RESEARCH REGARDING THE INFLUENCE OF MINERAL FERTILISATION ON THE WHEAT PRODUCTION UNDER PEDOCLIMATIC CONDITIONS IN THE ALMĂJ DEPRESSION

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Abstract. *The research covered the reaction to fertilisation of an autumn wheat variety assortment, on an alluvial soil type. The study results highlighted the fact that in the area where the research was carried out, panification wheat can be obtained from all researched varieties. The yield increase insured by nitrogen fertilisers, applied on a $P_{60}K_{60}$background resulted in an average of 13.2 kg grains/1 kg N s.a.at a N_{75}dosage and 13.6 kg grains /1 kg N s.a.at a N_{150}dosage for all 5 varieties during the 3 experimental years. When applying a N_{75}dose, the protein quantity increased by 42%, leading to a 163 kg/ha difference when compared to the control variant. Upon doubling the nitrogen dose to N_{150},the protein quantity was increased by 113%, determining a 337 kg/ha difference, in comparison with the N_0 variant.Both differences were insured as highly significant.*

Key words*: wheat, fertilisation, technology, pedoclimatic conditions*

INTRODUCTION

The special importance of wheat for the food industry is given by the fact that it is nutritional, concentratedandcan easily be turned to suitable food. More than any other plant, wheat has been used as human food since ancient times,remaining inseparable from civilised man during the course of his history. Wheat is one of the most important crop plants, and represents the food basis for the majority of the world's population (BILTEANU, 1991, IMBREA, 2014).

Due to the fact that wheat represents an old crop, man managed to improve its production and other agronomical characteristics, at first through selection. Only recently did we bestow a special attention to its nutritional quality. The wheat's nutritional valuewas improved by a continual increase in protein content of the grain and by improving the protein quality through raising the insufficient amino-acid content, especially lysine (PIRSAN, 2016, DAVID, 2016).

MATERIALS AND METHODS

The experimental field was located on a typical alluvial soil, on fluviatile clay–sandy deposits, humid phreatic, clay – sandy in Ap, with a de 3 – 5 m depth of the underground water level.The research objectives were to contribute in the establishment of variety structure and the optimization of their fertilisation, as well as of the effects of this important technological link on the grain quality.

We studied the influence of variable nitrogen fertiliser doses, applied on a constant $P_{60}K_{60}$ background on common wheat varieties, all pertaining to the species *Triticum aestivum vulgare*:

Factor A –cultivated variety

A_1 – Alex
A_2 – Ciprian
A_3 – Dropia
A_4 – NS 40S
A_5 – Renesansa

Factor B – fertilisation level

b_1 – $N_0P_{60}K_{60}$
b_2 – $N_{75}P_{60}K_{60}$
b_3 – $N_{150}P_{60}K_{60}$

The preceding plant was grain corn,the most frequent rotation in the area. Waste incorporation in the soil was achieved through 23-25 cm furrowing, and the seedbed was prepared with the disc harrow. Phosphorus and potassium fertilisers were applied under the furrow, and the nitrogen ones, half a dose upon preparing the seedbed and the other half in spring. Seeding happened during the second decade of October, with 600 w.g./m^2at a 12.5 cm distance. During vegetation, we usedGranstar Super 50 SG herbicide, 40 g/ha.

Physical analyses regarding the mass of 1000 grains (MMB) and hectolitre mass (MH) were carried out, as well as chemical analyses regarding the gross protein weight (%); humid gluten content (%);deforming indices (mm) and fall indices (sec.). We used international determination methods, accepted by I.S.T.A.

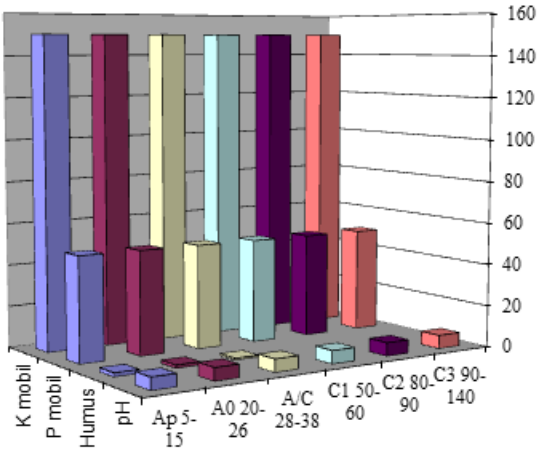


Figure 1. Results of soil chemical analysis in experimental field

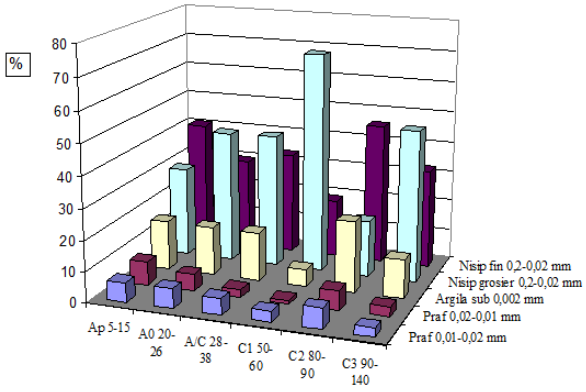


Figure 2. Results of soil physical analysis in experimental field

RESULTS AND DISCUSSIONS

Synthesis results from a two year experimental cycle, which, under climatic aspects, presented important deviations from the multiannual averages, presented in table 1, highlight the fact that by proper variety selection and fertilisation one may obtain yields of over 5500 kg/ha in panification wheat. At this level, the wheat crop is economically motivating for the cultivars in the area.

As an average, at the tested fertilisation levels, the varieties Alex, Ciprian ş iDropia produced harvests of over 4400 kg/ha. Yield differences between the three varieties were small, insignificant.

Table 1

Synthesis of results obtained during the experimental cycle2016-2017

Factor A Experimental variety	Factor B – Nitrogen dose			Factor A averages			
	$N_0P_{60}K_{60}$	$N_{75}P_{60}K_{60}$	$N_{150}P_{60}K_{60}$	Yield kg/ha	%	Difference kg/ha	Significance
Alex	3202	4181	5272	4418	100		
Ciprian	3442	4542	5544	4509	102	91	
Dropia	3341	4469	5417	4409	100	-90	
NS 40S	2657	3538	4757	3650	83	-768	0
Renesansa	3047	3920	4955	3974	90	-444	

DL5% = 651 kg/ha DL1% = 926 kg/ha DL0,1% = 1341 kg/ha

Factor B averages

Specification	$N_0P_{60}K_{60}$	$N_{75}P_{60}K_{60}$	$N_{150}P_{60}K_{60}$
Yield kg/ha	3137	4130	5189
%	100	132	165
Difference kg/ha		993	2050
Significance		XXX	XXX

DL5% = 376 kg/ha DL1% = 534 kg/ha DL0,1% = 774 kg/ha

The Serbian varieties under studyunder the conditions of the Almăj depression proved less adaptable, average yields with these varieties amounting to under 4000 kg/ha, respectively 3974 kg/ha with the Renesansa variety and 3650 kg/ha with the NS 40S variety.

Regarding the nitrogen fertilisersapplied on a constant $P_{60}K_{60}$background, the results indicate a good capitalization by the studied varieties.

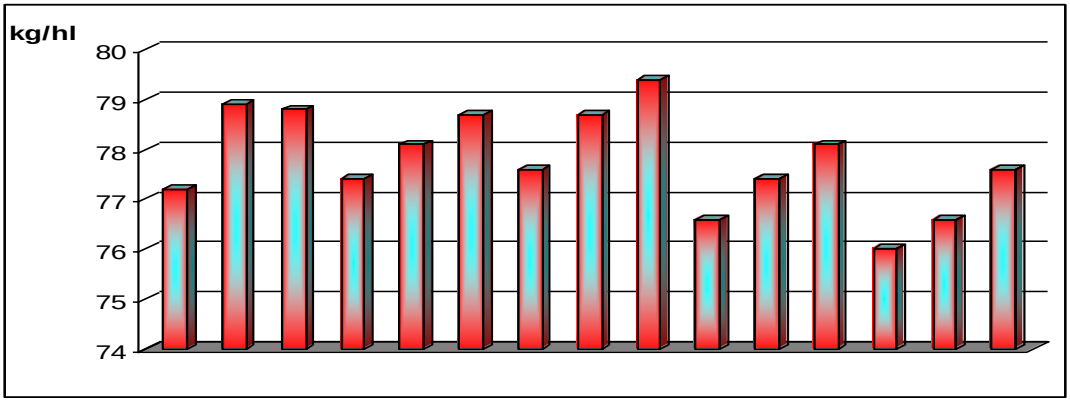
As an average, for the 5 varieties under study, the application of a N_{75} dose, increased the harvest by 32%, determining a 993 kg/ha yield difference, statistically insured as very significant. When doubling the nitrogen fertiliser dose to N_{150}, on the same $P_{60}K_{60}$background, a yield increaseof 65% resulted, which coincides with a yield difference of 2052 kg/ha from the control variant,insured statistically as very significant.

It I remarkable, that with the variant fertilised with $N_{150}P_{60}K_{60}$, the average for the experimental cycle with less than favourable climatic conditions, the Romanian varieties resulted in a harvest of over 5000 kg/ha (Ciprian 5544 kg/ha, Dropia 5417 kg/ha and Alex 5272 kg/ha). Among the Serbian varieties,the Renesansa variety was singled out, where the average yield per experimental cycle was of 4955 kg/ha, for the variant fertilised with $N_{150}P_{60}K_{60}$.

In conclusion, in the studied area, among the experimental varieties we recommend Ciprian, Alex and Dropia which can produce harvest of 5500-6000 kg/ha when fertilised with $N_{150}P_{60}K_{60}$.

The hectolitre mass variation depending onvariety and nitrogen dose applied on a $P_{60}K_{60}$ background.

The hectolitre massis an importantindices, which allows us to appreciate the wheat quality based on a physical criterion. In conclusion, all varieties presenting values over 75 kg/hl,will deliver a good flour output upon grinding and may be used in panfication.



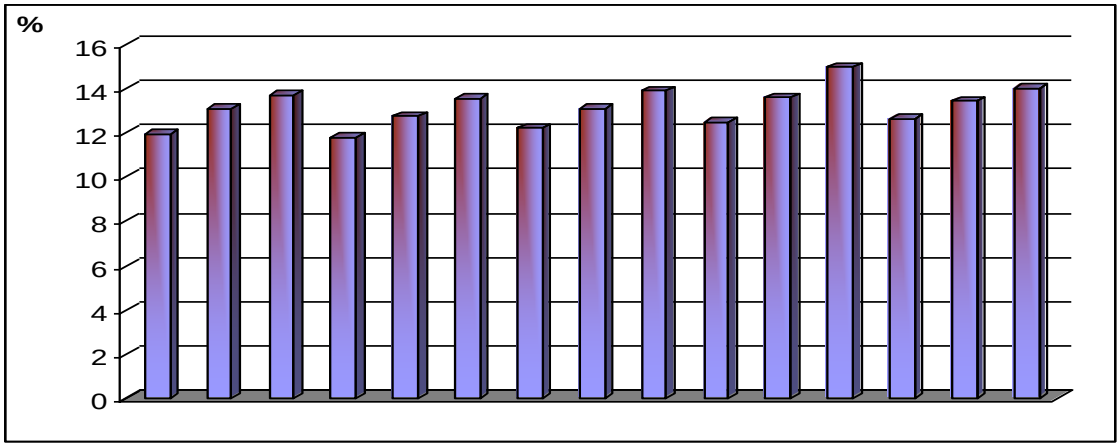
	Alex			Ciprian			Dropia			NS 40S			Renesansa		
	N_0	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**
	$P_{60}K_{60}$			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**		
MH kg/hl	77.2	78.9	78.8	77.4	78.1	78,7	77,6	78,7	79,4	76,6	77,4	78,1	76,0	76,6	77,6
X	78.3			78.3			78.5			77.3			76.7		

Figure 3 .Hectolitre mass variation according to variety and nitrogen dose determined during the experimental cycle 2016-2017

Protein content variation and production depending on variety and nitrogen dose

Since the protein content is specific to every variety, but also highly influenced by the applied technology and climatic conditions, it ranged, in the field researched during the experimental cycle, between extreme the values of 10.9% and 14.80%.

Nitrogen fertilisers, applied in doses of $N_{75}$and N_{150}on a $P_{60}K_{60}$ background, were well capitalized by the studied varieties, and contributed to the increase in protein contentunder the conditions of a soil with good natural fertility, on which the research were carried out.



	Alex			Ciprian			Dropia			NS 40S			Renesansa		
	N_0	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**	**N_0**	**N_{75}**	**N_{150}**
	$P_{60}K_{60}$			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**			**$P_{60}K_{60}$**		
% protein	11.96	13.07	13.69	11.76	12.73	13,51	12,20	13,10	13,88	12,49	13,58	14,95	12,63	13,43	14,00
X	12.90			12.66			13.06			13.67			13.35		

Figure 4.Variation in crude protein content according to variety and nitrogen dose determined during the experimental cycle 2016-2017

Table 2.providesthe result synthesis regarding the protein quantity during the experimental cycle 2016-2017, depending on variety and nitrogen fertilisation level on a constant $P_{60}K_{60}$ background.

The data presented show that the extreme values ranged between 331 kg/ha in the control variant ($N_0P_{60}K_{60}$) with the NS 40S varietyand 769 kg/ha, with the fertilised variant $N_{150}P_{60}K_{60}$, with theCiprian variety.

Nitrogen fertilisers applied on a $P_{60}K_{60}$backgroundincreased the protein content and grain production, and as such also increased the protein quantity per hectarewhich grew at the same time as the dosage, in the researched field.

Table 2

Synthesisof resultsonthe amount ofprotein(kg /ha) obtainedduring the experimental cycle 2016-2017

Factor A Variety	Factor B – Nitrogen doses			Average factor A			
	$N_0P_{60}K_{60}$	$N_{75}P_{60}K_{60}$	$N_{150}P_{60}K_{60}$	Protein yield kg/ha	%	Difference kg/ha	Significance
Alex	384	545	721	550	100		
Ciprian	408	579	769	585	106	35	XX
Dropia	408	585	745	579	105	29	XX
NS 40 S	331	494	672	499	91	-51	00
Renesansa	383	526	694	534	97	-16	0

DL5% = 13 kg/ha DL1% = 29 kg/ha DL0,1% = 92 kg/ha

Average factor B

Specification	$N_0P_{60}K_{60}$	$N_{75}P_{60}K_{60}$	$N_{150}P_{60}K_{60}$
Protein yield kg/ha	383	546	720
%	100	142	213
Difference kg/ha		163	337
Significance		XXX	XXX

DL5% =38 kg/ha DL1% = 52 kg/ha DL0,1% = 71 kg/ha

CONCLUSIONS

The study results highlighted the fact that in the area where the research was conducted, with all studied varieties, one can obtain panification wheat.

The yield increase determined by nitrogen fertilisers, applied on a $P_{60}K_{60}$background led to an average of 13.2 kg grains/1 kg N s.a.at a N_{75}dose and 13.6 kg grains /1 kg N s.a.at a N_{150}dose for the 5 varieties during the 3 experimental years.

On applying a N_{75}dose, the protein quantity increased by 42%, revealing a 163 kg/ha difference as compared to the control variant. When doubling the nitrogen dose to N_{150},the protein quantity increasedby 113%, revealing a 337 kg/ha difference as compared to the variant $N_{0.}$

Also, the protein quantity per hectarerepresents an important quality indices for wheat, and depends on the cultivated variety, fertilisation level and climatic conditions from the cultivation area.

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