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CONTENT OF SELECTED COMPONENTS IN FRUITS OF POLISH WATERMELON CULTIVAR "BINGO" AS DEPENDENT ON THE METHOD OF SEEDLING PRODUCTION AND IRRIGATION

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The results of the study on the content of selected chemical components of watermelon (total sugars, reducing sugars, vitamin C, carotenoids and beta-carotene) of Polish cultivar 'Bingo' are presented in the paper. Cultivation was conducted in two successive vegetative seasons (2005 and 2006) near Bydgoszcz, with the use of drip irrigation. During seedling production three different variants of irradiation were used: sunny light, artificial daylight and artificial blue light. The drip irrigation, used during the vegetative season, decreased the content of total sugars as well as that of carotenoids and beta-carotene in watermelon fruits, whereas the content of reducing sugars and vitamin C was higher than that in fruits obtained from control plots (without irrigation). Irradiation with artificial daylight during seedling production had a positive influence on the content of total carotenoids, beta-carotene and vitamin C in watermelon fruits. The content of sugars was differentiated in fruits of watermelon by irradiation of seedlings. Fruits of plants originated from seedlings irradiated with sunny light were characterised by the highest content of sugars.

INTRODUCTION

Watermelon (*Citrullus vulgaris* Schrad.) belongs to cucurbits (*Cucurbitaceae*) and as just as melon is grown in Poland unprofessionally, but it is valued as a vegetable in respect of its taste values [Świetlikowska, 2006]. Watermelon is characterised by high thermal requirements and because of this, the creation of cultivars adapted to temperate climate of Poland increased the possibilities for its cultivation in the open field [Lisiecka, 1993]. An important factor in watermelon cultivation is water [Gajc-Wolska & Przybył, 2005], because during intensive growth of fruits the soil-moisture should be high (75-80%). Modern agricultural practices for watermelon, including the use of irrigation, and additionally, properly prepared seedlings, ensure obtaining fruits characterised by high quantitative and qualitative parameters. The main component of fruit dry matter are carbohydrates such as saccharose, glucose and fructose. Mutual ratio among the sugars is changing during fruit ripening. At the beginning, glucose is predominant, after that – fructose, and finally – saccharose. The content of sugars in a fresh mass of fruits is about 7% [Fajkowska, 1985]. Parenchyma contains not much vitamins (vitamin C about 8 mg/100 g fresh mass) and mineral salts, but quite a lot of potassium (130 mg/100 g in edible parts) [Kunachowicz *et al.*, 1998]. On the basis of studies of many authors [Mangels *et al.*, 1993], it is claimed that watermelon, like tomato and pink grapefruit, is a valuable source of lycopene which is characterised by supporting properties for treatment of neoplastic diseases. Watermelon is consumed only in the raw state, hence it can be an additive to fruit salads.

The aim of the study was to determine the degree of changes in the content of total sugars and reducing sugars and also vitamin C as well as total carotenoids and beta-carotene in watermelon fruits of Polish cultivar 'Bingo' affected by irradiation during seedling production and irrigation used in the vegetative season.

MATERIAL AND METHODS

Field experiments were carried out in two successive vegetative seasons (2005 and 2006) at Kruszyn Krajeński near Bydgoszcz. Trials were established as two-factorial experiment in split-plot design, with four replications. The first row factor was irrigation used in two treatments: control (without irrigation), surface drip irrigation with the use of drip-line 'T-Tape' (in-line emitters spaced 20 cm apart; emitter's output was 5 L/l.m.). Tensiometers were used in order to determine date and water doses. The second row factor was the light used during seedling production: S – sunny light (greenhouse, control), N – artificial blue light, D – artificial daylight. In experiment, used was made of TLD Philips lamps (36 W): daylight colour 54 and blue colour 18. Irradiance on the height of top buds was determined with the use of phyto-photometer at a level 50 μmol/s for both the light colours. In order to keep the uniform irradiance of plants, seedlings were moved and

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TABLE 1. Influence of various variants of drip-irrigation and lighting on selected qualitative features in watermelon, cultivar 'Bingo' (average of years 2005 and 2006).

Water variant	Light variant		Vitamin C content (mg/100 g)	Carotenoids content (mg/100 g)	Total sugars content (mg/100 g)	Monosaccharides content (mg/100 g)
			$\bar{X}$ ± SEM	$\bar{X}$ ± SEM	$\bar{X}$ ± SEM	$\bar{X}$ ± SEM
Non irrigated		D	7.5±0.5	3.10±0.1	9.5±0.2	4.65±0.05
		N	7.2±0.2	1.83±0.02	10.9±0.1	5.71±0.1
		S	8.2±0.1	1.69±0.04	13.5±0.2	7.21±0.2
	Mean		7.63	2.27	11.3	5.86
Irrigated		D	10.5±0.3	2.64±0.03	8.7±0.2	5.59±0.01
		N	7.2±0.5	1.00±0.1	11.1±0.1	6.03±0.03
		S	7.3±0.1	0.76±0.02	12.9±0.1	7.55±0.04
	Mean		8.33	1.47	10.9	6.39
Mean		D	9.0	2.97	9.1	5.12
		N	7.2	1.42	11.0	5.87
		S	7.8	1.23	13.2	7.38
	Mean		8.00	1.87	11.1	6.12
$LSD_{p=0.05}$		Water variant	n.s.	0.06	0.3	0.12
		Light variant	n.s.	0.12	0.3	0.03
		Interaction	0.3	n.s.	n.s.	n.s.

D – artificial daylight, N – artificial blue light, S – sunny light, n.s. – not significant difference, ± SEM – standard error of the mean

lamps were raised in respect to the seedling growth. Polish medium early cultivar 'Bingo' (PNE 195) was used in the study. This cultivar is characterised by large fruits of bright green colour with green spots and fruit flesh of pink-red colour. This cultivar is designed for cultivation under screen as well as in the open field. Seeds of watermelon were sown (400 pcs) to 3 cuvettes filled with 'universal vegetable medium' produced on the base of highmoor peat. After 8 days seedlings were planted out singly to a pot (9 cm in diameter) filled with same background (medium) like in the case of sowing. Equalized plants were divided into 3 groups. Two groups were displaced to phytotrone (growth chamber) on shelves under lamps emitting artificial daylight and artificial blue light. The third part was planted in a greenhouse. Seedlings were transplanted in the open field. Plant spacing in a row was 0.8 m and row spacing was 1 m. Single plot was a row including 10 plants. Field experiment was carried out according to farming directions [Fajkowska, 1985]. Cultivation measures were conducted mechanically according to needs. Harvest was conducted according to fruit ripening (physiological maturity). Experimental material was the edible part of watermelon fruit. Chemical analyses were carried out for: total sugars and reducing sugars – according to Test G-24 [Talburt & Smith, 1987], carotenoids and beta-carotene according to Polish Standard [PN-90/-75101/12], and vitamin C – according to Polish Standard [PN-A-04019:1998]. These analyses were done in fresh fruits, directly after harvest.

RESULTS AND DISCUSSION

The content of the studied components in edible parts of watermelon fruits was significantly differentiated according to investigated factors. Irrigation, used during the vegetative season, differentiated the content of total sugars as well as that of total carotenoids and beta-carotene: it evoked a decrease in their contents, but it increased the content of reducing sugars in fruits of watermelon (Table 1). Irradiation with sunny light during seedling production had a positive influence on the accumulation of total sugars and reducing sugars in watermelon fruits. According to Kunachowicz *et al.* [1998], in 100 g of edible part of fruit there are from 8.4 g of total sugars and 3.0 g of monosaccharides. In our experiment the highest content of total sugars was found in fruits originated from seedlings irradiated with sunny light and non-irrigated plots (13.5 g/100 g fresh mass, including 53.3% of monosaccharides). Irradiation of the seedlings with artificial daylight influenced an increase of the content of total carotenoids and beta-carotene, whereas irrigation decreased the content of these components in fruits. Fruits obtained from non-irrigated plots were characterised by the highest carotenoids content , especially from plants originated from seedlings irradiated with artificial daylight (3.1 mg/100 g fresh mass). According to Mangels [1993], watermelon contains 230 μg beta-carotene and 4100 μg lycopene in 100 g of edible parts of fruits. Watermelon fruits cannot be recognized as a rich source of vitamin C, since its content, on average for plots, was 8.0 mg/100 g fresh mass. Similar results were obtained by Gajc-Wolska [2000]. In our investigation, fruits from irrigated plots and plants originated from seedlings irradiated with artificial daylight were characterised by the higher content of vitamin C (10.5 mg/100 g fresh mass).

CONCLUSIONS

1. The drip irrigation, used during the vegetative season, decreased the content of total sugars as well as that of carotenoids and beta-carotene in watermelon fruits, whereas the content of reducing sugars was higher than that in fruits obtained from control plots (without irrigation).

2. Irradiation with artificial daylight during seedling production had a positive influence on the content of total carotenoids and beta-carotene in watermelon fruits. The content of sugars total, including reducing sugars, was differentiated in fruits of watermelon by irradiation of seedlings. Fruits of plants originated from seedlings irradiated with sunny light were characterised by the highest content of sugars.

3. Analysis of variance of the results indicated the influence of both the investigated factors on the content of vitamin C in watermelon fruits. Fruits originated from seedlings previously irradiated with artificial daylight and irrigated during the vegetative season were characterised by the highest content of vitamin C.

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ZAWARTOŚĆ WYBRANYCH SKŁADNIKÓW W OWOCACH KAWONA POLSKIEJ ODMIANY 'BINGO' W ZALEŻNOŚCI OD SPOSOBU PRODUKCJI ROZSADY I NAWADNIANIA

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W pracy przedstawiono wyniki badań zawartości wybranych składników chemicznych kawona (cukrów ogółem, redukujących, witaminy C, karotenoidów i beta-karotenu) polskiej odmiany 'Bingo'. Uprawa była prowadzona w dwóch kolejnych sezonach wegetacyjnych (2005 i 2006 roku) koło Bydgoszczy, z zastosowaniem nawadniania kroplowego. Podczas produkcji rozsady zastosowano naświetlanie siewek światłem słonecznym, dziennym sztucznym i niebieskim sztucznym. Nawadnianie kroplowe zastosowane w okresie wegetacji obniżało zawartość cukrów ogółem, a także sumy karotenoidów i beta-karotenu w owocach kawona, natomiast zawartość cukrów redukujących i witaminy C była wyższa niż w owocach kawona pochodzących z obiektów kontrolnych. Naświetlanie światłem białym sztucznym zastosowanym podczas produkcji rozsady miało dodatni wpływ na zawartość sumy karotenoidów i beta-karotenu oraz witaminy C w owocach kawona. Poziom badanych cukrów był różnicowany poprzez naświetlanie rozsad w owocach kawona, a największą ich zawartością charakteryzowały się owoce roślin pochodzące z siewek naświetlanych światłem słonecznym.