

USABILITY OF DIFFERENT TYPES AND CULTIVARS OF SALAD CHICORY (*Cichorium intybus* L. var. *foliosum* (Hegi) Bish.) FOR SPRING CULTIVATION

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Abstract: Leaf chicory type belongs to valuable vegetables in terms of its high nutrition and taste qualities. In spite of those advantages, in Poland, chicory is relatively little known. The purpose of field experiment carried out in the years 2009–2010 was the assessment of possibility of cultivation different types and cultivars of salad chicory in climatic conditions of Lower Silesia. In the experiment there were used 9 types of chicory: ‘Palla Rossa 3’, ‘Orchidea Rossa’, ‘Rosso di Verona’, ‘Grumolo bionda’, ‘Capotta di mantovana’, ‘Pan di Zucchero’, ‘Rosso di Treviso 2’, ‘Rosso di Chioggia’, ‘Variegato di Castelfranco’ and two breed cultivars ‘Indigo’ and ‘Fidelio’. The highest marketable yield was recorded for ‘Grumolo bionda’ (4.24 kg·m⁻²) and ‘Capotta di mantovana’ (4.00 kg·m⁻²), while the lowest one characterized ‘Fidelio’ cv. (1.27 kg·m⁻²) and ‘Rosso di Chioggia’ (1.56 kg·m⁻²). The highest amount of nitrates was observed in ‘Rosso di Verona’ – 1063.60 mg NO₃·kg⁻¹ and the lowest quantity – in ‘Indigo’ cv. (302.23 mg NO₃·kg⁻¹). The highest phosphorus content featured the plants of intensive red leaves (0.50 do 0.58% s.m.), while the highest quantity of calcium green – leaf plants. Average magnesium content in chicory leaves equaled 0.20% f.m.

Key words: radicchio, yielding, bolted plants, nitrates, macroelements

INTRODUCTION

Botanical variety salad chicory (*Cichorium intybus* L. var. *foliosum* (Hegi) Bish.) involves three types of this plant: Belgian endive (also called witloof), sugar chicory (sugarloaf) and radicchio chicory, called Italian or red [Baraccia et al. 2003]. Radicchio originates from Italy where it has been widely cultivated. There can be distinguished numerous types of this vegetable and its name covers both red – leaf forms and the green ones, as well as chicory featuring variegated leaves. However, in other countries, this term refers exclusively to chicory with red leaf lamina [Hill 2004]. Previously, red

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chicory was growing only in the region of Veneto, where its types have still been cultivated on a large scale. The most popular include: 'Rosso di Chioggia', which became the source of a number of useful cultivars, as well as of less common ones, like: 'Rosso di Treviso', 'Variegato di Castelfranco' and 'Rosso di Verona' [Barcaccia et al. 2003]. Particular plants form above ground parts of different shape – it can be leaf rosettes or loose heads, elongated ones resembling Peking cabbage or Romaine lettuce and spherical, compact as in the case of butterhead lettuce [Perkins-Veazie et al. 1991]. Analyses with the use of molecular markers proved that red plants of chicory belong to *Cichorium intybus* L. var. *foliosum* (Hegi) Bish. species, while 'spotted' (variegato) are formed as a result of controlled or random crossbreeding between plants belonging to *Cichorium intybus* L. var. *foliosum* and *Cichorium endivia* L. var. *latifolium* Heigi [Varotto et al. 1995].

A characteristic property of all chicory types and cultivars is their bitter taste due to the presence of arborescens lactones, mainly lactucin and lactucopicrin [Dirnik et al. 1985]. These days, many European countries and the United States introduce chicory to their cultivation regarding its biological value, diversity of forms and the possibility of using it as a component of salad mixtures [Gianquinto 1997]. Red chicory also features considerable antioxidant properties and it contains carotenoids, vitamins: A, B₆, K, as well as macro- and microelements, such as: phosphorus, potassium, zinc, copper or iron [Ćustić et al. 2000, Mulabagal et al. 2009].

The aim of research conducted in the years 2009–2010 was the assessment of yielding and nutrition status of different types and cultivars of salad chicory cultivated in the conditions of Lower Silesia.

MATERIALS AND METHODS

Field experiment was carried out in Vegetable and Decorative Plants Research – Development Station in Psary, belonging to Department of Horticulture at Wrocław University of Environmental and Life Sciences. The experiment was established on black degraded soil, containing 1.8% of humus as well as 63 mg P and 50 mg K per one dm³. There was assessed usability for cultivation of 11 types and cultivars of red – leaf salad chicory: 'Palla Rossa 3', 'Orchidea Rossa', 'Indigo' cv. (from Bejo Zaden firm), 'Fidelio' cv. (from Clause Tezier firm), 'Rosso di Verona', green – leaf: 'Grumolo bionda', 'Capotta di mantovana' and 'Pan di Zucchero' (sugarloaf type), then 3 containing anthocyanins coloration of leaves: 'Rosso di Chioggia', 'Rosso di Treviso 2' and 'Variegato di Castelfranco'. Two – factorial experiment was established according to randomized split – plot method, in three replications. Each of the latter ones involved planting of 40 plants in 45 × 35 cm spacing. The area of one plot for harvesting amounted 6.3 m². Seeds, which underwent dressing with Grevitt 200 SL preparation, were sown in the first week of March into multipots filled with peat substrate, each containing 2–3 seeds per 54 cm³ pot capacity. In the course of plants growing, there was applied fertilization with Florovit (0.3%), which took place twice. After emergence, seedlings were thinned and one, the most vigorous plant was left in each pot. Ready, 7-week old transplants were planted in the last week of April into the field fertilized

with nitrogen in the dose of 150 kg N·ha⁻¹ and potassium 100 kg K₂O·ha⁻¹. During plant growing period there were introduced typical treatments, including irrigation and weeding. Within the mentioned period chicory was subjected to biometric measurements to determine the following parameters: plant height and diameter, as well as the number of leaves sent on a plant. Harvesting took place in the first week of July, accompanied by determination of total yield of above ground parts of plants, marketable yield – distinguishing 4 fractions of unit weight: 100–200 g, 200–300 g, 300–400 g, > 400 g and non commercial yield with plants with disease symptoms. There was also counted the number of bolted plants. During the harvest, there were collected 5 plants from each plot to undergo chemical analyses. In chicory leaves there were determined macroelements in dry matter: Ca and K with the use of flame photometry method, Mg and P due to colorimetric method and nitrates – by potentiometric method, in fresh [Nowosielski 1988]. The results were subjected to statistical analysis using Tukey test, at significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

Weather conditions in the years of experiment varied considerably (tab. 1). During the period of chicory growth, between April and May, mean air temperature was higher than those recorded for many years (except for May 2010), with definitely hotter April and May 2009. The years research was conducted also differed in precipitation level. The highest amount of precipitation was recorded in May 2010 (134.5 mm), while the lowest one featured April 2009 (4.2 mm).

Table. 1. Mean temperatures and summary precipitation during the experimental period in Experimental Station in Psary

Tabela 1. Średnie temperatury i sumy opadów w okresie badań w Stacji Doświadczalnej w Psarach

Month Miesiąc	Average monthly temperature Średnia temperatura miesiąca °C		Total monthly precipitation Miesięczna suma opadów mm		Mean value of monthly temperatures years 1970–2000 Średnia wieloletnia temperatura miesięczna za 1970–2000 mm	Deviation from average sum of monthly precipitation in the years of examination Średnia wieloletnia miesięczna suma opadów za 1970–2000 mm
	2009	2010	2009	2010		
April Kwiecień	13.9	10.8	4.2	26.4	8.1	31.9
May Maj	15.8	13.3	54.2	134.5	13.9	49.9
June Czerwiec	17.0	17.5	79.3	24.8	16.7	64.9
July Lipiec	21.0	21.0	115.9	79.1	18.5	75.4

Table 2. The yielding of salad chicory according to a plant type
Tabela 2. Plonowanie cykorii sałatowej w zależności od typu

Types of salad chicory Typy cykorii sałatowej	Total yield of above ground parts of plants Plon całkowity części nadziemnych				Marketable yield Plon handlowy				Non commercial yield of plants with disease symptoms Plon roślin chorych				Share of marketable yield in total yield Udział plonu handlowego w plonie całkowitym				The unit weight of edible parts Jednostkowa masa części jadalnych				
	2009		2010		2009		2010		2009		2010		2009		2010		2009		2010		
	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	mean	średnia	
	kg·m ⁻²																				
	%																				
Fidelio	2.56	2.49	2.53	1.36	1.18	1.27	0.15	0.05	0.10	53.13	47.39	50.26	214	188	201						
Indigo	7.49	4.36	5.93	3.26	3.02	3.14	1.46	0.47	0.96	43.52	69.27	56.40	296	274	285						
Orchidea rossa	4.28	2.63	3.46	2.13	2.40	2.27	0.64	0.28	0.46	49.77	91.25	70.51	334	283	308						
Palla Rossa 3	3.21	3.02	3.12	2.28	2.30	2.29	0.78	0.56	0.67	71.03	76.16	73.59	324	320	322						
Capotta di mantovana	6.73	3.93	5.33	4.81	3.19	4.00	0.00	0.00	0.00	71.47	81.17	76.32	735	436	586						
Grumolo bionda	4.86	5.03	4.95	4.05	4.43	4.24	0.82	0.19	0.51	83.33	88.07	85.70	598	589	594						
Variegato di Castelfranco	5.91	4.38	5.15	3.62	3.73	3.68	1.21	0.00	0.61	61.25	85.16	73.21	465	575	520						
Rosso di Chioggia	2.01	1.88	1.95	1.63	1.48	1.56	0.00	0.00	0.00	81.09	78.72	79.91	244	234	239						
Rosso di Treviso 2	4.07	3.05	3.56	3.76	2.96	3.36	0.91	0.00	0.46	92.38	97.05	94.72	442	405	423						
Rosso di Verona	5.03	3.87	4.45	2.52	3.46	2.99	1.20	0.00	0.60	50.10	89.41	69.75	396	439	417						
Pan di Zucchero	4.14	4.45	4.30	2.42	3.89	3.16	0.00	0.83	0.42	58.45	87.42	72.93	622	612	617						
Mean – Średnia	4.47	3.55	4.06	2.89	2.91	2.90	0.90	0.40	0.76	64.99	80.83	72.91	424	395	410						
LSD ₀₅ = 0.05 for types of chicory (A)	0.59 0.78 0.21 0.85 0.93 0.26 0.73 0.35 0.18 18.45 23.58 6.22 0.14 0.15 0.04																				
NIR = 0.05 dla typów cykorii (A)																					
For years (B) – Dla lat (B)	0.48 0.61 0.42 14.60 0.10																				
Interaction – Interakcja A × B	0.68 0.86 0.59 20.64 0.14																				

Table 3. Marketable yield considering fractions, kg·m⁻²
 Tabela 3. Plon handlowy z uwzględnieniem frakcji, kg·m⁻²

Types of salad chicory Typy cykorií salatowej	100-200			200-300			300-400			>400		
	2009	2010	mean średnia	2009	2010	mean średnia	2009	2010	mean średnia	2009	2010	mean średnia
Fidelio	0.38	0.30	0.34	0.71	0.88	0.80	0.27	0.00	0.14	0.00	0.00	0.00
Indigo	0.00	0.17	0.09	0.18	1.21	0.70	3.08	0.70	1.89	0.00	0.94	0.47
Orchidea rossa	0.03	0.55	0.29	0.00	0.58	0.29	1.06	0.77	0.92	1.04	0.50	0.77
Palla rossa 3	0.17	0.28	0.23	0.54	0.54	0.54	1.01	0.94	0.98	0.56	0.54	0.55
Capotta di mantovana	0.20	0.00	0.10	0.00	0.61	0.31	0.52	0.69	0.61	4.09	1.89	2.99
Grumolo bionda	0.00	0.39	0.20	0.06	0.00	0.03	0.68	0.69	0.69	3.31	3.35	3.33
Variegato di Castelfranco	0.37	0.05	0.21	0.00	0.21	0.11	1.04	0.44	0.74	2.21	3.03	2.62
Rosso di Chioggia	0.50	0.63	0.57	0.50	0.85	0.68	0.36	0.00	0.18	0.27	0.00	0.14
Rosso di Treviso 2	0.07	0.19	0.13	0.06	0.49	0.28	1.34	0.72	1.03	2.29	1.56	1.93
Rosso di Verona	0.00	0.25	0.13	0.32	0.72	0.52	0.00	0.33	0.17	2.20	2.16	2.18
Pan di Zucchero	0.00	0.05	0.03	0.23	0.15	0.19	0.00	1.46	0.73	2.19	2.23	2.21
Mean – Średnia	0.25	0.29	0.34	0.35	0.62	0.80	1.04	0.75	0.84	2.02	1.80	1.78
LSD _α = 0.05 for types of chicory (A)	0.18	0.22	0.06	0.28	0.42	0.10	0.73	0.43	0.17	1.13	0.85	0.29
NIR = 0.05 dla typów cykorií (A)												
For years (B) – Dla lat (B)			0.14			0.24			0.40			0.67
Interaction – Interakcja A × B			0.20			0.34			0.57			0.95

Significantly lowest total yield of above – ground parts was obtained from ‘Rosso di Chioggia’ and ‘Fidelio’ cv., while the highest one characterized ‘Capotta di mantovana’, ‘Variegato di Castelfranco’, ‘Grumolo bionda’ and ‘Indigo’ cv. (tab. 2). Among the examined types and cultivars of salad chicory significantly highest marketable yield was recorded for ‘Grumolo bionda’ ($4.24 \text{ kg}\cdot\text{m}^{-2}$) – the chicory forming green – leaf rosettes and for ‘Capotta di mantovana’ ($4.00 \text{ kg}\cdot\text{m}^{-2}$) – the one which does not produce heads in the conditions of the experiment conducted. Similar level of yielding to ‘Indigo’ cv. ($3.14 \text{ kg}\cdot\text{m}^{-2}$) characterized ‘Variegato di Castelfranco’ ($3.68 \text{ kg}\cdot\text{m}^{-2}$), ‘Rosso di Treviso 2’ ($3.36 \text{ kg}\cdot\text{m}^{-2}$) and ‘Pan di Zuccherò’ ($3.16 \text{ kg}\cdot\text{m}^{-2}$). Significantly lowest marketable yield was obtained from ‘Fidelio’ cv. ($1.27 \text{ kg}\cdot\text{m}^{-2}$) and ‘Rosso di Chioggia’ ($1.56 \text{ kg}\cdot\text{m}^{-2}$). Marketable yield of chicory is influenced by numerous factors, including the term and way of cultivation, variety, course of weather conditions and fertilization [Francke 2007, Francke and Majkowska-Gadomska 2008, Rožek 2007]. Tossini et al. [2009], examining chicory plants within ‘Rosso di Chioggia’, which featured different length of plant growing period, recorded higher field in cultivars of a long growing period ($3 \text{ kg}\cdot\text{m}^{-2}$) as compared to those of a short growing period ($2 \text{ kg}\cdot\text{m}^{-2}$). Francke [2007] proved that marketable yield of chicory, Palla Rossa 3 from spring cultivation was by 31% higher than that originating from the autumn and cultivation from seedlings provided twice higher yield in comparison to cultivation from sowing. In research involving fertilization with diverse doses of nitrogen, amounting from 50 to 200 $\text{kg}\cdot\text{ha}^{-1}$, Bie-siada and Kołota [2008] recorded that the yields of ‘Indigo’ cv. ranged from 3.59 to 5.10 $\text{kg}\cdot\text{m}^{-2}$, while in experiments by Ćustić et al. [2003], connected with the effect of diverse mineral and organic fertilization on marketable yield of salad chicory, yield size was between 0.49 to 4.90 $\text{kg}\cdot\text{m}^{-2}$.

It is worth noticing that percentage share of marketable yield in total yield produced by particular types and cultivars of salad chicory did considerably differ. In chicory forming loose rosettes of leaves marketable yield also included whole, not damaged external leaves of typical coloring, while in those forming more or less compact heads only the latter ones were considered as marketable yield. Therefore, the most considerable share of marketable yield in total yield was reported for ‘Rosso di Treviso 2’ (94.72%) and Grumolo bionda’ (85.70%), while the lowest yield was obtained from ‘Fidelio’ cv. (50.26%) and ‘Indigo’ cv. (56.40%) plants forming external rosettes of green leaves and compact heads with leaves of intensive red color.

The highest number of non commercial heads characterized ‘Indigo’ cv. ($0.96 \text{ kg}\cdot\text{m}^{-2}$) and ‘Palla rossa 3’ ($0.67 \text{ kg}\cdot\text{m}^{-2}$). Elevated number of chicory heads affected by diseases was observed in 2009, which was connected with increased precipitation in summer months in relation to 2010, as well as to the data from many years.

The highest mean unit weight of edible parts featured ‘Pan di Zuccherò’ (617 g), forming elongated heads similar to those of Chinese cabbage, as well as the green – leaf and variegated plants not forming heads – ‘Grumolo bionda’, ‘Capotta di mantovana’ and ‘Variegato di Castelfranco’ (from 520 to 594 g). In the chicory producing heads, i.e. ‘Fidelio’ cv., ‘Indigo’ cv., ‘Orchidea Rossa’ ‘Palla Rossa 3’ ‘Rosso di Chioggia’ and ‘Rosso di Verona’, the weight of edible parts ranged from 201 to 417 g and it was similar to that recorded by Francke [2007] in spring cultivation. Also Žnidarčič et al. [2004] investigating *Cichorium intybus* L. var. *silvestre* Bisch, stated that marketable heads

weight varied from 131.0 to 476.4 g in particular years of experiment, depending on chicory type. In research by Rożek [2007] mean heads weight of 'Indigo' cv. and 'Leonardo' ranged, average, from 224 to 441 g and from 307 to 568 g, while in experiments by Rangarajan and Ingall [2001] for di Chioggia type, these values were between 190 and 310 g. Biesiada and Kołota [2010] recorded mean weight of chicory heads of 'Indigo' cv. – 265 g.

In 'Fidelio' cv. and 'Rosso di Chioggia' there was obtained the highest marketable yield of heads weighing 200–300 g (0.80 and 0.68 $\text{kg}\cdot\text{m}^{-2}$), while in 'Indigo' cv., 'Orchidea Rossa' and 'Palla Rossa 3' it was between 300–400 g. The remaining types produced large heads of weight ranging more than 400 g (tab. 3), and thus the yield of this fraction amounted from 2.62 to 3.33 g ('Variegato di Castelfranco', 'Capotta di mantovana', 'Grumolo bionda') and from 1.93 to 2.21 g for 'Rosso di Treviso 2', 'Rosso di Verona', and 'Pan di Zucchero'.

Our own investigation proved that the highest number of leaves on a plant was produced by 'Rosso di Treviso 2' (34 leaves), while the lowest number of leaf lamina featured 'Fidelio', 'Orchidea Rossa' and 'Palla Rossa 3' (from 20 to 21 leaves) (fig. 1). The highest value of leaf rosette diameters characterized 'Capotta di mantovana' (48 cm), whereas the lowest one belonged to 'Fidelio' cv. (32 cm). The longest edible parts were produced by 'Variegato di Castelfranco' (36 cm), 'Grumolo bionda' (34 cm) and 'Rosso di Treviso 2' (32 cm) and the shortest length of heads featured 'Palla Rossa 3' (12 cm), 'Fidelio' cv., 'Indigo' cv., 'Orchidea Rossa' and 'Rosso di Verona' (14–16 cm).

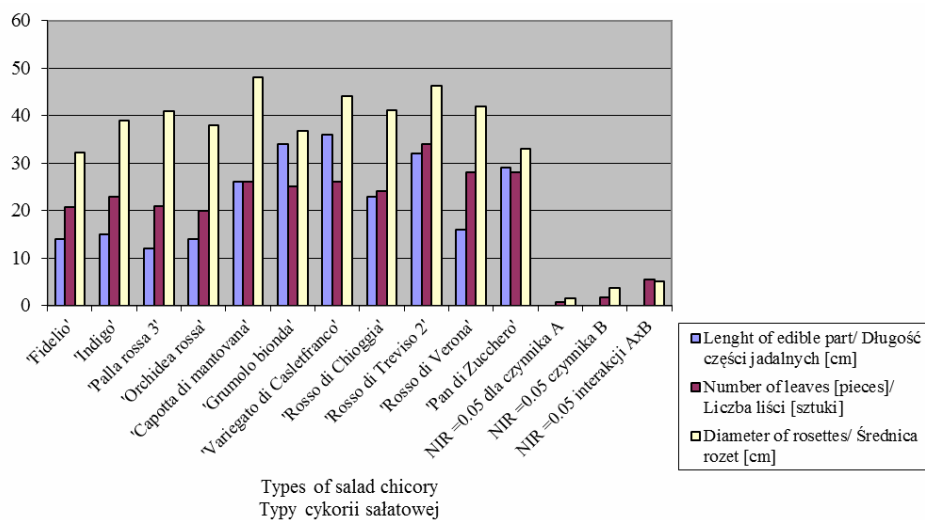


Fig. 1. Length of edible part, number of leaves and diameter of rosettes in salad chicory (average of years 2009-2010)

Rys. 1. Długość części jadalnych, liczba liści i średnica rozet cykorii sałatowej (średnia z lat 2009-2010)

One of more considerable problems to be faced by salad chicory producers can be its too early bolting. There are several factors intensifying this phenomenon: low temperature in the period between seeds sowing and germination, long day or too high temperature in the course of plants growing [Gianquinto 1997, Pimpini and Gianquinto 1988]. The chicory to show the most intensive tendency to bolt was 'Rosso di Chioggia' (14.1%) and to a lower degree, 'Rosso di Verona' (5.8%), 'Variegato di Castelfranco' (5.0%) and 'Capotta di mantovana' (3.3%), while in the remaining chicory types and cultivars there were not recorded such plants (fig. 2). In 2010 bolting was not observed in any of the examined plants, probably due to relatively even temperatures during plant growing period. Žnidarčič et al. [2004] reported chicory bolting which ranged from 0 to 20%, depending on chicory type. In research by Grevsen [1992] the author proved that temperature increase in the course of cultivation, from 15 to 25°C reduces bolting by 30%. According to the same author, covering plants with polypropylene foil diminishes the number of bolted plants by about 35%. The most advantageous effects of bolting elimination were obtained due to covering plants with a foil and cultivation at the temperature of 20°C. These findings were partly confirmed by Rangrajan and Ingall [2001] who recorded bolting which ranged up to 21% in 'Rosso di Chioggia' and 14% 'Rosso di Chioggia Medio'.

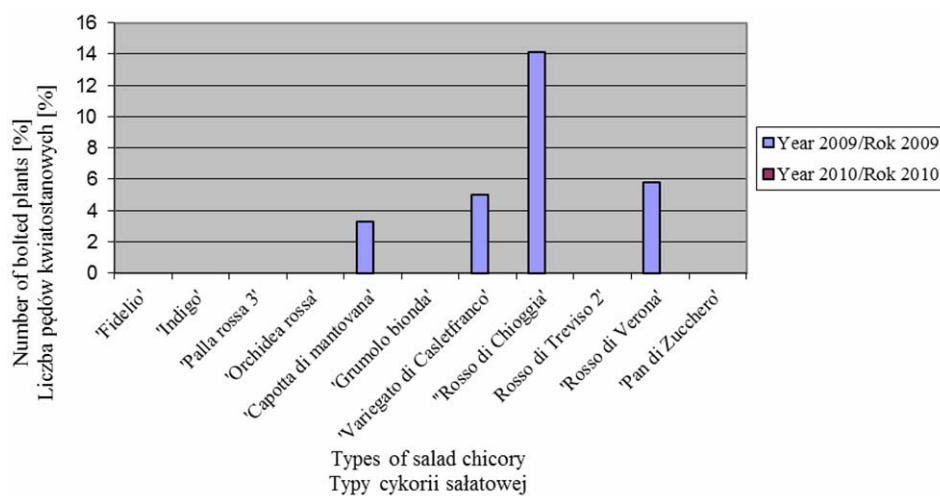


Fig. 2. Number of bolted plants in the examined types of salad chicory

Rys. 2. Liczba pędów kwiatostanowych wytworzonych przez badane typy cykorii sałatowej

According to Ćustić et al. [1994], as well as to Biesiada and Kołota [2008], salad chicory shows relatively low tendency to accumulate nitrates. This opinion can be confirmed by our own investigation in which any of the examined chicory plants did not exceed permissible content of nitrates (tab. 4). Average of chicory accumulated 608.01 mg NO₃·kg⁻¹. At nitrogen fertilization applied in the experiment, in the dose of

150 kg N·ha⁻¹ the highest amount of nitrates was recorded in 2010 for 'Rosso di Verona' (1063.60 NO₃·kg⁻¹), 'Grumolo bionda' (873.19 NO₃·kg⁻¹) and 'Rosso di Treviso 2' (840.07 NO₃·kg⁻¹), while the lowest nitrates quantity featured 'Indigo' cv. (302.23 NO₃·kg⁻¹). In research by Biesiada and Kołota [2008], heads of 'Indigo' cv. chicory contained from 375 to 1380 mg NO₃·kg⁻¹, at nitrogen fertilization doses 50 and 200 kg N·ha⁻¹. Francke and Majkowska-Gadomska [2008] reported average nitrates content in Palla Rossa 3 ranking from 1130.2 to 1400.9 mg NO₃ kg⁻¹.

The content of phosphorus in the examined chicory amounted from 0.35 to 0.58% d.m. It is worth stressing that red chicory contained definitely higher quantities of this element than the green or variegated ones. The highest amount of phosphorus was recorded for 'Indigo' cv. (0.58% d.m.) and 'Palla Rossa 3' (0.57% d.m.), while the lowest content values belonged to 'Grumolo bionda', 'Variegato di Castelfranco' and 'Pan di Zucchero' (from 0.35 to 0.39%). In reexamination by Biesiada and Kołota [2008] phosphorus content in 'Indigo' cv. ranged from 0.44 to 0.57% d.m.

The content of potassium in all the examined chicory equaled, average, 6.97% d.m. the highest quantity of this element was observed in 'Grumolo bionda' and 'Capotta di mantovana' respectively 8.37 and 8.40% d.m., while the lowest amount of potassium characterized 'Pan di Zucchero' (5.58% d.m.). Generally, higher amounts of potassium was recorded in 2009 than in 2010, except for 'Grumolo bionda', 'Rosso di Chioggia' and 'Pan di Zucchero'. In research by Čustić et al. [2003] potassium content in chicory heads was between 3.31 and 5.16% d.m. while Biesiada and Kołota [2008] reported average content of potassium in 'Indigo' cv. ranging from 4.80 to 5.42% d.m.

The highest content of calcium featured chicory of green and variegated leaves: 'Pan di Zucchero' (1.78% d.m.), 'Grumolo bionda' (1.65% d.m.) and 'Variegato di Castelfranco' (1.46% d.m.), while the lowest amount of this element was recorded in 'Rosso di Verona' (1.18% d.m.) and 'Capotta di mantovana' (1.01% d.m.). In the remaining plants Ca content did not exceed 1% d.m, which partly remains in agreement with the data recorded by Biesiada and Kołota [2008, 2010].

The content of magnesium ranged in particular chicory from 0.15 to 0.28% d.m. The most considerable amounts of this element was recorded in 'Pan di Zucchero' variety (0.28% d.m.), while the lowest quantity featured 'Indigo' cv. (0.15% d.m.).

CONCLUSIONS

1. The highest marketable yield and unit weight of edible plant parts was recorded for green and variegated chicory forming loose rosettes of leaves. Lower yield was obtained from plants producing compact heads. The most favourable yielding featured 'Grumolo bionda' chicory, while the lowest yield size was obtained from 'Fidelio' cv.
2. Radicchio characterizes low tendency to nitrates accumulation. The highest nitrates content was determined in 'Rosso di Verona' and the lowest one in 'Indigo' cv.
3. The most considerable content of phosphorus was observed in chicory of intensively red leaves, potassium – in green – leaf, calcium in green – leaf and variegated plants.
4. The examined types and cultivars showed a slight tendency to bolting and the highest one featured 'Rosso di Chioggia' (only in 2009).

5. The highest share of marketable yield in total yield was recorded for 'Rosso di Treviso 2', while the lowest one in 'Fidelio' cv.

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PRZYDATNOŚĆ RÓŻNYCH FORM I ODMIAN CYKORII SAŁATOWEJ (*Cichorium intybus* L. var. *foliosum* (Hegi) Bish.) DO UPRAWY WIOSENNEJ

Streszczenie. Cykoria sałatowa jest cennym warzywem o dużych walorach smakowych i odżywczych, stosunkowo mało znanym w Polsce. Celem doświadczenia przeprowadzonego w latach 2009–2010 było zbadanie możliwości uprawy w warunkach klimatycznych Dolnego Śląska różnych typów i odmian użytkowych cykorii sałatowej. W doświadczeniu wykorzystano 9 typów cykorii: ‘Palla Rossa 3’, ‘Orchidea Rossa’, ‘Rosso di Verona’, ‘Grumolo bionda’, ‘Capotta di mantovana’, ‘Pan di Zuccherò’, ‘Rosso di Treviso 2’, ‘Rosso di Chioggia’ ‘Variegato di Castelfranco’ oraz dwie odmiany użytkowe ‘Indigo’ i ‘Fidelio’. Największy plon handlowy odnotowano u ‘Grumolo bionda’ (4,24 kg·m⁻²) i ‘Capotta di mantovana’ (4,00 kg·m⁻²), zaś najmniejszy u ‘Fidelio’ (1,27 kg·m⁻²) oraz ‘Rosso di Chioggia’ (1,56 kg·m⁻²). Najwięcej azotanów zaobserwowano u ‘Rosso di Verona’ – 1063,60 mg NO₃·kg⁻¹, najmniej zaś u odmiany ‘Indigo’ (302,23 mg NO₃·kg⁻¹). Największą zawartością fosforu charakteryzowały się rośliny o intensywnie czerwonych liściach (0,50 do 0,58% s.m.), zaś wapnia te o liściach zielonych. Zawartość magnezu w liściach cykorii wynosiła średnio 0,20% s.m.

Słowa kluczowe: radicchio, typy, plonowanie, pędy kwiatostanowe, azotany, makroelementy

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