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NUTRITION OF LACY TREE PHILODENDRON (*Philodendron bipinnatifidum* Schott et Endl.). PART I. THE EFFECT ON PLANT GROWTH

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Abstract. The main aim of the study conducted in the years 2007–2008 was to evaluate the effect of increasing levels of N, P, K and Mg nutrition on growth of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) grown in peat moss substrate for cut leaves to be used as floral green. Analyses were conducted for five increasing macroelement levels in the substrate, while maintaining a constant quantitative ratio of N : P : K : Mg = 1.0 : 0.75 : 1.25 : 0.75. On the basis of chemical analyses the constant nutrient levels were provided in the substrate, amounting to (in mg·dm^{-3}): L-1: N 100, P 75, K 125, Mg 75; L-2: N 150, P 112, K 187, Mg 112; L-3: N 200, P 150, K 250, Mg 150; L-4: N 250, P 187, K 312, Mg 187 and L-5: N 300, P 225, K 375, Mg 225. At all nutrition levels microelement contents were identical, amounting to (in mg·dm^{-3}): Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5 and Mo 2.0. Optimal yield of fresh and dry mass of aboveground parts of plants, as well as the number and length of leaves, width of leaf blades, length of petioles and leaf colour intensity was on the level of L-4 containing (in mg·dm^{-3}): N 250, P 187, K 312, Mg 187; L-5: N 300, P 225, K 375, Mg 225, Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5, Mo 2.0.

Key words: plant nutrition, floral green, substrate analysis, philodendron

INTRODUCTION

In recent years there is observed an increased interest in floral green on the part of florists. Species used for this purpose include e.g. Japanese fatsia (*Fatsia japonia* Decne. et Planch.), Bells of Ireland (*Molucella laevis* L.), *P*hilodendron xanadu Croat, *Asparagus virgatus* Baker, sicklethorn also known as Asparagus fern (*Asparagus falcatus* L.), as well as lacy tree philodendron, also called split leaf philodendron (*Philodendron bipinnatifidum* Schott et Endl., syn. *Philodendron selloum* K. Koch.). Lacy tree philodendron is one of the 500 species belonging to the genus *Philodendron,* family

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Araceae (arum); [Chmiel et al. 2000]. The above mentioned family comprises also *Aglaonema* Schott, anthurium (*Anthurium cultorum* Birdsey), *Spathiphyllum* Schott and *Zamioculcas* Schott. More extensive studies on the optimization of nutrition of species from the above mentioned family concerned mainly hydroponic cultivation of anthurium [Dufour and Guérin 2003, 2005, Kleiber and Komosa 2008a, b, Kleiber and Komosa 2010].

The name of the genus *Philodendron* comes from a Greek word *philo* – "to like" and *dendron* – "a tree" [Bohmig 1958]. Lacy tree philodendron is a large and strongly growing epiphyte originating from southern Brazil, which height and span under natural conditions may reach 2 meters. This species is characterized by strong vegetative growth [Stahn et al. 1987]. Minimum air temperature required for its cultivation is 12–15°C [Czekalski 2006], with the optimal ranges of 18–24/15–18ºC (day/night) [Domingos and Almeida 2003], while the temperature of the substrate should not drop below 20°C [Czekalski 2006]. McConnell et al. [2007] described the botanical characteristics and basic cultivation conditions for *Philodendron* too. Tree philodendron may be grown both for floral green and as a pot plant with ornamental leaves. Decorative value of ornamental plants is determined by their morphological traits, such as habit, the mass of green parts and leaf colour intensity. These traits are particularly important in case of plants with ornamental leaves [Wang et al. 2005]. They may be significantly modified by appropriate plant nutrition.

There is relatively little data on the optimization of philodendron nutrition. Optimal content of macroelements in leaves showed Poole et al. [1976] and Uchida [2000]. Conover and Poole [1982] tested the influence of N-source treatment on the growth and tissue nutrient content. Mentioned authors didn't found the influence of different forms of nitrogen on quality of philodendron. Nowak et al. [1995] studied the different fertilization schedule in case of *Philodendron selloum* (K. Koch.) – authors found the best plant performance for Azofoska and Plantacote 4M application. Also a study by Chmiel and Wojtania [1996] showed a positive effect of the application of Azofoska on dry mass of lacy tree philodendron. However, to date no studies have been conducted in Poland on the optimization of nutrition in tree philodendron grown in peat substrate for floral green.

The aim of the study was to evaluate the effect of increasing levels of nutrition with macroelements on growth of lacy tree philodendron grown in peat substrate, particularly in terms of yield of fresh leaf mass and other biometric parameters of leaves. As a result of conducted studies optimal levels of nutrients in the substrate were determined for the cultivation of lacy tree philodendron.

MATERIALS AND METHODS

Vegetation experiments were conducted in the years 2007–2008 in an unheated greenhouse of the Marcelin Experimental Station, the Poznań University of Life Sciences. The study investigated the effect of increasing levels of N, P, K and Mg nutrition on growth of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl., *syn. P. sélloum*) grown in peat moss substrate (light peat).

Vegetation experiments were conducted using peat moss (from Latvia), limed to pH (in H_2O) of 6.00 with a dose of 7.0 g chalk·dm^{-3} (54.3% CaO), established on the basis of the neutralization curve. Contents of available forms of nutrients in peat moss substrate, after it had been deacidified, was as follows (in mg·dm^{-3}): $N-NH_4$ 35, $N-NO_3$ traces, P 20, K 18, Ca 2045, Mg 164, $S-SO_4$ 25, Fe 19.8, Zn 1.8, Mn 2.7, Cu 0.4, B 0.5, Na 18, Cl 29, EC 0.49 mS·cm^{-1}, pH (H_2O) 6.00. At 14 days after liming the other macro and micronutrients were applied.

The effects of increasing macroelement levels in the peat moss substrate were analyzed (denoted as L-1, L-2, L-3, L-4 and L-5), at the maintenance of a constant quantitative ratio between the nutrients N : P : K : Mg = 1.0 : 0.75 : 1.25 : 0.75. Studied ratios between nutrients based on the content of macroelement recommended for growing of leaves decorative plants [Breś et al. 2008]. Contents of nutrients in the analyzed nutrition levels were as follows (in mg·dm^{-3}): L-1: N 100, P 75, K 125, Mg 75; L-2: N 150, P 112, K 187, Mg 112; L-3: N 200, P 150, K 250, Mg 150; L-4: N 250, P 187, K 312, Mg 187 and L-5: N 300, P 225, K 375, Mg 225. For all the fertilization levels standard microelement contents in the substrate were used (in mg·dm^{-3}): Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5 and Mo 2.0. In the vegetation period of plants in combinations L-1 to L-5 constant levels of macro and microelements were maintained on the basis of chemical analyses of substrate, performed on a monthly intervals.

The pot experiment was performed in 10 replications, with 1 pot with 1 plant comprising one replication. Lacy tree philodendron cuttings were planted on 27.04.2007 to plastic containers filled with 5 dm^3 peat moss substrate enriched to the assumed fertility (L-1 to L-5). At 10–12-day intervals between 08.06–08.10 (2007) and 15.04–29.09 (2008) throughout the entire period of the study measurements were taken of plant height, the number of leaves, leaf dimensions (length and width of leaf blades, length of petioles) (Fig. 1) and the number of produced cuttings.

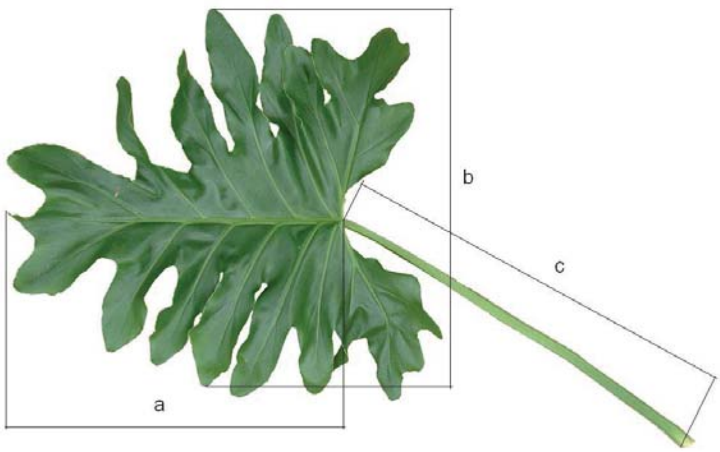

Fig. 1. Biometric measurements of lacy tree philodendron leaf (*Philodendron bipinnatifidum* Schott et Endl.): a – length of leaf blade, b – width of leaf blade, c – length of petiole

Ryc. 1. Pomiary biometryczne liści filodendrona podwójnie pierzastego: a – długość blaszki liściowej, b – szerokość blaszki liściowej, c – długość ogonka liściowego

In the vegetation period on 29.06, 27.07, 03.09, 08.10 (2007) and 30.06, 24.07, 5.09, 29.09 (2008) measurements were taken using a SPAD 502 Minolta camera for colour intensity of leaf blades. After the completion of the experiment (10.10.2007 and 29.09.2008) the degree of substrate overgrowing with roots was determined. The degree of peat overgrowing with roots (in %) mere estimated visually comparing the volume of root with volume of pot filled with peat. Fresh and dry mass of aboveground parts of plants were determined, leaving on the plant only the youngest leaves. Results of biometric measurements of plants were analyzed statistically using the Duncan test at the significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

Fresh and dry mass of plant. A significant effect on the fresh mass of the aboveground plant part was found for the nutrition levels of lacy tree philodendron (tab. 1). The lowest yield of fresh mass was produced by plants at the lowest levels of nutrition (L-1 and L-2), i.e. 91.2 and 106.4 $g \cdot plant^{-1}$, respectively, while the highest at L-4 and L-5 of 158.1 and 163.5 $g \cdot plant^{-1}$. A similar trend was observed for the dry mass of the aboveground plant part (tab. 1). Nowak et al. [1995], in the study on the application of slow-release fertilizers in the cultivation of *Philodendron selloum* (K. Koch.), reported the highest fresh mass of the aboveground plant part in the substrate fertilized with the polycompound fertilizer Azofoska (3 $g \cdot dm^{-3}$ and top dressing with Sonneveld medium) and a fertilizer Plantacote 4M at a rate of 9 $g \cdot dm^{-3}$. Also a study by Chmiel and Wojtania [1996] indicated a positive effect of the application of Azofoska on dry mass of lacy tree philodendron.

Table 1. The effect of nutrition levels on the aboveground plant part fresh and dry mass of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) grown in peat moss

Tabela 1. Wpływ poziomów żywienia na świeżą i suchą masę części nadziemnej filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.) uprawianego w torfie wysokim

	Year Rok	Nutrient level – Poziom żywienia				
		L-1	L-2	L-3	L-4	L-5
Fresh mass of aboveground plant parts (in $g \cdot plant^{-1}$)	2007	71.8	106.0	128.5	131.7	136.8
	2008	110.5	106.8	134.6	184.4	190.1
Świeża masa części nadziemnej rośliny (w $g \cdot roślina^{-1}$)	mean średnia	91.2 a	106.4 ab	131.6 bc	158.1 d	163.5 d
Dry mass of aboveground plant part (in $g \cdot plant^{-1}$)	2007	11.9	17.1	20.1	21.1	21.6
	2008	17.9	17.6	20.8	29.2	28.7
Sucha masa części nadziemnej rośliny (w $g \cdot roślina^{-1}$)	mean średnia	15.0 a	17.5 ab	20.4 bc	25.1 c	25.2 c
Relation of the fresh to dry mass of aboveground plant part	2007	6.0	6.2	6.4	6.2	6.4
	2008	6.2	6.1	6.5	6.3	6.6
Stosunek świeżej do suchej masy części nadziemnej rośliny	mean średnia	6.1 a	6.2 a	6.5 a	6.3 a	6.5 a

Values described with identical letters do not differ significantly at $\alpha = 0.05$;
Wartości opisane tymi samymi literami nie różnią się od siebie istotnie przy $\alpha = 0,05$

The quantitative ratio between the fresh and dry mass of the aboveground plant part in case of all analyzed combinations did not differ significantly, ranging from 6.1 to 6.5. In all the analyzed combinations older plants (2008) had a higher yield of fresh and dry mass of the aboveground plant parts in comparison to younger plants (2007).

Number of leaves. In philodendron tree a significant effect of nutrition levels was found on the number of formed leaves (tab. 2). It was biggest for combinations L-4 and L-5 (6.5 and 6.7 leaves·plant^{-1}). In contrast, it did not differ significantly in the other combinations. In all the analyzed nutrition levels, except for L-3, in the second year of culture the number of leaves was bigger.

Table 2. The effect of nutrition levels on the number of leaves, plant height and the degree of substrate overgrowing with roots of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) grown in peat moss

Tabela 2. Wpływ poziomów żywienia na liczbę liści, wysokość roślin oraz stopień przerośnięcia podłoża korzeniami filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.) uprawianego w torfie wysokim

	Year Rok	Nutrient level – Poziom żywienia				
		L-1	L-2	L-3	L-4	L-5
Number of leaves (leaves·plant^{-1}) Liczba liści (sztuki·roślina^{-1})*	2007	5.2	5.4	5.9	5.7	5.9
	2008	6.4	6.3	5.6	7.3	7.4
	mean średnia	5.8 a	5.9 a	5.8 a	6.5 b	6.7 b
Plant height (in mm) Wysokość roślin (w mm)	2007	267.4	288.6	288.7	287.6	265.7
	2008	403.3	398.7	444.3	497.4	445.2
	mean średnia	335.4 a	343.7 a	366.5 a	392.5 b	355.5 a
The degree of peat overgrowing with roots (in %) Stopień przerośnięcia torfu korzeniami (w %)	2007	92.0	77.0	98.0	83.0	93.0
	2008	95.0	86.0	99.0	93.0	96.0
	mean średnia	93.5 b	81.5 a	98.5 b	88.0 ab	94.5 b

Values described with identical letters do not differ significantly at $\alpha = 0.05$;
Wartości opisane w wierszach tymi samymi literami nie różnią się od siebie istotnie przy $\alpha = 0{,}05$

Plant height. The level of macroelement nutrition significantly modified plant height. It was highest in combination L-4 (392.5 mm). In contrast, it did not differ significantly in the other combinations (tab. 2). In all the analyzed combinations an increase was found for plant height in the second year of culture.

The degree of root system overgrowing. A significant variation was shown for the degree of root system overgrowing between analyzed combinations (tab. 2). It was smallest in case of combination L-2 (81.5%), while it was significantly bigger for the other analyzed nutrition levels. However, with ageing of plants (2008) the degree of substrate overgrowing with root systems improved in comparison to younger plants (2007).

Chmiel and Wojtania [1996] reported that the minimal commercial height of philodendron tree is 350 mm. In the first year of this study (2007) mean plant height in all the analyzed combinations was smaller than the height recommended by the above mentioned authors, although 2-year old plants exceeded it markedly. The biggest number of leaves was found for plants grown at the highest levels of nutrient treatments L-4 and L-5. A higher number of leaves in philodendron tree was recorded for plants in a study by Nowak et al. [1995], which were fertilized with Azofoska (8.2 leaves), Plantacote 4M and 6M (with 9.4 and 8.4 leaves, respectively) and Osmocote Plus with 9.2 leaves·plant^{-1}.

Biometric parameters of leaves. From the practical point of view – when leaves of *Philodendron bipinnatifidum* (Schott et Endl.) are used as floral green – biometric parameters of leaves are of great importance. A significant effect of increasing macronutrient nutrition levels of plants was observed on the length and width of leaf blades, the length of petioles and colour intensity of leaf blades (tab. 3). The longest and widest leaf blades were formed by plants grown at L-3 to L-5, while the longest petioles were found in plants at L-4 and L-5. Dark green was the colour of leaf blades in combinations L-4 and L-5 (48.6 and 46.7), while it was lighter at L-1 and L-2 (42.8).

Table 3. The effect of nutrition levels on length, width and intensity of leaf blades green colour and the length of petioles of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) grown in peat moss

Tabela 3. Wpływ poziomów żywienia na długość, szerokość i intensywność zielonego zabarwienia blaszki liściowej oraz długość ogonka liściowego filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.) uprawianego w torfie wysokim

	Year Rok	Nutrient level – Poziom żywienia				
		L-1	L-2	L-3	L-4	L-5
Lenght of leaves blade (in mm) Długość blaszki liściowej (w mm)	2007	190.9	208.2 ab	213.9	226.1	215.5
	2008	254.4	286.1	309.3	345.7	350.6
	mean średnia	222.7 a	247.2 ab	261.6 b	285.9 b	283.1 b
Width of leaves blade (in mm) Szerokość blaszki liściowej (w mm)	2007	183.6	193.3	209.9	215.3	212.0
	2008	239.2	267.0	296.9	348.6	330.7
	mean średnia	211.4 a	230.2 ab	253.4 b	282.0 c	271.4bc
Lenght of petiole (in mm) Długość ogonka liściowego (w mm)	2007	188.8	193.8	196.3	206.1	191.2
	2008	250.3	249.9	288.5	326.5	307.8
	mean średnia	219.6 a	221.9 a	242.4 a	266.3 b	249.5 ab
Colour intensity of leaves blade (SPAD units) Intensywność zabarwienia blaszek liściowych (SPAD)	2007	42.0	40.4	42.9	45.8	43.4
	2008	43.6	45.2	48.9	51.3	49.9
	mean średnia	42.8 a	42.8 a	45.9 ab	48.6 b	46.7 ab

Values described with identical letters do not differ significantly at $\alpha = 0.05$;
Wartości opisane w wierszach tymi samymi literami nie różnią się od siebie istotnie przy $\alpha = 0,05$

Colour intensity of leaves increased in older leaves. According to Wang et al. [2005], the optimal reading of leaf blade colour in lacy tree philodendron (using a SPAD camera) ranged from 44.7 to 53.5. In this study similar results were recorded in case of plants fed most intensively with macroelements (L-3 to L-5; at 45.9, 48.6 and

46.7, respectively). The above mentioned authors reported that in lacy tree philodendron there is a significant linear dependence between the value of a SPAD reading and the determined chlorophyll content in leaves, in case of chlorophyll a amounting to $R^2 = 0.97$, chlorophyll b: $R^2 = 0.96$, while for total chlorophyll it was $R^2 = 0.97$.

Number of formed cuttings. Analyzed plant nutrition levels, apart from the significant effect on the vegetative parts of plants, significantly modified also the number of cuttings formed by a plant as well as their weight (tab. 4). The lowest number of cuttings was formed by plants in combinations L-4 and L-5 (1.1 and 1.0 cuttings·plant^{-1}), while it was significantly more in case of the other nutrition levels. Significantly the highest fresh mass of cuttings was recorded in plants grown at L-2 and L-4. The plant nutrition level did not have a significant effect on quantitative ratios of fresh to dry mass of cuttings.

Table 4. The effect of nutrition levels on formation of cuttings, their fresh and dry mass as well as quantitative relations in cultivation of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) in peat moss

Tabela 4. Wpływ poziomów żywienia na twarzenie sadzonek, ich świeżą i suchą masę oraz wzajemne relacje ilościowe w uprawie filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.) w torfie wysokim

	Year Rok	Nutrient level – Poziom żywienia				
		L-1	L-2	L-3	L-4	L-5
Number of cuttings formed by plants (cutting·plant^{-1}) Liczba sadzonek wytworzonych przez rośliny (sadzonka·roślina^{-1})	2007	1.6	1.5	1.6	1.6	0.8
	2008	3.4	3.3	2.3	0.6	1.1
	mean średnia	2.5 b	2.4 b	2.0 b	1.1 a	1.0 a
Fresh mass of cuttings (g·plant^{-1}) Świeża masa sadzonek (g·roślina^{-1})	2007	17.6	36.3	28.8	58.6	13.3
	2008	40.8	76.6	38.9	22.7	21.6
	mean średnia	29.2 b	56.5 c	33.9 b	40.7 c	17.5 a
Dry mass of cuttings (g·plant^{-1}) Śucha masa sadzonek (g·roślina^{-1})	2007	2.7	5.4	4.1	8.3	2.0
	2008	6.9	12.6	6.3	3.0	3.7
	mean średnia	4.8 b	9.0 c	5.2 b	5.7 b	2.9 a
Relation fresh to dry mass of cuttings Stosunek świeżej do suchej masy sadzonek	2007	6.5	6.7	7.0	7.1	6.7
	2008	5.9	6.1	6.2	7.6	5.8
	mean średnia	6.2 a	6.4 a	6.6 a	7.4 a	6.3 a

Values described with identical letters do not differ significantly at $\alpha = 0.05$;
Wartości w wierszach opisane tymi samymi literami nie różnią się od siebie istotnie przy $\alpha = 0,05$

The ratio of width : length of leaf blades. A significant positive correlation was found between the width and length of leaf blades in lacy tree philodendron (tab. 5). The value of the correlation coefficient for the analyzed fertilization levels ranged from 0.96 (L-3) td 0.99 (L-5) in 2007, while it was from 0.92 (L-1) to 0.97 (L-5) in 2008. This correlation was highly significant (coefficient of determination $R^2 > 0.88$), which means that the established linear regression equations are consistent with recorded empirical data in over 88%.

For example: the linear regression equation for nutrition level L-4 in 2008 is y = 0.4892x + 17.94. This means that at the width of the leaf blade (x) of 300.0 mm its expected length (y) will be 326.1 mm. The width of leaf blades and their length, in case of lacy tree philodendron, are similar.

Table 5. Coefficients of determination, correlation and regression equations for length and width of leaf blades of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.)
Tabela 5. Współczynniki determinacji, korelacji i równania regresji dla długości i szerokości blaszki liściowej filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.)

Year Rok	Nutrient level Poziom żywienia	Coefficients of correlation Współczynnik korelacji (r)	Coefficients of determination Współczynnik determinacji (R^2)	Regression equations Równanie regresji y = ax + b
2007	L-1	0.97*	0.94	y = 1.2016x – 45.79
	L-2	0.98*	0.96	y = 1.1263x – 41.15
	L-3	0.96*	0.93	y = 1.1491x – 35.93
	L-4	0.97*	0.95	y = 1.1535x – 45.49
	L-5	0.99*	0.92	y = 1.1586x – 37.69
2008	L-1	0.92*	0.84	y = 0.7208x + 5.58
	L-2	0.95*	0.90	y = 0.8635x + 1.99
	L-3	0.94*	0.88	y = 0.6577x + 9.34
	L-4	0.95*	0.90	y = 0.4892x + 17.94
	L-5	0.97*	0.93	y = 0.5331x + 15.35

Significantly at $\alpha = 0.05$; Istotne przy $\alpha = 0,05$

Resuming up it my be stated that the fresh and dry mass of aboveground parts of plants, the length and width of leaf blades, the number of leaves, the number and weight of cuttings, as well as the intensity of leaves green colour, were optimal in case of nutrition level L-4, containing (in mg·dm^{-3}): N 250, P 187, K 312, Mg 187, Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5 and Mo 2.0. For the purpose of practical diagnosis of fertilizer requirements in lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.), assuming a +/– 10% deviation from mean results of this study, resulting from biological and laboratory-related variation, it may be recommended the following ranges of standard values (in mg·dm^{-3}): N 225–275, P 168–206, K 281–343, Mg 168–206, Fe 67–83, Mn 22–28, Zn 18–22, Cu 9–11, B 1.3–1.7 and Mo 1.8–2.2. Standard values (similar as guide values for plant analysis) are determined with increasing frequency in scientific literature instead of the lower and upper threshold values of nutrients in substrates for ornamental plants [Kleiber and Komosa 2010]. This makes it possible to significantly reduce the research cycle for the diagnoses of fertilizer requirements of ornamental plants, particularly when many new species and cultivars are introduced annually. Standard values make it possible to obtain quantitatively and qualitatively optimal growth and yield of plants.

SUMMARY

To date no studies have been conducted on the optimization of nutrition in lacy tree philodendron grown in peat moss substrate for leaves to be used as floral green. Thus the main aim of the studies conducted in the years 2007–2008 was to evaluate the effect of increasing levels of nutrition with N, P, K and Mg on growth of lacy tree philodendron (*Philodendron bipinnatifidum* Schott et Endl.) grown in peat moss substrate. Analyses were conducted for five increasing levels on macroelement contents in the substrate, maintaining a constant quantitative ratio of N : P : K : Mg = 1.0 : 0.75 : 1.25 : 0.75. Nutrient contents in the analyzed nutrition levels were as follows (in $mg \cdot dm^{-3}$): L-1: N 100, P 75, K 125, Mg 75; L-2: N 150, P 112, K 187 Mg 112; L-3: N 200, P 150, K 250, Mg 150; L-4: N 250, P 187, K 312, Mg 187 and L-5: N 300, P 225, K 375, Mg 225. For all this levels the contents of microelements were the same, amounting to (in $mg \cdot dm^{-3}$): Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5 and Mo 2.0

On the basis of conducted analyses it was found that plant nutrition level significantly modified the fresh and dry mass of aboveground plant part, as well as the number of leaves and biometric parameters such as length and width of leaf blades as well as the length of petioles. The highest length and width of leaf blades were found in plants grown on L-4 and L-5 levels. A significant positive correlation was found between the length and width of leaf blades. Plant nutrition level had a significant effect on the intensity of leaf blade colour. The most advantageous decorative value was observed for plants grown at L-3 to L-5. The analysis of biometric measurements showed that the best growth and high suitability of plants for floral green was found in lacy tree philodendron grown in peat moss substrate at the level L-4 containing (in $mg \cdot dm^{-3}$): N 250, P 187, K 312, Mg 187, Fe 75.0, Mn 25.0, Zn 20.0, Cu 10.0, B 1.5 and Mo 2.0.

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ODŻYWIANIE FILODENDRONA PODWÓJNIE PIERZASTEGO (*Philodendron bipinnatifidum* Schott et Endl.). CZ. I. WPŁYW NA WZROST ROŚLIN

Streszczenie. Głównym celem badań przeprowadzonych w latach 2007–2008 była ocena wpływu wzrastających poziomów żywienia N, P, K i Mg na wzrost, rozwój i plonowanie filodendrona podwójnie pierzastego (*Philodendron bipinnatifidum* Schott et Endl.) uprawianego w substracie z torfu wysokiego, z przeznaczeniem na zieleń ciętą. Badano pięć wzrastających poziomów makroelementów w podłożu, przy zachowaniu stałej relacji ilościowej między N : P : K : Mg = 1,0 : 0,75 : 1,25 : 0,75. Na podstawie analiz chemicznych utrzymywano stałe poziomy składników pokarmowych w podłożu, które były następujące (w mg·dm^{-3}): L-1: N 100, P 75, K 125, Mg 75; L-2: N 150, P 112, K 187 Mg 112; L-3: N 200, P 150, K 250, Mg 150; L-4: N 250, P 187, K 312, Mg 187; L-5: N 300, P 225, K 375, Mg 225. Na wszystkich poziomach zawartości mikroelementów były jednakowe i wynosiły (w mg·dm^{-3}): Fe 75,0, Mn 25,0, Zn 20,0, Cu 10,0, B 1,5, Mo 2,0. Optymalny plon świeżej i suchej masy części nadziemnej roślin, liczba i długość liści, szerokość blaszki liściowej, długość ogonka liściowego oraz intensywność zabarwienia liści uzyskano na poziomie L-4, zawierającym w (w mg·dm^{-3}): N 250, P 187, K 312, Mg 187, Fe 75,0, Mn 25,0, Zn 20,0, Cu 10,0, B 1,5, Mo 2,0.

Słowa kluczowe: żywienie roślin, zieleń cięta, analiza podłoża, filodendron

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