THE FERTILIZATION EFFECT ON THE PRODUCTION OF BEANS GRAINS AND THE PROTEIN CONTENT IN THE SOIL AND CLIMATE CONDITIONS OF THE BANAT PLAIN

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Abstract: *Researches have been done in the most favorable areas for the cultivation of beans, on a black, humid and very fertile soil type, that is in an iron oxides reduction process. The experiences were trifactorial, organized after the divided lot with three repetitions method. The studied factors were: Factor A – the cultivated type(Avans and Diva) ; Factor B – the fertilization with nitrogen(40 kg/ha P_2O_5 and 80 kg/ha P_2O_5); Factor C – the nitrogen dose(N_0, N_{50}, N_{100}). In this study are presented data concerning the influence of the factors on the plant's height, the number of ramifications per plant, the number of pods per plant, the number of beans per pod, the weight of the beans per plant and the variation of the mass of 1000 beans. The harvest variation was between 1400 kg/ha and 2600 kg/ha, the mass of 1000 beans had an amplitude between 1809 and 4339 and the protein content was between 24,22% and 28,11% for the Avans type and between 24,46% and 28,06% for the Diva type. The height of the plants has grown, under the influence of fertilization, from 40,30cm (N_0P_{40}) to 45,50cm ($N_{100}P_{80}$) at the Avans type and from 34,40cm (N_0P_{40}) to 45,50cm ($N_{100}P_{80}$) at the Diva type. The number of ramifications per plant has grown from 4,30 (N_0P_{40}) to 5,80 ($N_{100}P_{80}$) at the Avans type and from 3,60 (N_0P_{40}) to 5,90 ($N_{100}P_{80}$) at the Diva type. The number of pods per plant, in the researched domain, has grown from 15,60 to 22,50 at the Avans type and from 13,60 to 20,40 at the Diva type. The number of beans per pod was almost the same for each type; the result was between 4,80 (N_0P_{40}) and 5,50 – 5,80 ($N_{100}P_{80}$). The results of the biometrical measurements are in positive relations with the results of the harvest.*

Key words: *beans, cultivation technology.*

INTRODUCTION

Beans are cultivated nowadays in 111 countries, on a surface of about 25 million hectares. The surface cultivated on own fields decreased in our country to over 168 tsd. ha in 1985 and to about 25 tsd. ha today. To this are to be added important surfaces cultivated in intercalated crop system in the countryside.

Being a plant with grains rich in protein (23 – 25%) and glucide (48 – 55%), adapted to the pedoclimatic conditions of our country, it is important to increase the cultivated surfaces and the yields obtained nowadays. This is particularly the research field of the present paper.

MATERIALS AND METHODS

In order to give an answer to the fertilization question of beans cultivated for their grains in the region Peciu Nou, there has been organized a bifactorial experiment according to the subdivided plots method, with three repetitions and with the following graduations of the factors:

A Factor – the cultivated variety

a_1 – Avans

a_2 – Diva

B Factor – the fertilization level by using phosphorus

b_1 – 40 kg/ha P_2O_5;

b_2 – 80 kg/ha P_2O_5;

C Factor – the fertilization level

$c_1 – N_0$;
$c_2 – N_{50}$;
$c_3 – N_{100}$.

The soil works were done according to the current technology. The seeding took place in the first decade of April, with a row distance of 50 cm and with 45 germinable seeds /m^2.

The researches were done on Câmpia Banatului (Banat Plain), on the territory of Foeni, on a moderate gleyed vertic chernozem, clayey – argillaceous, having a pH (H_2O) 6,75 in Ap, a humus content of 2,79%, average supplied with nitrogen (total amount of N: 0,137%) and phosphorous (26,4 ppm P) and well supplied with potassium (146 ppm K).

A Factor variety	B Factor P_2O_5 doses	C Factor Nitrogen doses			The averages of the D factor			
		N_0	N_{50}	N_{100}	Yield kg/ha	%	Difference kg/ha	Signification
Avans	P_{40}	1920	2148	2404	2230	100		
	P_{80}	1999	2306	2606				
Diva	P_{40}	1492	1763	2091	1780	80	-450	000
	P_{80}	1619	2044	1670				

The following biometric measurements were done, regarding:

- the plants height in cm; the number of ramifications/plant; the number of pods /plant; the number of grains/pod; the grains weight /plant; the mass of 1000 grains; the row protein content (%).

RESULTS AND DISCUSSIONS

The yield results are given in Table 1.

Table 1

The beans yield according to the soil and to the fertilization determined in 2008

The averages of the C factor

Specification	N_0	N_{50}	N_{100}
Yield kg/ha	1757	2066	2193
%	100	117	125
Difference kg/ha		309	436
Signification		XXX	XXX

The averages of the B factor

Specification	P_{40}	P_{80}
Yield kg/ha	1969	2041
%	100	104
Difference kg/ha		72
Signification		X

DL 5%=144 kg/ha DL1%= 204 kg/ha DL 0,1%= 291 kg/ha
DL 5%=82 kg/ha ; DL1%= 108 kg/ha ; DL0,1%=139 kg/ha
DL5%= 64 kg/ha; DL1%= 87 kg/ha ; DL0,1% =118kg/ha

We notice that, for the studied factors, the yields varied very much, between 1400 kg/ha and 2600 kg/ha. By comparing the results obtained for the two varieties for the two fertilization levels with nitrogen and phosphorus, the results show a better production capacity for the Avans variety. The yield obtained for Diva variety was 20% lower, the difference being of 450 kg/ha, which is statistically significantly negative. By increasing the doses of phosphor fertilizer from P_{40} to P_{80} the yield was not particularly much influenced, the yield increase being of only 4%, the difference being of 72 kg/ha, a significant statistical difference. It results that the increase of the soil's phosphor content (26,4 ppm. P in the first 20 cm of the soil profile does not motivate the phosphor doses increase with over 40 kg/ha. The nitrogen fertilizers used in the 3-5 leaves vegetation phase in doses of N_{50} increased the yield with 17%, respectively with 309 kg/ha. The increase of the nitrogen doses to N_{100} also increased the yield with up to 25%, which means a yield difference of 436 kg/ha. To notice is that the yield differences generated by the nitrogen fertilizers are very significant. Figure 1 presents the results of the measurements done

regarding the mass of 1000 grains. It results that for all studied variants the highest values were obtained for the Avans variety, as compared with the Diva variety.

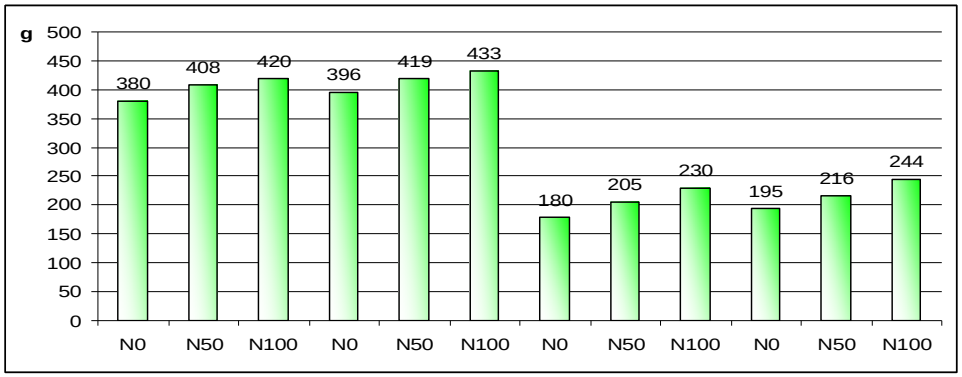


Fig. 1. MMB (g) variation according to fertilization

The fertilizers containing phosphor poorly influenced the measured MMB values as compared to the nitrogen fertilizers. In the researched field the MMB varied between 180 g (N_0P_{40}) and 244 g ($N_{100}P_{80}$) for Diva variety. Figures 2 – 8 present the results of the measurements done regarding the plant height, the number of ramifications / plant, the number of pods /plant and the number of grains /plant for the two varieties, according to their fertilization.

It results that all analyzed characteristics related to the obtained yields are positive.

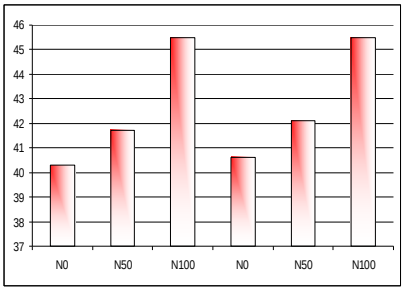


Fig. 2 The plant height variation (cm) for the for the Avans variety, according to the fertilization

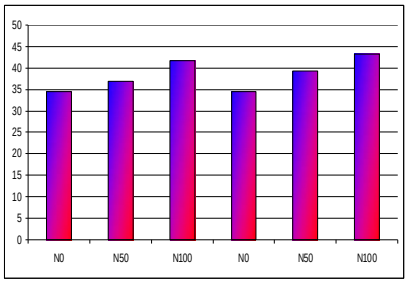


Fig. 3 The plant height variation (cm). Diva variety, according to the fertilization.

	P_{40}			P_{80}		
X	40,3	41,70	45,5	40,6	42,1	45,50
S^2	0,61	0,61	1,65	0,44	0,49	0,65
S	0,78	0,78	1,28	0,66	0,70	0,81
S_x	0,08	0,08	0,13	0,07	0,07	0,08
S %	1,94	1,87	2,82	1,63	1,66	1,77

	P_{40}	P_{80}				
X	34,40	36,80	41,70	34,50	39,20	43,20
S^2	0,44	1,36	2,21	0,25	1,16	0,76
S	0,66	1,17	1,49	0,50	1,08	0,87
S_x	0,07	0,12	0,15	0,05	0,11	0,09
$S_{\%}$	1,93	3,17	3,57	1,45	2,75	2,02

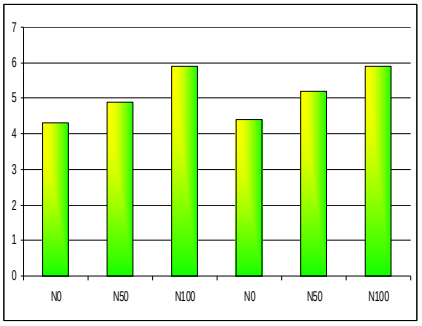


Fig.4. The number of ramification /plant variation (nr) for the Avans variety, according to the fertilization.

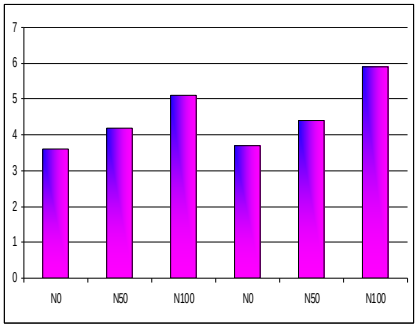


Fig.5. The number of ramification /plant variation (nr) for the Diva variety, according to the fertilization

	P_{40}			P_{80}		
X	4,30	4,90	5,80	4,40	5,20	5,90
S^2	0,21	0,09	0,16	0,24	0,36	0,09
S	0,46	0,30	0,40	0,49	0,60	0,30
S_x	0,05	0,03	0,04	0,05	0,06	0,03
$S_{\%}$	10,6	6,126	6,90	11,1	11,53	5,084

	P_{40}			P_{80}		
X	3,60	4,20	5,10	3,70	4,40	5,90
S^2	0,24	0,16	0,49	0,21	0,24	0,09
S	0,49	0,40	0,70	0,46	0,49	0,30
S_x	0,05	0,04	0,07	0,05	0,05	0,03
S	13,61 %	9,52	13,73	12,39	11,13	5,08

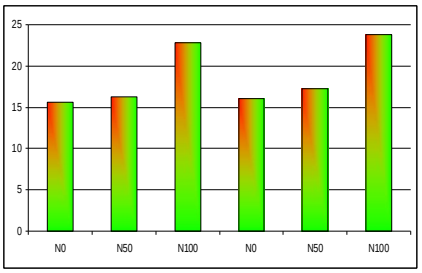


Fig.6. The number of pods /plant variation (nr) for the Avans variety, according to the fertilization

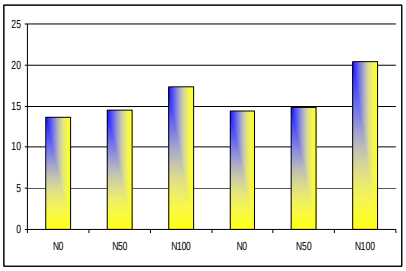


Fig.7. The number of pods /plant variation (nr) for the Diva variety, according to the fertilization

	P_{40}			P_{80}		
X	15,6	16,300	22,80	16,00	17,30	23,80
S^2	0,44	0,21	2,16	0,40	0,41	2,16
S	0,66	0,46	1,47	0,63	0,64	1,47
S_x	0,07	0,05	0,15	0,06	0,06	0,15
$S_{\%}$	4,25	2,81	6,45	3,95	3,70	6,18

	P_{40}			P_{80}		
X	13,60	14,50	17,40	14,40	14,8	20,400
S^2	0,64	0,45	4,04	0,44	0,76	1,44
S	0,80	0,67	2,01	0,66	0,87	1,20
S_x	0,08	0,07	0,20	0,07	0,09	0,12
$S_{\%}$	5,88	4,63	11,55	4,61	5,89	5,88

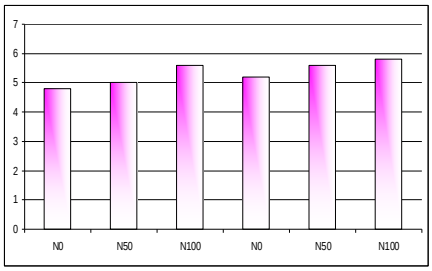


Fig.8. The number of grains /pod variation (nr) for the Avans variety, according to the fertilization

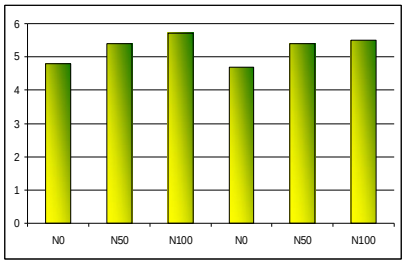
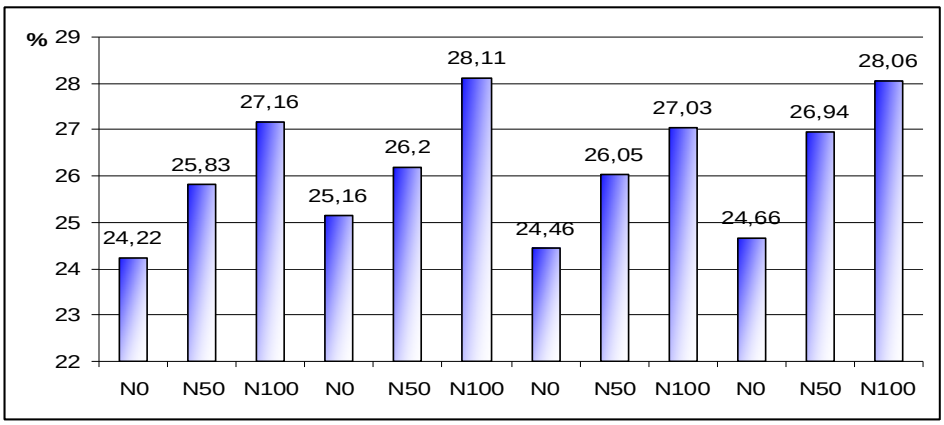


Fig.9. The number of grains /pod variation (nr) for the Diva variety, according to the fertilization

In figure 10 is given the row protein content variation (%) according to the fertilization.



P40	P80	P40	P80
AVANS		DIVA	

Fig. 10 The row protein content variation (%) according to variety and fertilization

The obtained results show the favourable effect of the fertilizers upon the protein content, which increased for the Avans variety from 24,22% (N_0P_{40}) to 28,11% ($N_{100}P_{80}$) and from 24,46% (N_0P_{40}) to 28,06% ($N_{100}P_{80}$) for the Diva variety.

CONCLUSIONS

The results obtained during the first research year lead to some conclusions which must still be confirmed or infirmed by the results we are going to obtain in the following years.

- The Avans beans variety is better adapted to the pedoclimatic conditions of the region in which the researches were carried out, as compared to the Diva variety.

The average Avans variety yield obtained for the researched levels was 20%, respectively 450 kg/ha superior to the yield of the Diva variety.

- The fertilizers containing phosphor applied is doses of P_{40} and P_{80} poorly influenced the yield on the soil these fertilizers were used in an average quantity.

By increasing the doses from P_{40} to P_{80} the yield increased with only 4%, which means a significant difference of 72 kg/ha.

- The fertilizers containing nitrogen increased the average yield with 17% for a doses of N_{50} and with 25% for a doses of N_{100} for all the studied factors

- The mass of 1000 grains varied between 380 g (N_0P_{40}) and 438 ($N_{50}P_{80}$) for the Avans variety and of between 180 g (N_0P_{40}) and 244 g ($N_{100}P_{80}$) for the Diva variety.

- The row protein content for both varieties was favourable influenced by the nitrogen fertilizers. So, the Avans variety increased from 24,22% (N_0P_{40}) to 28,11% ($N_{100}P_{80}$), and from 24,46% (N_0P_{40}) to 28,06% ($N_{100}P_{80}$) for the Diva variety.

The plants height increased under the influence of fertilizers from 40,30 cm (N_0P_{40}) to 45,50 cm ($N_{100}P_{80}$) for the Avans variety and from 34,40 cm (N0P40) to 45,50 cm (N100P80) for the Diva variety.

The number of ramifications /plant increased from 4,30 N0P40 to 5,80 N100P80 for the Avans variety and from 3,60 N0P40 to 5,90 N100P80 for the Diva variety.

The number of pods /plant increased in the researched field from 15,60 to 22,50 in the case of Avans variety and from 13,60 to 20,40 for the Diva variety.

The number of grains /pod was closed between the two studied varieties, being situated between 4,80 N0P40 and 5,50 – 5,80 N100P80.

The results of the biometric measurements are positive as compared to the obtained yield results.

The results of the measurements regarding the plants' height, the number of ramifications, the number of pods /plant, the number of grains/pod and the weight of grains /plant related to the obtained yield results are positive.

BIBLIOGRAPHY

1. AXINTE, M., ROMAN, GH., BORCEAN, I., MUNTEAN, L.S., Fitotehnie, Editura I.Ionescu de la Brad Iaşi, 2006
2.BÎLTEANU, GH., BÎRNAURE, V., Fitotehnie, Bucureşti, Ed. Ceres, 1998.
3. BORCEAN, I., BORCEAN, A., DAVID GH., Cultura şi protecţia leguminoaselor cultivate pentru boabe, Timişoara, Ed. de Vest, 2003.
4. BORCEAN, I., BORCEAN, A., Cultura şi protecţia integrată a cerealelor leguminoaselor şi a plantelor tehnice, Timişoara, Ed. de Vest, 2004.
5. FEHER ECATERINA, POPA, FL.GH., Cercetări cu privire la influenţa îngrăşămintelor chimice cu azot, fosfor şi potasiu şi a diferitelor tipuri de Nitragin asupra producţiei soiurilor de fasole Ardeleana, în condiţiile solului brun-roşcat, Craiova, Analele Univ. din Craiova, vol. XX, 1989.
6. IMBREA, FL., Contribuţii la tehnologia de cultivare a fasolei pentru baobe în Banat, Timişoara, Teză de doctorat U.S.A.M.V.B., 2001.