The hydroculture of calla

Lévai P. and Turi-Farkas Zs.

Department of Floriculture Landscape Architecture, Faculty of Horticulture, College of Kecskemet

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Summary: Hydroculture was established in the early 40's. This technology became wide-spread in 60's. Because of economic considerations it played little role in Hungarian ornamental plant growing. The forthcoming joining of the EEC as well as the strict enviroment protection regulations, this technology is likely to spread in our country and like in most of the West European countries, cut flowers will be grown in hydroculture. Closed systems match the most strict environmental regulations. Calla can be well adopted to this technology because of its origin and water demand.
We have studied three growing methods: PUR-agrofoam, container and soil-heated, of which soil-heated proved to be the best significantly.

Introduction

We have been growing cut flowers (carnation, *Calla*, Rose) at the Department of Ornamental Plant Production and Gardening of the Collage Faculty of the University of Horticulture and Food Industry since 1988.

Importance of hydroponics increases day by day. Due to the increasing urbanisation growing sites are decreasing and rapid industrial production may exhaust the peat supply too. The contamination of water supply is a real problem and hydroculture is possibly one of the solution. Closed circulation systems match even the strictest environmental regulations. No soil is needed, so the expensive sterilization as well as change of soil are not needed. Due to its origin and water demand, *Calla* fits well with this growing technology.

The basic aim of the research was to compare the effect of three different growing technologies (plastic foam, non-heated containers, sub-heated containers) to the plant growth and development as well as to the yield per plant.

Review of literature

Eight species of *Calla* live in tropic areas and in South Africa, wide spread in the so called *Calla* swamp. Place of its origin is essential to the rhythm of vegetation. When swamp is under water in the rainy season, plants start to grow leaves.

During the dry season, when the swamp dries out *Calla* looses the leaves and draws back to the rhizomes and the differentiation of inflorescences takes place *(Nagy,* 1972).

Zantedeschia aethiopica is the oldest known species. From the floriculture point of view it is the most important variety of white cut flower *(Röber* et. al, 1994).

Calla is neutral to the length of photoperiod. It is a facultative long-day plant, but may bloom also in short-days (Nagy, 1986).

This plant demands moderate-temperature, 12–14 °C at blooming *(Nessman,* 1993). Temperature affects blooming considerably, the temperature 8–10 °C can retard it *(Röber* et. al, 1994).

Calla has an extremely high water demand, because of its swamp origin. It is important to supply water according to its stage of development *(Domokos,* 1967). Water application should be considered as "little and often". Water should be given little at once but often. If the soil is not freely drained, tubers or the root system will quickly rot *(Andrew,* 1998). Irrigation ought to be started right after plantation, once a week at the beginning, then can even be kept under water *(Gugenhan,* 1991).

This plant has a low demand for soil, makes do with almost all kinds of soil, if the soil has a good drainage ability (Miessner,1968).

Calla likes slightly acidic pH with an optimum of 5.5–7.0 and has a very high demand for nutrients *(Nagy,* 1972).

According to Andrew (1998), *calla* is grown well at pH 5.0–7.5, but to avoid bacterial rot caused by *Erwinia*, a pH of 6.0–7.0 is most satisfactory. Calla is very susceptible to virus, bacterial and fungal diseases. To avoid virus, clean material should be used *(Andrew,* 1998).

Meristems meant a new era in the propagation of *Calla*. Tubers produced by tissue culture are free from infections and one of the most dangerous diseases, the so called *Erwinia* can be eliminated *(James,* 1997).

Growing in glass houses is the most widespread with a plantation at the end of August and beginning of September. Vigorous varieties are planted at the density of 6–8 tubers per sq. metre, while less vigorous ones are at 8–10 tubers per sq. metre *(Nagy,* 1986). The yield of this plant varies between 2–4 flowers per stock *(Diener,* 1997) while, according to Nagy (1986) vigorous stocks can produce as much as 12–16 cut flowers, what means 60–80 flowers per sq. metre.

In Belgium in the recent 10 years researches have been focussed on the development of environmental substrates. Recycled Polyurethane- (PUR)-substrate is very easy to handle and can certainly be re-used for 10 years *(Benoit-Coustermans,* 1995).

Material and method

Calla is grown in two houses. The French Filclair house was established in 1993–94, sponsored by PHARE. Hydroculture was established in two of the blocks.

Climate is computerised in the house. Isolation and shading is assured by energy-courtain. The concrete floor has a 1.5% slope. The mineral solution is circulated by a BCPO-40-1/3 pump in a closed system. Mineral nutrients are fed from a container of concentrate. Feeding tubes pass the solution to the flower beds, while the unused solution is gathered in a 3 m^3 basin.

The second part of the research is located in the previously East-German Primeur-1 type of house with temperature-saving heating and soil-heating operating systems.

We have chosen *Zantedeschia aethiopica* "Perle von Stuttgart" variety. Rhizomes were planted in containers and polyurethane plastic foams respectively in the second decade of July. A short period of dormancy was dated at the end of August. Growing technology in the houses coincides with each other.

We examined the effect of the three growing methods in the entire growing period (from sprouting to dormancy).

– in polyurethane plastic foam
– normal containers
– soil heated containers

on the growth and flower yield of the population.

Height of plants and the yield per plant was measured regularly in the vegetation period.

Results

Evaluation was planned in a random block multivariate analysis of variance.

Table 1 The hydroculture of Calla 1996–98 Study of height and yield of plants

Methods	1996–1997.		1997–1998	
	Average height of plants	Average yield per plant	Average height of plants	Average yield per plant
agrofoam	57.60	5.23	59.23	5.30
container	58.03	11.72	62.96	12.00
soil-heated	86.45	8.40	87.12	8.78
SD 5%	11.845	3.380	20.261	3.40

In 1996/97 the height of plants were as follows: 57.6 cm in a polyurethane plastic foam; 58.03 cm in normal containers and 86.45 cm in soil-heated containers. The significant difference was 11.846. According to this height correlates with soil-heated technology, while there is no difference between the two latter.

Average yield of inflorescences per plant in 1996/97 was 5.22 in polyurethane plastic foam; 11.72 in normal containers and 8.4 in soil-heated containers. SD 5%=3.38 shows a difference in favour of the containers. The second and third technology is not showing difference, but the second one proved to be better as a whole. SD of the first and third technologies is minimal though a little bit in favour of the third.

In 1997/98 an average height per plant according to first, second and third technology was: 59.23 cm, 62.96 cm and 87.12 cm. The significant difference for soil heated containers was 20.261.

Yield was 5.30; 12.0 and 8.78 flower per plant in the agrofoam, containers and soil-heated subsequently. SD 5% was 3.4, which showes significantly better yield in favour of containers.

Conclusions

As a results of our *Calla* growing technology research of 1996/97, it can be stated that sub-heated containers resulted significantly in the best growth, while per stock yield of cut flowers was in favour of the normal container technology.

The difference in height can be explained by the different heating systems.

Retarded plant growth and development is also explained by the fact that plastic foams are less likely to warm up than peat-based soil substitutes.

The Primeur-1 house has the most favourable heating system and here we set the third technology. Sub-heating was the most favourable for the development of the plant.

As far as cut flower yield per plant is concerned, normal container technology was the most successful. Yield was slightly lower in sub-heated technology. Here the higher temperature resulted in excessive growth. Yield could be increased in PUR agrofoam blocks by applying subheating.

References

Andrew, S. (1998): Zantedeschia – Spectacular growth. Flora Culture Inernational

Benoit, F. & Ceustermans, N. (1995): Horticultural aspects of ecological soilless growing methods. Acta Horticulturae, 396: 11–24.

Diener, U. (1997): Zantedeschia – schwierig, aber lukrativ. Grtnerbörse 97(8): 433–435.

Domokos J. (1967): Disznövénytermesztés. Mezőgazdasági Kiadó, Budapest 392 p.

Gugenhan, E. (1991): Calla im Aufwind. Zierpflanzenbau, 24: 1009–1010.

James, Ch. (1997): Kalla: Neue Wege durch Meristem. Deutscher Gartenbau 90(50): 2678.

Lévai P., Farkas Zs. & Kovács A. (1992): A hidrokultúrás szegfűtermesztés technológiájának kidolgozása, összefüggésben a fajták értékelésével. Akadémiai Pályázat. 1–78.

Lévai P. & Farkas Zs. (1996): A hidrokultúrás vágott-virág termesztés tapasztalatai. 25 éves Jubileumi Tudományos Napok Kiadványa, KÉE KFK, Kecskemét, 76–79.

Lévai P. & Farkas Zs. (1998): Evaluation of the experiments on cut flower hydroponics. Lippay János Vas Károly Int. Scientific Symposium.

Lévai P. & Farkas Zs. (1998): Vágott virágok talajnélküli termesztése. Magyar Tudomány Napi Megyei Tudományos Fórum, Kecskemét, 1998. november 5.

Miessner, E. (1968): Zierpflanzen VEB Deutscher Landwirtschaftsverlag, Berlin, 872.

Nagy B. (1972): Vágott virágok. Mezőgazdasági kiadó, Budapest, 179.

Nagy B. (1986): Növényházi disznövények termesztése és hajtatása. Mezőgazdasági kiadó, Budapest, 540.

Nessmann, P. (1993): Szobanövények. Delta 2000 Könyvkiadó, Budapest, 134.

Röber et. al (1994): Topfpflanzenkulturen. Verlag Eugen Ulmer, Stuttgart, 420.