

## THE INFLUENCE OF WHEAT FERTILIZATION WITH CHEMICAL FERTILIZERS ASSOCIATED WITH THE APPLICATION OF CALCAREOUS AMENDMENTS FOR GLOSA AND CRIȘANA TYPES OF WINTER WHEAT

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### Abstract

*The study related to the influence of fertilization for the Glosa and Crișana types of wheat has been performed at the agricultural farm Sânicolau Roman – Bihor, over the period 2012-2014, in different weather conditions, with a level of rainfall between 491.7 mm/m<sup>2</sup> in 2012, 596.7 mm/m<sup>2</sup> in 2013 and 599.9mm/m<sup>2</sup> in 2014.*

*In order to correct the reaction of the soil, amendments have been performed with CaCO<sub>3</sub>, 3t/ha and 6t/ha CaCO<sub>3</sub>. The calcium ion reaches the plant neutralizing certain acids and avoids the intoxication of the plant and the relaunching of its metabolism through using nitrogen, but without losing any of it.*

*The analysis of the production for the two above mentioned types of wheat has been performed in the conditions of nitrogen and phosphorus fertilization, with increasing doses: N<sub>60</sub>P<sub>80</sub>, N<sub>120</sub>P<sub>80</sub>, N<sub>150</sub>P<sub>80</sub>, without the application of the amendments and of the fertilization with the same doses of fertilizers in association with the application of the amendments in doses of 3t/ha CaCO<sub>3</sub> și de 6t/ha CaCO<sub>3</sub>.*

**Key words:** doses of fertilizers, amendments, acid reaction, calcium ion.

### INTRODUCTION

The realization of the agricultural crops on the basis of the nutritious substances from the soil depends on certain external and external factors of the soil, but ensuring the soil with nutrients is an essential condition.

Fertilizers represent the main agricultural and chemical means of quantity and quality modification of the agricultural productions and of influence upon different types of soil fertilization. (Rusu M. et al., 2005).

The winter wheat is one of the agricultural plants which positively reacts to the application of fertilizers in all the pedoclimatic conditions existent in our country. (Bîlteanu Gh., et al., 1989).

The acid reaction of the soil has got a negative influence in what the wheat plants' phosphorus supply is concerned, and it makes way to the apparition of high quantities of aluminium, iron and manganese in the soil, elements which become toxic once they overpass a tolerance limit. În such cases the soil end up lacking calcium and microelements. (Ca, B, Mo, etc.).

A too acid reaction offers the soil physical and chemical features which do not favour the growth of plants. The factors that negatively influence the growth of the plants are: conce high  $H^+$  și  $Al^{3+}$ , ion concentrations, a high content of  $Fe^{2+}$  și  $Mn^{2+}$  ions, a low content of nutritious elements, a non adequate activity of certain species of micro organisms, the bogging of the water. (Ciobanu Ghe.,2012).

The  $Ca^{2+}$  ion has the role to create the link between the walls of the cells, maintaining the intercellular structure and sticking them one to the other. Inside the cells the calcium finds itself în all its components, being the balance product of the cytoplasm, chloroplasts and mitochondrias.(Berca M., 2011).

The calcium that reaches the tissues, through the cell, contributes extremely efficiently to the reduction of a disease attack, especially to the diseases from the bacteria category which can not be destroyed once they are installed in the plant. (Easterwood, 2002, quoted by Berca M.,2011).

By applying the calcium ion  $Ca^{2+}$ , under the form of calcium nitrate one can reduce or eliminate the *Fusarium oxysporum* attack.

One of the effects of the calcium nutrition is that of the increase of nitrogen fertilization. If nitrogen is applied together with soluble calcium as a fertilizer, it reduces a lot the volatilization of the ammonium. (Berca M.,2011).

The correction of the acid aspect of the acid soils can be done through application of calcareous amendments, following at the same time the increase of magnesium and calcium content. The amendments increase the positive action of the mineral and organic fertilizers.

The doses of calcareous amendments, mainly, must ensure, through their growth, a neutralization equal to at least  $\frac{3}{4}$  from the potential acid aspect (hydrolytic) of the soil and a movement of the saturation degree with bases of its own, at a level of over 90%. (Rusu M. et al., 2005).

The administration of the calcareous amendments can be done: when the estate of the soil and of the cultures allow the access of agricultural machines, after the harvesting of the cultures, when the soil is deeply frozen.(Berca M.,1999).

Neutralizing the acid aspect of the soil through the calcareous amendments represents a basic measure to increase the acid soils' production capacity.

## **MATERIAL AND METHOD**

The study related to the influence of the chemical fertilization associated with the application of calcareous amendments upon the wheat production for the Glossa and Crișana types of wheat has been performed at

an agricultural farm from the locality of Sânicolau Român, county of Bihor, over the period 2012-2014.

The experimental factors analyzed have been:

- Factor A- the soil
  - a<sub>1</sub>- Glosa
  - a<sub>2</sub>- Crișana
- Factor B- fertilization with nitrogen and phosphorus:
  - b<sub>1</sub> – N<sub>0</sub>P<sub>0</sub>
  - b<sub>2</sub> – N<sub>60</sub>P<sub>80</sub>
  - b<sub>3</sub> – N<sub>120</sub>P<sub>80</sub>
  - b<sub>4</sub> – N<sub>150</sub>P<sub>80</sub>
- Factor C- fertilization with nitrogen and phosphorus associated with doses of CaCO<sub>3</sub>:
  - c<sub>1</sub>- 0
  - c<sub>2</sub>-3t/ha
  - c<sub>3</sub> - 6t/ha

The technology applied to the Glosa and Crișana types of wheat has respected the technological requests specific for the wheat in the conditions of a preluvisoil.

- The sowing has been done in the optimum period: 1-20 octombrie;
- The phosphorus fertilizers have been applied in autumn, before the sowing, and the nitrogen fertilizers have been applied fractionally, 1/3 from the nitrogen has been applied in spring, in March and another 1/3 has been applied at the end of April;
- The calcareous amendments have been applied în autumn, under the ploughing.

The rainfall during the three years of wheat culture has been different: the following rainfall has been registered: in 2012-491,7, in 2013-596,7mm/m<sup>2</sup>, and in 2014-599,9mm/m<sup>2</sup>.

For the analysis of the production level of the two types of wheat (factor A), the production has been analyzed in the conditions of nitrogen and phosphorus fertilization (factor B) and the production in the case of nitrogen and phosphorus fertilization, simultaneously with the application of the amendments (factor C), has been chosen as a witness the variant b<sub>1</sub>c<sub>1</sub>- for the Glosa type N<sub>0</sub>P<sub>0</sub> and the amendments 0 and b<sub>2</sub>c<sub>2</sub> – for the Crișana type N<sub>0</sub>P<sub>0</sub> and amendments 0.

## RESULTS AND DISCUSSIONS

The analysis of the wheat production according to the level of nitrogen and phosphorus fertilization associated with the application of

CaCO<sub>3</sub> amendments for the Glosa type of wheat during the three years of study, 2013-2015, is presented in table 1.

Table 1

The influence of the amendments and of the chemical fertilizers upon the Glosa winter wheat production in the conditions of the preluvisoil from Sânicolau Român (2013-2015)

Doses of CaCO <sub>3</sub>	Variants of fertilizat ion	Annual production 2012		Annual production 2013		Annual production 2014		Average production 2012-2014	
		Kg/ha	%	Kg/ha	%	Kg/ha	%	Kg/ha	%
0	N <sub>0</sub> P <sub>0</sub>	3150	100	3420	100	3540	100	3370	100
	N <sub>60</sub> P <sub>80</sub>	3370	106.98	3750	109.64	3770	106.49	3630	107.71
	N <sub>120</sub> P <sub>80</sub>	3620	114.92	4230	123.68	4300	121.46	4050	120.17
	N <sub>150</sub> P <sub>80</sub>	3950	125.39	4700	137.42	4760	134.44	4470	132.64
3	N <sub>0</sub> P <sub>0</sub>	3270	100	3540	100	3660	100	3490	100
	N <sub>60</sub> P <sub>80</sub>	3550	108.56	4250	120.05	4350	118.85	4050	116.04
	N <sub>120</sub> P <sub>80</sub>	3870	118.34	4650	131.35	4770	130.32	4430	126.93
	N <sub>150</sub> P <sub>80</sub>	4250	129.96	5150	145.48	5240	143.16	4880	139.82
6	N <sub>0</sub> P <sub>0</sub>	3380	100	3550	100	3600	100	3510	100
	N <sub>60</sub> P <sub>80</sub>	3750	110.94	4560	128.45	4620	128.33	4310	122.79
	N <sub>120</sub> P <sub>80</sub>	4280	126.62	5270	148.45	5570	154.72	5040	143.58
	N <sub>150</sub> P <sub>80</sub>	4450	131.65	5730	161.40	6020	170.05	5400	153.84

Over the three years of studying the Glosa type of wheat (2012-2014), in the conditions of fertilizing it with increasing doses of nitrogen and with constant doses of phosphorus, in association with increasing doses of amendments, we have obtained a wheat production which presents significant differences in comparison with the witness wheat culture which has not been chemically fertilized and to which no other amendments have been applied.

The highest production of wheat has been obtained in 2014, in a quantity of 6020 kg/ha in the conditions of fertilizing the wheat with N<sub>150</sub>P<sub>80</sub> and through the application of some amendment doses of 6t/ha.

From the analysis of the three years of study it can be noticed that the highest production has been obtained in 2014, for the three levels of fertilization as well as for the non fertilized witness, this high production being due to the low level of rainfall, of only 599.9 mm/m<sup>2</sup>, in comparison with the year 2012, when the level of rainfall was of 491.7 mm/m<sup>2</sup>, determining a lower level of wheat production.

From the analysis of the average productions for the Glosa type of wheat, for the period of the three years of study, it can be noticed that the production growth increases proportionally with the increase of the chemical fertilizer doses, reaching 32.64% in the case of fertilization with N<sub>150</sub>P<sub>80</sub>, in comparison with the non-fertilized witness, and, in the case of applying the fertilizers and the amendments it reaches an increase of

39.82% in case of using  $N_{150}P_{80}$  and of some doses of 3 t/ha and of 53.84% when using some doses of  $N_{150}P_{80}$  and 6t/ha of calcareous amendments.

The wheat production obtained for the Crişana type of wheat, over the period 2012-2014 through fertilization with different doses of nitrogen and phosphorus, associated with increasing doses of calcareous amendments are registered in table 2.

Table 2

The influence of the amendments and of chemical fertilizers upon the Crisana winter wheat production in the conditions of Oradea's preluvisoil (2013-2015)

Doses of $CaCO_3$	Variants of Fertilization	Annual production 2012		Annual production 2013		Annual production 2014		Average production 2012-2014	
		Kg/ha	%	Kg/ha	%	Kg/ha	%	Kg/ha	%
0	$N_0P_0$	2950	100	3130	100	3220	100	3100	100
	$N_{60}P_{80}$	3120	105.76	3350	107.02	3460	107.45	3310	106.77
	$N_{120}P_{80}$	3370	114.23	3600	115.01	3740	116.14	3570	115.16
	$N_{150}P_{80}$	3580	121.35	3850	123.32	3970	123.29	3800	122.58
3	$N_0P_0$	3170	100	3260	100	3350	100	3260	100
	$N_{60}P_{80}$	3350	105.67	3740	114.72	3830	114.32	3640	111.65
	$N_{120}P_{80}$	3680	116.08	4150	127.30	4260	127.16	4030	123.61
	$N_{150}P_{80}$	3960	124.92	4730	142.33	4840	144.47	4510	138.34
6	$N_0P_0$	3250	100	3370	100	3400	100	3340	100
	$N_{60}P_{80}$	3540	108.92	4020	119.28	4170	124.41	3910	117.06
	$N_{120}P_{80}$	3970	122.15	4810	142.72	5170	152.05	4650	139.22
	$N_{150}P_{80}$	4420	136.00	5350	158.75	5440	162.00	5070	151.79

The production obtained at the Crişana type of wheat, during the three years of study,(2012-2014), presents quite high variations according to the study year, in which the rainfall level was low, according to the fertilization level as well as according to the doses of applied amendments.

At the same level of fertilization, meaning  $N_{150}P_{80}$  and of application of amendments of 6t/ha, the lowest production was of 4420g/ha in the year 2012, when the level of rainfall was of 491.7 mm/m<sup>2</sup>, and the highest production was of 5440 kg/ha in the year 2014, when the quantity of rainfall was of 599,9 mm/m<sup>2</sup>. In the year 2013, when the level of rainfall was close to the level existent in the year 2014, meaning 596.7mm/m<sup>2</sup>, the production obtained was of 5350kg/ha.

The production increase realized at the average obtained productions in the three years of study, increases significantly from 6.77%, in the case of fertilization with  $N_{60}P_{80}$ , but without the application of amendments, and reaches 51.79%, in the case of fertilization with  $N_{150}P_{80}$  and of application with the amendments of 6 t/ha of  $CaCO_3$ .

The analysis of the average productions realized by the Glosa and Crişana types of wheat, in the case of fertilizing them with increasing doses

of fertilizers and of applying the amendments, and the differences obtained are presented in tables number 3, 4.

Table 3

The average production (201-2014) for the Glosa type of winter wheat in the conditions of the preluvisoil existent in Sânicolau Român

Doses of CaCO <sub>3</sub>	Variants of fertilization	Average production Glosa 2012-2014		± d	Significance
		Kg/ha	%		
0	N <sub>0</sub> P <sub>0</sub>	3370	100	-	-
	N <sub>60</sub> P <sub>80</sub>	3630	107.71	+260	-
	N <sub>120</sub> P <sub>80</sub>	4050	120.17	+680	xx
	N <sub>150</sub> P <sub>80</sub>	4470	132.64	+1100	xxx
3	N <sub>0</sub> P <sub>0</sub>	3490	100	-	-
	N <sub>60</sub> P <sub>80</sub>	4050	116.04	+560	x
	N <sub>120</sub> P <sub>80</sub>	4430	126.93	+940	xx
	N <sub>150</sub> P <sub>80</sub>	4880	139.82	+1390	xxx
6	N <sub>0</sub> P <sub>0</sub>	3510	100	-	-
	N <sub>60</sub> P <sub>80</sub>	4310	122.79	+800	xx
	N <sub>120</sub> P <sub>80</sub>	5040	143.58	+1530	xxx
	N <sub>150</sub> P <sub>80</sub>	5400	153.84	+1890	xxx

LSD 5%=404

LSD 5%=418

LSD 5%=421

LSD 1%=595

LSD 1%=616

LSD 1%=620

LSD 0.1%=419

LSD 0.1%=952

LSD 0.1%=958

Table 4

The average production (201-2014) for the Crișana type of winter wheat in the conditions of the preluvisoil existent in Sânicolau Român

Doses of CaCO <sub>3</sub>	Variants of fertilization	Average production Crișana 2012-2014		± d	Significance
		Kg/ha	%		
0	N <sub>0</sub> P <sub>0</sub>	3100	100	-	-
	N <sub>60</sub> P <sub>80</sub>	3310	106.77	+210	-
	N <sub>120</sub> P <sub>80</sub>	3570	115.16	+470	x
	N <sub>150</sub> P <sub>80</sub>	3800	122.58	+370	-
3	N <sub>0</sub> P <sub>0</sub>	3260	100	-	-
	N <sub>60</sub> P <sub>80</sub>	3640	111.65	+380	-
	N <sub>120</sub> P <sub>80</sub>	4030	123.61	+770	xx
	N <sub>150</sub> P <sub>80</sub>	4510	138.34	+1250	xxx
6	N <sub>0</sub> P <sub>0</sub>	3340	100	-	-
	N <sub>60</sub> P <sub>80</sub>	3910	117.06	+570	xx
	N <sub>120</sub> P <sub>80</sub>	4650	139.22	+1310	xxx
	N <sub>150</sub> P <sub>80</sub>	5070	151.79	+1730	xxx

LSD 5%=372

LSD 5%=436

LSD 5%=401

LSD 1%=550

LSD 1%=641

LSD 1%=591

LSD 0.1%=849

LSD 0.1%=940

LSD 0.1%=887

From the analysis of the average production for the three years of study (2012-2014), it can be noticed that the application of some increasing doses of complex fertilizers brings a significant increase of production. For the Glosa type of wheat the production increase is of 7.71%, when having been fertilized with  $N_{60}P_{80}$ , of 20.17% when having been fertilized with  $N_{120}P_{80}$  and it reached 32.64%, when having been fertilized with  $N_{150}P_{80}$ , in comparison with the non-fertilized variant. In what the Crișana type of wheat is concerned, the production increase realized at the fertilization with  $N_{60}P_{80}$  is of 6.77%, at the fertilization with  $N_{120}P_{80}$  it is of 15.16%, and it reaches 22.58% when being fertilized with  $N_{150}P_{80}$ , in comparison with the non-fertilized variant.

By applying the calcareous amendments in association with chemical fertilizers, the production growth increases significantly. At the Glosa type of wheat, the production increase is of 39.82 when applying 3t/ha of amendments in association with fertilizing doses of  $N_{150}P_{80}$ , and it reaches 53.84% when applying 6t/ha of amendments and fertilizers like  $N_{150}P_{80}$ . At the Crișana type of wheat, the production increase is of 38.34% by applying  $N_{150}P_{80}$  and 3t/ha  $CaCO_3$  and it reaches 51.79% by applying  $N_{150}P_{80}$  and 6t/ha of  $CaCO_3$ .

At the application of the amendments associated with increasing doses of chemical fertilizers, the average production realized at the Glosa type of wheat is higher than that of the Crișana type of wheat, the difference of production being of +370kg/ha at a fertilization with doses of  $N_{150}P_{80}$  and 3t/ha  $CaCO_3$  and of +330 kg/ha at a fertilization with  $N_{150}P_{80}$  and 6t/ha  $CaCO_3$ .

## CONCLUSIONS

The study performed over a period of three years for the Glosa and Crișana types of winter wheat (2012-2014), at an agricultural farm from Sânicolau Român-Bihor county, emphasizes the advantages of fertilization and of applying calcareous amendments upon the production, production which also depends on the level of rainfall existent in each of the studied years.

At the Glosa type of wheat, the highest production was obtained in the year 2014, in a quantity of 6020 kg/ha when the culture was fertilized with  $N_{150}P_{80}$  and when the culture has been applied doses of amendments of 6t/ha, realizing an production increase of 70.05% in comparison with the non-fertilized variant.

At the Crișana type of wheat, the highest production was obtained in the year 2014, and it represented a quantity of 5440kg/ha in the conditions of fertilization with  $N_{150}P_{80}$  and of application of some amendment doses of

6t/ha, realizing a production increase of 62.00 % în comparison with the non-fertilized variant.

Quantitatively, the difference of the average production of the two types of autumn wheat realized during the three years of study (2012-2014) is higher in the case of the fertilized variants to which no amendments have been applied and lower at the variants where doses of 3t/ha and of 6t/ha respectively have been applied. For the Glosa type, the difference is of +320kg/ha, at the fertilization with  $N_{60}P_{80}$ , of +480kg/ha at the fertilization with  $N_{120}P_{80}$  and of +670kg/ha at the fertilization with  $N_{150}P_{80}$ , without the application of the amendments.

By applying amendments in association with increasing doses of chemical fertilizers, the average production realized by the Glosa type is higher than that of the Crișana type, and the difference of production is of +370kg/ha at the fertilization with doses of  $N_{150}P_{80}$  and 3t/ha  $CaCO_3$  and of +330 kg/ha at the fertilization with  $N_{150}P_{80}$  and 6t/ha  $CaCO_3$ .

From the analysis of the above presented data it comes out that the fertilization of the wheat culture in the conditions of the preluvisoil existent în the village of Sânicolau Roman-Bihor county, associated with the application of calcareous amendments brings significant increases of production. The maximum levels of production have been obtained by applying amendments in doses of 6t/ha and when fertilizing the wheat culture with  $N_{150}P_{80}$ .

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