ESTABLISHING THE OPTIMUM DOSES OF NITROGEN AND PHOSPHORUS FOR THE FERTILIZATION IN WINTER WHEAT

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Abstract

Ensuring high and constant wheat crops determines the use of chemical fertilizers in order to ensure the growth and development of plants. The fertilizers are applied on the soil for the absorption through the plants' roots or they are applied foliary for the absorption through the leaves.

When establishing an optimum dose of nitrogen we must have in view the expected wheat production and the nitrogen contribution from the soil which is determined by the previous plant. In order to establish the optimum dose of phosphorus we must predict the production level and we must take into account the phosphorus contribution from applying the manure to the wheat culture or to the previous plants.

The calculation for the phosphorus and nitrogen doses have been done for the 3000-5000kg/ha levels of production and for the following previous plants: corn, sugar beet and pea.

Key words: fertilization, nitrogen dose, phosphorus dose, previous plant.

INTRODUCTION

Nitrogen is the main nutritive element necessary for the soils existent in Romania. Nitrogen favorizes the vegetative development of the plants, the formation of vigurous plants well fraternized, with leaves of a dark – green color, facilitates the photosynthesis process, the formation of the production elements and assimilation of protean substances in the grains.

Nitrogen insufficiency determines the formation of some very poorly developed plants, of a green-yellowish colour, with reduced productions. The excess of nitrogen facilitates a strong vegetative development, with an exaggerated fraternization, a high water consumption which favorizes the attack of foliary diseases and which delays the vegetation.

The wheat absorbs nitrogen from the applied chemical fertilizers and from the reserves found in the soil, resulted from the mineralization of the organic substances. For crops of 4000-5000kg/ha the absorption of nitrogen ends at blooming and for higher crops the nitrogen absorption is done until the stage when the grain starts to be filled.

Establishing the nitrogen doses and their distribution have in view the following: the wheat's requirements according to the vegetation stages, the nitrogen quantity found on the soil and accessible to the plants during the

vegetation period, the nitrogen's mobility and the danger of its migration in depth together with the water from the rainfall.

In order to determine the doses which can actually be applied some corrections must be done according to the nitrogen contribution brought by the manure, by the one brought by the leguminous cultures, by the introduction into the soil of the vegetal cellulose remains , by not ensuring the cultures with P and K, by the reserves of nitrates from the soil, by the foliar analysis or by other green tissues, by the pluviometric regime from the culture year and from the previous year (Hera, 1984, quoted by Ciobanu, 2007).

The phosphorus contributes together with the nitrogen to the compulsory fertilization of the wheat culture. The wheat is the most sensitive cereal to phosphorus insufficiency having an effect especially on the young plants which have a poorly developed radicular system and absorb the phosphorus from fertilizers. The phosphorus contributes together with the nitrogen to the improvement of the resistance during the hibernation period, to the development of the fraternization and the radicular system, to the prevention of disease occurrence and it also favors the quality of the crop.

MATERIAL AND METHODS

Establishing the nitrogen doses represents a balance situation in which we take into account the total content of the soil in nitrogen and in mobile forms during the vegetation and which depends on: the natural fertility of the soil, the previous plant, the fertilization system applied to the previous plants.

Calculating the nitrogen doses applied can be realized after different methods and formulas but we can also use the following formula: (I.C.C.P.T. Fundulea, 1990).

$$D_N=30xR_p-N_s-N_{gg}+N_{pr}$$

where:

D_N-the nitrogen dose, kg/ha;

R_p- expected crop, t/ha;

N_s-the contribution of the soil in nitrogen, 20kg/ha in the poor soils and 60kg/ha in the fertile soils;

N_{gg}- the nitrogen contribution of the manure, 2kg N/t manure applied directly to the wheat, 1kgN/t manure applied to the previous plant;

N_{pr}-the correction according to the previous plant, we decrease 30kg N/ha after the leguminous for beans, then we decrease 20kg N/ha after the

mash and the clover, we add 20-25kg N/ha after late non-fertilized previous plants.

Calculation of the phosphorus doses has in view the content of the soil in mobile phosphorus, the fertilization with manure, the expected production and the specific consumption, using the following formula:

$$D_P = 15 \times R_p - P_{gg}$$

where:

D_P- the phosphorus dose kg P_2O_5/ha;

R_p- the expected crop, t/ha;

P_{gg}- the phosphorus contribution from manure, 1.2kgP_2O_5/t manure, if it has been administered directly to the wheat, 0.8kg P_2O_5/t manure administered to the previous culture.

The calculation of the nitrogen and phosphorus doses has been done for crops comprised between 3000-5000kg/ha, for which we have used as previous plants the following: corn, sugar beet, and pea that have not been fertilized with manure.

The used factors were:
- Factor A, includes the following expected/foreseen crops:

  a_1-3000kg/ha

  a_2-3500kg/ha

  a_3-4000kg/ha

  a_4-45000kg/ha

  a_5-5000kg/ha

- Factor B, represents the previous plant:

  b_1- corn

  b_2-sugar beet

  b_3-pea

RESULTS AND DISCUSSION

In order to establish the nitrogen and phosphorus doses necessary to obtain expected wheat productions five levels of production and three previous plant variants have been taken into consideration (Table 1).

The calculated doses of nitrogen, according to the above presented formula show that the nitrogen necessary for the wheat plants increases proportionally with the increase of the expected production level, for the same previous plant, from 80kg N/ha for 3000kg of wheat/ha to 140 kg N/ha for 5000 kg of wheat/ha.

For the same level of foreseen production the necessary of nitrogen is different. Thus, for a production of 3000 kg/ha the nitrogen dose is of 80kg N/ha in the case of establishing the culture after corn, of 85kh N/ha when

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the previous plant is the sugar beet and of 30kg N/ha when the previous plant is a leguminous for grains, like the pea in this case.

It is to be noticed that the previous plant has got an important role in establishing the doses of nitrogen fertilizers. Thus, if the previous plant is the sugar beet the nitrogen doses are comprised between 85-145 kg N/ha, for the production levels of 3000-5000kg/ha and when the previous plant is a leguminous like the pea the nitrogen doses are comprised between 30-90kg N/ha for the production levels of 3000-5000 kg/ha.

The phosphorus doses necessary for the foreseen productions, calculated with the above mentioned formula depend on the foreseen production levels and on the application of the manure to the previous plant (Table 1).

Thus, we can notice that the phosphorus doses increase according to the increase of the foreseen production level regardless of the previous plant. Thus, for a wheat production of 3000kg/ha the dose of phosphorus is of 45kg/ha and reaches 75kg/ha for a production of 5000kg/ha.

Table 1

Establishing the optimum doses of nitrogen
and phosphorus for the fertilization of autumn wheat

Expected productions	Doses	
	N kg/ha	P kg/ha
b_1- corn		
a_1-3000kg/ha	80	45
a_2-3500kg/ha	95	52.5
a_3-4000kg/ha	110	60
a_4-4500kg/ha	125	67.5
a_5-5000kg/ha	140	75
b_2-sugar beet		
a_1-3000kg/ha	85	45
a_2-3500kg/ha	100	52.5
a_3-4000kg/ha	115	60
a_4-4500kg/ha	130	67.5
a_5-5000kg/ha	145	75
b_3-pea		
a_1-3000kg/ha	30	45
a_2-3500kg/ha	45	52.5
a_3-4000kg/ha	60	60
a_4-4500kg/ha	75	67.5
a_5-5000kg/ha	90	75

The administration of nitrogen fertilizer doses for the cultures established after the leguminous plants is done in spring time and in case the culture is established after a leguminous plant that had been harvested very

late, the nitrogen doses are administered in a percentage of 1/3 from the total quantity before sowing and the rest of 2/3 is administered early in spring.

The doses of phosphorus fertilizers are applied in autumn when preparing the field for sowing, usually being incorporated under the ploughing.

CONCLUSIONS

In order to obtain high wheat productions it is necessary to ensure the necessary nutritious substances for the plant development during the whole vegetation period.

The wheat is a plant that answers favourably to the application of chemical and organical fertilizers although they present a reduced specific consumption of nutritive elements. If there are enough quantities of phosphorus and potassium the size of the crops depends on the continuity of nitrogen nutrition.

The nitrogen dose is established according to: the requirements of the wheat on vegetation stages, the quantity of nitrogen found in the soil in a form accessible to the plants during the vegetation stage and the danger of the depth washing with the water from the rainfall.

In order to calculate the nitrogen dose one must have in view the expected production level and the contribution brought by the previous plant.

The nitrogen dose increases according to the increase of the production level but decreases in case of wheat cultivation after a previously leguminous culture, which brings about an important nitrogen contribution. For a production level of 5000kg/ha, the nitrogen dose is of 90kgN/ha in the case of after pea culture and of 145kg N/ha in case of after sugar beet culture.

The phosphorus dose is according to the expected production level regardless of the previous plant.

When establishing the optimum nitrogen doses of fertilizers one must have in view the economical efficiency as well, taking into account the fact that nitrogen fertilizers are obtained through a high consumption of energy and that production costs are high.

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