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ZINC AND COPPER CONTENT IN VEGETABLES GROWN NEAR COMMUNICATION ROUTES IN ŚRODA WIELKOPOLSKA COMMUNE

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ABSTRACT. In vegetables grown in the neighbourhood of high car traffic, zinc and copper contents were determined. The mean values of copper and zinc in selected vegetables species were lower than the valid standards. Only in a few samples of red cabbage and red beet, the concentration of zinc was higher than the admissible value (50 $mg \cdot kg^{-1}$ d.m.).

Key words: copper, zinc, vegetables

Introduction

Increased development of motorization leads to more intensive contamination of areas adjacent to communication tracks. In big urban agglomerations in the neighbourhood of transport routes, cars are the major source of air pollution (80%) creating a serious endangerment for human health (**Kabata-Pendias** and **Pendias** 1993).

In order to evaluate the range of these threats on the area of Poland and in order to undertake appropriate actions to decrease the danger following from excessive contamination of soils and cultivated plants, monitoring studies have been conducted for many years (Report about the environmental conditions in Wielkopolska 1999). The results of these studies are discussed in many publications. Also the present work constitutes a fragment of studies on the effect of environmental pollution caused by the communication routes with a high intensity of traffic on vegetable plants cultivated in the region of Środa Wielkopolska.

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Material and methods

In 1998, studies were carried out to evaluate the content of zinc and copper in vegetables cultivated in the vicinity of communication routes in Środa Wielkopolska commune using the regulations valid in Poland and defined by the **Instruction of the Minister of Health and Social Welfare** (1993). For analysis plants were sampled in the period from May to September from farms specializing in vegetable production and supplying them to the markets in Poznań agglomeration (mainly by selling their crops to the Wielkopolski Agricultural and Horticultural Wholesale Market in Franowo and to "HORTEX" enterprise in Środa Wielkopolska which contracts vegetables for processing purposes. Totally, 118 samples were taken including: cucumber 17, white cabbage 16, onion and chives 16, cauliflower 11, red beet and carrot 8 samples each, potato and Chinese cabbage 7 each, red cabbage and tomato 5 each, parsley 4, savoy cabbage 3, leek 3 and 1 samples of broccoli. The localisation of vegetable plantations is show in figure 1. The edible parts of vegetables taken for analyses were washed, disintegrated, dried at +55°C and homogenized.

Fig. 1. Map of Środa Wielkopolska Commune
Ryc. 1. Mapa Gminy Środa Wielkopolska

Zinc and copper were determined in vegetable plants by dry combustion method. Air dry material in the amount of 2.5 g was transferred into porcelain crucible pots and subjected to mineralization in a combustion furnace LINN, Electro Therm at 450°C. Than, the combusted material was dissolved in 10% HCl, subsequently it was heated and transferred into flasks. In the solution prepared in the described way, the concentra-

tion of zinc and copper was determined by the flame method of atomic absorption using Zeiss AAS-3 apparatus. The precision and accuracy of the determinations was evaluated using certified plant material CABBAGE LEAVES.

Results and discussion

The 24-hour requirement of an adult person for zinc is about 15 mg, and for copper is about 1.5-4 mg (**Collective work** 1997).

Plants containing, among others, excessive amounts of zinc and copper are harmful to consumers. The greatest amounts of these metals enter into human organism with the consumed food through the alimentary tract. Vegetables accumulate great amounts of heavy metals in their edible parts. The instruction of the Minister of Health of 1993 defines the admissible concentrations of zinc and copper in fresh and frozen vegetables in $mg \cdot kg^{-1}$: 10 Zn and 4 Cu, which converted into dry mass make 50 $mg \cdot kg^{-1}$ Zn and 20 $mg \cdot kg^{-1}$ Cu.

Table 1 contains extreme and mean contents of zinc and copper in the analysed vegetable species independent of the date of sampling.

The concentration of zinc was within the range from 9.35 $mg \cdot kg^{-1}$ d.m. (cucumber) to 128.28 $mg \cdot kg^{-1}$ d.m. (red cabbage). The mean value of zinc in all analysed vegetables was 38.61 $mg \cdot kg^{-1}$ d.m. According to **Kabata-Pendias** and **Pendias** (1993), zinc content in plants in the range from 20 to 100 $mg \cdot kg^{-1}$ d.m. is regarded as appropriate, while **Mocek** et **al.** (1997) inform that values contained in the interval of 50-70 $mg \cdot kg^{-1}$ are safe and do not create any threat to human health.

In our studies, only in two species of vegetables: red cabbage and red beet, the determined zinc content exceeded the admissible standards. **Sękara** and **Poniedziałek** (1999) of heavy metals in vegetables grown in Cracow region, also indicated that red beet has the greatest tendency to zinc accumulation.

The smallest mean content of zinc (in $mg \cdot kg^{-1}$ d.m.) was identified in the edible parts of: potato (13.37); onion (25.33); tomato (25.52) and carrot (28.30).

The mean copper content in the analysed vegetables amounted to 5.31 $mg \cdot kg^{-1}$ d.m. The copper content ranged between 0.64 $mg \cdot kg^{-1}$ d.m. (onion chives) and 14.34 $mg \cdot kg^{-1}$ d.m. (parsley). Great amounts of copper were accumulated by: parsley, celery and cucumber, while the least amounts were found in red cabbage and leek. **Jasiewicz** (1994) also showed the accumulation of significant amounts of copper in celery roots. Or the other hand, a higher content of copper in red beet, as compared to carrot, agrees with the results reported by **Chodak** et **al.** (1995).

In all studied vegetable plants grown at communication tracks in Środa Wielkopolska commune, no excessive contents of copper were found. Concentrations of Cu smaller than required as standards in edible parts of vegetables grown in Poznań agglomeration were also found by **Breś** (1998), by **Golcz** and **Dłubak** (1998) and by **Sękacz** and **Poniedziałek** (1999) in root vegetables grown Cracow agglomeration.

Table 1

Content of zinc and copper in edible parts of vegetables (mg·kg^{-1})
Zawartość cynku i miedzi w częściach jadalnych warzyw (mg·kg^{-1})

Species Gatunek	Zinc – Cynk		Copper – Miedź	
	extreme values wartości skrajne	mean średnia	extreme values wartości skrajne	mean średnia
Group 1. Vegetables whose edible parts are roots and tubers Grupa 1. Warzywa, których częścią jadalną są korzenie i bulwy				
Red beet – Burak ćwikłowy	19.08-107.64	51.93	4.74-9.04	6.69
Carrot – Marchew	21.10-33.82	28.30	3.40-10.42	5.77
Celery – Seler	29.88-54.84	46.68	6.10-12.02	8.33
Persley – Pietruszka	30.02-56.94	43.30	7.68-14.34	10.64
Potato – Ziemniak	9.56-18.46	13.37	1.76-14.34	3.45
Mean – Średnia		36.71		6.98
Group 2. Vegetables whose edible parts are leaves Grupa 2. Warzywa, których częścią jadalną są liście				
White cabbage – Kapusta biała	10.30-99.46	36.90	2.06-9.38	3.51
Red cabbage– Kapusta czerwona	25.03-128.28	52.73	2.88-3.84	3.24
Savoy cabbage – Kapusta włoska	23.40-52.08	38.36	3.60-4.38	3.80
Chinese cabbage – Kapusta pekińska	19.40-57.18	40.20	3.50-8.02	5.19
Onion – Cebula szczypior	9.36-70.02	25.33	0.64-9.52	3.59
Leek – Por	31.54-55.14	41.03	2.86-3.86	3.35
Mean – Średnia		39.09		3.78
Group 3. Vegetables whose edible parts are inflorescences Grupa 3. Warzywa, których częścią jadalną są kwiatostany				
Cauliflower – Kalafior	25.48-59.92	43.40	2.94-6.58	4.37
Broccoli – Brokuł	45.78	45.78	4.16	4.16
Mean – Średnia		44.59		4.27
Group 4. Vegetables whose edible parts are fruits Grupa 4. Warzywa, których częścią jadalną są owoce				
Tomato – Pomidor	9.36-37.38	25.52	0.64-12.01	6.30
Cucumber – Ogórek	9.35-72.14	46.36	0.64-12.02	7.26
Mean – Średnia		35.94		6.78
Total mean Średnia ogólna		38.61		5.31
Admissible concentration Dopuszczalne stężenie	50		20	

Conclusions

1. The admissible amount of zinc concentration was exceeded only in two vegetable species – red cabbage and red beet.

2. Copper content in the studied vegetables were significantly lower than the admissible concentration.

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ZAWARTOŚĆ CYNKU I MIEDZI W WARZYWACH UPRAWIANYCH PRZY TRASACH KOMUNIKACYJNYCH W GMINIE ŚRODA WIELKOPOLSKA

S t r e s z c z e n i e

W 1998 roku w Katedrze Nawożenia Roślin Ogrodniczych w Poznaniu podjęto badania, których celem było oznaczenie zawartości cynku i miedzi w warzywach rosnących w gospodarstwach produkcyjnych w Środzie Wielkopolskiej. Nie stwierdzono przekroczenia zawartości miedzi w częściach jadalnych badanych roślin, natomiast przekroczenie dopuszczalnego stężenia cynku stwierdzono tylko u dwóch gatunków warzyw: kapusty czerwonej i buraka ćwikłowego.