Thaiszia - J. Bot., Košice, 21: 123-130, 2011
http://www.bz.upjs.sk/thaiszia

THAISZIA
JOURNAL OF
BOTANY

Influence of intensive fertilization on growth performance of decorative cultivars of *Nymphaea* sp. in Botanical Garden of P.J.Šafárik University in Košice, Slovakia

ROBERT GREGOREK

Botanical Garden of P. J. Šafárik University in Košice, Mánesova 23, 043 52 Košice, Slovak Republic, robert.gregorek@upjs.sk

Gregorek R. (2011): Influence of intensive fertilization on growth performance of decorative cultivars of *Nymphaea* sp. in Botanical Garden of P.J.Šafárik University in Košice, Slovakia. – Thaiszia – J. Bot. 21: 123-130. – ISSN 1210-0420.

Abstract: Aquatic plants, especially water lilies, are popular complements of the gardens with water elements. However, the principles of management for these species not always use the results of serious investigations. Particularly, the technique and intensity of fertilization markedly influence both the qualitative and quantitative characteristics of these plants. Within the area of Botanical Garden of P.J. Šafárik University in Košice, there was prepared and applied the methodology for investigation of the growth responses to various regimes of management. Using the cultivar *Nymphaea x hybr.* „Marliacea Chromatella" as a model example, this paper presents the influence of different doses of fertilizer to water lilies with reccomendations for the floricultural practice.

Keywords: *Nymphaea* sp., fertilization, floriculture

Introduction

Important component parts of the exposition areas of Botanical Garden of P.J. Šafárik University in Košice (hereinafter referred to as BG PJŠU) are water elements. 3 big pools and a set of 16 smaller containers interconnected to the integrated whole by approximately 200 m long artificial stream enable to present the range of water plants there. Plants of the genus *Nymphaea* belong to the

most attractive macrophytes. At present, next to the botanical species *Nymphaea alba,* there are other 11 hybrid frost-proof cultivars as stable collection components maintained for a long time (Tab. 1).

Tab. 1. Hybrid frost-proof cultivars of *Nymphaea alba* in BG PJŠU

Variety of *Nymphaea x hybr.* assortment	Flower colour of the variety	Leaf of the variety
Charles de Meurville	raspberry red	green
Rosennymphe	candy pink	green elongated
Průhonice hybrid	white – pink (extraordinary large)	green
Perry's Beauty	neon pink	green
Marliacea Chromatella	yellow	green + claret spots
Gold Medal	yellow	green + claret spots
Sioux	orange - copper variable	green + claret specling
James Brydon	dark red early	green / small claret spots
Burgundy Princess	dark red	green / small claret spots
Gladstoniana	white cup-like	green circular shape
Gloire du Temple-sur-Lot	white (to slightly pink) chrysanthemum-like	green

Water lilies are dominants of water elements and much attention is deservedly paid to them by visitors of the botanical garden. For that reason the growers naturally focus their attention to master the technique of growing water lilies as best as possible. The goal is to reach the highest possible degree of aesthetic value of the plant with acceptable working severity and optimal cultivation costs. Positive health assesment and aesthetic effect of individual plants depend on status of leaves (colour, number, size, density) and especially intensity of formation, quality and size of flowers.

Within the description of water lily cultivars, HŘÍBAL (2003) presents data on a variety *Nymphaea x hybr.* „Marliacea Chromatella“:

„Yellow, cup-like flower with diameter of 100 – 180 mm, aromatic, 22-31 petals, 49-83 stamens, stigma is terminated with 10-15 threads. Leaves are green with conspicuous brown-chocolate marbling, length to 0,23 m, **number of leaves 15-20**, they form a circle with a diameter of 1,5 m (1,77 m^2) on water surface, area of leaves 0,62-0,83 m^2 „.

On the basis of his life experiences, HŘÍBAL (2003) presents also the highest recorded number of flowers formed by one individual plant during one year. This record number was related to the variety „Charles de Meurville“ - 58 flowers. There were no exact data for the variety „Marliacea Chromatella“ but, on the base of previously mentioned information, it is obvious that normal annual **number of flowers of individual plant of this variety is lower than 58 flowers per year.**

Our work was focused on observation of similar parameters in different growing regimes in conditions of BG PJŠU.

Material and methods

Before 2005, the preparatory works for set up of experiment were carried out with the aim to check the possibilities of intensive growing of water lilies using non traditional methods.. We took decision to register in detail the effects of application of special fertilizer mixture directly into root ball of individual plants during vegetative season (April – October).

In 3 consecutive years 2005 – 2007 in week intervals we registered the increase of number of leaves and flowers and we evaluated their largest size parameters in the respective season too. A detailed methodology was gradually checked out and the experiment was run in accordance with the established principles during all observation period (GREGOREK 2008b).

We dealed with problems of hydromacrophytes in wider scale. The most attention was paid to the evaluation of results of intensive growing of 2 important decorative varieties of water lily:

Nymphaea x hybr. „Marliacea Chromatella“
Nymphaea x hybr. „Charles de Meurville“

The important assumption to enable application of fertilizer mixture dose directly into root ball was formation and testing of new technique of water lily planting. The main idea and consequently also the detailed description of planting technique (Fig. 1) were presented and propagated on several occasions: GREGOREK (2005), GREGOREK (2007), GREGOREK (2008a), GREGOREK (2008b).

To support the intensive growth, the fertilizer mixture was used in conditions of BG PJŠU. Its composition and approximate determination of applied amount was evaluated on the base of previous long term experiences with water lily growing. The main goal was to verify the suitability of new technique of application of fertilizer mixture (directly into root ball without necessity of mechanical disturbance to root system) and to determine an optimal monthly dose in specific conditions of BG PJŠU.

Fertilizer mixture consisted of 2 simple components:

1. Slovcerit 80 % of weight
2. Močovina granulovaná 20 % of weight

Fertilizer *„Slovcerit“* (non chlorine multicomponent fertilizer), produced by the company AGRORACIO Senica s.r.o, Senica – Čačov, has declared composition as follows:

- nitrogen (N) 14%
- potassium (K_2O) 10%
- phosphorus (P_2O_5) 9%
- magnesium (MgO) 2%

+ copper, boron, molybdenum, zinc and sulphur

Nitrogen fertilizer *„Močovina granulovaná 1,8“* (granulated urea) is one-component fertilizer with total nitrogen content of min. 45,5 %. The producer is DUSLO a.s. Šaľa, SR.

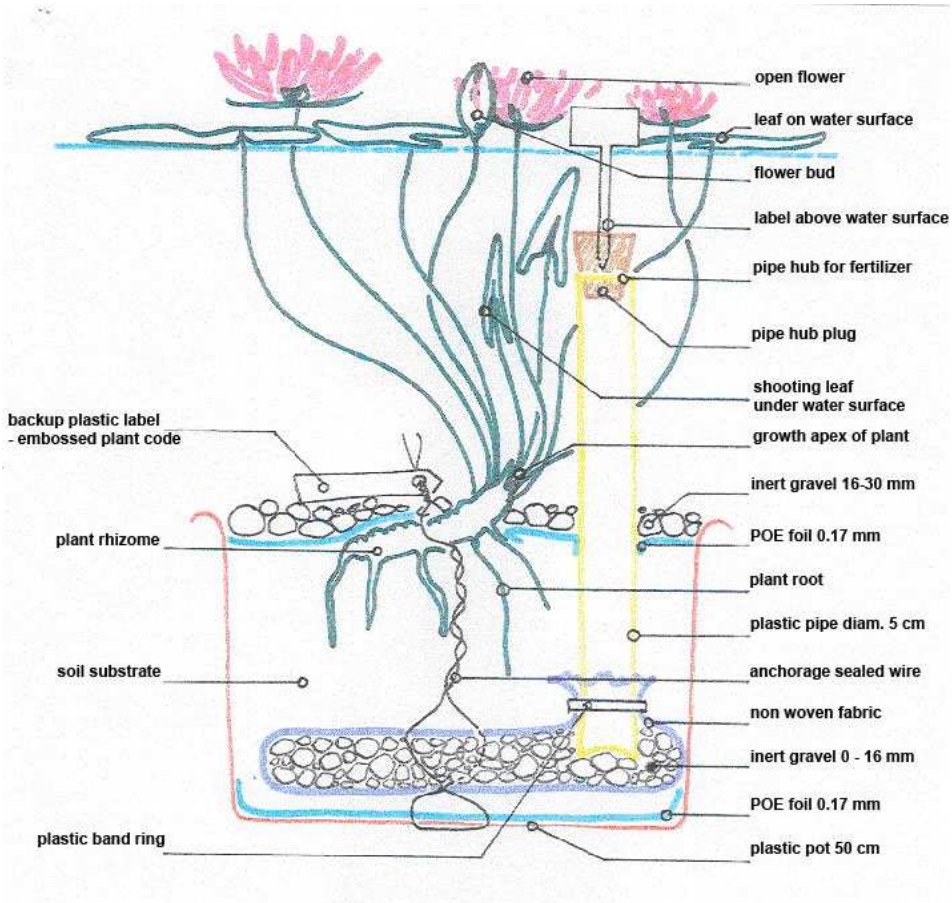

Fig. 1. Cross section of plastic pot with diameter of 0,5 m and arrangement of components for supply of fertilizer for individual plant *Nymphaea x hybr.* „Marliacea Chromatella“

Experimental plants were fertilized with different doses of fertilizer. There were specified 4 groups with different monthly dose of supporting fertilizer and 1 reference group without fertilization. Labeling with numbers „0“ to „4“ was a component part of the code of plants integrated in the experiment. During both registration and evaluation of marked plants, information on applied dose was always at the end of 3-digit code:

„0“ – without fertilization
„1“ – 10 g of fertilizer mixture per month
„2“ – 20 g of fertilizer mixture per month
„3“ – 40 g of fertilizer mixture per month
„4“ – 80 g of fertilizer mixture per month

Four individuals in each group of plants with different dose of fertilizer mixture were monitored and the results were presented in graph. Tags of individual plants is explained in the following example:

$B_2$4 – variety ´*Marliacea Chromatella*´, placed at the second site ("**2**") within the group where 80 g of fertilizer mixture (group „**4**") was supplied per plant each month in vegetation season.

During observations, we decided to register another parameter which was the most suitable for presentation of aesthetic effect, health and growth performance of a plant. In the third year of growing, when the plants reached their expected maximal parameters, we registered the numbers of simultaneously occurred vegetating leaves on water surface in week intervals.

Results and discussion

In particular, *Nymphaea x hybr.* „Marliacea Chromatella", with respect to the adequate growth dynamics, expressed itself in three year experiment as excellent model subject where the most persuasive differences between common cultivation techniques and the newly created method with gradual fertilizing into root ball during vegetation season could be presented. For those reasons I would like to summarise in brief just these results which could be compared with the findings of Hříbal (2003) mentioned above.

The registered data of created flowers of individual plants within 3 year observation are presented in the attached graph (Fig. 2).

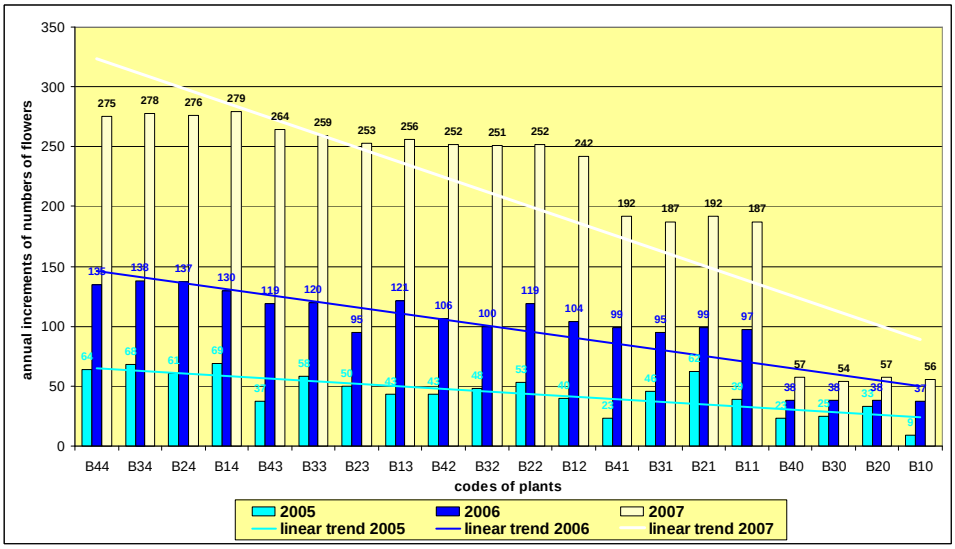

Fig. 2. Comparison of annual increments of numbers of flowers of *Nymphaea hybr.* „Marliacea Chromatella" in seasons 2005 – 2006 – 2007.

Number of leaves formed on individual plants within 3 years of observations is represented in summarized graph in Fig. 3.

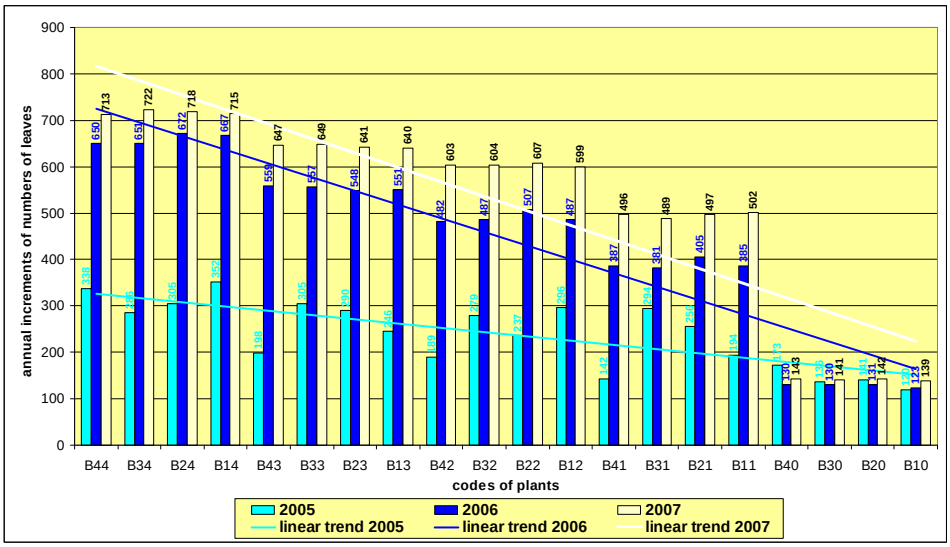

Fig. 3. Comparison of annual increments of numbers of leaves of *Nymphaea hybr.* „Marliacea Chromatella“ in seasons 2005 – 2006 – 2007.

Intensively fertilized plants were able to retain more undamaged fully functional leaves on water surface. The registered values are presented in Tab. 2.

The detailed analysis of data registered during 3 year observations of 2 different varieties of water lilies was discussed in wider scale (Gregorek, 2008a).

From the viewpoint of evaluation of successfulness of application of new technique of growing the variety *Nymphaea x hybr.* „Marliacea Chromatella“, only the most important data, which are presented above in graphs and table, will be emphasized:

In comparison with the description of the variety „Marliacea Chromatella“ presented by Hříbal (2003), we were succeed to overreach his maximum registered number of leaves (20) in summer season (end of August) at the lowest supporting dose of fertilizer (10 g) more than 9-times (average value for a group: 186 leaves simultaneously vegetating on water surface per individual plant).

The difference was even more convincing in plants with higher doses of supplementary fertilizer. The average value of 260 leaves of individual plant, reached in terms August/September, was 13-times higher than it was described for this variety growed by common techniques.

The highest number of recorded flowers formed by individual water lily plant per year was presented by Hříbal (2003) in the variety *Nymphaea x hybr.* „Charles de Meurville“ (58 flowers per season). Growing plants with using the new technique resulted to more than 4-times higher number of created flowers even at regular dose of more than 20 g of fertilizer mixture per month.

Tab. 2. Numbers of simultaneously vegetating leaves of *Nymphaea hybr.* „Marliacea Chromatella“ on individual plants with different fertilization regimes in 2007

Individual plants with code			
B	1-4	0-4	identification of variety "Marliacella Chromatella"
B	1-4	0-4	serial number of plant in group
B	1-4	0-4	number of group according to fertilizing regime

Recording date	$B_4 4$	$B_3 4$	$B_2 4$	$B_1 4$	$B_4 3$	$B_3 3$	$B_2 3$	$B_1 3$	$B_4 2$	$B_3 2$	$B_2 2$	$B_1 2$	$B_4 1$	$B_3 1$	$B_2 1$	$B_1 1$	$B_4 0$	$B_3 0$	$B_2 0$	$B_1 0$
	Number of leaves simultaneously occurring on individual plant in term of recording																			
4.5.2007	62	65	63	61	54	55	53	50	49	50	52	48	29	31	30	33	16	14	15	13
14.5.2007	113	113	112	111	100	98	99	100	99	90	94	92	64	64	66	65	26	24	26	28
21.5.2007	124	126	130	130	117	114	111	115	113	112	110	110	86	84	85	83	32	32	32	35
28.5.2007	160	157	156	155	138	140	143	147	125	122	130	136	103	110	108	107	45	38	41	40
May 2007																				
4.6.2007	164	166	165	162	150	154	152	153	137	138	136	134	126	128	127	125	40	43	42	43
12.6.2007	199	195	196	194	153	153	158	155	144	142	140	141	125	126	127	130	48	46	47	47
18.6.2007	182	187	186	185	158	155	161	162	154	150	154	152	150	149	148	144	46	49	48	49
25.6.2007	229	225	224	221	190	194	188	183	165	170	166	162	166	160	162	161	51	57	55	56
June 2007																				
2.7.2007	220	225	224	222	190	188	180	186	180	173	183	179	153	158	155	153	50	51	52	51
9.7.2007	228	224	228	226	168	172	162	170	164	161	168	162	146	146	147	148	50	48	48	46
17.7.2007	220	224	224	218	196	195	192	190	183	190	185	184	159	154	158	150	44	42	46	50
23.7.2007	236	232	236	234	210	200	207	211	194	192	198	190	164	165	166	168	50	48	48	47
31.7.2007	232	246	243	244	225	226	221	224	206	209	217	220	**182**	180	187	**192**	52	54	**56**	**60**
July 2007																				
6.8.2007	256	262	260	259	236	240	238	240	224	218	220	218	180	172	178	177	52	54	52	50
14.8.2007	245	249	246	242	226	224	222	228	219	220	222	222	176	179	178	180	54	**57**	**56**	59
20.8.2007	255	254	256	**260**	235	238	235	238	230	247	232	226	179	173	174	170	**58**	54	**56**	55
27.8.2007	256	255	254	254	249	243	246	244	235	233	238	**242**	180	**182**	**188**	190	46	50	**50**	54
August 2007																				
3.9.2007	**259**	**262**	**258**	254	**250**	**253**	**256**	**255**	**246**	**252**	**248**	240	108	104	106	102	50	50	48	42
13.9.2007	240	232	233	237	235	230	232	231	214	216	218	224	117	114	115	112	42	44	43	45
21.9.2007	189	190	192	198	184	192	189	190	166	162	168	170	86	80	85	88	34	35	35	36
28.9.2007	175	174	172	169	163	158	161	159	140	142	144	149	75	73	75	77	28	27	28	29
September 2007																				
5.10.2007	163	162	160	159	153	148	152	149	133	134	135	137	77	75	78	79	25	24	25	25
12.10.2007	142	148	144	143	139	134	138	135	108	109	110	112	75	74	78	78	13	13	17	17
19.10.2007	130	132	129	128	119	114	115	115	103	102	104	106	72	72	78	76	5	4	7	6
October 2007																				
2007*	**259**	**262**	**260**	**260**	**250**	**253**	**256**	**255**	**246**	**252**	**248**	**242**	**182**	**182**	**188**	**192**	**58**	**57**	**56**	**60**
****		**260.25**				**253.50**				**247.00**				**186.00**				**57.75**		

* the highest number of simultaneously occurring leaves on individual plants

**the highest number of simultaneously occurring leaves during recording

3.9.2007- average in groups B_x2, B_x3, B_x4
31.7.2007- average in group B_x1
14.8.2007- average in group B_x0

highlighted data over 251 of simultaneously occurring leaves
highlighted data of 201-250 of simultaneously occurring leaves
highlighted data of 151-200 of simultaneously occurring leaves
highlighted data of 101-150 of simultaneously occurring leaves
highlighted data of 51-100 of simultaneously occurring leaves
data lower than 50 of simultaneously occurring leaves

Considering the presented most important numeric values, one can expressly confirm that growth potential of water lily plants can be enhanced several times by using the regular appropriately selected application of suitable fertilizer mixture. Just for interest, considering the complex evaluation of other parameters (size of individual flowers and leaves, their quality etc.), the monthly application of 20 – 40 g of fertilizer mixture seems to be the most appropriate.

References

GREGOREK R. (2005): Vodné a močiarne rastliny v zbierkach Botanickej záhrady UPJŠ v Košiciach. Aquatic and marshy plants in collections of Botanical Garden of P. J. Šafárik in Košice. In: Introdukce a genetické zdroje rostlin; Botanické zahrady v novém tisíciletí : Zborník konferencie konanej 5.- 9. 9. 2005 na České zemědělské univerzitě v Praze – Suchdole. Praha : Botanická zahrada hl. m. Prahy, p. 101-103, ISBN 80-903697-0-7.

GREGOREK R. (2006): Čistá voda bez techniky. Záhradkár XLII (7): 54-55, ISSN 0862-5565.

GREGOREK R. (2007): Presádzame lekná. Záhradkár XLIII (7): 32-33, ISSN 0862-5565.

GREGOREK R. (2008a): Vysádzame vodné rastliny. Záhradkár XLIV (6): 30-33, ISSN 0862-5565

GREGOREK R. (2008b): Uplatnenie vybraných taxónov vodných makrofytov v záhradnej tvorbes podrobnejším zameraním na význam doplnkového hnojenia hybridných kultivarov rodu *Nymphaea.* Using the selected taxons of water macrophytes in garden formation with the special focus to the supplementary fertilizing of hybrid cultivars of the genus *Nymphaea* – dizertačná práca. Nitra : SPU, Katedra biotechniky krajinných úprav, 114 pp.

HŘÍBAL V. (2003): Zahradní jezírka a vodní rostliny. Praha: Grada Publishing a. s., 96+16 pp., ISBN 80-247-0590-7.

Received: January 14th 2011
Revised: October 03rd 2011
Accepted: November 02nd 2011