THE INFLUENCE OF FERTILIZATION SYSTEM ON SOME CHEMICAL CHARACTERISTICS OF CORN CROP

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ABSTRACT

This paper presents the effect of fertilization on some chemical characteristics of corn crop. The experiment, in a stationary rotation of 3 years (soy – wheat - corn) took place at SCDA Caracal using baticalcaric argic chernozem. The research`s purpose was the study of fertilization influence on protein, nitrogen, phosphorous, potassium, copper, manganese and zinc content of corn using different doses of nitrogen, phosphorous and potassium.
The combination of nitrogen and phosphorous fertilization lead to a more efficient valorification of the nitrogen in the soil and caused the growth of nitrogen content in corn beans. When growing the phosphorus dose, we noticed an increasing content of phosphorus in the corn beans. The fertilization had no impact on the potassium, manganese and zinc content but, it determined some variations of the copper content.

INTRODUCTION

Corn (Zea mays L.) is the third cereal crop as importance and the second after wheat in the international commerce. Corn occupies a leading place in the Romanian agriculture, through the big surfaces (30% of the arable fields), through production and also through the multiple use of corn beans in people`s alimentation, industry and livestock feed. Production level, economic efficiency and corn beans quality are the subject of many studies both nationally and internationally.

The improvement of corn beans quality represents an objective that must be followed with the same perseverance as the production capacity. This improvement enables both the diversification and the growth of the economic value of corn crops.
Knowing how to determine the corn beans quality is important in the improvement of production and other agronomic characteristics but it is also important for the improvement of some nutritional and industrial qualities (Pollak and Scott, 2005; Osorno şi Carena, 2008).

Generally, improvement testing of beans quality has bad consequences such as the reduction of production capacity and of resistance to diseases and pests. So, it is necessary to take into account the realization of a balance between the capacity of production and the indicators of beans quality when choosing hybrids (Scot t and colab., 2006).

Knowing the chemical composition of the corn beans is an important issue in characterizing any hybrid, so that its choice could be made in order to have a more efficient crop (Grecu and Legman, 1994).

MATERIALS AND METHODS

This experiment took place at SCDA Caracal using the method of subdivided parcels, with three factors, three times repeated during 2008 and 2010.

The soil used was baticalcaric argic chernozem representing in the arable layer (0 – 20 cm) a shale texture with a clay content (particles under 0.002 mm) of 36.2%, an apparent density of 1.42 g/ cm^3, a total porosity of 47% and a middle subsidence degree (resistence to penetration of 42 kg/cm^2).

Following its chemical characteristics, this soil presents a small to middle humus content, it is weak in nitrogen (0.130% N), middle to well supplied in phosphorous (43.6

ppm mobile P) and well to very well supplied in potassium (233.7 ppm mobile K), and the C : N report value is 16.53. The soil reaction is neutral to weak-alkaline (water pH has the value of 7.6). The sum of changeable bases is middle (25.60%), hydrolytic acidity (Ah has the small value of 2.04%), and V% has the increasing value of 92.62%.

For this experiment, we used the Olt hybrid with plant density of 70 000 plants/ha.

The experimental dispositive with a duration of 3 years comprised the following factors :

A factor : phosphorous fertilization (kg/ha) with the following steps :

a_1 - P_0; - a_2 - P_{40}; - a_3 – P_{80}; - a_4 - P_{120};

B factor : potassium fertilization (kg/ha) with the following steps :

b_1 – K_0; - b_2 – K_{80}; - b_3 – K_{40};

C factor : nitrogen fertilization (kg/ha) with the following steps :

c_1 – N_0; - c_2 – N_{60}; - c_3 – N_{120}; - c_4 -N_{180}; - c_5 – N_{240};

In the laboratory we determined the content of total dry substance using the vacuum drying oven at 105^0C, total forms of N, P and K through : the Kjeldahl (N_t) method, colorimetric method (P) and flamfotometric (K) method, in the last year of the experiment (2010).

The content of microelements was established through atomic absorption spectrophotometry.

RESULTS

Applying a system of balanced fertilization represents the basis for obtaining good crops. Researches made on the fields and in the laboratory lead to a series of appreciations concerning the content of micro and macroelements of corn beans.

Nitrogen content. The nitrogen content varied between 1,51 % (P_0) and 1,59 % (P_{120}) function of the phosphorous and potassium fertilization (table1) on a fund of K_0. The lowest nitrogen content was registered in case of $P_{80}K_0$ (1,34%) fertilization. On a K_{80} fund, the nitrogen content was influence by the dose of phosphorous. We noticed that the highest content of nitrogen/protein is obtained with a dose of P_{40} (1,88% nitrogen, 11,75% protein). In case of applying a dose of P_{80} the nitrogen conten rose but, the value is smaller (1.30%) in comparaison with a dose of P_{40} (1,88%).

On a constant fund of phosphorous, applying bigger doses of nitrogen determined a bigger content of nitrogen in the corn beans (table 2). The bigest nitrogen content is found in case of $P_{40}N_{240}$ variant. On a constant fund of nitrogen, applying phosphorous meant a different content of nitrogen. So, for all the nitrogen fertilization variants (N_0, N_{120}, N_{240}), the biggest nirogen content was registered in case of 40 kg s.a. phosphorous/ha.

As a conclusion, associating nitrogen and phosphorous fertilizations lead to a better valorification of the nitrogen in the soil, determining a growth of the nitrogen content in the corn beans. The biggest contents were noticed in the plants fertilized with $N_{120}P_{40}$ and $N_{240}P_{40}$.

The content of nitrogen (%)and protein (%) in the corn bean function of phosphorous and potassium fertilization

Table 1

	K 0		K 80	
	Nitrogen	Protein	Nitrogen	Protein
P 0	1,51	9,44	1,20	7,5
P 40	1,35	8,44	1,88	11,75
P 80	1,34	8,38	1,30	8,13
P 120	1,59	9,94	1,58	9,88

The content of nitrogen (%)and protein (%) in the corn bean function of phosphorous and nitrogen fertilization

Table 2

	N 0		N 120		N 240	
	Nitrogen	Protein	Nitrogen	Protein	Nitrogen	Protein
P 0	0,96	6,00	1,27	7,94	1,83	11,44
P 40	1,26	7,88	1,73	10,81	1,87	11,69
P 80	1,01	6,31	1,41	8,81	1,54	9,63
P 120	1,24	7,75	1,69	10,56	1,84	11,5

Phosphorous content in the corn beans grows on a fund of K_0 and K_{80} once the phosphorous doses are higher - to the level of $P_{80,}$ then we can notice a slight decrease in the case of P_{120} (tab.3).

On a constant fund of nitrogen, the phosphorous content in the corn beans grows for the variant without nitrogen once the phosphorous quantity is increased to maximum N_0P_{120} (0,285%). For the variants where we used N_{120} and N_{240}, the growth is up to P_{80}, then, we noticed a decrease of the phosphorous content when applying P_{120} (table 4).

Phosphorous content (%) in the corn beans function of phosphorous and potassium fertilization

Table 3

	K 0	K 80
P 0	0,24	0,23
P 40	0,27	0,29
P 80	0,30	0,30
P 120	0,29	0,28

Phosphorous content (%) in the corn beans function of phosphorous and nitrogen fertilization

Table 4

	N 0	N 120	N 240
P 0	0,220	0,225	0,255
P 40	0,275	0,255	0,305
P 80	0,275	0,300	0,330
P 120	0,285	0,275	0,300

Potassium content. On a fund of K_0, the percentage of potassium in the corn beans increased with the increasing of phosphorous doses up to P_{80} (0,39%), then, we noticed a slight decrease for P_{120} (0,37%) dose. On a fund of K_{80}, we noticed the increase of the potassium content for P_{120} (0,40%), (table5).

On a fund of nitrogen, the highest potassium content was registered for the $N_{240}P_{120}$(0,410%) variant (table 6).

Potassium content (%) in the corn beans function of phosphorous and potassium fertilization

Table 5

	K 0	K 80
P 0	0,34	0,34
P 40	0,37	0,38
P 80	0,39	0,38
P 120	0,37	0,40

Copper content. On a constant fund of phosphorous we noticed that if we do not apply phosphorous (P_0), the copper content rises in comparison with K_0 (2,41 mg/kg) when applying K_{80} (2,72 mg/kg) (table7). If we apply P_{40} and P_{80}, copper content decreases when applying 80 kg s.a. potassium/ha. On a fund of P_{120}, applying the same dose of K_{80} lead to an increase of copper content in the corn beans (2,89 mg/kg).

Applying different doses of nitrogen on a phosphorous fund lead to an increase of copper content once the doses were increased. The highest content was noticed for $P_{40}N_{240}$ variant (3,49 mg/kg) (table 8).

Copper content (mg/kg) in corn beans fonction of phosphorous and potassium fertilization

Table 7

	K 0	K 80
P 0	2,41	2,72
P 40	2,95	2,91
P 80	2,86	2,68
P 120	2,83	2,89

Copper content (mg/kg) in corn beans fonction of phosphorous and nitrogen fertilization

Table 8

	N 0	N 120	N 240
P 0	2,10	2,47	3,14
P 40	2,32	2,97	3,49
P 80	2,63	2,83	2,85
P 120	2,42	2,74	3,42

Manganese content. Here we noticed modifications function of phosphorous and potassium fertilization, these were comprised between 6,70 mg/kg (P_0K_{80}) and 7,87 mg/kg ($P_{40}K_{80}$) – table 9.

On a fund of phosphorous, applying nitrogen doses lead to a bigger manganese content (table 10).

Manganese content (mg/kg) in corn beans function of phosphorous and potassium fertilization

Table 9

	K 0	K 80
P 0	7,17	6,70
P 40	6,93	7,87
P 80	7,03	7,23
P 120	7,43	7,20

Manganese content (mg/kg) in corn beans function of phosphorous and nitrogen fertilization

Table 10

	N 0	N 120	N 240
P 0	5,95	6,85	8,00
P 40	6,45	7,55	8,20
P 80	6,80	7,10	7,50
P 120	6,55	6,80	8,60

Zinc content. On a fund of P_0 applying K_{80} dose lead to a decrease of the zinc content in the corn beans (22 mg/kg in comparison with 25 mg/kg). On a fund of P_{80} and P_{120}, applying K_{80} dose lead to an increase of the zinc content (table 11).

On a fund of P_0 applying nitrogen lead to an increase of the zinc content in the corn beans. When applying different doses of phosphorous, we noticed that the zinc content diminished (table 12).

Zinc content (mg/kg) in the corn beans function of phosphorous and potassium fertilization

Table 11

	K 0	K 80
P 0	25	22
P 40	26	26
P 80	21	22
P 120	23	26

Zinc content (mg/kg) in the corn beans function of phosphorous and nitrogen fertilization

Table 12

	N 0	N 120	N 240
P 0	22,50	23,50	24,00
P 40	27,00	26,00	24,50
P 80	24,50	20,00	20,50
P 120	26,00	23,00	24,50

CONCLUSIONS

1. The combination of the nitrogen fertilization with phosphorus permits more efficient use of nitrogen in the soil, increasing the nitrogen content of the corn. The highest content were determined in samples from the plants fertilized with $N_{120}P_{40}K_{80}$ (2,10%) and $N_{240}P_{40}K_{80}$ (2,19%).

2. At the supplementation of the dose of phosphorus we noticed an increase of the content of phosphorus in the grains of corn.

3. Fertilization procedure had no effect on the potassium dose in the corn plants.

4. Fertilization affected the copper system. Corn has accumulated large amounts of copper, as in the scheme of fertilization were included phosphorus and potassium. The content of the copper in the corn was not excessive, being within the normal range.

5. Manganese supply was not affected by fertilization applied in the experimental field.

6. In contrast to copper, zinc accumulation in corn was not affected by fertilization, the parameter values varied, with no clear trend of variation.

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