

ELŻBIETA KOZIK, MONIKA HENSCHKE, NATALIA LOCH

GROWTH AND FLOWERING OF *COREOPSIS GRANDIFLORA* HOGG. UNDER THE INFLUENCE OF OSMOCOTE PLUS FERTILIZERS

*From Department of Horticultural Plants Nutrition
August Cieszkowski Agricultural University of Poznań*

ABSTRACT. In pot growing of *Coreopsis grandiflora* 'Early Sunrise' cultivar, Osmocote Plus fertilizers 3-4M and 5-6M were applied in the doses of 1.5, 2.5, 3.5 g · dm⁻³ of substrate. Plants of better quality with a greater number of lateral shoots and inflorescences were obtained using Osmocote Plus 3-4M. The highest values of the investigated plant characteristics were obtained with the fertilizer dose of 3.5 g · dm⁻³ of substrate.

Key words: *Coreopsis grandiflora*, Osmocote Plus fertilization, growth, flowering

Introduction

In the recent years, perennial plants are more and more frequently used for the decoration of balconies and terraces. Species suitable for being grown in containers are characterized by a long period of flowering, attractive flower colours and low height. A significant asset of the new perennial plant cultivars is their flowering already in the first year of cultivation (**Bockelmann** 1997). One of this kind of plants is 'Early Sunrise', an abundantly and long flowering cultivar of *Coreopsis grandiflora* Hogg.

Among the decisive factors influencing the growth and flowering of perennial plants cultivated in pots is the proper fertilization. However, this factor has not been sufficiently investigated yet. In order to obtain plants with the best decorative values, the growers recommend fertilizers with a delayed action permitting plant production without any additional top dressing.

The objective of the present studies has been the determination of the effect of two types of Osmocote Plus fertilizers used in different doses on the growth and flowering of *Coreopsis grandiflora* Hogg. 'Early Sunrise' cv. grown in pots.

Material and methods

The studies were carried out in a greenhouse of the Experimental Station "Marcelin", Agricultural University of Poznań. From 24th April till 3rd July 2002, a two – factor experiment in completely random block design was carried out in reference to *Coreopsis grandiflora* Hogg. 'Early Sunrise' cv. The experiment was replicated in 2003 (from 23rd April till 5th July). Plants being in the growth phase of the 4th proper leaf were supplied by Syngenta Seeds Co. Ltd. in pallets, each containing 264 plants. The seedlings were transplanted into pallets with holes of 4 cm diameter and subsequently they were transferred into pots with 16 cm diameter and 1 dm³ volume. Mineral soil (light medium sand) mixed with raised peat from Latvia in 1:1 proportion with pH in H₂O = 6.4 was applied. The experimental factors included the type and the dose of Osmocote Plus fertilizers. Two types of fertilizers were used: Osmocote Plus with 3-4 months action 15 + 11 + 13 + 2 MgO + microelements, and Osmocote Plus with 5-6 months action 15 + 10 + 12 + 2 MgO + microelements. The fertilizers were used in three single doses before the plantation of plants into pots: 1.5, 2.5, 3.5 g · dm⁻³ of substrate. Each combination consisted of 10 pots with 2 plants in each pot.

In both years of studies, in the 6th and 10th weeks of growing, the numbers of buds and inflorescences and inflorescence diameters were measured in all plants. Biometrical measurements were carried out in the 10th week of growing in reference to the height of plants, length and the number of lateral shoots and the fresh mass of plants.

The results were statistically analysed using analysis of variance for three – factor experiments. In case of significant differences, mean values were grouped according to Newman-Keuls test at the significance level of $\alpha = 0.05$.

Results and discussion

The effect of Osmocote Plus fertilizers on the growth of *Coreopsis grandiflora* Hogg. in the 10th week of cultivation are shown in Table 1. It was found the plant height depended on the applied fertilizers and their doses. Higher plants were obtained after the application of Osmocote Plus with a shorter period of action (3-4 months) than after the use of Osmocote Plus with a longer period of action (5-6 months). Plants grown with the doses of 2.5 and 3.5 g · dm⁻³ of substrate were higher by 4.2 and 5.1 cm respectively than the plants with the smallest dose of 1.5 g · dm⁻³ of substrate. Similar effects were obtained by **Arnim** (1986) in his experiment with *Cyclamen persicum*; his plants were the higher the greater the doses of Osmocote Plus 3-4M fertilizer. Independent of the studied factors, in the particular years, the mean height of plants was 37.47-38.75 cm and it was lower than the height reported by **Kühn** (1999), i.e. 40 cm for the 'Early Sunrise' cultivar.

The type of fertilizer and the applied doses exerted also an effect on the lateral development and on the fresh mass of plants. *Coreopsis grandiflora* Hogg. plants with a greater number of longer lateral shoots and with a greater fresh mass were obtained after the use of the fertilizer with a shorter period of action. Independent of the applied fertilizer type, an increase of the dose from 1.5 g to 3.5 g · dm⁻³ of substrate contributed to an increase of the number of lateral shoots on the average from 14.60 to 21.27 (by 64%),

Table 1
Effect of Osmocote Plus fertilization on the growth of *Coreopsis grandiflora* 'Early Sunrise'
Wpływ nawożenia Osmocote Plus na wzrost nacylka wielkokwiatowego 'Early Sunrise'

Type of fertilization Rodzaj nawożenia	Dose substratum Dawka podłoża g · dm ⁻³	Height of plants (cm) Wysokość roślin (cm)			Length of lateral shoots (cm) Długość pędów bocznych (cm)			Number of lateral shoots (cm) Liczba pędów bocznych (cm)			Fresh matter (g · plant ⁻¹) Świeża masa (g · roślinie ⁻¹)		
		2002	2003	Mean Średnia	2002	2003	Mean Średnia	2002	2003	Mean Średnia	2002	2003	Mean Średnia
Osmocote Plus 3-4M	1.5	34.08a*	36.28b	35.18a	18.04ab	24.11de	21.07a	13.55a	16.50bc	15.03a	35.70bc	32.10a	33,90b
	2.5	39.13c	40.53cd	39.83bc	20.89bc	26.25ef	23.57b	19.45cd	20.45d	19.95c	46.60d	44.30d	45,45cd
	3.5	39.80c	42.50d	41.15c	22.58cd	29.65g	26.11c	19.60cd	23.85e	21.72c	56.10e	49.70d	52,90e
	Mean Średnia	37.67a	39.77b		20.50b	26.67c		17.53a	20.27c		46.13b	42.03a	
Osmocote Plus 5-6M	1.5	34.95a	34.73a	34.84a	16.71a	23.77de	20.24a	13.71a	14.65ab	14.18a	31.00ab	25.25a	28,13a
	2.5	37.90bc	39.30c	38.60b	19.57b	26.61ef	23.09b	16.80bc	19.05cd	17.93b	42.50cd	41.10cd	41,80c
	3.5	38.98c	39.15c	39.06b	20.56bc	27.17f	23.86b	18.55cd	23.10e	20.83c	47.90d	48.30d	48,10d
	Mean Średnia	37.28a	37.73a		18.94a	25.85c		16.35a	18.93b		40.47a	38.22a	
Mean for Osmocote Plus 3-4M Średnia dla Osmocote Plus 3-4M			38.72b			23.59b				18.90b			44.08b
Mean for Osmocote Plus 5-6M Średnia dla Osmocote Plus 5-6M			37.50a			22.40a				17.64a			39.34a
Mean for doses Średnia dla dawek	1.5	35.01a			20.65a			14.60a				31.01a	
	2.5	39.21b			23.33b			18.94b				43.63b	
	3.5	40.11b			25.00c			21.27c				50.50c	
Mean for years Średnia dla lat		37.47a	38.75b		19.72a	26.26b		16.94a	19.60b		43.30b	40.13a	

*Means indicated by the same letter are not significantly different at $\alpha = 0.05$

**Średnie oznaczone tymi samymi literami nie różnią się istotnie przy $\alpha = 0.05$

Tabela 2
Effect of Osmocote Plus fertilization on the flowering of *Coreopsis grandiflora* 'Early Sunrise'
Wpływ nawożenia Osmocote Plus na kwitnienie natchyłka wielkokwiatowego 'Early Sunrise'

Type of fertilization Rodzaj nawożenia	Dose substratum Dawka podłoża g · dm ⁻³	Number of buds and inflorescences Liczba pąków i kwiatostanów						Diameter of inflorescences (cm) Średnica kwiatostanów (cm)					
		6 week of cultivation 6 tygodni uprawy			10 week of cultivation 10 tygodni uprawy			6 week of cultivation 6 tygodni uprawy			10 week of cultivation 10 tygodni uprawy		
		2002	2003	Mean Średnia	2002	2003	Mean Średnia	2002	2003	Mean Średnia	2002	2003	Mean Średnia
		Osmocote Plus 3-4M	1.5	7.92a	11.65bc	9.78a	15.71a	21.65bc	18.68a	4.72a	5.10ab	4.91a	3.63bc
	2.5	10.77b	16.20e	13.49c	22.84cd	29.75e	26.30c	5.27b	5.17b	5.22b	3.65bc	3.44ab	3.55ab
	3.5	14.17de	19.55f	16.86d	27.23e	33.15f	30.19d	4.97ab	5.15b	5.06ab	3.91c	3.63bc	3.77bc
	Mean Średnia	10.95b	15.80d		21.93b	28.18d		4.98a	5.14a		3.73b	3.40a	
Osmocote Plus 5-6M	1.5	7.59a	11.75bc	9.67a	14.95a	18.05ab	16.5a	4.95ab	5.18b	5.07ab	4.00c	3.36ab	3.68b
	2.5	8.91a	13.75cd	11.33b	20.16bc	26.35d	23.26b	5.01ab	5.09a	5.05ab	3.52bc	3.57bc	3.55ab
	3.5	11.95bc	15.80de	13.88c	22.83cd	27.96e	25.40bc	5.30b	5.18b	5.24b	3.97c	3.94c	3.95c
	Mean Średnia	9.48a	13.77c		19.31a	24.12c		5.09a	5.15a		3.83b	3.62b	
Mean for Osmocote Plus 3-4M Średnia dla Osmocote Plus 3-4M				13.38b			25.05b			5.06a			3.57a
Mean for Osmocote Plus 5-6M Średnia dla Osmocote Plus 5-6M				11.63a			21.72a			5.12a			3.72b
Mean for doses Średnia dla dawek	1.5	9.73a			17.59a			4.99a				3.53a	
	2.5	12.41b			24.78b			5.13b				3.55a	
	3.5	15.37c			27.79c			5.15b				3.86b	
Mean for years Średnia dla lat		10.22a	14.78b		20.62a	26.15b		5.03a	5.15a		3.78b	3.51a	

*Means indicated by the same letter are not significantly different at $\alpha = 0.05$

*Średnie oznaczone tymi samymi literami nie różnią się istotnie przy $\alpha = 0.05$

and the fresh mass of plants increased from 31.01 to 50.50 g (by 63%). Also **Boertje** (1980) in his experiment with petunia, **Piskornik et al.** (2000) in an experiment with *Helleborus niger*, and **Harm** (2002) in pot growing of different perennial plant species obtained a fresh mass of plants which was the higher, the greater the applied dose of fertilizers with a delayed action.

The effect of Osmocote Plus on the flowering of plants is presented in Table 2. In the two years of studies, in both terms of measurements, the flowering was more abundant after the application of Osmocote Plus 3-4M in comparison to plants fertilized with Osmocote Plus 5-6M. In the 6th week of growing, the diameters of inflorescences were about 5 cm long. This size agrees with the description of the discussed cultivar presented by **Würth** (1996). In the 10th week of cultivation, it was observed that the inflorescences started to become less abundant. Furthermore, with the use of Osmocote Plus 3-4M, the inflorescences became slightly smaller than after the application of Osmocote Plus 5-6M. According to **Yuan et al.** (1998), the inflorescences of *Coreopsis grandiflora* 'Sunray' cv. are smaller when the temperature during growth reaches 15-26°C. According to this statement, the size of inflorescences in our own experiment could have been influenced by the temperature with in the period between the 6th and the 10th week of growing in the greenhouse exceeded 20°C. A significant increase of the number of inflorescences in both years of studies was obtained under the increased amount of fertilizers in the substrate.

It must be noted that the atmospheric conditions prevailing during the 2 years of experiments had an effect on the values of the studied characteristic features. A significantly greater yield of fresh mass of plants and greater inflorescences (in the 10th week of cultivation) were obtained in 2002. On the other hand, the values of the other features were significantly higher in 2003.

Conclusions

1. The growth and flowering of *Coreopsis grandiflora* Hogg. 'Early Sunrise' cv. depended on the dose and type of Osmocote Plus fertilizer.
2. Better quality plants were obtained after the application of Osmocote Plus 3-4M than after the use of Osmocote Plus 5-6M.
3. After an increase of the dose of Osmocote Plus from 1.5 to 3.5 g · dm⁻³ of substrate, high and well developed plants with a great number of splendid inflorescences were obtained.

References

- Arnim J.** (1986): Neue Dünger und Düngungsverfahren für den Zierpflanzenbau. Zierpflanzenbau 6: 242-243.
- Bockelmann I.** (1997): Der Weg zur Topfstaupe. Gärtnerbörse 13: 758-759.
- Boertje G.A.** (1980): Results of liquid feeding in the production of bedding plants. Symposium on substrates in horticulture other than soils in situ. Acta Horticulturae 99: 17-24.
- Harm U.** (2002): Feinsteuerung durch flüssige Nachdüngung. Zierpflanzenbau 5: 32-34.
- Kühn J.** (1999): Bereicherung des frühen Sortiments. Gärtnerbörse 17: 30-35.

- Piskornik M., Klimek A., Lis-Krzyściński A., Gąsior A., Krzywdą A.** (2000): Wpływ nawozów o spowolnionym działaniu na wzrost siewek ciemiernika białego (*Helleborus niger* L.). Zesz. Nauk. ISiK 7: 297-301.
- Würth Ch.** (1996): Lückenfüller aus Samen gezogen. Taspo Gartenbaumagazin 5: 35-41.
- Yuan M., Carlson W.H., Heins R.D., Cameron A.C.** (1998): Effect of forcing temperature on time to flower of *Coreopsis grandiflora*, *Gaillardia x grandiflora*, *Leucanthemum x superbum*, and *Rudbeckia fulgida*. Hort Science 33 (4): 663-667.

WZROST I KWITNIENIE NACHYLKA WIELKOKWIATOWEGO
(*COREOPSIS GRANDIFLORA* HOGG.)
POD WPŁYWEM NAWOZÓW OSMOCOTE PLUS

S t r e s z c z e n i e

W latach 2002-2003, w Katedrze Nawożenia Roślin Ogrodniczych Akademii Rolniczej w Poznaniu, przeprowadzono doświadczenia nad wpływem nawozów Osmocote Plus na wzrost i kwitnienie nachylka wielkokwiatowego (*Coreopsis grandiflora* Hogg.) 'Early Sunrise'. Czynniki doświadczenia były typ nawozu – Osmocote Plus 3-4 miesięczny lub 5-6-miesięczny oraz dawki nawozu – 1,5, 2,5, 3,5 g · dm⁻³ podłoża. W 6 i 10 tygodniu wegetacji, badano wpływ nawożenia na wielkość kwiatostanów oraz obfitość kwitnienia, natomiast w 10 tygodniu określono wysokość, liczbę i długość pędów bocznych oraz świeżą masę roślin. Uzyskane wyniki wskazują, że korzystniejszy wpływ na krzewienie i kwitnienie roślin miał nawóz o krótszym okresie działania. Stwierdzono także, że dawka nawozów – 3,5 g · dm⁻³ podłoża, wpłynęła na uzyskanie największych wartości wszystkich badanych cech roślin.