Аграрен университет – Пловдив, Научни трудове, т. LIV, 2009 г.
Девета научнопрактическа конференция "Екология, земеделие, животновъдство", Агроеко 2009
Agricultural University – Plovdiv, Scientific Works, vol. LIV, 2009
Ninth Scientific Practical Conference "Ecology, Agriculture, Animal Husbandry", Agroeco 2009

EFFECT OF FERTILIZATION ON THE CHROMIUM CONTENT IN VEGETABLE SPECIES

M. KAMBUROVA

Agricultural University – Plovdiv
12, Mendeleev Str., 4000 Plovdiv, Bulgaria

INTRODUCTION

The studies of the setting in changes in the content of the microelements are of a particular interest [1-4]. Some of these studies are directed to clarifying the effect of fertilization upon the content of the microelements in plants and productivity of plants under influence of foliar fertilizer [5, 6].

The interest in chromium, a poorly studied microelement, has also grown recently. As is known, the chromium content in plants is low. Studies of the content of this element in 135 plant samples from 29 botanical families showed that, with the exception of one of these samples, the chromium content was 0.01 to 0.1 ppm in their dry mass.

The aims of the present research are to study the influence of the level of fertilization in soil upon the content of chromium in headed cabbage and spinach. To establish the chromium content in the plants.

MATERIAL AND METHODS

The study was carried out at the Maritsa Vegetable Crops Research Institute – Plovdiv. The experiment was carried out with mineral and organo-mineral fertilization. The scheme of fertilization variants is shown in the Tables 1 and 2.

The stationary experiment was set on a strongly leached meadow cinnamon soil with a neutral reaction pH 6.8 – 7.0 with the humus content of 2.2 %.

Apparatus — Spectrophotometer VSU with 1-cm light path quartz cells.

Procedure — A wet burning of the plant sample was carried out in which a mixture of sulphuric and nitric acids was used for the oxidation of the organic substance. A portion of 2 g of air-dry plant material was placed into a Kjeldal flask and moistened with 4 ml distilled water. 5 ml conc. sulphuric acid and 10 ml conc. nitric acid were added. The flask was slightly heated to avoid splashing of the

solution decomposition and fuming away of HNO_3.After cooling the solution was diluted with water and filtered. It was transferred into a volumetric flask of 50 ml and diluted to the mark with distilled water. Aliquot parts of this solution were taken for analysis. The oxidation of Cr(III) to Cr(VI) was performed with potassium permanganate in a sulphuric acid medium.

In separatory funnel of 100 ml are introduced the solutions: 2 ml of 1.2 M hydrochloric acid, 2 ml of $1x10^{-4}$ M NBT, aliquote of the prepared solution of plant sample. It is diluted up to a volume of the aqueous phase of 10 ml with distilled water and extracted with 3 ml of 1,2-dichloroethane for 15 s. The organic phase is filtered through a dry paper into a 1 cm cuvette and the absorbance measured at 260 nm. A blank is run in parallel in the absence of plant sample. A calibration graph is constructed with standards similarly treated.

RESULTS AND DISCUSSION

The fertilization brought about considerable changes of the chromium content in vegetable species. The influence of the fertilization in soil upon the content of chromium in headed cabbage and spinach has been studied (Table 1 and Table 2). Two variants of fertilization for the two crops are applied - $N_{360}P_{360}K_{360}$ and $N_{480}P_{480}K_{360}$. The content of chromium is higher in headed

Table 1 Chromium content in headed cabbage (mg/kg dry mass)

№	Variants N P K	Cr mg/kg NBT method	Reliab. P= 99 %	RSD* %
1	$N_0P_0K_0$	1.20	a	2.2
2	$N_{360}P_{360}K_{360}$	6.20	a	1.9
3	$N_{480}P_{480}K_{360}$	5.80	f	1.7
№	Variants N P K + 4 t/dka manure	Cr mg/kg NBT method	Reliab. P= 99 %	RSD* %
4	$N_0P_0K_0$	1.50	c	2.5
5	$N_{360}P_{360}K_{360}$	5.80	b	1.6
6	$N_{480}P_{480}K_{360}$	5.00	d	1.8

*Relative Standard Deviation for NBT method (n = 6)

Cabbage(Fig.1) 6.20 mg/kg and 8.00 mg/kg Cr in spinach(Fig.2) in fertilization with $N_{360}P_{360}K_{360}$. In fertilization with higher doses of nitrogen and phosphorus, the content of chromium in vegetable crops decreases. Determined by the method with NBT, the lowest content of this element was in the plants fertilized with $N_{480}P_{480}K_{360}$, respectively 5.80 mg/kg Cr in cabbage and 7.40 mg/kg Cr in spinach.

In the experiment with mineral and organomineral fertilization with 4 t/dka manure (Table 1 and Table 2) the same subordination can be seen as in mineral fertilization. Plants accumulate more chromium in fertilization with $N_{360}P_{360}K_{360}$. With the increase of the fertilization norm of nitrogen and phosphorus introduced in soil like $N_{480}P_{480}K_{360}$, the amount of the chromium accumulated in plants decreases. In headed cabbage the difference is 0.8 mg/kg dry mass, and in spinach 0.4 mg/kg dry mass. The experimental data (Table 1 and Table 2) show that the content of chromium in vegetable crops in different levels of fertilization increases several times in comparison with the control non- fertilized.

Table 2 Chromium content in spinach (mg/kg dry mass)

№	Variants N P K	Cr mg/kg		
		NBT method	Reliab. P= 99 %	RSD* %
1	$N_0P_0K_0$	1.00	a	2.0
2	$N_{360}P_{360}K_{360}$	8.00	c	1.9
3	$N_{480}P_{480}K_{360}$	7.40	b	1.1
№	Variants N P K + 4 t/dka manure	Cr mg/kg		
		NBT method	Reliab. P= 99 %	RSD* %
4	$N_0P_0K_0$	1.00	c	1.4
5	$N_{360}P_{360}K_{360}$	2.40	a	1.6
6	$N_{480}P_{480}K_{360}$	2.00	d	1.9

*Relative Standard Deviation for NBT method (n = 6)

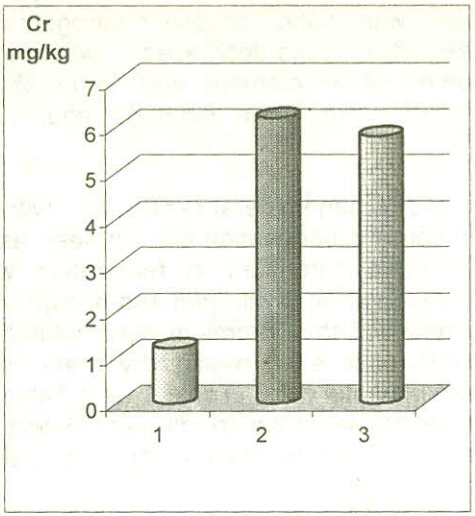

Fig. 1. Content of Cr in headed cabbage in different levels of fertilization:
1- $N_0P_0K_0$, 2- $N_{360}P_{360}K_{360}$,
3- $N_{480}P_{480}K_{360}$

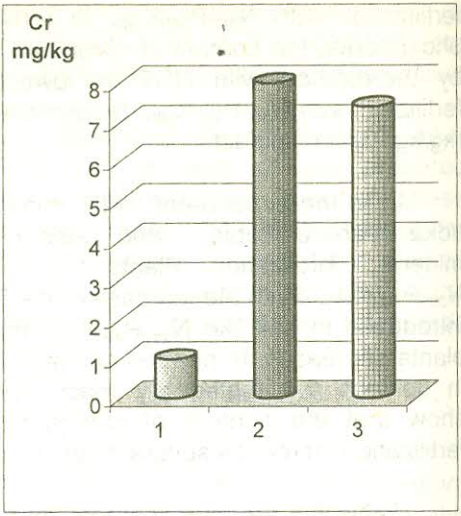

Fig. 2. Content of Cr in spinach in different levels of fertilization:
1- $N_0P_0K_0$, 2- $N_{360}P_{360}K_{360}$,
3- $N_{480}P_{480}K_{360}$

REFERENCES

1. Kostova D., Seven Scientific Practical Conference with International Participation "Ecological Problems of Agriculture" Agroeco 2005, Plovdiv, vol. L, N 1, 325 (2005).
2. Kostova D.,Determination of manganese with Toluidene Blue in some vegetable crops, VII National Scientific Conference with International Participation, "Ecology and Health 2008", Plovdiv (2008).
3. Kostova D., International scientific-practical conference "Climate, ecology and agriculture of Eurasia" , Irkutsk, 94- 99 (2009).
4. Kostova D., Journal of Analytical Chemistry, vol. 65, N 2 (2010).
5. Panayotov N., Crop Science, 44, 5, 449 (2007)
6. Panayotov N., The annals of "Valahia" University of Targoviste, Fascicle VI "Food technology, aquaculture and fishing", 24-30 (2005).