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THE INFLUENCE OF THE FERTILIZING SYSTEM ON THE MICROELEMENTS CONTENTS IN CONDOR SOYBEAN CULTIVAR

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Abstract

In the literature there are data regarding the influence of the chemical fertilizers on the microelements contents in different vegetal products considered specific for some plants. Because the pedoclimatic conditions influence to a large extent the microelements contents, also the genetic potential of the species and the genus, the researches made for the Condor soybean tried to establish the effect of the chemical fertilizers in soy plants cultivated on the reddish preluvosol soil from Moara Domneasca, inside the greenhouse USAMV Bucharest [4, 5].

The experimental variants tested doses of 50 and 100 kg N/ha applied on two phosphorus levels of 40 and 80 kg P_2O_5/ha.

In the soybean were determined by Atomic Absorption Spectroscopy variable contents of the microelements Zn, Cu, Fe, Mn, Pb, Ni, Co, Cr, Cd depending on the experimental variants.

INTRODUCTION

Soybean is one of the most important agricultural plants for people's and animals' food. There is a developed food industry which has as basic raw material the soybean flour, reach in vegetal protein where a different many products are realized: milk, cheese, vegetal meat, macaroni, biscuits, margarine, oil etc. Although in our country the soybean cultivated area decreased after December 1989, it continued to be a priority for some private enterprisers and researchers [1].

Because of the economic importance of soybean, the present researches had the purpose to establishing the effect of the fertilizing system on the yield and on the microelements content from Condor soybean cultivar.

MATERIAL AND METHODS

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

The used biologic material was the following: late sowings Condor soybean cultivar, fall resistant, a good diseases resistance and a high genetic potential.

The used soil was the reddish preluvosol from Moara Domneasca, mixed in proportion of 2:1 with sand.

When the experiment was started components and soil mixture were analyzed.

For the fertilization, 3 nitrogen levels and 3 phosphorous levels were used in the variants presented in the experimental scheme (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

Nitrate ammonium fertilizer, with 34.4% N, was used for nitrogen and superphosphate fertilizer, with 18% P_2O_5 for phosphorous, calculated according to the pots capacity.

During the vegetation period, in the critical moments of plants development (blooming, beginning of binding pods, end of their growing) were analyzed soil and plants samples, biometrical measurements were effectuated and in the end the beans were analyzed in order to determine the microelements contents.

RESULTS AND DISCUSSION

From table 2 data, the results when we started the experiment are: the soil mixture was poor in nutritive elements, with low content of soluble salts and 7.36 pH.

When the experiment ended, the plants were gathered by variants and the grains yield was recorded. In table 3 the results are discussed.

According to the table 3 data, as compared to the unfertilized control variant, the variants 8 ($N_{50}P_{80}$), 2 ($N_{50}P_0$), and 5 ($N_{50}P_{40}$), had the highest grains yield of 9.4 q/ha, 8.4 q/ha and respectively 7.79 q/ha, the results being statistically very significant.

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	0.086	21.5	trace	21.5	trace	10
2	Sol	7.26	0.0480	1.75	15.5	17.25	trace	20
3	Mixture soil-sand 2:1	7.36	0.0329	15.25	5.75	21.0	trace	20

Table 3

The influence of fertilization on the soybeans grains yield

No.	Variant	Yield (q/ha)	%	Differences	Signification
1	N_0P_0 control	5.50	100	Mt	-
2	$N_{50}P_0$	13.90	252.7	+8.4	xxx
3	$N_{100}P_0$	8.94	162.5	+3.44	x
4	N_0P_{40}	8.41	152.9	+2.91	ns
5	$N_{50}P_{40}$	13.29	241.6	+7.79	xxx
6	$N_{100}P_{40}$	8.66	157.4	+3.16	ns
7	N_0P_{80}	7.96	144.7	+2.46	ns
8	$N_{50}P_{80}$	14.90	270.9	+9.40	xxx
9	$N_{100}P_{80}$	7.10	129.0	+1.60	ns
DL 5%= 3.41 q/ha, DL 1%= 4.64 q/ha, DL 0.1% = 6.27 q/ha					

They underline the fact that the soybean which fixes the nitrogen in the nodules, the nitrogen dose of 50 kg/ha is enough from the economic point of view, and the phosphorous which is in synergism with may lead to the efficient growth of yield, but in this case supplementary expenses have to be made, but unjustified related to the phosphate fertilizer.

In soybeans were analyzed the macroelements content of N, P, K [4, 6], and crude protein (%) (table 4), and microelements total forms (ppm) (table 5).

From the table 4 data, one can notice that in the soybeans the limits of total nitrogen content varied between 5.41% (control variant) and 6.19% the variant 3 fertilized with 100 kg N/ha.

The crude protein which in soybean usually varies between 27-50% [1] varied in this case between 33.83% at the unfertilized variant and 38.74% at the variant 3 in which the 100 kg N/ha dose significantly influenced the quantity (+3.44 q/ha).

The total phosphorus content in the soybean grains had maximum values in the case of unfertilized control variant (0.984%) and 0.678% at variant 5 ($N5_0P_{40}$), the variant that as variant 3 ($N_{100}P_0$) had the lowest K_t (1.7%) content.

Table 4

The content of macroelements (%) and crude protein (%) in the soybean grains

No.	Variant	N_t (%)	P_t (%)	K_t (%)	Crude protein (%)
1	N_0P_0 control	5.4130	0.984	1.9	33.83
2	$N_{50}P_0$	5.8158	0.836	1.8	36.34
3	$N_{100}P_0$	6.1989	0.766	1.7	38.74
4	N_0P_{40}	6.0319	0.804	2.15	37.69
5	$N_{50}P_{40}$	5.6979	0.678	1.7	35.61
6	$N_{100}P_{40}$	5.9042	0.813	1.95	36.90
7	N_0P_{80}	5.8158	0.771	1.80	36.34
8	$N_{50}P_{80}$	6.0123	0.807	1.95	37.57
9	$N_{100}P_{80}$	5.6390	0.777	2.0	35.24

From the table 5 data, which present the microelements content of the soybean [5], one may notice that the values for Zn, Cu, Fe, are within the specified limits in the literature, for Mn they have minimum values (at the critical concentration of 13-14 ppm). In the soybean grains were also determined Pb, Ni, Co, Cr, Cd in which the variation limits do not show any differences between the fertilization systems applied.

Table 5

The microelements content (ppm) in soybean grains

No.	Variant	Zn	Cu	Fe	Mn	Pb	Ni	Co	Cr	Cd	Mo
1	N_0P_0 control	37	15	66	14	2	12	0.37	5.8	1.36	0.9
2	$N_{50}P_0$	38	14	74	14	2	8	0.25	trace	1.32	3.5
3	$N_{100}P_0$	46	14	73	15	1	11	0.08	5.4	1.61	3.6
4	N_0P_{40}	40	14	70	14	1	10	trace	0.4	1.53	2.7
5	$N_{50}P_{40}$	50	13	55	13	1	9	trace	0.6	1.54	3.9
6	$N_{100}P_{40}$	37	14	96	14	2	11	trace	0.4	1.56	4.2
7	N_0P_{80}	48	16	81	14	2	13	trace	2.4	1.56	2.5
8	$N_{50}P_{80}$	44	15	120	15	3	14	0.19	17.7	1.56	4.7
9	$N_{100}P_{80}$	52	14	59	13	trace	13	trace	4.2	1.48	1.7
Limits from literature		12 – 80	4 – 30	50 – 300	14 – 100						0.5–5

Regarding the Mo and Zn influence on the crude protein accumulation in the soybean we may notice the followings:
Mo can be found in some enzymes which activate the nitrogen cycle, this way being affected the N fixing in the nodules, the reduction of the nitrate ion is blocked, amino acids formation and proteins synthesis is lowered. This fact is also presented in figure 1 where correlation coefficient is R= 0.764*, significant [2, 3].

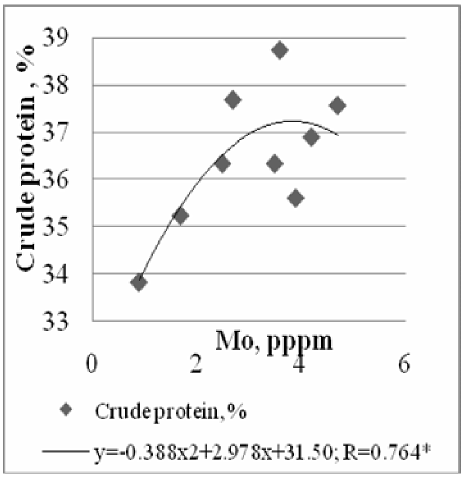

Fig. 1. The influence of the Mo content, ppm, on the soybeans crude protein accumulation (%)

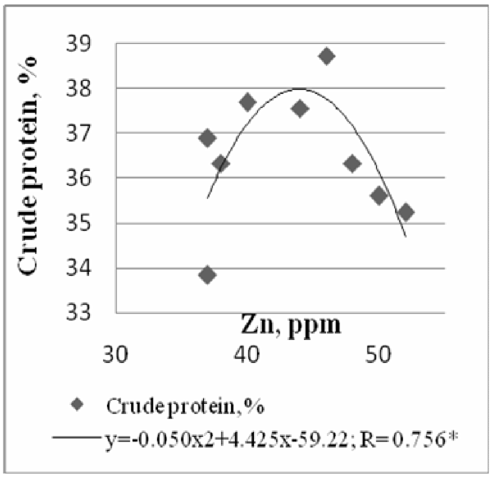

Fig. 2. The influence of the Zn content, ppm, on the soybeans crude protein accumulation (%)

From the figure 2 results that in the case of Zn deficiency, because the enzymes catalyzing the tryptophan synthesis inactivate, is affected the synthesis and metabolism of proteins. The correlation between Zn content and protein accumulation in the soy beans is significant (R=0.756*).

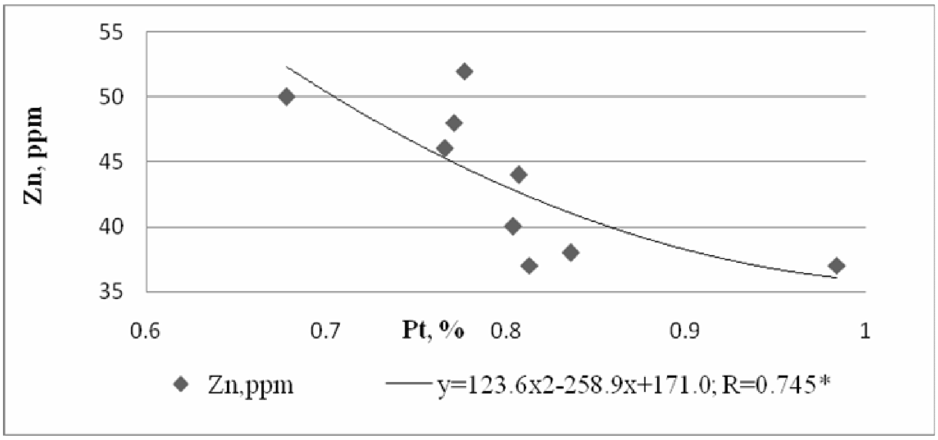

Fig. 3. The soybean Zn absorption, ppm, depending on Pt content (%)

Zn absorption in the soybeans is diminished at higher contents of total phosphorous, phenomenon explained by the antagonistic relation between the two ions.

CONCLUSIONS

1. The nitrogen dose of 50 kg/ha is enough from the economic point of view, the phosphorous doses variation may lead to the production increase, but supplementary expenses are necessary unjustified with the phosphate fertilizer costs.
2. From the statistic point of view very significant results as compared to the unfertilized control variant were obtained in variants 8 ($N_{50}P_{80}$), 2 ($N_{50}P_0$), and 5 ($N_{50}P_{40}$) with grains yields crops of 9.4 q/ha, 8.4 q/ha and respectively 7.79 q/ha.
3. The crude protein which in soybean grains varies between 27-50% [1] varied in this case between 33.83% at the unfertilized variant and 38.74% at the variant 3 in which the 100 kg N/ha dose influenced significantly the quantity (+3.44 q/ha).
4. The soybean grains microelements content of Zn, Cu, and Fe is between the specified limits in the literature.
5. The correlation between the Zn content and protein accumulation in the soybeans is significant (R=0.756*).
6. Zn absorption in soybean is diminished at higher total phosphorous, phenomenon explained by the antagonistic relation between the two ions.

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