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NUTRIENTS CONTENTS IN SWEET BASIL (*Ocimum basilicum* L.) HERB DEPENDING ON CALCIUM CARBONATE DOSE AND CULTIVAR

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Abstract. Basil, cultivated as a medicinal and seasoning plant, has strict requirements as to climate, as well as soil fecundity and humidity. The herb harvested during flowering period, contains, besides valuable essential oil, plant dye, vitamins and mineral components. The undertaken studies were aimed at analyzing the contents of macro and microelements in the herbs of two basil cultivars ('Kasia' and 'Wala'), depending on the doses of calcium carbonate – 6 and 12 g·dm^{-3} substratum. The total nitrogen contents was on quite an even level – from 5.23 to 5.43% d.m. A significant effect of the examined cultivar was reported upon the N-total contents, whereas the calcium carbonate dose did not differentiate the content of this component in a plant. Significant effects of calcium fertilizer dose and cultivar were reported upon potassium and calcium contents in basil herb. The double dose of $CaCO_3$ caused the decrease of potassium and calcium amounts in the plant. Higher concentrations of K and Ca were found in the herb of 'Kasia' than 'Wala' cultivar. Higher zinc, manganese and copper contents were found in plants of 'Wala' cultivar, as compared to plants of 'Kasia' cultivar. Doubling the dose of calcium carbonate caused the decrease of manganese, copper and iron concentrations in basil herb, as compared to a single dose. Only as to zinc no such response was reported. The concentrations of nutrients in the examined substratum was differentiated depending on the analyzed factors.

Key words: fertilization, cultivar, microelements, and microelements

INTRODUCTION

The specificity of herbal plants is genetically conditioned through their differentiated chemical composition, occurring already within a species. A special source of qualitative differentiation of curative raw materials is their developmental variability, depending upon many external factors. Plant nutrition is one of the agrotechnical fac-

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tors, affecting the quality of the obtained raw materials. The optimal fertilization intensifies the formation of fresh weight and specific substances of herbal plants [Węglarz 2006]. It should be emphasized that both lack and excess of particular nutrients may cause disturbances in a system's metabolism, and, consequently, decreased contents of biologically active substances. From among 92 elements that naturally exist in the natural environment, it is only several that are regarded as indispensable for plants. Calcium is an element taken up from the soil by plants only in a relatively low pH, as Ca^{2+}, in soluble form. This component, together with the remaining macro- and microelements, is responsible for the correct functioning of physiological processes taking place in plants and in the human organism. Calcium regulates the activity of many enzymes, e.g. ATPase, amylase, phospholipase, and it easily connects with saccharides. In human organism it fulfils two basic functions: it constitutes the supporting structure of the skeleton and is an activator of enzymes taking part in biochemical processes, in. a. in blood coagulation and transmitting electric and chemical signals from the surface of cells inside [White and Broadley 2003].

The basil herb (*Basilici herba*) is one of the most frequently used culinary and pharmacological raw materials, containing a significant amount of biological components with strong curative properties. Basil is a plant of warm climate and is very demanding as to temperature and insolation, as well as soil fecundity and humidity [Nurzyńska-Wierdak 2001, Nowak 2000, Martyniak-Przybyszewska 2001]. Basil has low calorific value and high nutritional values. It contains carotene, vitamins A, B_6, C, as well as calcium, potassium, phosphorus, magnesium, iron. The basil herb also contains flavonoids and is an antioxidant [Leonard et al. 2001, Golcz and Seidler-Łożykowska 2008].

The undertaken studies were aimed at analyzing the contents of macro- and microelements in plants of two basil cultivars, depending on different calcium carbonate doses in the substratum.

MATERIAL AND METHODS

The studies with sweet basil of 'Kasia' and 'Wala' cultivars were performed in a glasshouse in the following terms in the year 2008 from 28th February to 15th May and in the year 2009 from 10th March to 28th May. The plants grew in two-liter pots filled with highmoor peat, limed with $CaCO_3$ in two doses: 6 and 12 $g \cdot dm^{-3}$ of substratum. The experiment was established with the use of complete randomization method in eight repetitions. A repetition was a pot with one plant. The mineral abundance of highmoor peat before administering nutrients was ($mg \cdot dm^{-3}$): $N\text{-}NH_4$ – tr., $N\text{-}NO_3$ – 20, $P\text{-}PO_4$ – tr., K – 6, Ca – 692, Mg – 9. The reaction of this substratum was 4.3 pH, and the general salt concentration: 0.2 $mS \cdot cm^{-1}$. The nutrients were applied in the following amounts ($g \cdot dm^{-3}$ substratum): N – 0.6; P – 0.5; K – 1.0; Mg – 0.4 and ($mg \cdot dm^{-3}$ substratum) Fe – 8.0; Cu – 13.3; Mn – 5.1; B – 1.6; Mo – 3.7; Zn – 0.74, applying ammonium saltpeter, superphosphate (17.6% P); potassium chloride, one-water magnesium sulfate, chelat – Fe; sulfates – Cu, Mn, Zn, boric acid, ammonium molybdate. Microelements were applied once, before planting the seedlings into the pots. Besides, before planting

¼ of nitrogen, potassium and magnesium was applied, as well as the whole dose of phosphorus. The remaining part of nutrients was administered in three doses: after positioning the plants in their permanent place.

Characterization of the examined cultivars.

'Kasia' – medium-sized plants, rounded habit, with anthocyanin stem of brown shade, large, drooping, rolling leaves, poorly notched leaf edges. Light-violet flowers. Plants of this cultivar can be grown in pots. They contain high quantities of essential oil (1.5%).

'Wala' – tall plants of uplifted habit, with anthocyanin stem of violet shade, large, slightly rolling leaves, poorly notched leaves. Light violet flowers. Essential oil contents is on the level of 1.2% [Seidler-Łożykowska 2004].

Plant material for analyses was sampled in the initial phase of flowering, at experiment liquidation. In the leaves total nitrogen was determined with the use of Kjeldahl's method (Tecator), and after mineralization by means of "dry" method (temp. 550°C), phosphorus (by colorimetric method with ammonium vanado-molybdate), sulfur with barium chloride, chlorine with silver nitrate, also colorimetrically, as well as potassium, calcium, magnesium, zinc, copper, iron and manganese, using ASA method (Perkin-Elmer, Analyst 300) [Nowosielski 1988].

The substratum for analyses was also sampled at experiment liquidation. The chemical analysis of substratum was performed in 0.03 M extract of acetic acid, using a universal method, according to Nowosielski [1988].

The statistical elaboration of results was performed using the method of variance analysis on mean values, for difference assessment using Tukey's test, at the significance level of $\alpha = 0.05$. Due to similar relationships occurring in both the study years, mean values for microelements of the year 2008 and 2009 were presented in the tables, as well as the values for microelements from the year 2009 .

RESULTS AND DISCUSSION

The examined basil cultivars and the applied nutrition with calcium carbonate differentiated the mineral composition of plants (tab. 1). The total nitrogen contents was on quite an evened level from 5.23 to 5.42% d.m. A significant effect of the examined cultivar was reported upon the contents of N-total, whereas the calcium carbonate dose did not differentiate the content of this component in a plant. In the case of mineral nitrogen we obtained the reverse relationship, despite the fact that no significant effect was found upon the concentrations of ammonium and nitrate nitrogen of the examined factors in basil herb, a decreasing tendency was marked in the mineral nitrogen contents under the influence of a higher dose of $CaCO_3$. With the application of 6 g $CaCO_3 \cdot dm^{-3}$ substratum the mineral nitrogen contents in a plant was 0.67% d.m., and at 12 g $CaCO_3 \cdot dm^{-3}$ substratum – 0.47% d.m. Nitrate nitrogen contents in basil leaves was on a low level, which proves positive of the quality of the obtained raw material. Seidler-Łożykowska et al. [2006], examining basil of 'Wala' cultivar, coming from conventional and ecological growings, obtained a significantly lower N-total content, ranging from 2.42–3.77%. Golcz et al. [2006] report that total nitrogen content in basil herb depended upon the cultivar and nitrogen fertilizer dose, and it ranged from 1.24% to 3.96% d.m. for 'Wala' cultivar.

Table 1. Effect of cultivar and calcium fertilization on macroelement concentrations in sweet basil herb (% d.m.) (mean of the years 2008–2009)
Tabela 1. Wpływ odmiany i nawożenia wapniowego na zawartość makroelementów w zielu bazylii pospolitej (% s.m.) (średnia z lat 2008–2009)

Cultivar Odmiana (A)	Dose Dawka $CaCO_3$, $g \cdot dm^{-3}$ (B)	N-total N-og.	$N-NH_4$	$N-NO_3$	P	K	Ca	Mg	$S-SO_4$	Cl
Kasia	6	5.41	0.12	0.56	1.09	4.72	2.76	0.31	0.32	0.93
Wala	6	5.35	0.11	0.54	1.17	4.59	2.53	0.28	0.24	0.83
Mean – Średnia B		5.37	0.12	0.55	1.13	4.65	2.64	0.29	0.28	0.88
Kasia	12	5.42	0.09	0.40	1.09	4.46	2.16	0.31	0.30	0.86
Wala	12	5.23	0.11	0.33	0.97	4.26	1.73	0.28	0.28	0.80
Mean – Średnia B		5.33	0.10	0.37	1.03	4.36	1.95	0.29	0.29	0.83
Mean Średnia	Kasia	5.41	0.11	0.48	1.09	4.59	2.46	0.31	0.31	0.89
	Wala	5.29	0.11	0.43	1.07	4.42	2.13	0.28	0.26	0.81
$LSD_{0,05\ for}$										
A		0.099	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	0.084	0.113	i.d. – r.n.	0.049	i.d. – r.n.
B		i.d. – r.n.	i.d. – r.n.	0.113	0.085	0.084	0.113	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.
A × B		i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	0.165	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.

A × B – interaction – współdziałanie, i.d. – insignificant differences; r.n. – różnice nieistotne

Differences in phosphorus contents in the raw material herb were slight, its amounts ranged from 0.97 to 1.17% d.m. Lower concentration of this element was reported in growing the plants of 'Wala' cultivar, fertilized with $CaCO_3$ in the amount of 12 g·dm^{-3}, and higher – at the dose of 6 g·dm^{-3} of calcium carbonate in the same cultivar. These differences can be explained by phosphorus reversing at increased amounts of calcium in substratum. This process is a slow phenomenon that is why the differences were small. The contents of phosphorus in the examined basil herb was on a high level, as compared to the values given by Őzcan and Akbulut [2007], Őzcan et al. [2005] and Őzcan [2004]. The authors, examining the leaves and flowers of basil from the Southern Turkey, found that phosphorus contents in them ranged from 0.49% to 0.83%. Similar results were obtained by Seidler-Łożykowska et al. [2006, 2009], analyzing basil herb from different crops.

A significant effect of calcium fertilizer dose and the examined cultivar was reported upon potassium contents in basil herb. Double dose of $CaCO_3$ caused a slightly lower potassium content in a plant. In the case of the examined cultivar a higher potassium content was obtained in the herb of 'Kasia' cultivar (4.59% d.m.) than 'Wala' (4.42% d.m.). A similar potassium content in basil herb was obtained by Őzcan et al. [2005] (4.0%), whereas Seidler-Łożykowska et al. [2006, 2009] found that the potassium contents in basil herb ranged quite broadly (from 2.98 to 5.21% d.m.) and depended on the kind of soil and the manner of cultivation. According to Őzcan and Akbulut [2007], as well as Őzcan [2004], the potassium contents in basil ranged from 2.48% to 2.76%.

Table 2. Effect of cultivar and calcium carbonate dose upon microelement contents in basil herb (mg·kg^{-1} d.m.) (year 2009)
Tabela 2. Wpływ odmiany oraz dawki węglanu wapnia na zawartość mikroelementów w zielu bazylii (mg·kg^{-1} s.m.) (rok 2009)

Cultivar Odmiana (A)	Dose Dawka $CaCO_3$, g·dm^{-3} (B)	Zn	Mn	Cu	Fe
Kasia	6	77.20	310.7	11.70	189.65
Wala	6	81.80	316.3	11.35	186.65
Mean – Średnia B		79.50	313.5	11.52	188.15
Kasia	12	80.65	261.7	8.65	180.80
Wala	12	83.75	266.9	10.25	168.10
Mean – Średnia B		82.20	264.3	9.45	174.45
Mean	Kasia	78.92	286.2	10.17	185.23
Średnia	Wala	82.77	291.6	10.80	177.38
$LSD_{0,05\ for}$					
A		i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.
B		i.d. – r.n.	9,245	0,731	i.d. – r.n.
A × B		i.d. – r.n.	i.d. – r.n.	1,517	i.d. – r.n.

A × B – interaction – współdziałanie; i.d. – insignificant differences; r.n. – różnice nieistotne

Table 3. Effect of cultivar and calcium fertilization upon chemical composition of substratum from sweet basil cultivation ($mg \cdot dm^{-3}$) (mean of the years 2008 and 2009)

Tabela 3. Wpływ odmiany i nawożenia wapniowego na skład chemiczny podłoża z uprawy bazylii pospolitej ($mg \cdot dm^{-3}$) (średnia z lat 2008 i 2009)

Cultivar Odmiana (A)	Dose Dawka $CaCO_3$, $g \cdot dm^{-3}$ (B)	$N\text{-}NH_4$	$N\text{-}NO_3$	P	K	Ca	Mg	$S\text{-}SO_4$	Cl	EC $mS \cdot cm^{-1}$	pH H_2O
Kasia	6	236.0	182.5	150.0	521.5	1447.2	182.0	823.0	185.0	2.50	5.22
Wala	6	211.0	189.2	172.0	558.2	1343.5	197.5	803.7	188.7	2.24	5.18
Mean – Średnia B		223.5	185.8	161.0	539.8	1395.3	189.7	813.3	186.8	2.37	
Kasia	12	141.0	179.7	162.5	403.5	2590.2	177.5	777.7	177.5	2.07	5.80
Wala	12	189.5	174.5	160.0	388.7	2276.7	218.0	698.0	177.5	2.09	5.72
Mean – Średnia B		165.2	177.1	161.2	396.1	2433.5	197.7	737.8	177.5	2.08	
Mean	Kasia	188.5	181.1	156.2	462.5	2018.7	179.7	800.3	181.2	2.29	
Średnia	Wala	200.3	181.8	166.0	473.5	1810.1	207.7	750.8	183.1	2.16	
$LSD_{0,05\ for}$											
A		i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	18.162	i.d. – r.n.	i.d. – r.n.	0.083	
B		18.359	i.d. – r.n.	i.d. – r.n.	42.608	461,11	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	0.083	
A × B		35.405	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	i.d. – r.n.	0.161	

A × B – interaction – współdziałanie; i.d. – insignificant differences; r.n. – różnice nieistotne

An interesting relationship was reported in the case of calcium concentration in a plant. An increased $CaCO_3$ dose did not cause the increase of this element's content in the examined raw material, but its decrease. In the objects with double dose of $CaCO_3$ we received 0.69% less calcium than in plants nourished with a single $CaCO_3$ dose. Calcium intake and transport in a plant is constantly examined. This element is one of the components, which are difficult to reutilize in plants.

Magnesium concentration in basil herb did not significantly depend upon the cultivar and dose of $CaCO_3$, its amount was on average 0.3% d.m., irrespectively of the examined factors. Similar values of this nutrient in basil were obtained by Őzcan and Akbulut [2007] (0.31%). Larger quantities of this element in basil herb are given by Őzcan [2004] (0.57%) and Seidler-Łożykowska et al. [2009] (0.59–0.85% d.m.).

The contents of sulfur and chlorine in basil were differentiated to a small degree, depending on $CaCO_3$ dose and cultivar. The highest sulfur content (0.32% d.m.) and chlorine (0.93% d.m.) was found in basil herb of 'Kasia' cultivar, fertilized with a lower calcium carbonate dose 6 g · dm^{-3} substratum.

The performed analysis of microelement contents in the herbs of experimental plants did not reveal significant differences between the respective means, except for the contents of manganese and zinc at variable nitrogen fertilization (tab. 2). Doubling the calcium carbonate dose caused the decrease of manganese, copper and iron concentration in basil herb as compared to a single dose. Only with zinc no such response was reported. Higher concentrations of zinc, manganese and copper were these in 'Wala' cultivar plants, as compared to those of 'Kasia' cultivar. Golcz et al. [2007], examining basil coming from various localities, report that the content of manganese equaled 175.7 $mg \cdot kg^{-1}$ d.m., iron – 438.9 $mg \cdot kg^{-1}$ d.m., copper – 15.6 $mg \cdot kg^{-1}$ d.m. and zinc – 80 $mg \cdot kg^{-1}$ d.m. Suchorska-Orłowska et al. [2006], as well as Witoszyńska and Jendryczko [1994] point to the fact that the amount of microcomponents in herbal raw materials is characterized by significant changeability, resulting from the developmental phase, species and part of the analyzed plant. The analyzed sweet basil plants revealed uneven abilities of accumulating the examined micro- and microelements, probably caused by differentiated nutrition and cultivar features. However, the examined herbal raw material contained quite a high level of mineral components and that is why it can be a source of easily assimilable elements in human diet.

The concentration of nutrients in the examined substratum was differentiated according to the analyzed factors (tab. 3). A higher mean salt concentration – 2.37 $mS \cdot cm^{-1}$ – was obtained at a lower dose of $CaCO_3$, when the following values were found in the substratum: 185.87 mg $N\text{-}NO_3 \cdot dm^{-3}$, 539.87 mg $K \cdot dm^{-3}$, 813,3 mg $S\text{-}SO_4 \cdot dm^{-3}$ and 186,8 mg $Cl \cdot dm^{-3}$, lower salt concentration – 2.08 $mS \cdot cm^{-1}$ was found in the substratum with a higher dose of $CaCO_3$ in these objects lower contents of nitrates (177.12 $mg \cdot dm^{-3}$), potassium (396.12 $mg \cdot dm^{-3}$), sulfur (737,8 $mg \cdot dm^{-3}$) and chlorine 177,5 $mg \cdot dm^{-3}$ were reported. Having analyzed the substratum, we found a significant effect of $CaCO_3$ dose upon the concentrations of potassium and calcium. A lower potassium content was obtained in objects with higher calcium carbonate dose, where more calcium was obtained, as compared to the objects in which a lower $CaCO_3$ dose was applied.

CONCLUSIONS

1. Higher total nitrogen, potassium, calcium, magnesium and sulfur contents were characteristic of plants of 'Kasia' cultivar, as compared to those of 'Wala' cultivar.

2. Calcium carbonate dose significantly differentiated the contents of $N\text{-}NO_3$, P, K in basil herb.

3. Higher contents of zinc, manganese and copper were found in plants of 'Wala' cultivar, as compared to the plants of 'Kasia' cultivar, whereas the contents of iron were higher in plants of 'Kasia' cultivar.

4. Significant effect of calcium carbonate dose was reported upon the contents of manganese and copper in sweet basil.

5. General salt concentration in the examined substratum was differentiated depending on the concentrations of particular nutrients in the substratum. Higher mean salt concentration 2.38 $mS \cdot cm^{-1}$ was obtained in the substratum, where higher concentrations of $N\text{-}NO_3$, K, $S\text{-}SO_4$ and Cl were found, whereas lower salt concentration 2.08 $mS \cdot cm^{-1}$ substratum was found in objects where lower contents of nitrates, potassium, sulfur and chlorine were reported.

REFERENCES

Golcz A., Politycka B., Seidler-Łożykowska K., 2006. The effect of nitrogen fertilization and stage of plant development on the mass and quality of sweet basil leaves (*Ocimum basilicum* L.). Herba Pol., 52, 1/2, 22–30.

Golcz A., Seidler-Łożykowska K., Kozik E., Mieloszyk E., 2007. Zawartość mikroskładników w surowcach wybranych gatunków roślin zielarskich z upraw ekologicznych. Rocz. AR Pozn. 383, Ogrodnictwo 41, 477–481.

Golcz A., Seidler-Łożykowska K., 2008. Bazylia pospolita (*Ocimum basilicum* L.). Wyd. UP, Poznań.

Leonard S., Hardin K., Leklem J., 2001. Vitamin B content of species. J. Food Comp. Anal. 14(2), 163–167.

Martyniak-Przybyszewska B., 2001. Rośliny przyprawowe. Wyd. UWM, Olsztyn.

Nowak B., 2000. Leksykon roślin uprawnych i użytkowych. Wiedza Powszechna, Warszawa.

Nowosielski O., 1988. Zasady opracowywania zaleceń nawozowych w ogrodnictwie. PWRiL, Warszawa.

Nurzyńska-Wierdak R., 2001. Analiza zawartości i składu chemicznego olejku dwóch form bazylii wonnej (*Ocimum basilicum* L.). Annales UMCS, Sect. EEE 9 suppl., 189–193.

Őzcan M., 2004. Mineral contents of some plants used as condiments in Turkey. Food Chem. 84, 437–440.

Őzcan M., Arslan D., Űnver A., 2005. Effect of drying methods on the mineral content of basil (*Ocimum basilicum* L.). J. Food Eng. 69, 375–379.

Őzcan M.M., Akbulut M., 2007. Estimation of minerals, nitrate and nitrite contents of medicinal and aromatic plants used as Spice, condiments and herbal tea. Food Chem. 106, 852–858.

Seidler-Łożykowska K., 2004. Introduction of new Polish cultivars of sweet basil (*Ocimum basilicum* L.) to cultivation. 3rd Conf. on medicinal and aromatic plants of southeast European countries. Nitra, 64.

Seidler-Łożykowska K., Kozik E., Golcz A., Mieloszyk E., 2006. Zawartość makroelementów i olejku eterycznego w surowcach wybranych gatunków roślin zielarskich z upraw ekologicznych. J. Res. Appl. Agric. Eng. 51(2), 161–163.
Seidler-Łożykowska K., Mordalski R., Kucharski W., Golcz A., Kozik E., Wójcik J., 2009. Economic and qualitative value of the Raw material of chosen species of medicinal plants from organic farming. Part II. Yield and quality of sweet basil herb (*Ocimum basilicum* L.). Acta Sci. Pol., Agricultura 8(3), 29–35.
Suchorska-Orłowska J., Jadczak D., Brzostowska-Żelechowska D., 2006. Zawartość niektórych mikroskładników w wybranych gatunkach ziół. Folia Hortic. Supl. 2, 174–180.
Węglarz Z., 2006. Zróżnicowanie roślin leczniczych a ich jakość. Folia Hort., Supl. 1, 30–37.
White P.J., Broadley M.R., 2003. Calcium in plants. Ann. Bot. (Lond.) 92, 487–511.
Witoszyńska T., Jendryczko A., 1994. Rośliny lecznicze naturalnym źródłem mikroelementów. Wiadomości Zielarskie 4, 8–9.

ZAWARTOŚĆ SKŁADNIKÓW POKARMOWYCH W BAZYLII POSPOLITEJ (*Ocimum basilicum* L.) W ZALEŻNOŚCI OD DAWKI WĘGLANU WAPNIA I ODMIANY

Streszczenie. Bazylia, uprawiana jako roślina lecznicza i przyprawowa ma duże wymagania klimatyczne oraz względem żyzności i wilgotności gleby. Ziele zbierane w okresie kwitnienia zawiera oprócz cennego olejku eterycznego, barwniki roślinne, witaminy i składniki mineralne. Podjęte badania miały na celu przeanalizowanie zawartości makro- i mikroelementów w zielu dwóch odmian bazylii (‘Kasia’ i ‘Wala’) w zależności od dawek węglanu wapnia 6 i 12 g·dm^{-3} podłoża. Zawartość azotu ogółem kształtowała się na dość wyrównanym poziomie od 5,23 do 5,43% s.m. Odnotowano istotny wpływ badanej odmiany na zawartość N-ogółem, natomiast dawka węglanu wapnia nie różnicowała zawartości tego składnika w roślinie. Odnotowano istotny wpływ dawki nawozu wapniowego oraz odmiany na zawartość potasu i wapnia w zielu bazylii. Podwójna dawka $CaCO_3$ spowodowała, iż otrzymano mniejszą ilość potasu i wapnia w roślinie. Większą koncentrację K i Ca stwierdzono w zielu odmiany Kasia niż Wala. Wyższą zawartością cynku, manganu i miedzi odznaczały się rośliny odmiany Wala w porównaniu z roślinami odmiany Kasia. Podwojenie dawki węglanu wapnia spowodowało obniżenie koncentracji manganu, miedzi i żelaza w zielu bazylii w porównaniu z pojedynczą dawką, tylko przy ilości cynku nie odnotowano takiej reakcji. Koncentracja składników pokarmowych w badanym podłożu różnicowana była w zależności od analizowanych czynników.

Słowa kluczowe: żywienie, odmiana, makroelementy, mikroelementy

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