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INFLUENCE OF THE FERTILIZING SYSTEM ON TOTAL N, P, K AND CRUDE PROTEIN CONTENT IN CONDOR SOYBEAN

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Abstract

Soybean is known to be one of the leguminous plants for beans having a wide spreading area on all the continents, 51% of the beans production is obtained in USA, where it takes the third place, after corn and wheat. In Romania is considered to be a leguminous plant used for its beans, being very important for human and animal feeding. It has high nutritional value, contains over 30% protein substances and 17-25% oil [2], proteins having a special feeding value.

Researche done at USAMV Bucharest in 2007, in the greenhouse of the Agrochemistry Department for the Condor species on reddish preluvosoil from Moara Domnească, had as purpose to establish the influence of the fertilization system on the soybeans quality, on the N, P, K and crude protein accumulation in the beans.

The results show that the nitrogen applied in a rate of 100 kg/ha produced the accumulation in bean of 38.74% crude protein, and variant 4 (N_0P40), fertilized with 40 kg P_2O_5 on the ha, accumulated 37.69 crude protein. In the case of variant 8 ($N_{50}P_{80}$), the content in crude protein in bean, 37.57% closed to the one in variant 4, does not justify from the economic point of view, the fertilizers costs.

INTRODUCTION

Soybean, in all countries where it is known, is important as an oleoprotein plant, due to its composition; it has multiple uses in the food industry, covering the protein deficit. Presently, owing to research and scientific discoveries in the field of alternative energetic resources, it is considered the third source of Diesel type regenerable biofuel, being outbeat by rape and sun flower. [6]

Soybean is the plant which, due to its quantitative and qualitative level, assures a part of the necessary nutritional substances needed in human feeding, animal feeding and industry. It is the first on the food oil market.

It has a great economic importance because of the multiple use of the beans which have a high protein content, over 30%, fat over 20%, approximately 15% unnitrogenated extractive substances, lecithin (1.6-2.5%), vitamin N (B_1-thiamine, B_2-riboflavin and B_6-pyridoxine) and enzymes (lipoxidaze, lipase, urease, amylase).

When one establishes the fertilization system for soybean culture, the following must be considered: soil fertility, fertilizers quantity from the previous years, previous culture, also the available quantity of minerals and organic fertilizers [5]. Of the total nutritive elements, in the beans remain 75% N, 75% P_2O_5 and 60% K_2O.

The greatest part of nitrogen and phosphorus is in the beans, while potassium is equally distributed in seeds and in vegetative parts. Soybean consumes for 100 kg seeds and the subsequent secondary biomass, 7.1 - 11 kg N, 1.6 - 4 kg P_2O_5, 1.8 - 4 kg K_2O [3, 4].

MATERIAL AND METHODS

Research done in 2007 in the greenhouse of the University of Agronomic Sciences and Veterinary Medicine, Bucharest, in pots, Mitscherlich type, having a capacity of 8 kg.

The biologic material used: semi-tardy Condor, fall resistant, having diseases resistance and a high genetic potential.

The used soil was reddish preluvosol from Moara Domnească, mixed with sand 2:1. When the experiment was started, the components analysis was made, also of the soil used [1].

For fertilization, 3 nitrogen levels were used and 3 phosphorous levels, as shown in Table 1.

Table 1

Experimental scheme

No.	Variant		N kg/ha	P_2O_5 kg/ha
1	N_0P_0 control	N_0P_0 control	-	-
2	N_1P_0	$N_{50}P_0$	50	-
3	N_2P_0	$N_{100}P_0$	100	-
4	N_0P_1	N_0P_{40}	-	40
5	N_1P_1	$N_{50}P_{40}$	50	40
6	N_2P_1	$N_{100}P_{40}$	100	40
7	N_0P_2	N_0P_{80}	-	80
8	N_1P_2	$N_{50}P_{80}$	50	80
9	N_2P_2	$N_{100}P_{80}$	100	80

For N ammonium nitrate 34.5% N was used as fertilizer and for phosphorus, superphosphate 18% P_2O_5, the rates being calculated considering the pots capacity.

At the end of the experiment, beans were analysed for establishing the macroelements content, N, K, P total forms and also the crude protein content was calculated.

RESULTS AND DISCUSSIONS

From Table 2, when the experiment was started, one finds out that the soil mixture was not very rich in nutritive elements, having a low content of soluble salts and a pH of 7.36, the reaction of a less alkaline soil.

Soybean does not need special soil, this allowing cultivating it on almost all soil types, except for heavy, acid, salty soils. The best results are obtained on the sandy-loamy, loamy and clayey-loamy soils, deep, fertile, calcium, phosphorous and potassium rich soils, with a soil reaction of: pH = 5 and pH = 8.5, the optimum being pH = 6.7.

Table 2

Components and soil mixture analysis

No.	Specification	pH	Content of soluble salts %	N-NH_4^+ ppm	N-NO_3^- ppm	NH_4^++NO_3^- ppm	PO_4^{3-} ppm	K^+ ppm
1	Sand	7.16	0.0860	21.50	traces	21.50	traces	10
2	Soil	7.26	0.0480	1.75	15.50	17.25	traces	20
3	Soil-sand mixture 2:1	7.36	0.0329	15.25	5.75	21.00	traces	20

Table 3

Influence of fertilization on Nt content, %, in soybeans

No.	Variant	Nt %	Difference	Signification
1.	N_0P_0 control	5.4130	Mt	-
2.	$N_{50}P_0$	5.8158	+0.4028	x
3.	$N_{100}P_0$	6.1989	+0.7859	xxx
4.	N_0P_{40}	6.0319	+0.6189	xxx
5.	$N_{50}P_{40}$	5.6979	+0.2849	ns
6.	$N_{100}P_{40}$	5.9042	+0.4912	xx
7.	N_0P_{80}	5.8158	+0.4028	x
8.	$N_{50}P_{80}$	6.0123	+0.5993	xx
9.	$N_{100}P_{80}$	5.6390	+0.2260	ns
DL5%=0.3363% Nt, DL1%=0.4566 %Nt, DL0.1%=0.6126 %Nt				

In the V_3 (N_{100} P_0) variant and V_4 (N_0 P_{40}) unilaterally fertilized with N_{100}, respectively P_{40}, the variation analysis indicates very significant differences, and at V_6 (N_{100} P_{40}) distinct significant difference regarding the influence of the NP fertilization system on the Nt content, %, in soybeans.

Between the Nt (%) content in soybean and the nodosities number on the roots, the correlation is significant (correlation coefficient, $R = 0.6534^{*}$), is explained by the fact that a part of the N content in soybeans comes from the N fixed on the nodosities (Figure 1).

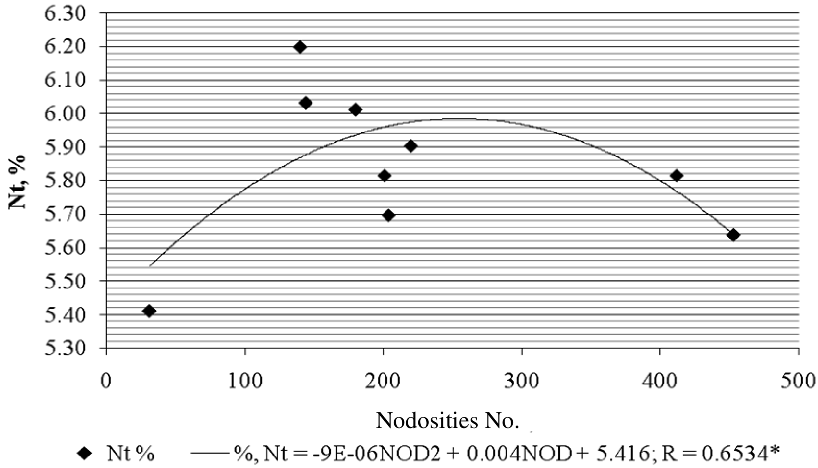

Fig. 1. Correlation between the Nt content, %, from soybeans and nodosities number on the root

Table 4

Influence of fertilization on the Pt content, %, in soybeans

No.	Variant	Pt %	Difference	Signification
1.	N_0P_0 control	0.984	Mt	-
2.	$N_{50}P_0$	0.836	-0.148	ns
3.	$N_{100}P_0$	0.766	-0.218	oo
4.	N_0P_{40}	0.804	-0.180	o
5.	$N_{50}P_{40}$	0.678	-0.306	ooo
6.	$N_{100}P_{40}$	0.813	-0.171	o
7.	N_0P_{80}	0.771	-0.213	oo
8.	$N_{50}P_{80}$	0.807	-0.177	o
9.	$N_{100}P_{80}$	0.777	-0.207	oo
DL5%=0.1515% Pt, DL1%=0.2056%Pt, DL0.1%=0.2759%Pt				

As concerning the influence of the NP fertilization system, experimented on the Pt content from the soybeans, a negative, significant difference was noticed, after interpreting the variance in V_5 ($N_{50}P_{40}$) analysis with the biggest beans production.

In the Kt case in the beans, the influence of soil fertilization in the NP system shows a very negative significant difference in variant V_3 ($N_{100}P_0$) and a positive one in the variant V_4 (N_0P_{40}).

Table 5

Influence of fertilization on Kt content, %, in soybeans

No.	Variant	Kt %	Difference	Signification
1.	N_0P_0 control	1.90	Mt	-
2.	$N_{50}P_0$	1.80	-0.10	o
3.	$N_{100}P_0$	1.70	-0.20	ooo
4.	N_0P_{40}	2.15	+0.25	xxx
5.	$N_{50}P_{40}$	1.70	-0.20	ooo
6.	$N_{100}P_{40}$	1.95	+0.05	ns
7.	N_0P_{80}	1.80	-0.10	o
8.	$N_{50}P_{80}$	1.95	+0.05	ns
9.	$N_{100}P_{80}$	2.00	+0.10	x
DL5%=0.0896%Kt, DL1%=0.1216 %Kt, DL0.1%=0.1632 %Kt				

Table 6

Influence of fertilization on crude protein content, %, in soybeans

No.	Variant	Crude protein %	Difference	Signification
1.	N_0P_0 control	33.83	Mt	-
2.	$N_{50}P_0$	36.34	+2.51	x
3.	$N_{100}P_0$	38.74	+4.91	xxx
4.	N_0P_{40}	37.69	+3.81	xxx
5.	$N_{50}P_{40}$	35.61	+1.78	ns
6.	$N_{100}P_{40}$	36.90	+3.07	xx
7.	N_0P_{80}	36.34	+2.51	x
8.	$N_{50}P_{80}$	37.57	+3.74	xxx
9.	$N_{100}P_{80}$	35.24	+1.41	ns
DL5%=1.9199% , DL1%=2.6062 %, DL0.1%=3.4966%				

As regards the quality of soybeans expressed through the crude protein content, one can notice significant difference in V_3 ($N_{100}P_0$) and V_4 (N_0P_{40}) variants in the case of the unilateral fertilization, also in V_8 ($N_{50}P_{80}$) where the N applied quantity was half of the V_3 and double in case of P as compared to V_4, the effect being the result of the synergism between the two elements.

Fertilization significantly determines the protein quantity in soybeans. By assortment, doses, applications, fertilizers determine the proteins content and also the amino acids from soybeans. The N containing fertilizers determine the proteins content variation and produces important modifications to its quality. Though P does influence the protein content only to a small extent, it has the role of maintaining the N effect and attenuating the negative influence of the big rates on the quantity and quality of protein, having as a result better assimilation and metabolism of the absorbed N forms.

CONCLUSIONS

1. The crude protein which varying in soybean between 27-50% [2], in this case vary between 33.83% at the unfertilized variant and 38.74% at variant 3 of 100 kgN/ha.
2. The quality of soybeans seen in the crude protein content presents significant differences at variants V_3 ($N_{100}P_0$) 38.74% and V4 (N_0N_{40}) 37.69%, in the case of unilateral fertilization.
3. At the variant V_8 ($N_{50}P_{80}$) in which the applied quantity of N was half reduced as compared to V_3 and doubled as compared to V_4, the crude protein content was of 37.57% this being the result of the synergism effect between N and P.
4. Because the costs for fertilizers increased, the differences of the crude protein content at V_4 (N_0P_{40}) and V_8 ($N_{50}P_{80}$) are too small to economically justify the expenses for 50 kg N and 40 kg P.

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