

THE INFLUENCE OF FERTILIZATION AND SOIL TILLAGE ON THE DYNAMICS OF AMMONIACAL NITROGEN FROM THE CHERNOZEM CULIVATED WITH WHEAT AT SCDA CARACAL

INFLUENȚA FERTILIZĂRII ȘI LUCRĂRILOR SOLULUI ASUPRA DINAMICII AZOTULUI AMONICAL DIN CERNOZIOMUL CULTIVAT CU GRÂU LA SCDA CARACAL

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Summary: This paper presents the results of researches from SCDA Caracal, regarding the dynamic of ammoniacal nitrogen on chernozem in condition of irrigation function of the method of soil tillage and fertilization. The experiment took place over a period of three years and regarded the following factors: A factor – irrigation, B factor – the method of soil tillage with 3 phases, C factor – nitrogen fertilization on constant fund of phosphorus with 4 phases. The content of ammoniacal nitrogen is presented on the dates it was taken as sample during the vegetation period at 0-20 cm depth. The dates for samples were: November 1, before applying the first dose of nitrogen, December 8, after 30 days from the first dose, April 25 after 30 days from the second dose and July 28 when the plants were mature. The determinations regarding the dynamic of ammoniacal nitrogen in the soil for wheat culture, highlight important aspects, but also the effect of soil tillage, creating new situations nitrogen supply for the plants. The analyses regarding the content of ammoniacal nitrogen were made in the last year of experiments. Analyzing the content of ammoniacal nitrogen function of the soil tillage, we recorded values almost similar at the sample dates after using different machines. There are differences between the normal plough at 18-23 cm (6.23 ppm $N-NH_4^+$) and chisel at the same depth (6.94 ppm $N-NH_4^+$) or at 8-10 cm depth (6.46 ppm $N-NH_4^+$).

Rezumat: În lucrare se prezintă rezultatele cercetărilor efectuate la SCDA Caracal, care au urmărit dinamica azotului amoniacal pe solul cernoziomic în condiții de irigare în funcție de metoda de lucrare a solului și de fertilizarea aplicată. Dispozitivul experimental cu o durată de trei ani a cuprins următorii factori: factorul A – irigarea, factorul B – metoda de lucrare a solului cu trei graduări, factorul C – fertilizarea cu azot pe fond constant de fosfor cu patru graduări. Conținutul de azot amoniacal se prezintă în dinamică la datele la care s-au ridicat probele în timpul perioadei de vegetație pe adâncimea 0 – 20 cm. Datele de recoltare a probelor pentru evidențierea dinamicii azotului amoniacal în sol ($N-NH_4^+$) au fost: 01 noiembrie înainte de aplicarea primei doze de azot, pe 08 decembrie la 30 zile de la aplicarea azotului, pe 25 aprilie la 30 zile de la fertilizarea cu a doua doză de îngrășământ și pe 28 iulie la maturitatea plantelor. Determinările privind dinamica azotului amoniacal din sol la cultura de grâu, evidențiază aspecte importante privind folosirea îngrășămintelor cu azot în diferite doze și în condiții de irigare, dar și efectul sistemului de lucrare a solului, creându-se noi situații de aprovizionare a plantelor cu azot. Analizele efectuate în vederea determinării conținutului de azot amoniacal s-au efectuat în ultimul an de experimentare. Analizând conținutul de azot amoniacal în funcție de lucrarea de bază a solului, acesta a prezentat valori apropiate la datele de recoltare a probelor de sol după tipurile de utilaje utilizate.

Key words: nitrogen doses, wheat culture, fertilization, irrigation, tillage
Cuvinte cheie: doze de azot, cultura de grâu, fertilizare, irigare, lucrările solului

INTRODUCTION

Plants absorb nitrogen from the soil mainly under nitric form (NO_3) or ammoniacal

form (NH_4), the acid environment favorizing nitric absorption and the neutral environment favorizing ammoniacal absorption.

In case of the absorption of both ions, the rithm of nitrogen accumulation in the plant increases, determinating a more rapid development of the plant.

At the present level of soil fertilization in our country, the crops are realized because of a big consumption of nitrogen from the soil, it does not overpass the rithm of renewal of the layer of organic nitrogen through pedogenetic processes (RĂUȚĂ C., 1998).

In soil, ammoniacal nitrogen and nitric nitrogen have a different behavior, the nitric one is more used because it is solubilized in the soil and the other one is in a smaller measure, varying at different species, vegetal organs or fruits and function of the culture conditions.

We noticed that plants have little tolerance in what concerns the excess of ammonium ions in comparison with the nitric ion.

The researches made regarding the influence of different soil tillage, irrigation and doses of fertilizers used on the dynamics of nitrogen taken from the soil, which are the object of this paper, highlighted a series of important aspects that would be presented for the ammoniacal nitrogen for wheat culture, aspects that highlight the rational use of nitrogen fertilizers in conditions of irrigation and different soil tillage.

MATERIAL AND METHOD OF RESEARCH

The researches were made at SDCA Caracal and had as object the dynamics of ammoniacal nitrogen on chernozem in conditions of irrigations and function of the method of soil tillage and the fertilizers.

The soil from the experiment presents a moderate acid reaction, with a small content of humus (3.18%), it has little supply of nitrogen (0,130 % N total), a medium quantity of phosphorus (43,8 ppm P mobile) and well supplied with potassium (233,7 ppm K mobile).

The 3 years experiment involved the following factors:

A factor – irrigation

B factor – the method of soil tillage with 3 phases:

b₁ – plough at 18-20 cm + harrowing, and preparing the germination layer using 2 disks and 1 harvester

b₂ – chisel at 18-20 cm + harrowing with the distance between the active pieces of 35 cm, 2 disks;

b₃ - chisel at 8-10 cm + harrowing with the same distance between the active pieces and 2 tillages with the sowing disk;

C factor – nitrogen fertilization on a uniform fund of P80 with 4 phases and the following doses:

c₁ – N₀ ; c₂ - N₅₀ ; c₃ - N₁₀₀ ; c₄ - N₁₅₀

The experience was made according to the techical demands, chosing the method of subdivided parcels.

The phosphorus fertilizers were applied every fall (as superphosphat simple with 20% P₂O₅) before ploughing and the nitrogen as ammonioum azotate with 33,5%N in the established quantities, in 2 phases – N₂₅ in the fall and the rest in the end of winter.

As wheat we cultivated the Lovrin 34 with density of 550 b.g./ m², at 12,5 cm between rows, 5-6 cm depth and the seeds treatment was made with Sumi 8 Plus in a dose of 1,5l/t seeds.

In what concerns the temperature regime, there were few months with abnormal temperatures, the weather becoming warmer, and there were not temperature problems for the wheat culture.

Analyzing the quantity of precipitations, we notice that they have diminished in the first year of the experiment, with a minus of 24,4 mm; during the second year we have recorded a growth with 132,9 mm, but especially in the last year we recorded a growth of 437,2 mm in comparison with the yearly average of the region – 537,4 mm (because of the climate changes). During the experiment we have recorded a surplus of 182,0 mm.

The content of ammoniacal nitrogen is presented at the dates when the samples were taken, during the vegetation period, at 0-20 cm depth.

RESULTS AND DISCUSSIONS

The dates of the samples were: November 1, before applying the first dose of nitrogen, December 8, after 30 days from the first dose, April 25 after 30 days from the second dose and July 28 when the plants were mature.

The determinations for every date of sampling function of the 3 experimental factors, highlight a series of different aspects.

- In what concerns the irrigation, we have registered the most reduced values of ammoniacal nitrogen from all the samples. On the first determination, November 1, the content of ammoniacal nitrogen in the soil was 7.79 ppm N- NH_4^+ , after 30 days the content was 6,24 ppm N- NH_4^+ . On April 25, after applying the second dose of fertilizer, the content increased up to 10.97 ppm N- NH_4^+ . When the wheat was harvested, as a consequence of the nitrogen consumption and the loses caused by levigation (determined by irrigation and low precipitations) the content of ammoniacal nitrogen was 4,15 ppm N- NH_4^+ (figure 1.1)

- Function of the soil tillage, the content of ammoniacal nitrogen in the soil had similar values for all the samples (figure 1.2)

For the first determination, the content was between 4,22 – 4,40 ppm N- NH_4^+ , for the second, it has grown as effect to the first dose of nitrogen fertilizer (from 4,47 to 6,06 ppm N- NH_4^+), for the next determination the content has grown even more (effect of the second dose) from 10,96 to 12,74 ppm N- NH_4^+ . For the last determination, the content of ammoniacal nitrogen reduced because of plant consumption and the loses caused by levigation, reducing from 4,86 to 4,40 ppm N- NH_4^+ . The average values of the determinations were between 6,23 and 6,94 ppm N- NH_4^+ .

- Considering the nitrogen fertilization, function of the 4 doses used, the values of ammoniacal nitrogen modified during all the phases.

On the first determination from November the content of ammoniacal nitrogen in the soil was almost the same (4 – 4,4 ppm N- NH_4^+), than it grew because of the nitrogen doses. On the determination from December 8 the values varied between 5.09 and 5,34 ppm N- NH_4^+ , and in April, they varied between 6,53 and 16,69 ppm N- NH_4^+ . At harvesting, the content of ammoniacal nitrogen reached the values that initially existed in the soil (4,52 – 4,03 ppm N- NH_4^+) as a result of levigation and plant consumption. (figure 1.3). Calculating the average value, we can observe that these have grown function of the doses applied (from 5,13 ppm non fertilized variants to 7,61 ppm N- NH_4^+ for fertilized variants with maximum dose).

- When we irrigated, for the normal plough 18-20 cm depth, the values for the ammoniacal nitrogen were higher than when using chisel for both depth and dates of determinations.

On first determination (November) the values of nitric nitrogen in the soil were between 4,4 and 3,3 ppm N- NH_4^+ , on the following one (December) the content varied between 4,4 and 6,6 ppm N- NH_4^+ . In April, on the third determination the content of nitric nitrogen has grown between 5,00 and 13,6 ppm N- NH_4^+ and at harvesting the wheat the content diminished – 3,3 ppm N- NH_4^+ .

After working the soil with chisel at 18-20 cm + harrowing, we registered the higher content of ammoniacal nitrogen for wheat culture, the value we have found being between 1,1 and 5,5 ppm N- NH₄⁺ on the first determination, between 6,6 and 8,8 ppm N- NH₄⁺ on the second one and between 6,00 and 15,10 ppm N- NH₄⁺ on the third. These growing values are the effect of the nitrogen doses applied in December and March, and the small values between 3,3 and 2,2 ppm N- NH₄⁺ registered when harvesting are determined by plant consumption and levigation on the soil profile caused by the irrigations and rain.

Working with chisel at 8-10 cm + harrowing determined the accumulation of big quantities of ammoniacal nitrogen in wheat culture, that were superior to the normal plough and very closed to the chisel at normal depth.

The values obtained during vegetation of wheat were: on the initial determination between 3,3 and 5,5 ppm N- NH₄⁺, on the second they have grown from 4,4 to 7,7 ppm N- NH₄⁺, on the following one they have also grown with 7,2 – 19,4 ppm N- NH₄⁺ following the nitrogen fertilization, but when harvesting, they have reduced with 1,1 – 9,9 ppm N- NH₄⁺ because of the levigation and plant consumption (table 1).

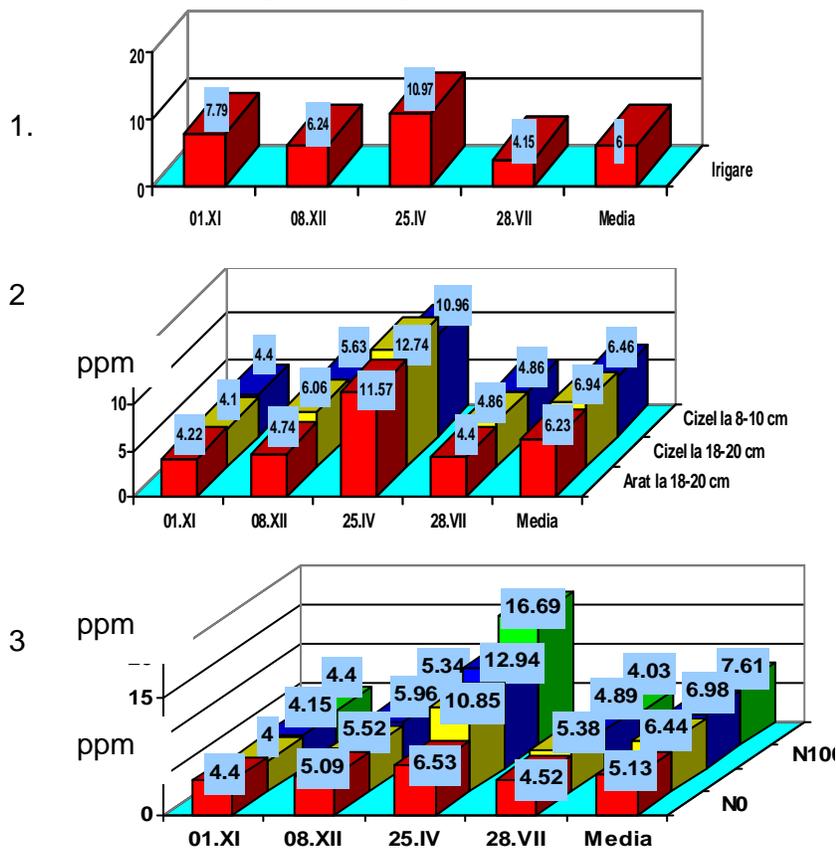


Figure 1. The evolution of ammoniacal nitrogen in the soil (N-NH₄⁺) for different dates of sampling and their average for wheat culture function of the experimented factors.

1.1. Irrigation; 1.2. Soil tillage; 1.3. Nitrogen doses applied on constant fund of P80

Table 1

Values N - NH₄⁺ ppm at the wheat culture

Variant	Before applying the doses of nitrogen 1 November	30 days from the first application of the dose 8 Decembre	30 days after the second dose 25 April	The harvest of the wheat 28 Julie
a b ₁ c ₁	4,40	4,40	5,00	3,30
a b ₁ c ₂	3,30	6,60	19,40	2,20
a b ₁ c ₃	3,30	6,60	11,30	3,30
a b ₁ c ₄	3,30	4,40	13,60	3,30
a b ₂ c ₁	3,30	6,60	6,00	3,30
a b ₂ c ₂	4,40	5,50	8,20	2,20
a b ₂ c ₃	5,50	6,60	12,30	2,20
a b ₂ c ₄	1,10	8,80	15,10	3,30
a b ₃ c ₁	3,30	5,50	7,20	2,20
a b ₃ c ₂	3,30	7,70	9,30	9,90
a b ₃ c ₃	4,40	5,50	11,20	1,10
a b ₃ c ₄	4,40	6,60	13,10	1,10

CONCLUSIONS

1. The determinations regarding the dynamics of ammoniacal nitrogen in the soil for the wheat culture, highlight important issues regarding the use of nitrogen fertilizers in different doses and in conditions of irrigation, and also the effect of soil tillage on this dynamics, because new situations of nitrogen supply appear. The analyses made in order to determinate the content of ammoniacal nitrogen were done in the last year of the experiment.

2. Considering nitrogen fertilization, function of the 4 doses that were used, the values of ammoniacal nitrogen have modified during all the phases.

3. For the wheat culture, in conditions of irrigations, the values of the ammoniacal nitrogen content varied between 4,15 ppm (at harvesting) and 10,97 ppm (after the second dose of nitrogen – April 25), with an average of 6 ppm. These values are low because of levigation.

4. Working with chisel at 18-20 cm determined a higher content of ammoniacal nitrogen in the soil (6,94 ppm) in comparison with the common plough at the same depth (6,23 ppm), and when we have used the chisel at 8-10 cm, the content of ammoniacal nitrogen was 6,46 ppm.

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