crop rotation is essential. It is good to be interspersed with the main crop in a crop rotation with rapid growth, able to capitalize residual nitrogen in the spring and it can be used in spring as green manure for spring-summer crops.

In order to reduce the nitrogen losses and the risk of water pollution of Borcea arm, it is better to choose the proper rotations, ensuring the maintenance of soil covered with vegetation for a longer period of time, especially in wet seasons, to properly manage waste as vegetable (especially with C / N ratio high) and limited to the minimum necessary work to mobilize soil [2].

Other means of reducing the residual nitrogen can be: rotation that also includes a winter crop, intercrop introduction of native species, resistant to cold and frost, able to occupy quickly the land and form a vegetation cover, thick enough, and uniform to protect the soil from the rain effects in autumn - winter.

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