THE DYNAMICS OF THE TOTAL N, P, K CONTENT AND OF DRY MATTER ACCUMULATION DURING VEGETATION PERIOD IN CONDOR SOYBEAN

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Soybean, in all the countries of the world where it is known, has a great importance as an oleoprotein plant. The research endeavours made in the world and in Romania are directed to the increase of production potential and to improve the beans quality (the content in protein and oil, aminoacids and fat acids spectrum, etc.). The soybean consumes and at the same time stores high quantities of nutritive elements in its seeds and in the other organs, mainly nitrogen. The used biologic material: semi-late Condor variety resistant to fall, diseases and with a high genetic potential. The used soil was the reddish preluvosol from Moara Domnească, mixed with sand 2 : 1.

Key words: Semi-late Condor variety; Production potential; Beans quality.

INTRODUCTION

Soybean, in all the countries of the world where it is known, has a great importance as an oleoprotein plant. Due to its components, it has many uses in the food industry, covering protein deficit[2,3]. During this period of discoveries and inventions, it is classified as the third source of regenerable biofuel, Biodiesel type, after the rape and the sun-flower[6].

In the context of the present world agriculture, soybean culture is on the fourth place – from the surface viewpoint, and from the global production of cca 163 million tones view point, it is on the fifth place.

The research endeavours made in the world and in Romania are directed to the increase of production potential and to improve the beans quality (the content in protein and oil, aminoacids and fat acids spectrum, etc.)[1,4].

The increase of the protein content (over 45%) and in oil (over 25%) also improving their quality, are a amelioration objectives, approached with great interest, having in view its value as food. Another important aspect is obtaining a superior genetic progress for the agronomically valuable characters – production capacity, shekind resistance, fall, height for the insertion of the basis pods, resistence to unfavourable environmental conditions, diseases and pests.

Obtaing of soils adapted to different agroecologic areas means, actually, extra production, the soybean being one of those species in which any variation of the climatic factors may significantly affect its growth and development, having negative influences on the production. So, creating varieties adapted to the different photoperiod and thermoperiod conditions is a great objective, having in view its practical importance.

The soybean consumes and at the same time stores high quantities of nutritive elements in its seeds and in the other organs, mainly nitrogen.

MATERIALS AND METHODS

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

The used biologic material: semi-late Condor variety resistant to fall, diseases and with a high genetic potential.

The used soil was the reddish preluvosol from Moara Domnească, mixed with sand 2 : 1.

Before starting the experience were analysed the components and the used soil mixture.

Soil determinants and analyses:

– soil's pH: in aqueons suspension 1: 2.5 using potentiometric method;

– the total content of soluble salts: in aqueous extract 1:5, using *conductometric* method;

– content in $N\text{-}NH_4^+$, $N\text{-}NO_3^-$, $P\text{-}PO_4^{3-}$, K^+ soluble forms in aqueous extract 1:5, dosage by *spectrophotometric*, flame photometric methods.

During the vegetation period in the critical stages of plants growing (blooming, pods appearance, the end of their formation), were collected plants samples, were made agrochemical analyses in dynamics of soybean plants and was determined dry matter accumulation.

Determinations and plant analyses:

– N, P, K content in total forms in soybean plants using digest method and volumetric, spectrophotometric, flame photometric dosage method.

For fertilization were used 3 nitrogen levels and 3 phosphorus levels in the variants presented in Table 1, each variant has 3 repetitions.

Table 1

Experimental scheme

No.	Variant		N kg/ha	P_2O_5 kg/ha
V1	N_0P_0 control	N_0P_0 control	-	-
V2	N_1P_0	$N_{50}P_0$	50	-
V3	N_2P_0	$N_{100}P_0$	100	-
V4	N_0P_1	N_0P_{40}	-	40
V5	N_1P_1	$N_{50}P_{40}$	50	40
V6	N_2P_1	$N_{100}P_{40}$	100	40
V7	N_0P_2	N_0P_{80}	-	80
V8	N_1P_2	$N_{50}P_{80}$	50	80
V9	N_2P_2	$N_{100}P_{80}$	100	80

For nitrogen was used ammonium nitrate fertilizer 34.5% N and for phosphorous superphosphate 18% P_2O_5, calculated according to pots capacities.

RESULTS AND DISCUSSIONS

In Table 2 are presented the analyses results for each component, but also for the soil mixture. This way, when this experience was started the soil mixture was deficient in with nutritive elements, having a low content of soluble salts and pH of 7.36.

The dynamics of Nt content during vegetation period in soybean plants

The dynamics of N shows that during vegetation period for the N_{100} fertilized variant in the first stage analysis, of intensive growth, a leaves accumulation occurs, after this, the N is metabolized in the phase from 13.07.2007; in the last stage (03.10.2007) the total N content is higher, due to the valorification of N fixed in the nodosities at V_6 ($N_{100}P_{40}$) and V_9 ($N_{100}P_{80}$) for which the values of Nt accumulated in plants are higher due to the applied phosphorus and to its synergism effect made with N. In the case of the control variant, unfertilized, the N_t content in plants reaches a maxim value in the last stage of the analysis, due to fixed nitrogen valorification by the symbiotic bacteria (Fig. 1).

The dynamics of P_t content during vegetation period in soybean plants

The dynamics of content in the total phosphorus, P_t has in increasing trend, from the first analysis stage to the last one, due to the metabolization and its accumulation in the bean as phosphoproteids (Fig. 2).

The dynamics of K_t content during vegetation period in soybean plants

The dynamics of K_t content shows a decrease starting with the first stage of analysis towards the last one due to the metabolization and accumulation in bean (Fig. 3).

The dynamics of nutritive elements accumulation shows that these two processes, usually follow an increasing trend, then there are equal rates accumulations, and finally accumulations become decreasing. The phenomenon occurs in the case of macroelements (N, P, K), sometimes the macro-elements accumulation rates being higher than the dry matter accumulation.

Table 2

Components and soil mixture analysis

No	Specification	pH	Content of soluble salts %	$N\text{-}NH_4^+$ ppm	$N\text{-}NO_3^-$ ppm	$NH_4^+ + NO_3^-$ ppm	PO_4^{3-} ppm	K^+ ppm
1	Sand	7.16	0.086	21.5	traces	21.5	traces	10
2	Soil	7,26	0.0480	1.75	15.5	17.25	traces	20
3	Soil-sand mixture 2:1	7,36	0.0329	15.25	5.75	21.0	traces	20

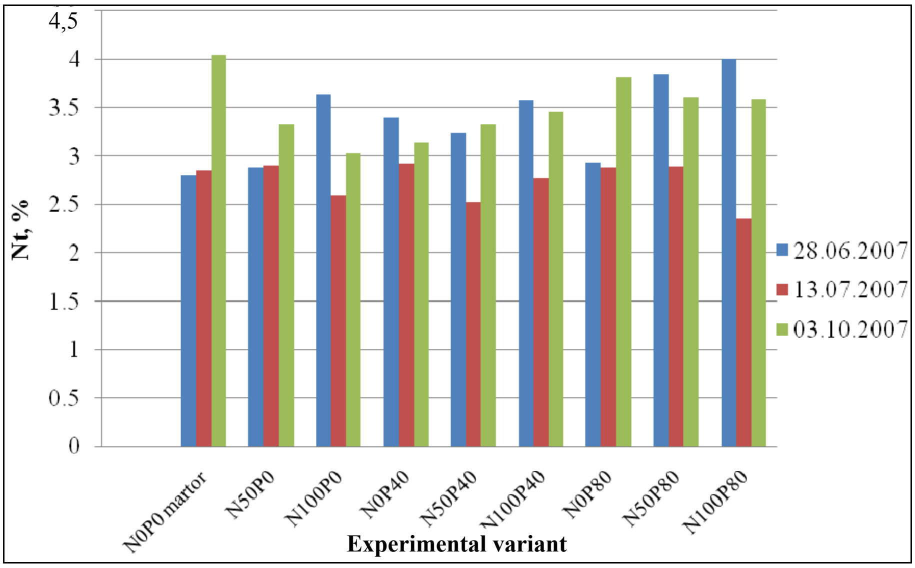

Fig. 1. The dynamic of N_t, %, content during the vegetation period in soybean plants.

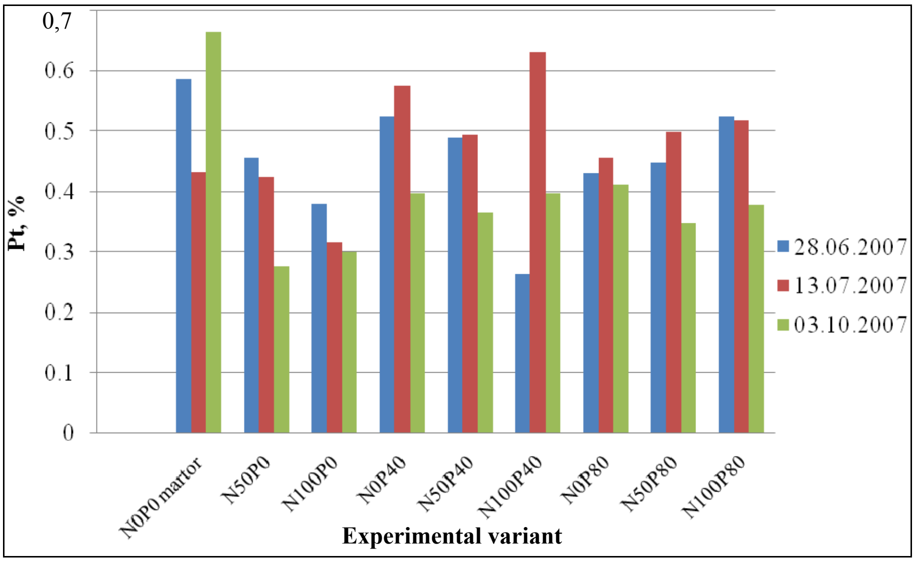

Fig. 2. The dynamic of P_t, %, content during the vegetation period in soybean plants.

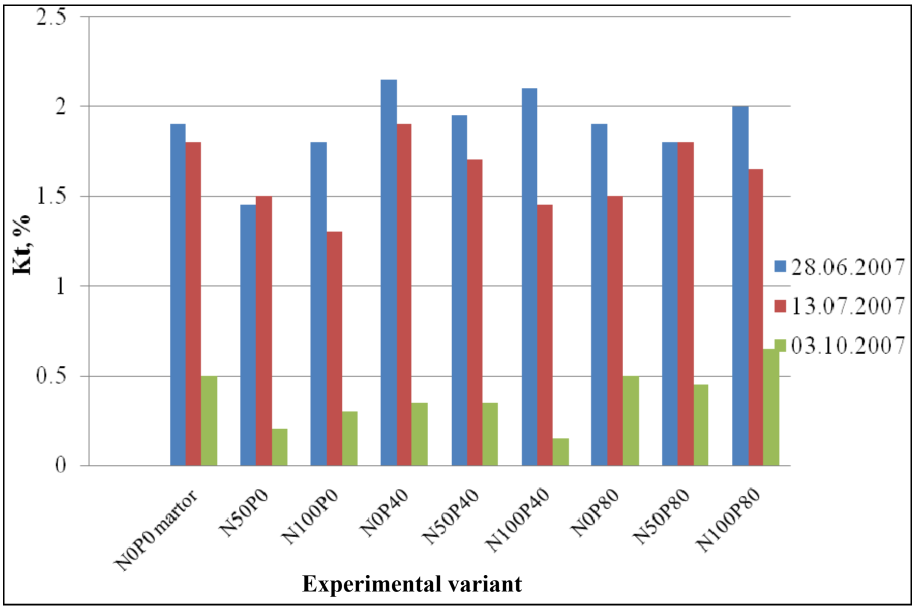

Fig. 3. The dynamic of K_t, %, content during the vegetation period in soybean plants.

As compared to this specific of the parallelism between main mineral elements and dry matter accumulation, for microelements the rates of their accumulation are lower than dry matter accumulation, during the first phenophases of vegetative growth. During the maturity phenophases and the decline ones the rates of nutrients accumulations are in equilibrium with the dry substance accumulation, and towards the final stage of vegetation, the rates of nutrients accumulations are inferior to those of dry matter.

The dynamics of the dry matter accumulation during vegetation period in soybean

The synthesis of the useful organic substances of plants (proteins, nucleic acids, vegetable oils, vitamins) is made through the absorption of N, P but also of other organogenetic elements, their separation and binding in the composition of organic compounds take place through photosynthesis, but also K, Mg, Ca, Fe, Mn, Mo contribute quantitatively and metabolically to this essential processes.

Accumulation of dry matter in the soybean followed the normal storage process, V_2 ($N_{50}P_0$), registering 29.41% dry substance, followed by V_8, V_3, V_7, V_6 having contents between 28.96% (V_8) and 28.36% (V_6) and very low variations. The control unfertilized variant accumulated 26.79% dry matter, and V_5 ($N_{50}P_{40}$) with the highest beans yield had the smallest content 20.40% (Fig. 4).

Application of an optimal fertilization determines a normal absorption of the needed nutrients for synthesis and for organic compounds accumulation in plants, useful for the development of vital metabolic processes and a better accumulation of dry matter [6,7,8].

The influence of the fertilization system on the dry matter accumulation (%) in soybean plants shows very significantly positive differences for the V_2 ($N_{50}P_0$), V_3 ($N_{100}P_0$), V_7 (N_0P_{80}), V_8 ($N_{50}P_{80}$) variants and very significantly negative differences for V_5 ($N_{50}P_{40}$), (Table 3).

Table 3

Components and soil mixture analysis

No	Variant	Dry matter %	Differences	Signification
1	N_0P_0 control	26.79	Mt	-
2	$N_{50}P_0$	29.41	+2.62	xxx
3	$N_{100}P_0$	28.71	+1.92	xxx
4	N_0P_{40}	26.66	-0.13	ns
5	$N_{50}P_{40}$	20.40	-6.39	ooo
6	$N_{100}P_{40}$	28.36	+1.57	xx
7	N_0P_{80}	28.57	+1.78	xxx
8	$N_{50}P_{80}$	28.96	+2.17	xxx
9	$N_{100}P_{80}$	27.95	+1.16	x
DL 5%=0.9043% , DL 1%= 1.2276%, DL 0.1% = 1.6471%				

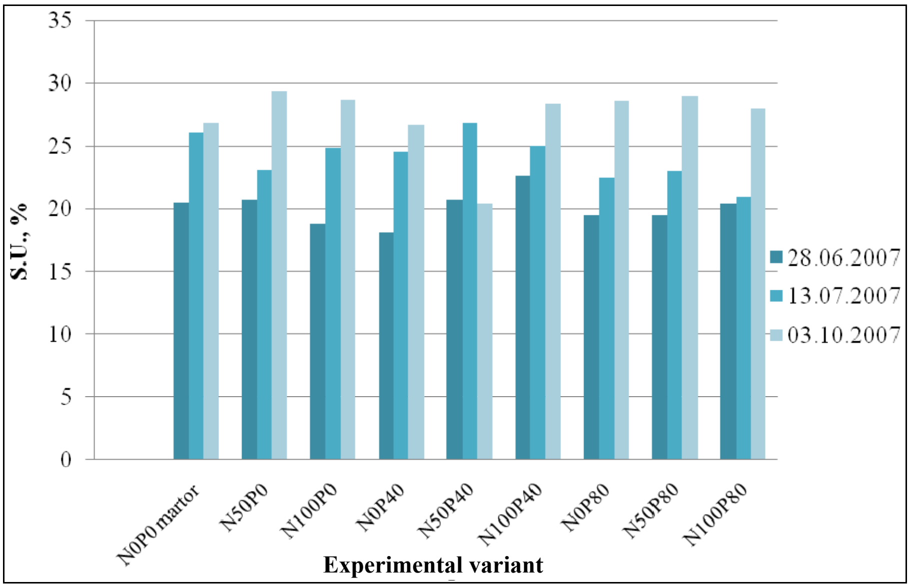

Fig. 4. The dynamic of dry matter, %, content during vegetation period in soybean plants.

CONCLUSIONS

The dynamics of nutritive elements accumulation shows that these processes follow an increasing trends next occur an equal rates accumulation period, after this accumulations decrease. The phenomenon is applicable to the macroelements (N, P, K), sometimes the macroelements accumulation rates exceeding the dry substance rates.

During the maturity phenophases and the decline ones the rates of nutrients accumulations are in equilibrium with the dry substance accumulation, and towards the final stage of vegetation, the rates of nutrients accumulations are inferior to those of dry matter.

The control unfertilized variant accumulated 26.79% dry matter, and V_5 ($N_{50}P_{40}$) with the highest beans yield had the smallest content 20.40%.

The influence of the fertilization system on the dry matter accumulation (%) in soybean plants shows very significantly positive differences for the V_2 ($N_{50}P_0$), V_3 ($N_{100}P_0$), V_7 (N_0P_{80}), V_8 ($N_{50}P_{80}$) variants and very significantly negative differences for V_5 ($N_{50}P_{40}$).

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