2008 vol. 68, 71-80
DOI: 10.2478/v10032-008-0006-3

EFFECT OF THE COLOUR OF LIGHT ON CUCUMBER (*CUCUMIS SATIVUS* L.) SEEDLINGS

Piotr PISZCZEK, Beata GŁOWACKA
University of Technology and Life Sciences
Bernardyńska 6, 85-029 Bydgoszcz, Poland

Received: October 23, 2007; Accepted: January 16, 2008

Summary

Seedlings of a greenhouse variety of cucumber, Marinda F_1, were produced in a growth chamber under fluorescent lamps emitting 'daylight' and blue light, each at quantum irradiance of 50, 55 or 60 $\mu mol \cdot m^{-2} \cdot s^{-1}$.

The seedlings were assessed in terms of growth dynamics, the more important morphological features and the concentration of selected pigments in fresh leaf weight.

It was found that plants growing under blue lamps were taller, had longer internodes, a thicker stem and a higher dry matter content in fresh shoot weight. The number of leaves was not dependent on either the colour of light or the level of quantum irradiance. However, plant height, internode length and stem thickness, and dry matter content in fresh shoot weight increased as the irradiance level increased from 50 to 60 $\mu mol \cdot m^{-2} \cdot s^{-1}$. At the highest level of quantum irradiance, the concentrations of chlorophyll and carotenoids were greater in the leaves of plants grown in 'daylight'. The concentration of anthocyanins did not depend on the colour of light or the level of quantum irradiance.

key words: cucumber, seedlings, blue light, quantum irradiance

INTRODUCTION

One of the most important abiotic environmental factors affecting the growth and development of plants is light (Kraepiel *et al.* 2001). Seedlings produced in insufficient light become etiolated, more susceptible to damage and disease, and come into bearing later. Until recently, the role of light in horticultural production was investigated mainly in terms of irradiance, with less significance attached to the quality of light in the sense of its spectral composition. By using light of a specific quality, one can strongly influence the growth and development of plants. Grown under a light with a low red to far-red ratio, stems of chrysanthemum plants increase in length considerably, but in a reverse situation growth is inhibited, plants are more compact, and even begin to branch out (Khattak *et al.* 2004). Similar responses to the red/far-red ratio were also

Corresponding author:
e-mail: ozdob@utp.edu.pl
© Copyright by RIVC

found in cucumber, melon and tomato seedlings (Takaichi *et al.* 2000). Supplementing the natural light with waves from the blue region of the spectrum effectively reduces the growth of tomato, capsicum and lettuce seedlings, and chrysanthemum cuttings (Mortensen & Strømme 1987, Rajapakse & Kelly 1992, Li *et al.* 2000). In narcissus, the leaves become shorter and the flower shoots stiffen (Woźny & Jerzy 2007). The use of blue fluorescent lamps in the production of tomato seedlings makes it possible, in most cases, to obtain seedlings that are short and stocky, with a strong and thick stem, short internodes and intensely dark-green leaves. The dry matter content of these plants as a share of fresh weight of the above-ground parts is also higher, and the plants begin to produce flower buds sooner (Głowacka 2002, 2004). The effect of blue light on the growth of cucumber seedlings is not fully understood yet. Shinkle & Jones (1988) showed the inhibitory effect of blue light on the growth of cucumber seedlings, but cucumber seedlings of the cultivar Marinda F_1 placed under fluorescent lamps emitting blue light at a level of 55 $\mu mol \cdot m^{-2} \cdot s^{-1}$ were taller than the seedlings grown under lamps that emitted light close to natural light, with the plants maintaining the right growth habit (Piszczek & Głowacka 2005).

The aim of the experiments was to determine the effect of blue light at different quantum irradiance levels on cucumber seedlings of the cultivar Marinda F_1.

MATERIALS AND METHODS

The experiments were carried out on a greenhouse variety of cucumber, Marinda F_1, during two periods: from 5 January to 18 February, and from 22 September to 5 November 2006. Two factors were varied – the colour of light and quantum irradiance. Seeds were sown in trays with a universal vegetable substrate STM-4 with a pH of 6.5. After 10 days, seedlings were pricked out into 9 cm diameter pots filled with the same substrate, and 3 days later the plants were transferred into a growth chamber where natural light could not enter. The pots were placed on shelves under Philips TLD 36 Watt fluorescent lamps that emitted 'daylight' (colour 54) and blue light (colour 18). The 'daylight', whose colour was close to that of natural light served as the control. Each of the two colours of light was applied at three levels of quantum irradiance measured at the level of plant growth tips (Table 1).

Table 1. Quantum irradiance levels under fluorescent lamps

Lamp	Light	Quantum irradiance ($\mu mol \cdot m^{-2} \cdot s^{-1}$)		
		low	medium	high
daylight colour 54 blue colour 18	daylight blue	50.0	55.0	60.0

In order to ensure that plants were provided with uniform growth conditions, the pots on all the shelves were rearranged every two days. As the plants grew, the lamps were raised to ensure quantum irradiance remained at the same level. The

experiments were set up in a totally random system, in four replications with four plants each.

The temperature in the growth chamber was maintained at 20°C during the day (7 am - 11 pm), and at 16°C at night (11 pm - 7 am), with air relative humidity kept at 80%. The temperature of the substrate was 19.5-21.5°C.

In order to determine the growth dynamics of the seedlings, the height of all the plants was measured once a week, from the top edge of the pot to the tip of the shoot. In both experiments, after 5 weeks, when flower buds had appeared in most of the plants, the height of all the plants was measured, the number of fully developed leaves was determined, and the average length of internodes was calculated by dividing plant height by the number of leaves. Using a micrometer, the thickness of the stem was measured at the level of the lowest leaf.

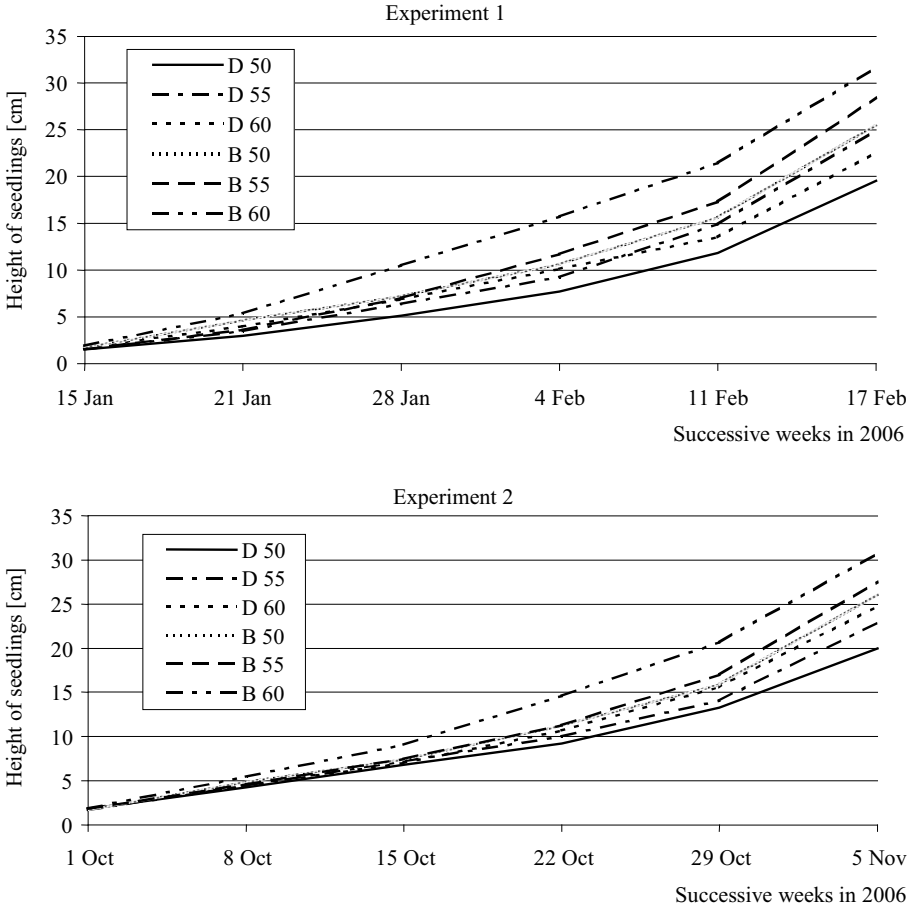
For each colour of light and irradiance level, 8 plants were randomly chosen and cut at the height of the rim of the pot. They were used for determining fresh weight, and after drying at 105°C – of dry weight. On the basis of the obtained results, the percentage of dry matter in fresh shoot weight was calculated.

From the remaining eight plants for each light colour and irradiance level, 5 plants were randomly chosen. From each of them, the third leaf from the bottom was removed in order to determine the concentrations of chlorophyll and carotenoids in fresh weight. The concentrations of the pigments were determined by the method of extraction in an 80% aqueous solution of acetone and using a UV-VIS 1601 PC SHIMADZU spectrophotometer. Absorbance readings were taken at the wavelengths of 645 and 663 nm for chlorophyll, and 440 and 652 nm for carotenoids. Anthocyanins were extracted from leaf tissue with a 1% solution of HCl in methanol. Absorbance readings were taken at the wavelengths of 530 and 657 nm.

The obtained results were evaluated statistically with a two-factorial analysis of variance, and the mean values for each combination were assessed with Tukey's test at a significance level of P=0.05.

RESULTS AND DISCUSSION

Figure 1 shows the growth dynamics of cucumber seedlings growing under fluorescent lamps emitting 'daylight' and blue light at three levels of quantum irradiance. In both experiments, from the second week onwards, the fastest growth was observed in plants under blue light at the highest irradiance. Plants under 'daylight' lamps were shorter from the second week onwards, and that difference was observed over the entire duration of the experiments. Likewise, in an earlier experiment, a more intense growth of cucumber seedlings of the same cultivar had been observed under the influence of blue light (Piszczek & Głowacka 2005).



D 50 – 'daylight', 50 μmol·m^{-2}·s^{-1} B 50 – blue light, 50 μmol·m^{-2}·s^{-1}
D 55 – 'daylight', 55 μmol·m^{-2}·s^{-1} B 55 – blue light, 55 μmol·m^{-2}·s^{-1}
D 60 – 'daylight', 60 μmol·m^{-2}·s^{-1} B 60 – blue light, 60 μmol·m^{-2}·s^{-1}

Fig. 1. Growth dynamics of cucumber seedlings depending on the colour of light and quantum irradiance

Table 2 presents the results of the last measurements of plant height, the number of leaves, internode length and stem thickness. At each of the applied levels of quantum irradiance, plants growing under blue-light lamps were taller. This relationship also applied to internode lengths. In both experiments, stronger growth of plants and greater elongation of internodes was most often observed at the highest level of quantum irradiance, whereas the weakest growth and smallest internode elongation in both experiments were recorded at the lowest irradiance.

Irrespective of the level of quantum irradiance, a lower number of leaves was recorded in plants illuminated with blue light, but only in the first experi-

ment. In all the other cases, neither the colour of light nor the level of irradiance was found to have an effect on the number of leaves produced.

Table 2. Effect of light on the morphological features of cucumber seedlings

Experiment 1							
Feature	Light (A)	Quantum irradiance (B) ($\mu mol \cdot m^{-2} \cdot s^{-1}$)			Mean A	$LSD_{0.05}$	
		50	55	60			
Plant height (cm)	'daylight'	19.5	25.0	22.6	22.4	A = 1.29	A/B = 2.23
	blue	25.6	28.5	31.8	28.6	B = 1.81	B/A = 2.81
	mean B	22.6	26.8	27.2			
Number of leaves	'daylight'	6.9	7.2	7.2	7.1	A = 0.39	A/B = 0.82
	blue	6.4	6.6	6.4	6.5	B = 0.59	B/A = 0.88
	mean B	6.7	6.9	6.8			
Internode length (cm)	'daylight'	2.83	3.47	3.14	3.15	A = 0.191	A/B = 0.332
	blue	4.00	4.32	4.97	4.43	B = 0.285	B/A = 0.403
	mean B	3.42	3.90	4.06			
Stem thickness (mm)	'daylight'	4.28	4.69	4.53	4.50	A = 0.223	A/B = 0.386
	blue	5.01	5.25	5.91	5.39	B = 0.332	B/A = 0.470
	mean B	4.65	4.97	5.22			
Experiment 2							
Feature	Light (A)	Quantum irradiance (B) ($\mu mol \cdot m^{-2} \cdot s^{-1}$)			Mean A	$LSD_{0.05}$	
		50	55	60			
Plant height (cm)	'daylight'	20.0	22.9	24.8	22.6	A = 1.22	A/B = 2.11
	blue	26.1	27.6	30.8	28.2	B = 1.79	B/A = 2.56
	mean B	23.1	25.3	27.8			
Number of leaves	'daylight'	6.0	6.1	6.3	6.1	A = 0.29	A/B = 0.54
	blue	6.0	6.1	6.3	6.1	B = 0.43	B/A = 0.66
	mean B	6.0	6.2	6.3			
Internode length (cm)	'daylight'	3.33	3.75	3.94	3.67	A = 0.131	A/B = 0.227
	blue	4.35	4.52	4.89	4.59	B = 0.195	B/A = 0.276
	mean B	3.84	4.14	4.42			
Stem thickness (mm)	'daylight'	4.75	4.93	5.03	4.90	A = 0.121	A/B = 0.210
	blue	5.22	5.49	5.94	5.55	B = 0.181	B/A = 0.255
	mean B	4.99	5.21	5.49			

In both experiments, the largest stem thickness was recorded in plants under blue light illumination. In the first experiment, the irradiance level of blue light did not affect stem thickness, whereas plants growing in 'daylight' at the highest irradiance had thicker stems than those growing at the medium and lower levels of quantum irradiance. In the second experiment, stem thickness increased as the level of irradiance increased, irrespective of the colour of light. In 'daylight', plants growing at the highest level of quantum irradiance had thicker stems than those growing at the lowest irradiance. In the case of the plants illuminated with blue light, increasing the level of quantum irradiance caused an increase in stem thickness.

Stimulation of shoot growth and internode elongation with blue light is rarely found in the literature, as the reverse effect is observed more frequently (Benson & Kelly 1990, Brown *et al*. 1995, Głowacka 2002, 2004, 2006, Li *et al*. 2000). The effect of stronger plant growth in blue light at higher irradiance had been observed in tomato seedlings cv. Delfine F_1, although in 'daylight' the seedlings were found to grow better at lower irradiance levels (Głowacka 2004). Like in the tested cucumber cultivar, in various tomato cultivars the number of leaves on the stem did not change under the influence of light, or it was lower, and plants placed under blue lamps had a thicker stem base (Głowacka 2002, 2004, 2006).

In general, fresh plant weight (Table 3) corresponded to the results of plant height (Table 2).

Table 3. Effect of light on shoot weight in cucumber seedlings

Experiment 1							
Feature	Light (A)	Quantum irradiance (B) (µmol·m^{-2}·s^{-1})			Mean A	$LSD_{0.05}$	
		50	55	60			
Fresh weight (g)	'daylight'	12.95	14.96	14.26	14.06	A = 1.250	A/B = 2.334
	blue	15.42	15.45	18.02	16.30	B = 1.861	B/A = 2.556
	mean B	14.19	15.21	16.14			
Dry weight (g)	'daylight'	0.93	1.06	1.22	1.07	A = 0.129	A/B = 0.268
	blue	1.22	1.23	1.65	1.37	B = 0.192	B/A = 0.323
	mean B	1.08	1.15	1.44			
Dry weight (%)	'daylight'	7.14	7.11	8.58	7.61	A = 0.400	A/B = 0.219
	blue	7.86	8.03	9.23	8.37	B = 0.595	B/A = 0.290
	mean B	7.50	7.57	8.91			
Experiment 2							
Feature	Light (A)	Quantum irradiance (B) (µmol·m^{-2}·s^{-1})			Mean A	$LSD_{0.05}$	
		50	55	60			
Fresh weight (g)	'daylight'	13.05	14.11	16.33	14.50	A = 1.692	A/B = 2.930
	blue	16.50	18.11	20.79	18.47	B = 2.518	B/A = 3.562
	mean B	14.78	16.11	18.56			
Dry weight (g)	'daylight'	0.86	0.94	1.09	0.96	A = 0.122	A/B = 0.211
	blue	1.08	1.24	1.55	1.29	B = 0.256	B/A = 0.256
	mean B	0.97	1.09	1.32			
Dry weight (%)	'daylight'	6.56	6.64	6.69	6.63	A = 0.112	A/B = 0.193
	blue	6.54	6.82	7.48	6.95	B = 0.166	B/A = 0.235
	mean B	6.55	6.73	7.09			

Taller plants most often had greater fresh weight regardless of the colour of light and the level of quantum irradiance. In both experiments, irrespective of the irradiance level, plants growing in blue light had greater fresh weight of the above-ground parts. Regardless of the colour of light, plants subjected to illumination at the highest level of quantum irradiance were found to have greater

fresh weight than those growing in the light of the lowest irradiance. Fresh weight of the seedlings obtained in 'daylight' was similar at all the applied levels of irradiance, but in blue light fresh weight of the above-ground parts of plants increased as irradiance increased. Similar relationships were also observed in the absolute dry matter content of the analyzed plants, as well as in the percentage of dry matter in fresh shoot weight.

The relationship between fresh weight and plant height also applies to other plant species, e.g. tomato and capsicum, and for that reason the effect of inhibiting plant growth in blue light translates into lower fresh weight of the above-ground parts (Głowacka 2004, Brown *et al*. 1995). The authors' research indicates that, irrespective of the effect of the colour of light on plant growth, the percentage of dry matter in fresh shoot weight is seen to increase under the influence of blue light, although the absolute dry matter content does not always change (Brown *et al*. 1995, Głowacka 2004, 2006). However, in chrysanthemum plants illuminated with blue-enriched light the total dry weight of shoots is seen to decrease (Oyaert *et al*. 1999, Rajapakse *et al*. 1992).

The concentrations of pigments in fresh weight of cucumber leaves are shown in Table 4. In the first experiment, the effect of the colour of light on chlorophyll content in the leaves was very weak and could be seen only at the highest level of quantum irradiance. In 'daylight' at 60 $\mu mol \cdot m^{-2} \cdot s^{-1}$, the concentrations of chlorophyll a and b, and the total concentration were higher. In the second experiment, regardless of the irradiance level, higher concentrations of chlorophyll were found under 'daylight' illumination. The level of quantum irradiance did not have any effect on chlorophyll content in plants growing in 'daylight', whereas in blue light a lower content was observed at the lowest level of quantum irradiance. The concentrations of carotenoids in the leaves of the seedlings obtained in the first experiment were on a rather similar level. Only at the highest level of quantum irradiance higher concentrations of these pigments were found under 'daylight' illumination. In blue light, the plants growing at the lowest irradiance contained more carotenoids than those exposed to light at higher irradiance levels. In 'daylight', the level of quantum irradiance did not affect the concentration of carotenoid pigments in the leaves. Likewise, in the second experiment, the irradiance level of 'daylight' illumination was not found to have an effect on the carotenoid content of the leaves, whereas in blue light the concentration of carotenoids was lower at the lowest level of quantum irradiance. Also, higher concentrations of these pigments were found more often in plants exposed to 'daylight' than those growing in blue light. In the first experiment, there was no measurable effect of light on the concentration of anthocyanins in the leaves. In the second experiment, in terms of the colour of light, the average anthocyanin content was higher under blue light illumination, and in terms of irradiance, the same relationship was found at the highest level of quantum irradiance. Both under 'daylight' and blue light illumination, the level of quantum irradiance did not have a significant effect on the concentration of anthocyanins. In terms of irradiance, the average anthocyanin content was higher at the lowest irradiance level than at the medium irradiance level.

Table 4. Effect of light on the concentration of pigments in fresh weight of cucumber leaves

Experiment 1							
Pigment content ($mg \cdot g^{-1}$)	Light (A)	Quantum irradiance (B) ($\mu mol \cdot m^{-2} \cdot s^{-1}$)			Mean A	$LSD_{0.05}$	
		50	55	60			
Chlorophyll a	'daylight'	1.47	1.32	1.44	1.41	A = 0.170	A/B = 0.296
	blue	1.56	1.57	1.14	1.42	B = 0.253	B/A = 0.359
	mean B	1.52	1.45	1.29			
Chlorophyll b	'daylight'	0.57	0.51	0.60	0.56	A = 0.065	A/B = 0.115
	blue	0.61	0.59	0.48	0.56	B = 0.097	B/A = 0.140
	mean B	0.59	0.55	0.54			
Chlorophyll – total	'daylight'	2.04	1.82	2.23	2.03	A = 0.234	A/B = 0.408
	blue	2.17	2.17	1.54	1.96	B = 0.349	B/A = 0.497
	mean B	2.11	2.00	1.89			
Carotenoids	'daylight'	0.82	0.74	0.80	0.79	A = 0.076	A/B = 0.133
	blue	0.82	0.74	0.62	0.73	B = 0.112	B/A = 0.161
	mean B	0.82	0.74	0.71			
Antho-cyanins	'daylight'	0.025	0.019	0.025	0.023	A = 0.006	A/B = 0.010
	blue	0.019	0.020	0.016	0.018	B = 0.008	B/A = 0.014
	mean B	0.022	0.020	0.021			
Experiment 2							
Pigment content ($mg \cdot g^{-1}$)	Light (A)	Quantum irradiance (B) ($\mu mol \cdot m^{-2} \cdot s^{-1}$)			Mean A	$LSD_{0.05}$	
		50	55	60			
Chlorophyll a	'daylight'	1.96	1.91	1.95	1.94	A = 0.114	A/B = 0.197
	blue	1.40	1.76	1.67	1.61	B = 0.169	B/A = 0.239
	mean B	1.68	1.84	1.81			
Chlorophyll b	'daylight'	0.67	0.66	0.67	0.67	A = 0.042	A/B = 0.073
	blue	0.49	0.58	0.56	0.54	B = 0.063	B/A = 0.089
	mean B	0.58	0.62	0.62			
Chlorophyll – total	'daylight'	2.64	2.57	2.62	2.61	A = 0.140	A/B = 0.173
	blue	1.89	2.34	2.48	2.24	B = 0.209	B/A = 0.295
	mean B	2.27	2.46	2.55			
Carotenoids	'daylight'	1.02	1.01	1.02	1.02	A = 0.054	A/B = 0.093
	blue	0.78	0.93	0.90	0.87	B = 0.080	B/A = 0.113
	mean B	0.90	0.97	0.96			
Antho-cyanins	'daylight'	0.041	0.033	0.038	0.037	A = 0.006	A/B = 0.010
	blue	0.050	0.038	0.050	0.046	B = 0.009	B/A = 0.013
	mean B	0.046	0.036	0.044			

An earlier experiment with the same cucumber variety revealed no effect of blue light on the chlorophyll content in the leaves; similar responses were observed in Recento F_1 tomato seedlings (Głowacka 2002, Piszczek & Głowacka 2005). However, experiments with chrysanthemum plants showed that increasing the blue component of light by means of spectral filters with

$CuSO_4$ resulted in an increase in the chlorophyll content of the leaves (McMahon & Kelly 1995).

The different responses of plants to blue light may be explained by the dissimilarities between the various species, or even cultivars, although in some cases the causes of this may be sought in the different characteristics of the light sources used. In their own experiments the authors used fluorescent lamps, whereas others enriched natural light with wavelengths from the blue range of the spectrum by means of spectral filters. The light filtered through an aqueous solution of copper sulphate is different from that emitted by blue fluorescent lamps, particularly in respect of the higher levels of the red component, which is also responsible for inhibiting plant growth (Rajapakse & Kelly 1992). These conjectures are also confirmed by the results of experiments on providing tomato seedlings with supplementary illumination using mixed light, i.e. daylight and blue light at the same time, which causes stronger inhibition in growth and a considerable increase in dry matter content of shoots in comparison with the use of blue light on its own (Głowacka 2006).

CONCLUSIONS

1. Blue light had a beneficial effect on the quality of cucumber seedlings cv. Marinda F_1. Plants growing under blue fluorescent lamps were taller, had longer internodes, thicker stems, and a higher dry matter content in fresh shoot weight.
2. The quality of the seedlings increased as the level of quantum irradiance increased from 50 to 55 and 60 $\mu mol \cdot m^{-2} \cdot s^{-1}$.
3. The number of leaves did not depend on the colour of light or the quantum irradiance level.
4. Chlorophyll and carotenoid concentrations were higher in the leaves of plants growing under 'daylight' lamps at the highest quantum irradiance level.
5. The concentration of anthocyanins was not influenced by the colour of light or the level of quantum irradiance.

REFERENCES

Benson J., Kelly J. 1990. Effect of copper sulphate filters on growth of bedding plants. Hort. Sci. 25(9): 1144.

Brown C.S., Schuerger A.C., Sager J.C. 1995. Growth and photomorphogenesis of pepper plants under red light-emitting diodes with supplemental blue or far-red lighting. J. Amer. Soc. Hort. Sci. 120(5): 571-577.

Głowacka B. 2002. [Effect of light colour on the growth of tomato (*Lycopersicon esculentum* Mill.) transplant]. Acta Sci. Pol., Hortorum Cultus 1(2): 93-103. [in Polish with English summary]

Głowacka B. 2004. The effect of blue light on the height and habit of the tomato (*Lycopersicon esculentum* Mill.) transplant. Folia Hort. 16/2: 3-10.

Głowacka B. 2006. [Response of the tomato (*Lycopersicon esculentum* Mill.) transplant to the daylight supplemented with blue spectrum.] Folia Hort. Suplement 2006/1: 145-149. [in Polish with English summary]

Khattak A.M., Pearson S., Johnson C.B. 2004. The effects of far red spectral filters and plant density on the growth and development oh chrysanthemums. Sci. Hort. 102: 335-341.

Kraepiel Y., Agnès C., Thiery L., Maldiney R., Miginiac E., Delarue M. 2001. The growth of tomato (*Lycopersicon esculentum* Mill.) hypocotyls in the light and in darkness differentially involves auxin. Plant Sci. 161: 1067-1074.

Li S., Rajapakse N.C., Young R.E., Oi R. 2000. Growth responses of chrysanthemum and bell pepper transplants to photoselective plastic films. Sci. Hort. 84: 215-225.

McMahon M.J., Kelly J.W. 1995. Anatomy and pigments of chrysanthemum leaves developed under spectrally selective filters. Sci. Hort. 64(3): 203-209.

Mortensen L.M., Strømme E. 1987. Effects of light quality on some greenhouse crops. Sci. Hort. 33: 27-36.

Oyaert E., Volckaert E., Debergh P.C. 1999. Growth of chrysanthemum under coloured plastic films with different light qualities and quantities. Sci. Hort. 79: 195-205.

Piszczek P., Głowacka B. 2005. Effect of light quality on growth of cucumber (*Cucumis sativus* L.) transplants. Veg. Crops Res. Bull. 63: 77-85.

Rajapakse N.C., Kelly J.W. 1992. Regulation of chrysanthemum growth by spectral filters. J. Amer. Soc. Hort. Sci. 117(3): 481-485.

Rajapakse N.C., Pollock R.K., McMahon M.J., Kelly J.W., Young R.E. 1992. Interpretation of light quality measurements and plant response in spectral filter research. Hort. Sci. 27(11): 1208-1211.

Shinkle J.R., Jones R.L. 1988. Inhibition of stem elongation in *Cucumis* seedlings by blue light requires calcium. Plant Physiol. 86: 960-966.

Takaichi M., Shimaji H., Higashide T. 2000. Effect of red/far-red photon flux ratio of solar radiation on growth of fruit vegetable seedlings. Acta Hortic. 514: 147-156.

Woźny A., Jerzy M. 2007. Effect of light wavelength on growth and flowering of narcissi forced under short-day and low quantum irradiance conditions. J. Hort. Sci. Biotechnol. 82(6): 924-928.

WPŁYW BARWY ŚWIATŁA NA ROZSADĘ OGÓRKA SIEWNEGO (*CUCUMIS SATIVUS* L.)

Streszczenie

Rozsadę szklarniowej odmiany ogórka Marinda F_1 produkowano w pokoju wzrostowym pod lampami jarzeniowymi, emitującymi światło „dzienne" i światło o barwie niebieskiej, każde o natężeniu napromienienia kwantowego 50, 55 i 60 μmol·m^{-2}·s^{-1}.

Określono dynamikę wzrostu roślin, ich ważniejsze cechy morfologiczne oraz zawartość wybranych barwników w świeżej masie liści.

Rośliny rosnące pod lampami o świetle niebieskim były wyższe, miały dłuższe międzywęźla, grubszą łodygę i większą zawartość suchej masy w świeżej masie pędów. Liczba liści nie była uzależniona ani od barwy, ani od poziomu natężenia napromienienia kwantowego. Natomiast wysokość rośliny, długość międzywęźli i grubość łodygi oraz zawartość suchej masy w świeżej masie pędu wzrastała w miarę zwiększania poziomu natężenia od 50 do 60 μmol·m^{-2}·s^{-1}. Przy najwyższym natężeniu napromienienia kwantowego zawartość chlorofilu i karotenoidów była większa w liściach roślin rosnących w świetle „dziennym". Zawartość antocyjanów nie była uzależniona od barwy światła i poziomu natężenia napromienienia kwantowego.