

## THE EFFECT OF NITROGEN AND PHOSPHORUS FERTILIZERS UPON THE QUALITY AND QUANTITY OF WINTER WHEAT PRODUCTION

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### Abstract

*In order to obtain bigger and constant productions we must supply the wheat plants with nutritious elements during the whole growing and development period.*

*The winter wheat had got a long period of vegetation, but the majority of the nutritious elements are absorbed during spring, in a short period of time, from the moment the plant enters the bellow estate and until its ripening in wax, when the nitrogen supply needs to be applied.*

*In winter, the consumption of nutritious elements, especially of nitrogen, determines the formation of the roots, the sprouting and union of the plants when the strengthening process takes place and an increased consumption of nutritious elements.*

*In order to ensure the plants' requests in what the nutritious elements are concerned during the whole vegetation period, the application of fertilizers with chemicals like nitrogen and phosphorus is a necessary and compulsory measure.*

*For analyzing the effect of the nitrogen and phosphorus fertilizers at the winter wheat culture we have analyzed the quantitative and qualitative production in the conditions of fertilizing the wheat culture with constant doses of phosphorus and with increasing doses of nitrogen associated with urea, in the period 2012-2014.*

**Key words:** chemical fertilizers, fertilization, doses of fertilization, average production.

### INTRODUCTION

The winter wheat is one of the agricultural plants which reacts positively to fertilizer application in all the weather conditions existent in our country. Nitrogen, in corresponding quantities, ensures a good union and rooting of the plants, it increases the plant's resistance to low temperatures, increases the number of fertile flowers in the wheat ear and improves the content of the grains in protean substances. ( Bîlceanu, 2003).

Nitrogen has got a big importance for the wheat nutrition as it determines a good growing and development of the plants, it being one of the main elements which form the complex molecule of the protide and they directly intervene into the chlorophyll synthesis, this way determining the plants' capacity of synthesis. ( Domuța et al., 2011).

Wheat absorbs nitrogen from the mineral fertilizers applied as well as from the soil purveyance which, in turn, come from the transformation of organic substances into minerals.( Borza, Stanciu, 2010).

Fertilization with phosphorus is a must on all types of soil existent in our country. The wheat is the most sensitive cereal when we talk about the lack of phosphorus, this lack can first of all affect the young plants that have a rootlet system very poorly developed. (L. S. Munteanu et all., 2001).

The free phosphorus existent in the soil is a critical element in the plants' nutrition, always being found in limited quantities in the Romanian soils. From these reasons, its application is a necessary parameter. Having in view how much the plants consume it, it is necessary that this phosphorus be in the soil in soluble form, between 50 and 100kg/ha(M.Berca, 2011).

The economic efficiency of the fertilizers in comparison with the content of fertilizing elements is established according to the conditions and the quality of the soil, to those of the plant and even to those of the type of cultivated wheat. Cultivated. (Marian, 1970).

The nutritious elements and the report between them influence the development of the rootlet system as well as the development of the aerial organs. In what wheat is concerned, the production of the brethren is tightly linked to the development of the roots and it is stimulated by the fertilization with phosphorus. ( Caramete et al.)

The fertilizers with phosphorus and with potassium are only applied under the basic plowing, and because they are hardly soluble, they shall be integrated in the area that has got the most roots. The nitrogen fertilizers are to be applied in doses of 80-160kg/ha. (.Borcean et all., 2006).

The quantity of fertilizers that are administered to the wheat are tightly influenced by the humidity of the soil. Thus we can emphasize the correlation between the humidity of the soil during sowing time, the dose of fertilizer and the production of winter wheat.( Bîlteanu, Bîrnaure,1989).

The annual regime of rainfall differs from one geographical region to another, according to the particularities of the general circulation of the atmosphere and to the local physical and geographical factors.(Pereș, 2012).

The field in the west part of the country is characterized by weather conditions extremely favorable for cultivating winter wheat. Annually there is about 600-700mm rainfall. ( Bîlteanu, 2003).

## MATERIAL AND METHOD

The study related to the effect of the chemical fertilizers with nitrogen and phosphorous upon the quantity and the quality of the winter wheat production has been realized for two types of wheat: Glosa and Renan, at the Leș-Bihor agricultural farm, over the period 2012-2014.

The analyzed factors have been:

- Factor A- soil
  - a<sub>1</sub>- Glosa
  - a<sub>2</sub>. Renan
- Factor B- fertilization with nitrogen and phosphorous:
  - b<sub>1</sub> – N<sub>0</sub>P<sub>0</sub>
  - b<sub>2</sub> – N<sub>120</sub>P<sub>80</sub>
  - b<sub>3</sub> – N<sub>120</sub>P<sub>80</sub>+Uree<sub>50</sub>
  - b<sub>4</sub> – N<sub>120</sub>P<sub>80</sub>+Uree<sub>70</sub>

The culture technology applied to the Glosa and Renan types of wheat has respected the technological requests of the wheat meant to exist on a brown luvic soil.

- The sowing of the two types of wheat fit in the optimum period 1st-20th of October;
- The fertilizers with phosphorus have been applied before sowing and the nitrogen fertilizers have been applied in three periods, 1/3 from the nitrogen has been applied in winter, 1/3 from the dose has been applied in the months February-March and 1/3 from the nitrogen dose has been applied in April-May.

The level of rainfall during the three years of study taken into consideration was the following: in 2012 – 491,7mm/m<sup>2</sup>, in 2013 - 596,7mm/m<sup>2</sup>, and in 2014 - 599,9mm/m<sup>2</sup>.

The analysis of the level of production and of its quality for the analyzed types of wheat (factor A) has been realized in the conditions of fertilizing the wheat with complex nitrogen and phosphorous chemical fertilizers, as well as fertilizing the wheat with urea (factor B). The witness variant was a<sub>1</sub>b<sub>1</sub> for the Glosa type and a<sub>2</sub>b<sub>1</sub> for the Renan type.

## RESULTS AND DISCUSSION

1. The efficiency of the nitrogen and phosphorus fertilizers upon the level of production in what the winter wheat is concerned.

Chemical fertilizers represent one of the most important winter wheat production increasing means. The positive effect of the nitrogen and phosphorous fertilization is significant, being determined by the doses applied and by the period in which these doses are applied.

The analysis of the wheat production level according to the level of fertilization with nitrogen, phosphorous and urea at the Glosa and Renan types of wheat, during the three years of study, 2012-2014, is presented in table 1.

Table 1

The influence of the chemical fertilizers upon the production level at the Glosa and Renan types of winter wheat in the conditions of a brown, luvic soil in Leş-Bihor (2012-2014)

Type of wheat	Variants of fertilization	Annual production Kg/ha			Average production 2012-2014		Differences	Significance
		2012	2013	2014	Kg/ha	%		
1 Glosa	N <sub>0</sub> P <sub>0</sub> .Mt.	3420	3560	3580	3520	100	-	-
	N <sub>120</sub> P <sub>80</sub>	4240	4560	4750	4516	128,29	996	xxx
	N <sub>120</sub> P <sub>80</sub> +Uree <sub>50</sub>	4650	4870	4960	4826	137,10	1306	xxx
	N <sub>120</sub> P <sub>80</sub> +Uree <sub>70</sub>	4760	4890	5150	4933	140,14	1413	xxx
2 Renan	N <sub>0</sub> P <sub>0</sub> -Mt.	3350	3620	3750	3573	100	-	-
	N <sub>120</sub> P <sub>80</sub>	4460	4750	4860	4690	131,26	1117	xxx
	N <sub>120</sub> P <sub>80</sub> +Uree <sub>50</sub>	4720	4940	5170	4943	138,34	1370	xxx
	N <sub>120</sub> P <sub>80</sub> +Uree <sub>70</sub>	4910	5350	5480	5246	146,82	1673	xxx
1	DL5% = 424,40	DL 1% = 623,77			DL 0,1 % = 964,17			
2	DL 5% = 428,76	DL 1% = 633,18			DL 0,1 % = 978,72			

The level of production at the Glosa type of wheat during 2012-1024 presents significant differences according to the doses of fertilizers applied in comparison to the non fertilized variant. By applying a dose of N<sub>120</sub>P<sub>80</sub> the average production during the analyzed period is of 4516 kg/ ha, realizing a production increase of 128,29% in comparison with the witness; and by applying increased doses of urea in the third stage of nitrogen fertilization, the difference of production is significant, the production increase is of 137,10%, at doses of N<sub>120</sub>P<sub>80</sub>+Uree<sub>50</sub> and of 140,14% when applying a dose of N<sub>120</sub>P<sub>80</sub>+Uree<sub>70</sub>.

For the Renan type of wheat the average production obtained during the analyzed period (2010-2014) presents significant differences according to the applied doses of fertilizers with nitrogen and phosphorous. When applying a dose of N<sub>120</sub>P<sub>80</sub> the production increase is of 131,26%, in comparison with the witness variant N<sub>0</sub>P<sub>0</sub>. By applying extra doses of urea during the third stage of nitrogen fertilization, the production increase is of 138,34% at doses of N<sub>120</sub>P<sub>80</sub>+Uree<sub>50</sub> and it reaches 146,82% in case of some doses of N<sub>120</sub>P<sub>80</sub>+Urea<sub>70</sub>.

From the analysis of the three years of study it can be noticed that the highest production has been obtained in 2014, being of 5150kg/ha at the Glosa type of wheat when the wheat has been fertilized with N<sub>120</sub>P<sub>80</sub>+Urea<sub>70</sub>

and of 5480kg/ha at the Renan type when having been fertilized with  $N_{120}P_{80}+Urea_{70}$ , this production being due also to the quantity of rainfall, which was of 599,9 mm/m<sup>2</sup>, in comparison with 2012 when the rainfall quantity was of only 491,7mm/m<sup>2</sup>

## 2. The influence of nitrogen and phosphorous fertilizers upon the quantity of wet gluten at the winter wheat.

The wet gluten represents an essential indicator of the wheat's quality for the bakery industry. A suitable fertilization of the wheat with nitrogen ensures high productions with a high level of gluten, gluten which, in turn, ensures the quality of the bakery products. By adding urea, which contains 46% nitrogen the content of gluten increases significantly.

In table 2 we present the study regarding the role of nitrogen and phosphorous fertilization upon the quantity of gluten in what the winter wheat is concerned, in comparison with the non fertilized variant, for the time period 2012-2014.

*Table 2*

The influence of chemical fertilizers upon the content of gluten at the Glosa and Renan types of winter wheat in Leş-Bihor (2012-2014)

Type of wheat	Variants of fertilization	2012		2013		2014		2012-2014	
		Wet gluten	%						
Glosa	$N_0P_0$	24.3	100	24.6	100	24.8	100	24.5	100
	$N_{120}P_{80}$	26.2	107.8	26.5	108.1	27.2	109.6	26.6	108.5
	$N_{120}P_{80}+Uree_{50}$	27.5	113.1	28.3	115.0	28.6	115.3	28.1	114.6
	$N_{120}P_{80}+Uree_{70}$	28.3	116.4	28.6	116.2	29.2	117.7	28.7	117.1
Renan	$N_0P_0$	25.2	100	25.8	100	26.2	100	25.7	100
	$N_{120}P_{80}$	26.5	105.1	27.2	105.4	27.9	106.4	27.2	105.8
	$N_{120}P_{80}+Uree_{50}$	27.8	110.3	28.5	110.4	29.7	113.3	28.6	111.2
	$N_{120}P_{80}+Uree_{70}$	28.5	113.0	29.4	113.9	30.0	114.5	29.3	114.0

The analysis of the gluten content for the two types of winter wheat, Glosa and Renan during the time period 2012-2014 presents significant increases according to the level of fertilization with nitrogen and phosphorous in comparison with the non fertilized variant.

In what the Glosa type of wheat is concerned, by applying to it doses of  $N_{120}P_{80}$ , the gluten content presents an increase of 108.5% in comparison to the non fertilized variant  $N_0P_0$ ; By supplying the nitrogen dose with urea -  $N_{120}P_{80}+Urea_{50}$ , the gluten content presents significant increases of 114.8%

and increasing the urea dose  $N_{120}P_{80}+Urea_{70}$ , determines an increase of 117.1% in comparison with the non fertilized variant.

The content of gluten at the Renan type of wheat also presents significant increases. By applying some doses of  $N_{120}P_{80}$  we register an increase of the gluten content of 106.4% in comparison with the non fertilized variant, during the period of time analyzed 2012-2014. By adding extra doses of urea, the gluten content increases with 113,3% at doses of  $N_{120}P_{80}+Uree_{50}$  and with 114,5% in case of a dose of  $N_{120}P_{80}+Urea_{70}$ , these representing values of 28,6 and 29,3 respectively, values which highly increase the quality of the wheat in what the bakery industry is concerned.

## 2.The influence of the nitrogen and phosphorous fertilizers upon the content of raw protein in what the winter wheat is concerned.

The content of raw protein from the wheat grain, together with the content of gluten form an indicator of the wheat's quality for the bakery industry. There is a constant desire to increase the content of proteins in the wheat and to improve the wheat's biological value. If plants are suitably supplied with nitrogen that is an essential condition for the biological synthesis of the proteins.

In table 3 we have presented the study regarding the interaction of the nitrogen and phosphorous fertilizers upon the winter wheat's quantity of proteins in comparison with the non-fertilized variant, over the period 2012-2014.

*Table 3*

The influence of chemical fertilizers upon the content of protein at the Glosa and Renan types of winter wheat in Leş-Bihor (2012-2014)

Type of wheat	Variants of fertilization	2012		2013		2014		2012-2014	
		Protein	%	Protein	%	Protein	%	Protein	%
Glosa	$N_0P_0$	13.0	100	13.2	100	13.4	100	13.2	100
	$N_{120}P_{80}$	13.5	103.8	13.7	103.7	14.0	104.4	13.7	103.7
	$N_{120}P_{80}+Uree_{50}$	13.8	106.1	14.1	106.8	14.4	107.4	14.1	106.8
	$N_{120}P_{80}+Uree_{70}$	14.2	109.2	14.5	109.8	14.8	110.4	14.5	109.8
Renan	$N_0P_0$	13.1	100	13.4	100	13.6	100	13.3	100
	$N_{120}P_{80}$	13.5	102.2	13.8	102.9	14.1	103.6	13.8	103.7
	$N_{120}P_{80}+Uree_{50}$	13.9	106.1	14.3	106.7	14.5	106.6	14.2	106.7
	$N_{120}P_{80}+Uree_{70}$	14.1	107.6	14.7	109.7	14.9	109.5	14.5	109.0

During our study period, 2012-2014, the application of nitrogen and phosphorus fertilizers determined a high content of protein in comparison to

the non fertilized variant. At doses of  $N_{120}P_{80}$  the increase of the protein content is of 104,4% for the Glosa type and of 103,6% at the Renan type. By supplying the nitrogen content and by adding urea into the fertilization dose the content of protein increases to 110,4% at the Glosa type and to 109,5% at the Renan type.

## CONCLUSIONS

By applying fertilizers with nitrogen and with phosphorous on the brown luvic soil from Leş-Bihor, important increases of production have been realized during the three years of study, increases with values between 28,29% and 40,14% at the Glosa type and 31,26% and 46,82% at the Renan type, according to the applied dose of NP.

The actual increases in the obtained production are according to the applied fertilization variant; by applying a dose of  $N_{120}P_{80}$ , the obtained difference of production is of 996 kg/ha at the Glosa type and of 1117 kg/ha at the Renan type; adding urea to the nitrogen dose  $N_{120}P_{80}+Urea_{70}$  has brought a difference of production of 1413 kg/ha at the Glosa type and of 1673kg/ at the Renan type.

The effect of the nitrogen and phosphorous fertilizers lead to increased productions both in what quantity as well as in what quality is concerned. Thus, by applying doses of  $N_{120}P_{80}$  the content of gluten has values of 26,6 at the Glosa type and of 27, 9 at the Renan type, and by adding urea into the fertilization dose, the content of gluten reaches to 28,7 at the Glosa type and to 30 at the Renan type. The content of protein follows a resembling increase with the gluten content according to the dose of nitrogen and to the dose of phosphorus.

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