INFLUENCE OF KXNP FERTILIZERS IN LONG TERM FIELD EXPERIMENTS ON WINTER WHEAT YIELD AND QUALITY IN THE PRELUVOSOIL CONDITIONS FROM NORTH – WEST PART OF ROMANIA

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Abstract

In Romania was set up since 1968 a stationary long term field experiments with fertilizers and lime in all the Agricultural Research Stations that belong to Agricultural Research and Development Institute of Fundulea.

The experiments was set up using a unitary scheme for researching the evolution of soil fertility and the influence of fertilizers and lime rates and combinations on level and quality yield of different crops.

The preluvosoil from North – West part of Romania is a medium provide with the main nutritive elements, with a weak acid reaction in the ploughing horizon.

In this paper are presented the results regarding the influence of potassium fertilizers applied on different NP background on winter wheat yield and quality in long term field experiment set up in 1974 at Agricultural Research and Development Station Oradea.

Key words: acid soils, potassium fertilizers, wheat, yield, quality.

INTRODUCTION

In Romania acid ploughing soils are spread on 2.0 millions ha which represent 20% from total agricultural land.

The factors which have a negative influence on growing plants are: high level soil content in the H^+ and Al^{3+} , Fe^+ and Mn^+ and low level soil content in main nutrients, low activity of microorganisms, and stagnation of water because of unsatisfactory infiltration.

Many researches on preluvosoil (Bedo and Lang, 1977, Ciobanu and Nagy 1986, Nemeth 1996) have shown the negative effect of long-term application of nitrogen, as ammonium nitrate, on soil reaction. Soil's high acidity leads to growth of mobile aluminium and manganese soil content, which can determine phytotoxicity in the first part of vegetative period, with negative influence on yield and its quality.

In connection with potassium fertilizers applied in long term field experiments there are a few published research data.

This paper presents the results regarding the influence of potassium fertilizers applied on different NP backgrounds in long term field experiments on winter wheat yield and its quality.

MATERIAL AND METHOD

Experimental site

The research data was obtained at the Agricultural Research and Development Station Oradea, using a unique design in all research network of Research Institute Fundulea. The investigation has been 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: $21^{0}56$ ' Eastern longitude, $47^{0}03$ ' Northern latitude and 136 m altitude.

The solidification rock consists of clay loam. The ground water is located at a depth of 6-8 m, the soil is a brown one with horizon disposition; the main physical and chemical characteristics are shown in table 1. The presence of clay migration, B horizon is to be noticed on the thickness of the soil profile, with high and very high values of the bulk density and compaction level and low or very low total porosity and hydraulic conductivity.

The soil reaction is acid in the ploughing A horizon, then slightly acid. The lack of $CaCO_3$ in the soil profile is underlined. The mobile Al content in the A horizon may cause poor growth of some crops (clover). The soil is well provided with mobile potassium and phosphorus. The soil humus medium content may not cause distortions to the neutronic determination of the soil moisture. (Table 1)

Table 1

Soil depth	Sand	Silt	Clay	OC	Humus	Ca CO ₃	Al mobile	pН	Ν	P mobile	K mobile
cm					%	%	mg/100g soil	1:2	Total	ppm	ppm
								H ₂ O	%		
0 - 5	43,5	28,3	28,2	1,25	2.32	0.00	3.68	6,3	0.12	21.8	83.0
5 - 15	41,8	28,4	29,8	1,12	2.28	0.00	2.32	6,4	0.11	22.7	102.1
15 - 30	40,0	28,5	31,5	1,02	1.91	0.00	0.52	6,3	0.09	5.7	112.1
30 - 60	32,0	28,0	40,0	0,99	1.93	0.00	0.77	6,6	0.09	6.1	117.9
60 - 90	24,1	36,7	39,2	0,29		0.00	0.32	6,6			
90 - 150	35,1	27,3	37,6	0,17		0.00	0.59	6,5			

The main properties of the preluvosoil from Oradea - Romania

Field experiment with potassium fertilizers was set up in 1974 using a crop rotation: pea – winter wheat – maize – sunflower.

The factors researched were the potassium and NP rates applied:

- a. potassium rate : K_0 , K_{40} , K_{80} , K_{120}
 - b. NP rates: N₀P₀; N₈₀P₄₀; N₈₀P₈₀; N₁₆₀P₈₀. (N was apllied like ammonium nitrate, in spring, P was aplied like superphosphate and K like KCl in autumn).

The crop rotation used in the field experiments was sunflower - wheat - corn - wheat. In the field experiment the influence of fertilizers applied on wheat kernels yield was determined and a statistical interpretation of the yield differences obtained between different treatements was made.

RESULTS AND DISCUSSION

Influence of potassium fertilizers on winter wheat yield (2006-2008)

In the conditions of preluvosoil from North –West part of Romania, without application of NPK fertilizers, even if a crop rotation by 4 years was used, the level of yield it's about 1000 kg/ha. The application of P fertilizers in the N_0P_0 backgrounds determined a progressive increase of yield with 150 - 500 kg/ha depending on K rates used.

In the case of background N_0P_0 the yields level are taking values between 10 q/ha and 15 q/ha. The yield spores because of K rates application are ranged between 1.5 q/ha and 5 q/ha.

In the case of background $N_{80}P_{40}$ the yield level are taking values between 26.4 q/ha and 36.8 q/ha. The higher yield spores was obtained through application of 80 kg/ha K₂₀.

The highest yield spores obtained, because of K rates application is 800 - 1000 kg/ha, were realized in the case of $N_{80}P_{40}$ respectively $N_{80}P_{80}$ backgrounds used. The highest level of yield (4650 kg/ha) was realized in variants were used $N_{160}P_{80}K_{80}$ fertilizers (Fig.1).



Fig. 1. The influence of KxNP fertilizers on winter wheat yield in preluvosoil conditions from Oradea 2006-2008

The research data has shown that potassium application reduced the negative effect on yield of high nitrogen rates, which in this type of soil are decreasing pH values and plant sensibility to diseases.

The use of higher rates of potassium fertilizers (K_{120}) determined an insignificant yield spores and it is not justified by economical viewpoint.

Influence of potassium fertilizers on dry gluten content of winter wheat crop

Even if the main fertilizers which had a good influence on wheat grain content is the nitrogen fertilizer, from the research dates presented (Fig. 2) was established that lower and middling rates of potassium (K₄₀) had a favorable effect on this indexes, the yields spores obtained were different because of the NP backgrounds used. In this case, on the N₈₀P₄₀ background the dry gluten content is increasing from 11.24 to 12.50, respectively to 12.87 when K₄₀ or K₈₀ was applied and on the N₁₆₀P₈₀ background the dry gluten content increased from 12.71 to 14.37 respectively to 14.73 when K₄₀ or K₈₀ was applied.

The higher rates of potassium fertilizer (K_{120}) lead to an decreasing of gluten content from wheat grain. This negative effect was established by the potassium fertilizer because it is stimulating a good synthesis of glucides better than synthesis of nitrogen substances. That is why when higher rates with K fertilizers were applied, the synthesis and moving of glucides to the grain were much more accumulated and the protein content decreased.



Fig. 2. The influence of KxNP fertilizers on dry gluten content (%) of winter wheat yield, Oradea 2006-2008

CONCLUSIONS

- ✓ Long term field experiments are important tools for examining the soil fertility and its influence on the yield level
- ✓ The main agrochemical indexes depends on the fertilizers' type and on the rates fertilizers level applied
- ✓ Potassium fertilizers have a significant influence on wheat yield. The best yield in preluvosoil conditions (45.6 q/ha) was obtained in the case of using $N_{160}P_{80}K_{80}$ rates.
- ✓ The lower potassium rates (K_{40} and K_{80}) influenced positive the dry gluten content of winter wheat. The best values of the dry gluten content (14.8%) in preluvosoil conditions was obtained in the variants fertilized with $N_{160}P_{80}K_{80}$

REFERENCES

- 1. Bedo Z., L. Lang, 1977, Growing and breeding of quality wheat. Agro-21 Fuzetek, 97/14, 8-28.
- 2. Ciobanu GH., Nagy M., 1986, Evitarea dezechilibrului de nutriție la grâul cultivat pe solurile brune luvice, prin aplicarea rațională a îngrășămintelor cu azot. Prod. veget. cereale și pl. tehn., nr. 2.
- 3. Nemeth T., 1996: Environment friendly fertilizer recommendation for sustainable agriculture. In: Environmental Pollution, ed. B. Nath et ALL ECRP, Queen Marz and Westfield, college, London, 99-105.