THE EVOLUTION OF NITRIC NITROGEN FROM THE SOIL UNDER THE INFLUENCE OF SOME FERTILIZER DOSES

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Abstract: *Through the experience realized at SCDA Caracal we have followed the effect of different doses of chemical fertilizers on the production of wheat, and especially on the evolution of nitric nitrogen at the surface of the soil (0 – 20 cm), which can bring about in drought conditions – phenomenon frequent in this area, big accumulations and pollution of the wheat crop. Many researches took place in our country and abroad concerning the influence of fertilizer doses, of nitrogen dynamics in the soil and the soil tillage on the wheat crop; they highlight a series of important aspects generated by the conditions of experimentation and the possibility of using some different machines for the basic soil tillage. When choosing the area for the experiment we have taken into account the suitability of cambic baticalcaric chernozem for the wheat culture. The problem of soil pollution with nitrates is a current issue for this area because the natural climate conditions, the lack of irrigation water (necessary for this culture) doesn't permit the nitrogen to migrate on the soil profile, but to remain in large quantities at its surface bringing about some harmful effects for the plants. In order to conserve water in the soil during the vegetation period, we have considered that it is necessary to use the chisel plough (18 – 20 cm). In our country, the prognosis of the effect of nitrogen fertilizers is different function of the soil (through specific items of nitrogen regime), function of the plant (with a specificity of nitrogen consumption), function of the nature and type of fertilizer, the method and technology of application and other important factors for the nitrogen circle. The crops use nitrogen as NO_3^-, because the ammonium ions from the soil are quickly oxidized to NO_3^- through the action of microorganisms. The study of nitrogen dynamics from the soil for different phases of wheat crop gives us clues on the moment we can intervene in the nourishing with nitrogen of this crop and the necessary doses, so that the crops can be economically justified.The dynamics of nitric nitrogen from the soil was made through the determination of this form of assimilable nitrogen for different dates during the vegetation period for the wheat culture, when we have taken soil probes, at the depth of 0-20 cm. We have obtained different values of nitric nitrogen in the soil, (4.46 ppm and 49.61 ppm) function of the doses of nitrogen. Theoretically, the chisel plough assures a suitable aeration corresponding the good development of nitrification process, with direct implications on the production that will be obtained. Because the fertilization is the main factor in obtaining high productions for any crop we have administrated different doses of nitrogen, between N_0 and N_{150} kg/ha on a constant fund of P_{80}, and the productions were between 1317 kg/ha and 6403 kg/ha. The data obtained from this experiment will be useful for wheat cultivators in the south Romania, but also other area having the same problems regarding drought, because this experience aims at conserving water in the soil through a different soil tillage.*

Key words**:** *nitric nitrogen, wheat crop, fertilizers, chisel*

INTRODUCTION

In the agrochemical system in our country the prognosis of the effect of nitrogen fertilizers is different function of the soil (through specific items of nitrogen regime), function of the plant, function of the form and fertilizer type, the method and appliance technology and other important factors for the nitrogen circle.

"Without nitrogen there is no life". It can be found in quantity of 0,2 – 4,5% in the dry substance of plants (ROMULUS MOCANU, 2007).

Ammoniacal nitrogen (NH_4^+) and the nitric one (NO_3^-) are the main forms used for the plants. These forms behave differently in the soil.

Plants absorb nitrogen from the soil under nitric form (NO_3^-) or ammoniacal form (NH_4^+).

The study of nitric nitrogen dynamics in the soil for different phases of the wheat culture gives us clues on the moment in which we can intervene in its nutrition with nitrogen and the doses we can use, so that the productions could be economically justified.

In our country, crops use nitrogen from the soil`s reserve, which surpasses the rhythm of restoration of organic nitrogen in the soil through pedogenetic processes (RĂUȚĂ, 1984).

Taking into consideration the importance of wheat culture, many specialists dedicated their time to the study of the influence of fertilizer doses, nitrogen dynamics and soil tillage on the wheat crop. From these studies resulted different and commun opinions generated by the experiment conditions and the possibility of using different machines for the basic soil tillage not only the mould board plough.

Mineral fertilization, basic soil tillage and nitrogen dynamics are important problems and have direct influence on the productions we obtain.

MATERIAL AND METHODS

The experience took place at SCDA Caracal using the method of liniar blocs on a single row with three repetitions, on baticalcaric cambic chernozem. The soil presents in the arable layer a moderate acid reaction, with middle nitrogen supply and good supply of phosphorus and potassium.

When we chose the area for the experiment we took into consideration the suitability of baticalcaric cambic chernozem for the wheat culture and we followed the effect of different doses of chemical fertilizers on the wheat crop, especially the evolution of nitric nitrogen from the surface of the soil (0 – 20 cm), which can bring about drought conditions – a frequent phenomenon in this area, big accumulations and pollution of the wheat crop.

The preparation of land for sowing (A factor) was made with ordinary plough at 18 – 20 cm – a_1 and the chisel at 18 – 20 cm + harrowing – a_2, as basic tillage and 2 discs for preparing the germinate bed. We sowed on October 15th the Romulus type with a density of 550 b.g./m^2, at the distance of 12,5 cm between rows, at depth of 5-6 cm and the treatment of seed was made with Lamardor in dose of 0,15 l/t seed.

Nitrogen fertilization on a uniform fund of phosphorus P80 – B factor – was made using 4 graduations with the following doses: b_1 - N_0; b_2 – N_{50} ; b_3 - N_{100} ; b_4 - N_{150} .

Phosphorus fertilizers were applied in the fall (as superphosphat simple with 20% P_2O_5) before the basic soil tillage, and the nitrogen as ammonium nitrogen with 33.5% N in the established doses, in 2 phases – N_{25} in the fall and the rest of the quantity at the end of the winter.

At the beginning of the experience we took soil samples in order to make the physical and chemical analyses of the soil.

We took samples at 0 – 20 cm depth, in order to establish the content of nitric nitrogen in the soil on November 1 (before applying nitrogen) and on December 7th (30 days after the appliance of nitrogen dose N_{25}).

In order to establish a nitric nitrogen dynamics in the soil we took similar soil samples (0 – 20 cm) during the vegetation period of the wheat between April 25 (30 days after the rest of the nitrogen dose) and July 20 immediately after harvesting.

RESULTS AND DISCUSSIONS

The dynamics of nitric nitrogen in the soil was analyzed, starting with November 1 before applying the nitrogen doses, continuing with three more dates of different intervals of time: December 8th (30 days after applying N_{25}), April 25th (30 days after applying the rest of the dose) and July 20th when harvesting.

Function of the 2 experimented factors, we obtained the following results:

- The content of this mineral form of nitrogen function of the doses of applied fertilizers increased constantly when the doses grew. The initial moderate values determined by the low content of nitric nitrogen in the soil at that moment increased on the second determination after applying nitrogen fertilizers because of the doses of fertilizers that were used, then it constantly diminished for the third and forth determination, as a following of the winter and spring levigation (there were precipitation that surpassed the normal averages) and also the nitrogen consumption by the plants.

The following of nitric nitrogen dynamics during the vegetation period of the wheat function of the basic soil tillage and the applied fertilizers, highlights the fact that in both the situations at the end of April we have registered the lowest content of nitric nitrogen in the soil, so it is possible that in this period can appear nitrogen lack.

The values of the averages indicated the same aspect of positive variation of nitric nitrogen, a constant increase from the unfertilized variant (8.17 ppm $N\text{-}NO_3^-$) at the maximum dose of nitrogen (40.92 ppm $N\text{-}NO_3^-$), "because of the stimulation of the nitrification process through the application of fertilizers" (MOCANU R., 1979).

In normal conditions for the wheat culture (lack of irrigation) and starting with the unfertilized variants, the values of nitric nitrogen content in the soil were not to small (12.34 ppm and 22.97 ppm**)**, because of the losses through levigation, a phenomenon that could appear in conditions of irrigation.

- Soil preparation with normal plough determined a smaller content of nitric nitrogen for the variant without nitrogen, in comparison with the situation where we used the chisel plough.

For the first determination, the values of nitric nitrogen in the soil were between 12.34ppm şi 47.12 ppm $N\text{-}NO_3^-$, then rose for bigger doses of N50 for the second determination 6.56ppm - 57.59 ppm $N\text{-}NO_3^-$, and for the third determination these values were reduced with more than half (3.41ppm - 26.04 ppm $N\text{-}NO_3^-$). For the last determination (wheat harvesting) we registered between 3.38 ppm and 14.70 ppm $N\text{-}NO_3^-$.

The use of chisel at 18 – 20 cm depth + harrowing, lead to the highest content of nitric nitrogen in the soil, big values being observed even for the unfertilized variants for all determination dates.

Table 1

Values $N\text{-}NO_3$ (ppm) for the wheat culture

Variant	Before nitrogen application	30 days from the application of N_{25}	30 days from the application of the rest of N dose	Wheat harvesting
a_1b_1	12.34	6.56	3.41	3.38
a_1b_2	27.56	26.41	9.45	5.22
a_1b_3	37.14	45.47	26.04	14.70
a_1b_4	47.12	57.59	23.93	13.91
a_2b_1	22.97	8.66	4.46	3.65
a_2b_2	22.71	37.80	13.67	9.45
a_2b_3	49.61	59.42	25.77	13.65
a_2b_4	60.11	62.16	35.77	26.77

In theory, the chisel plough assures a suitable aeration for the nitrification process, with direct implications on the crops.

At the first determination nitric nitrogen content in the soil was between 22.97 ppm and 60.11 ppm $N\text{-}NO_3^-$, then it grew for the second determination from 8.66 ppm to 62.16 ppm $N\text{-}NO_3^-$, and it diminished because of nitrogen consumption by the plants and the levigation caused by rain, 4.46 ppm and 35.77 ppm $N\text{-}NO_3^-$.

When we harvested, the nitric nitrogen in the soil was between 3.65 ppm and 26.77 ppm $N\text{-}NO_3^-$, as a following of the nitrogen consumption during the vegetation period as well as nitrogen losses.

CONCLUSIONS

The quantitative evolution of nitric nitrogen was different during the vegetation period of the wheat culture being influenced by the dates of application of fertilizer, the doses we used, the plants` consumption and levigation losses determined by the quantities of precipitations.

Regarding the system of soil tillage, we can say that the use of chisel, in comparison with the normal plough, determined the accumulation of big nitrogen quantities.

This indicates a suitable aeration for the nitrification process and influences the productions.

Knowing the dynamics of nitric nitrogen for the 4 dates will help us see which are the critical phases and maximum consumption of this form of nitrogen by the wheat, the moment when we have to intervene to stop the lack or excess of nitrogen and to establish the most efficient doses of fertilizers for the wheat culture to reduce the costs.

Through the nitrogen dynamics we can establish the limits of this form of nitrogen, which does not pollute the soil or the plants.

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