

THE INFLUENCE OF LIME APPLIED ON DIFFERENT NP BACKGROUNDS ON WINTER WHEAT YIELD IN PRELUVOIL CONDITIONS FROM ORADEA IN 2009-2011

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Abstract

This paper includes the research results obtained after 30 years of experiences in stationary field with chemical fertilizers and limes on preluvoil from Oradea.

Annual application of different rates and combinations of chemical fertilizers and limes with application of CaCO_3 once to six years determined a positive evolution of principal soil chemical properties.

The total nitrogen, phosphorus and potassium content is improved through the well balanced fertilization with NPK and liming with CaCO_3 once to six years.

In this paper are presented the results regarding the influence of lime applied on different NP background on winter wheat yield in long term field experiment set up at Agricultural Research and Development Station Oradea in 2009-2011.

Key words: winter wheat, lime, background, rate, yield

INTRODUCTION

Acid reaction, favoring partial shift of aluminum in soluble forms, in acid soils sometimes reaches the contents which cause phytotoxicity.

High concentrations of Al^{3+} in the nutrient solution manifest harmful effects on roots, suffering morphological changes, darkening, reduction of their growth in length and thickness; fundamental changes occur in adsorption capacity and retention of cations (Borlan Z., 1973, Hera Cr., et al., 1984).

It also leads to the decrease in phosphorus nutrition, which precipitates as aluminum phosphate at the root surface (Ciobanu Gh., et al., 2011).

Contents of mobile aluminum exceeding toxicity levels may appear in soils fertilized with nitrogen, in a rate above 100 kg / ha, and when applying moderate rates of phosphorus and potassium fertilizers (Ciobanu Gh., et. al., 2010).

The higher level of mobile aluminum content requires calcareous lime, influencing favorably the values of this agrochemical indicator while reducing soil acidity (Lixandru, Gh., 1990).

Long-term field experiments in different pedoclimatic conditions were carried out for a better knowledge of the application effect on time of lime rates on soil chemistry at the Agricultural Research Stations in Romania.

Lime application in preluvosoil conditions is a necessary measure in the case of using NP fertilizers in high rates.

This paper presents the results regarding the influence of lime rates on winter wheat yield.

MATERIAL AND METHOD

The research data was obtained at the Agricultural Research and Development Station Oradea in the long-term field experiments with fertilizers, using a unique design in the entire research network of the Research Institute in Fundulea from 2009 to 2011.

The investigation was carried out beginning with the autumn of 1974 in Oradea, in a flat plain area on the third terrace of the Crisul Repede River, whose geographical coordinates are: 21°56' Eastern longitude, 47°03' Northern latitude and 136 m altitude.

The application of long term NPK and lime fertilizers determines a differentiated evolution of preluvosoil chemical properties depending on the fertilizers rates applied, this having a strong influence on wheat/yield and its quality.

The experiment was designed as a completely randomized block with four repetitions. All plots were seeded at a rate of approximately 550 seeds /m², using Crișana variety (created at Agricultural Research and Development Station in Oradea), classified in A2 (B1) valuable group, being appreciated as an ameliorative one. It is recommended to be cultivated in hill area of Crișana, Maramureș, Transylvania and Bukovina regions and in the plain area of western Romania.

The results were processed by the "variance analysis" using regression equations, correlations and by the "response surface" for calculating fertilizer yield and optimal and maximum doses.

The main objectives were:

- to establish the efficiency of lime application and increasing doses;
- to establish the influence of different lime fertilizers applied on different grounds

Primary yield was calculated from STAS humidity of 14% is reported that moisture content of nitrogen, phosphorus, potassium and protein from beans.

RESULTS AND DISCUSSIONS

The experiments results regarding of lime influence on winter wheat yield cultivated on preluvosoil from Oradea in 2009 (Figure1) show that if were not applied limes, the application of nitrogen and phosphorous determined an increasing of yield in the same time with nitrogen rate from 0 to 160 kg/ha. Yield spore obtained were between 0,3 and 9,0 q/ha . Through the lime application in rate of 3, 6 and 9 t/ha the yield increased in the same time with increasing of nitrogen rate.

Unilateral application of lime increases the wheat yield from 30,8 q/ha in the variant without lime application to 35,1 q/ha by applying 9 t/ha CaCO_3 , the yield growth was 4,3 q/ha. Applying lime on different NP backgrounds lead to a different yield spore.

The average on five NP backgrounds and the application of 3 t/ha CaCO_3 realized an yield spore about 2,4%, respectively 10,1% in case of 6 t/ha and 14,1% in case of 9 t/ha CaCO_3 application.

The yields spore realized because of application of chemical fertilizers were different depending on rate applied and higher yield spore were registered when was applied 9 t/ha CaCO_3 every six years.

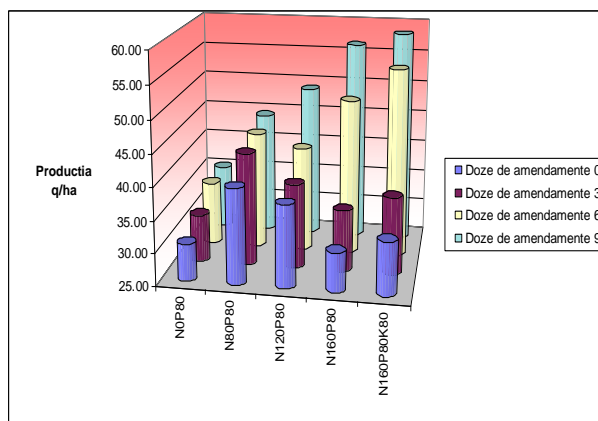


Fig.1. The influence of lime application on winter wheat yield cultivated on preluvosoil from Oradea in 2009

In 2010 the researches shown that without lime fertilizers the application of nitrogen and phosphorous fertilizers determined an increase of yield in the same time with increasing of nitrogen rate of 3, 6 and 9 t/ha were registered an increasing of yield.

Unilateral application of lime determines an increasing of winter wheat yield from 11,8 q/ha in the variant without lime application to 24,8 q/ha in variant with application of 6 t/ha CaCO_3 and yield spore was 13

q/ha. The different application of lime on different NP backgrounds lead to registration of higher spore yield (Figure 2.).

The average on five NP backgrounds, the application of 3 t/ha CaCO_3 registered an yield spore about 7,8%, the application of 6 t/ha CaCO_3 registered on yield spore by 11,5% and the application of 9 t/ha CaCO_3 determined an yield spore by 11,0%.

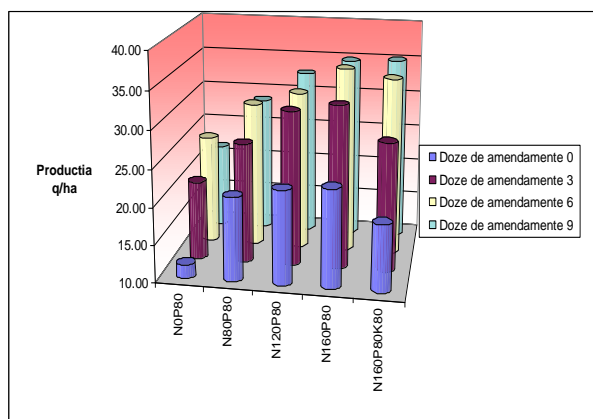


Figure 2 .The influence of lime application on winter wheat yield cultivated on preluvosoil from Oradea in 2010

The results registered in 2011 without lime application, shown that application of nitrogen and phosphorous fertilizers determined the increasing of nitrogen rate from 0 to 160 kg/ha. The yield spore were between 8,7 and 12,0 q/ha (Figure 3.).

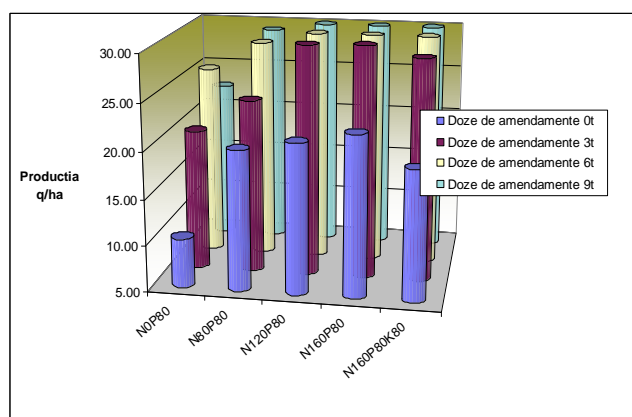


Fig 3 .The influence of lime application on winter wheat yield cultivated on preluvosoil from Oradea in 2011

The application of lime determined the increasing of winter wheat yield from 10,3 q/ha (without lime application) to 25,2 q/ha through the application of 6 t/ha ca CaCO₃ with an yield spore about 15,4 q/ha.

The average on five NP backgrounds the application of 3 t/ha CaCO₃ lead to an yield spore about 8,5% respectively 12,6% in case of 6 t/ha CaCO₃ application and 13,5% if were applied 9 t/ha CaCO₃.

The results obtained on preluvoil from Oradea since 2009 to 2011 show that without lime application, the fertilization with nitrogen and phosphorus fertilizers lead to a decreasing of yield in the same time with increasing of nitrogen rate from 0 to 160 kg/ha. The yield spore were between 8,8 and 26,0 q/ha.

Unilateral application of lime in this 3 years increases the winter wheat yield from 17,6 q/ha in variant without lime application, to 43,6 q/ha by application of 9 t CaCO₃ and the yield spore registered was 19.8 q/ha. Differentiated application of lime on different NP backgrounds lead to a higher yield spore (Table 1., Figure 4.).

Table 1.

The influence of lime (CaCO₃) on winter wheat yield on preluvoil from Oradea, 2009-2011

Level of fertilizations		Yield q/ha				Average		Difference	
		0 t	3 t	6 t	9 t	q/ha	%	q/ha	%
N ₀ P ₈₀		17,6	24,4	28,5	26,4	24,2	100	-	-
N ₄₀ P ₈₀		27,1	30,9	34,0	34,1	31,5	130	7,3	30
N ₈₀ P ₈₀		27,2	33,0	35,2	38,9	33,6	139	9,4	39
N ₁₆₀ P ₈₀		25,5	33,0	39,9	42,7	35,3	146	11,1	46
N ₁₆₀ P ₈₀ K ₈₀		23,8	31,1	40,8	43,7	34,8	144	10,6	44
Average	q/ha	24,2	30,5	35,7	37,1				
	%	100	126	14,8	153				
Difference	q/ha	-	6,3	11,5	12,9				
	%	-	26	48	53				

	CaCO ₃	NP	CaCO ₃ xNP
DL5%	2,30	1,67	4,64
DL1%	3,49	2,24	6,74
DL0,1%	5,60	2,98	10,25

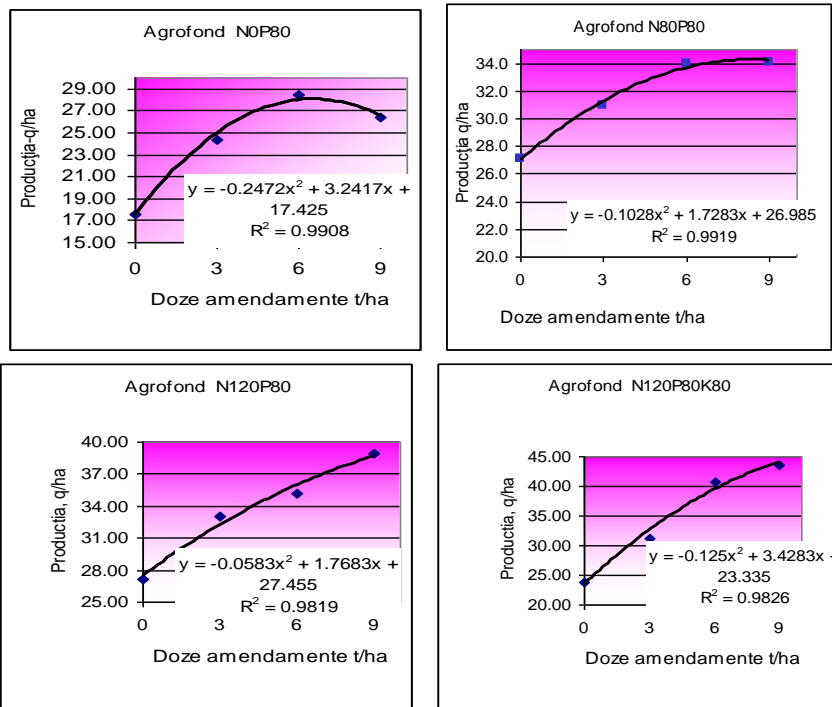
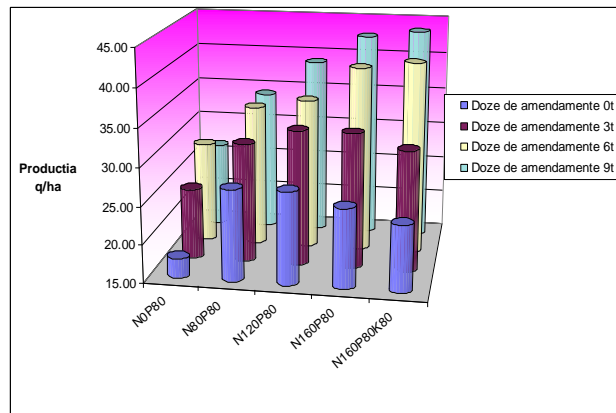


Fig. 4 .The influence of lime application on winter wheat yield cultivated on preluvosoil from Oradea in 2009-2011

Average of the five NP backgrounds, the application of 3 t/ha CaCO_3 is registering an yield spore about 6,3%, the application of 6 t/ha CaCO_3 realized an yield spore about 12,9%.

The higher level of yield were registered when the fertilizers were applied on a background with 9 t/ha CaCO_3 every 6 years.

CONCLUSIONS

The application of CaCO_3 is the main technological measure and in the acid soil conditions provide superior values of organo-mineral fertilizers.

The effect of lime application realized in stationary experiments since 2009 to 2011 on winter wheat yield is different depending on climatic conditions and NP backgrounds.

In average on three years of experiments the application of lime in rate by 6t/ha without NP fertilizers registered a maximum spore about 10,9 q/ha.

On NP backgrounds the levels of yield are increased, the higher level being registered in the variants where was applied 9 t/ha CaCO_3 every six years.

The application of lime on different NP backgrounds influence the main elements of productivity at winter wheat which has direct repercussions on yield levels achieved.

Based on the research results obtained in stationary experiments with fertilizers in 2009-2011 it can be concluded that the application of lime in rate by 9 t/ha every six years and annual fertilization with NP balanced rates, determined the increasing of yield spore 11,7 to 17,2 q/ha.

Using the systematic application of NP on preluvoil condition from North-Western part of Romania, it is necessary the periodical application of lime for the maintenance of agrochemical indicators at levels that allow achieving efficient levels of production.

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