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RESEARCH ON THE IMPACT OF THE GROWING MEDIUM ON PRODUCTION AND QUALITY OF *GERBERA HYBRIDA* FLOWERS IN PROTECTED CULTIVATION

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Abstract

Their high productive potential, tenderness and long lasting of flowers in water place the gerbera among the highly valued species for cut flowers grown in protected cultivation regime. Several surveys carried out among European flower growers and buyers rank gerbera 5th after carnations, roses, tulips and chrysanthemums (Frandin P. et all, 1990). Since in Romania, gerbera flowers have beenmuch appreciated and sought after by buyers at greenhouses in Sântandrei, Bihor, in the period 2020-2022 we conducted a research whose goal was to increase the productivity of gerbera plants and flower quality. To achieve the proposed goal, we used the Romeo hybrid variety cultivated on different substrates in six experimental working variants, each variant comprising four repetitions. The statistical analysis of the obtained results shows that the protocols related to variants 5 and 4 provide us with major concrete data regarding the increase of productivity and flower quality. We draw six conclusions which synthesize our research results.

Key words*: Gerbera hybrida, growing medium, peat, leaf soil, sand, fir bark, flower quality.*

INTRODUCTION

The genus *Gerbera* comprises several perennial herbaceous species that grow spontaneously in South Africa, Asia and South America. The species *Gerbera jamesonii* and *Gerbera viridifolia* laid the basis for obtaining numerous hybrids known as *Gerbera hybrida*. The plants appear in the form of rosettes formed by numerous deeply notched (penatifid) leaves, hairy petioles emerging from short rhizomes with easily trailing growth. Numerous roots penetrate the soil to a depth of 50-70 cm. Flower stalks are 20-90 cm long. Inflorescences are flower-heads of 5-18 cm in diameter with ligulate marginal flowers arranged radially and having tubular flowers in the middle. The fruit is a compressed achene (Garibaldi, 1993).

In recent years, through hybridization and selection, valuable hybrids with large flowers and long stems which are also resistant to preservation in water have been obtained (Șelaru, 1996).

Large flowers are today more of a requirement in Eastern Europe, while in the Western Europe people prefer the uniformity of the flower size even if average.

The flower colour and shape (involute, semi-involute, simple) are elements dictated more by trends and observed by breeders.

The plant presents particularities related to propagation and culture, the knowledge and mastery of which are required for the management of a correct technology and obtaining high and quality productions (Vlad, 2011).

The flowers are used for interior decoration, being kept in vases for 8-14 days. Gerbera can also be planted in green areas where it acts as an annual flowering plant (Viard, 2015).

MATERIALS AND METHODS

The working hypothesis we use is that by using a valuable, hybrid, resistant to both diseases and nematodes, by ensuring an appropriate mineral nutrition and by ensuring sustained

cultural hygiene, top production performance and economic efficiency can be achieved.

The main objectives through which we reached the proposed goal were the following ones:

- Observing a rigorous control of plant nutrition, comparing the culture on the organic growing medium with the classic plant growing in soil;
- Ensuring culture hygiene during the plant growing, especially by combating the common red spider mite, thrips, wilting and powdery mildew.

From the analysis of the state of research on gerbera culture in protected cultivation, the necessity and opportunity of the experiences undertaken in this study emerges based on the fact that domestic research works has not approached so far the issue in a complex manner by correlating the main factors that impact, to the greatest extent, the success of the culture: the hybrid used, the shading, and the culture system that controls the hydro-mineral regime.

The factors surveyed concerned the classic system of plant growing in soil.

This study is part of the current context with regard to the concerns of specialists to increase the production and quality of gerbera flowers.

We worked with the ROMEO red-coral hybrid, with the involute inflorescence and the diameter of 12-15 cm, obtained from the company Rosmaring, Obuda, Budapest.

The working experience comprised six variants, with 4 repetitions each, namely:

V1 - Soil culture system using classical technology;

V2 - Culture in substrate consisting of 40% peat, 20% beech leaves, 20% old manure, and 20% fir bark;

V3 - Culture in substrate consisting of 50% peat, 15% beech leaves, and 15% old manure, 20% fir bark;

V4 - Culture in substrate consisting of 60% peat, 10% beech leaves, 10% old manure, and 20% fir bark;

V5 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark;

V6 - Culture in substrate consisting of 70% peat, and 30% fir bark.

For the culture in the soil of the greenhouse, the following preparation works were done:

- Soil scarification at a depth of 50-60 cm;
- Basic fertilization following lab soil analysis with 15 kg/m^2 of peat and 15 kg/m^2 of well-decomposed cattle manure, the manure of other animals being not recommended, and with 20 g/m^2 of ammonium nitrate, 40 g/m^2 of superphosphate, 30 g/m^2 of potassium sulphate and 10 g/m^2 of magnesium sulphate;
- Plowing with a Wikon rotary tiller at a depth of 30-35 cm;
- Soil milling to a depth of 15-17 cm;
- Soil modelling in ridges with a width at the base of 60 cm and a height of 40 cm (Ţepardei, 2002).

The culture substrate from variants 2-6 was placed in 40 cm high ridges on polyethylene foil. Each variant was allocated an area of 120 m^2 for culture and four repetitions (Figure 1). The fir bark was chopped and the components of the substrates were mixed evenly. The pH was corrected to 6.5 for each variant. In variants 5 and 6, where the largest amount of peat was used for pH correction, an amount of 5 kg of calcium carbonate per m^3 was required (Leonardi, 1997).

PROTECTION AREA	4	3	2	1	PROTECTION AREA	ALLEY	PROTECTION AREA	4	3	2	1	PROTECTION AREA
	2	1	4	3				6	5	6	5	
	6	5	6	5				2	1	4	3	

Figure 1. Experiment placement draw

For the fertilization of the substrates, we made use of the following doses calculated per m^3:

- Superphosphate 2 kg; ammonium nitrate 0.5 kg, magnesium sulphate 1.5 kg, potassium sulphate 1.5 kg, borax 20 g, copper sulphate 25 g, iron sulphate 50 g;
- The basic fertilizers were mixed in powder form with the substrate, and those fertilizers containing microelements were dissolved in water and administered uniformly (Budoi, 2001; Davidescu & Davidescu, 1999).
- Two rows of plants were planted on a ridge, providing a density of 8 stems/m^2. The planting was done at the beginning of October, and maintenance works consisted of the following:
- Loosening the soil and substrate once a month without disturbing the plants;

- Drip irrigation of soil, and sprinkling over the period May-September;
- Fertilization (preceded by labanalyses on a monthly basis), with free-chlorine complex fertilizers that were dissolved and introduced into the drip irrigation system;
Throughout the growing period (i.e. three years) the mineral elements in the soil and culture substrate were maintained within the limits shown in Table 1 below:

Table 1. Content in mineral elements

Content in aqueous extract (1:5) in mg/100 g substrate						pH
N	P_2O_5	K_2O	CaO	MgO	Mineral residue %	
15-25	10-14	30-40	35-45	10-12	0.25-0.50	6.0-6.5

- Removal of aged leaves - was carried out on a timely basis by pulling them individually. In the summer this maintenance work was carried out twice a once, and a once month for the rest of the year. Flower production and flower quality decrease if senescent leaves are not removed and an optimal ratio between the leaves count and the flower count on a plant is not maintained (Zaharia, 1995).
- The activity of the gerbera root system was optimal at a temperature of 20°C. The higher temperature forced flowering but reduced flower quality (small flower heads, thin stems with low shelf life). Although it presents high requirements for light, during the summer we had to provide a light shading. Gerbera grows and blooms normally at a humidity of 60% in the substrate and 70% in the air (Burzo et al., 2005). To combat the "vascular disease" withering caused by three pathogens (i.e. *Phytophtora cryptogea*, *Verticillium* sp. and *Fusarium oxysporum*) monthly treatments were made with Previcur 0.15%, Fundazol 0.05%, Topsin 0.1%, and Ronilan 0.1% (Gheorgieș et al., 2003).
Powdery mildew (triggered by *Oidium erysiphoides*) occurred in the months and was combated with Rubigan 0.1%, and Afugan 0.05%.
With regard to the pests, the red spider mite (*Tetranychus urticae*) was the most common, and fought with Omite 0.08%, Torque 0.08% and Mitox 0.1%. Thrips (*Franklinella occidentalis*) also created problems for the elimination of which treatments were made with Methomex 0.06%, Sherpa 0.03%, Phosdrin 0.1%, and Thiodan 0.1%.

The flowers were harvested when they were fully opened and the neck of the flower stems was rigid. Harvesting was done by pressing the flower stem (left to right) twist and pull. No watering was performed in the harvest day (Vidalie, 2020).
In order to differentiate the variants of the Romeo hybrid culture, observations and determinations were made with regard to the total production, the flower quality and the economic efficiency.

RESULTS AND DISCUSSIONS

As one may notice from Table 2, the production of flowers harvested and sold ranged between 155 stems/m^2 for Variant 1 - Soil culture system using classical technology and 211 stems/m^2 for Variant 5 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark.

Table 2. Total production of Gerbera flowers obtained in the first year after planting under the influence of the growing medium

Variants	Flower production		±D	Significance of difference
	Absolute no of stems/m^2	Relative %		
V1 - Soil culture system using classical technology (control variant)	155	100	-	-
V2 - Culture in substrate consisting of 40% peat, 20% beech leaves, 20% old manure, and 20% fir bark	177	114	22	x
V3 - Culture in substrate consisting of 50% peat, 15% beech leaves, 15% old manure, and 20% fir bark	192	123	37	xx
V4 - Culture in substrate consisting of 60% peat, 10% beech leaves, 10% old manure, and 20% fir bark	205	132	50	xxx
V5 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark	211	136	56	xxx
V6 - Culture in substrate consisting of 70% peat, and 30% fir bark.	201	129	46	xx

DL 5% - 21.92; DL 1% - 32.26; DL 0.1% - 48.6

There is a 36% production increase in Variant 5, compared to the control variant (i.e. Variant 1), and between 14% in Variant 2 and 32% in the other variants.

The statistical analysis indicates a very significant difference between variants 5 (culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark), 4 (Culture in substrate consisting of 60% peat, 10% beech leaves, 10% old manure, and 20% fir bark), and the control Variant 1 (Soil culture system using classical technology).
Between variants 6, 3 and the control variant the difference is clearly significant, while between Variant 2 and the control variant the difference is significant.
The yield of gerbera flowers is favourably and qualitatively impacted by the culture substrate (see Table 3 below).

Table 3. Quality of Gerbera flowers obtained in the first year after planting under the impact of the growing medium

Variants	Flower production		
	Total (stems/m^2)	of which of top quality	
		Absolute (stems/m^2)	Relative %
V1 - Soil culture system using classical technology (control variant)	155	116	75
V2 - Culture in substrate consisting of 40% peat, 20% beech leaves, 20% old manure, and 20% fir bark	177	138	78
V3 - Culture in substrate consisting of 50% peat, 15% beech leaves, and 15% old manure, and 20% fir bark	192	152	81
V4 - Culture in substrate consisting of 60% peat, 10% beech leaves, 10% old manure, and 20% fir bark	205	178	87
V5 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark	211	192	91
V6 - Culture in substrate consisting of 70% peat, and 30% fir bark.	201	170	85

In the case of Variant 1, cultivated in the soil according to the classical technology, the percentage of top quality flowers with the length of the floral stems over 50 cm and the diameter of the flowers over 13 cm, was only 75% of the total plants harvested, while in Variant 5 (culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark), out of the total flowers harvested, 91% were categorised as top quality. In the other variants, the percentage of top quality flowers ranged between 87% and 78%, higher than in the case of control variant.
From the data presented in Table 4, it results that the highest economic efficiency in terms of profit was obtained in the cause of Variant 5 (789 lei/m^2), closely followed by Variant 4 (684 lei/m^2). In the other variants the profit obtained is lower than in the optimal variants.

Table 4. Economic efficiency of Gerbera cultivation under the influence of the growing medium

Variants	Expenses incurred lei/m^2	Flower production stems/m^2	Production value lei/m^2	Profit lei/m^2
V1 - Soil culture system using classical technology (control variant)	1562	155	2170	608
V2 - Culture in substrate consisting of 40% peat, 20% beech leaves, 20% old manure, and 20% fir bark	1873	177	2531	658
V3 - Culture in substrate consisting of 50% peat, 15% beech leaves, and 15% old manure, and 20% fir bark	2130	192	2803	673
V4 - Culture in substrate consisting of 60% peat, 10% beech leaves, 10% old manure, and 20% fir bark	2452	205	3136	684
V5 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark	2481	211	3270	789
V6 - Culture in substrate consisting of 70% peat, and 30% fir bark.	2341	201	3015	674

The selling price was variable during the year, ranging between 5 and 17 lei/plant. The expenses analysis shows very high levels in terms of the cost of heating with methane gas and other expenses that include indirect expenses and interest related to contracted loans.

From the economic efficiency perspective, although the production expenses were higher in the case of Variant 5 due to the increase in production and quality, the profit was higher than in the control variant i.e. Variant 1 by 181 lei/m^2, i.e. 1800000 lei/ha.

CONCLUSIONS

- Cultivation of gerbera in protected regime is a profitable activity for flower businesses but resulting in differentiated outcomes depending on the cultivation technology applied;
- Flower production and top quality flowerswere higher in Variant 5, where the substrate consisted of 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark;
- In the case of Variant 6 - Culture in substrate consisting of 70% peat, 5% beech leaves, 5% old manure, and 20%, although fir bark was the same as in Variant 5, the larger amount of bark and the lack of beech leaves and old manure resulted in obtaining lower productions by 10 stems/m^2 and 6% fewer top-quality flowers asagainst Variant 5;
- The thermal regime and the supply of water and nutrients were more effective and beneficial in the case of substrate containing 70% peat, 5% beech leaves, 5% old manure, and 20% fir bark.
- The additional expenses incurred for the procurement of the constituents and the making of the substrate in Variant 5, were recovered and secure a profit of 789 lei/m^2 (i.e. 7890000 lei/ha).
- Scientific results we obtained in this study can be considered as a valuable contribution to gerbera flowers businesses.

REFERENCES

Borgeois, H. (1998) Nitrogen fertilizers: multiple choices. *P.H.M. Horticultural Journal*, April.

Budoi, G. (2001). *Agrochemistry II. Fertilizers. Technologies. Efficiency*. Didactic and Pedagogical Publishing House, Bucharest.

Burzo, I., Amariuței A., Vâșca Z. D. (2005). *Physiology of flowering plants*. Elisavaros Publishing House, Bucharest.

Davidescu, D. & Davidescu, V. (1999). *Horticultural Agrochemistry*. Romanian Academy Publishing House.

Frandin, P. et. al. (1990). Study of the commercial impact of florets and new flowers. *L'Horticulture Francaise*, October, 1990.

Garibaldi, A.E. (1993). Treatise on floriculture. Edagricole, Italy.

Gheorgieș, C. & Geamăn, I. (2003). *Diseases of horticultural plants*. Universitas Co. Publishing House, Bucharest.

Ivașcu, M. (2007). *Edible flowers. Health and color*. Cetatea de Scaun Publishing House, Târgoviște.

Leonardi, D. (1997). Organic amendments organic and organo-mineral fertilizers: who are they? *P.H.M.*, October 1997.

Șelaru, E. & Drăghici, M. (1989). Research on the development of culture technology in the greenhouse-solarium. *IANB Scientific papers, Series 13, Horticulture*, vol. XXXII.

Șelaru, E. & Petrescu, M. (1993). *Floriculture*. Agricultural Technical Publishing House, Bucharest.

Șelaru, E. (1994) *Instructor of practical floriculture works*. AMC Workshops of the U.S.A.M.V. Bucharest.

Șelaru, E. (2002). *Culture for cut flowers*. Ceres Publishing House, Bucharest.

Selaru, E. (1996). *Horticulture. Second Edition*, The Farmer Open University. Bucharest.

Țepordei, R. (2002). *Floriculture.* Agricultural Sciences Publishing House. Bucharest.

Viard, M. (2015). *The flowers of the world*. Publishing House Hatier, Paris.

Vlad, I. (2011). *Floriculture*. University Publishing House, Oradea.

Vidalie, H. (2020). *Floral productions*. France, 2020.

Vlad, I. (2000). *Practical work on floriculture*. Western Printing House, Oradea.

Zaharia, D. (1995). Floriculture. AMC lithographed course, Agronomic Institute Cluj-Napoca.

***Green Profit Plants flowers and the people who buy them. America in bloom, 2023.

****Great Encyclopedia of Garden Plants & Flowers*, Bordas, Paris 2020.