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Study on the Effect of Different Growing Media on the Growth and Yield of Gerbera (*Gerbera jamesonii* L.)

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Abstract

To study the effect of different substrates on growth and yield of gerbera, this experiment was carried out as randomized completely block design with 14 treatments and 3 replications. Treatments were as fallowing: fine sand, peat + fine sand (25%+ 75%), peat + fine sand (50% + 50%), perlite + peat (75% + 25%), perlite + peat (50% + 50%), perlite + peat (25% + 75%), perlite + peat + expanded clay (25% + 70% + 5%), perlite + peat + expanded clay (50 %+ 25% + 25%), perlite + peat + expanded clay (25%+ 50% + 25%), perlite + expanded clay (50%+ 50%), cocopeat, cocopeat + perlite (75% + 25%), cocopeat + perlite (50% + 50%), coco peat + perlite + expanded clay (50% + 25% + 25%), plants were fertilized with a same nutrient solution. Results showed that the growing medium containing perlite + peat + expanded clay (25% + 70% + 5%) was the best treatment. In this substrate, flower number, flower diameter, shoot diameter, stem neck diameter, flower height and vase life showed significant difference among growing media.

Keywords: Gerbera, Expanded Clay, Growth, Peat, Perlite, Yield.

INTRODUCTION

Gerbera (*Gerbera jamesonii* L.) is one of the herbaceous plants with colorful and beautiful flowers that are used as cut, pot and garden flower. Various planting beds around the world is used for growing gerbera such as perlite, rock wool, vermiculite, sand, coconut fiber (cocopeat), expanded clay, organic substrates, compost cow, zeolite, pumice, sand etc. that reported by Khalaj, 2007 and Fakhri, *et al.,* 1995.

Soil-less cultures have been successfully used for several decades with the aim to intensify production and reduce cost (Maloupa *et al.,* 1993). Peat is the most widely used substrate for potted plant production in the nurseries and accounts for a significant portion of the materials used to grow potted plants (Marfa` *et al.,* 2002; Ribeiro *et al.,* 2007). Since the last few years, cocopeat, also known as coir dust or coconut mesocarp has been considered as a renewable sphagnum peat substitute for the use in horticulture (Yau and Murphy, 2000; Pickering, 1997).

Perlite has been widely used in soil-less cultures too. Perlite, an aluminosilicate of volcanic origin, is rather inert (low buffering and cation exchange capacities of 0–1 mg/L). In general, it has a closed cellular structure, with the majority of water being retained superficially and released slowly at a relatively low tension, providing excellent drainage of the medium and aeration of rhizosphere (Maloupa *et al.,* 1993). The objective of this study was to determine the effect of different substrates on growth and yield of gerbera under an open soil-less production system.

MATERIALS AND METHODS

This experiment was carried out as Randomized Completely Block Design (RCBD) with 14 treatments and 3 replications for study on the effect of different substrate on growth and yield of gerbera (*Gerbera jamesonii* L.) over a period of 6 months along with their physical and chemical properties (Verdonck and Gabriels, 1992) are mentioned at table 1.

Plants were fertilized with a same nutrient solution. In this experiment, sand, perlite and expanded clay were used with 0.5-1, 1-2 and 3-5 mm in diameter range respectively. The greenhouse temperature and relative humidity were 18-28 °C and 50-70% and also the amount of light was 23000-25000 (Lumen/m^2). Gerbera transplanted in 4 liters size pots. They were irrigated 3-4 times per day.

Electrical conductivity and pH of nutrient solution was 5.5-6.5 and 1.5-2 ds/m respectively. In a period of six months, some quality and quantity characteristics of flowers were measured such as flower number, flower stem height, flower disc diameter, stem diameter, stem neck diameter and vase life. Standard procedures were followed to collect the data for growth and flowering parameters. The statistical analysis of the treatments was tested using analysis of variance and means were compared by Duncan's Multiple Range Test (Steel *et al.,* 1996).

RESULTS AND DISCUSSION

The selecting media is based on many factors such as availability, high quality and low price for producers. The different types of media can be used as peat and recently cocopeat (coconut fiber), rock wool, vermiculite, perlite, expanded clay, pumice and sand. In this experiment, based on various sources of external and internal reviews, common media used in various gerbera cultures were evaluated (Sindahu *et al.,* 2010; Khalaj, 2007; Venezia *et al.,* 1997; Mascecarini, 1998; Pisanu *et al.,* 1994).

There are significance differences ($P \leq 1\%$) between the flower numbers of treatments (table 2). The results of analysis (table 3) showed that 7th treatment, which includes a mixture of perlite + peat + expanded clay (25% + 70% + 5%), produced maximum flower numbers against others with 31 numbers and sand bed alone produced 11.3 flowers that have lowest production. The flower numbers of gerbera in 7th treatment could be the results of faster plant development due to good root system and better physicochemical properties of mixes. Growth medium is known to have a

large effect on value of potted ornamental plants (Vendrame *et al.,* 2005). Cation exchange capacity (CEC) of Bed No.7 is 80 Cmol charge (table 1). According to different researches, organic materials and high cation exchange capacity (CEC) increase the absorption and storage of nutrient, water and also by creating of suitable conditions for plant root growth, can increase qualitative and quantitative characteristics of flowers. If peat has been used alone, it because of pressing and decreasing ventilation and so sand or perlite due to little or no good properties would not be useful (Khalaj, 2007).

Among the physical characteristics, aeration and water holding capacity are probably the most important factors while, among the chemical characteristics, nutritional status, and salinity level have a crucial role on plant development (Dewayne *et al.,* 2003). Nowak and Strojny (2004) reported that the total porosity, bulk density, shrinkage water capacity and air capacity of the growing substrates had significant effects on the number and weight of fresh flowers in gerbera. Data showed that flower disc diameter influenced significantly (P≤1%) by the different media (table 2) and the largest flower diameter, 11.6 cm in 7th treatment and the lowest flower diameter 10.9 cm from 1st (sand alone) is derived (table 3). In Fakhri *et al.,* (1995) experimental design reported that the largest flower diameter obtained from mixes of peat and perlite. They have been noted that media physicochemical characteristics improving because of the organic matter existence was the main reason of differences.

Results showed significant difference (P≤5%) in the stem and stem neck diameter (table2). Significantly greatest mean stem and stem neck diameter were produced in medium 7 with 0.79 and 0.58 cm respectively (table 3). Similar results were reported by Aswath and Padmanabha, 2004. There was significant difference (P≤5%) in the flower height (table 2), significantly greater mean flower height were produced in medium 7 with 54.5 cm, the highest of growing media (table 3). Greater flower height and more yields produced by plants grown in medium 7 suggest that this treatment is best suited for growing gerbera flower in among these media. Medium 7, by 0.39 ds /m has the least salinity than other media, so good root medium has provided for nutrient absorption and growth for plants.

Survey such as that conducted by Papadopoulos (1996) has shown that mixture of perlite and peat with equal volume produced the maximum flower height with 69 cm. Aswath and Padmanabha (2004) reported that in gerbera electrical conductivity in medium had significant influence on stalk length, stalk thickness and flower diameter. Ozcelik *et al.,* (1997) studied during the 1994-95 years on the effects of different planting media as the alone or the combination on quality and quantity of gerbera, they observed that the most appropriate mixture for gerbera yield in 15-month period. A strong relationship between substrate physicochemical properties and gerbera quantity and quality characteristics has been reported in this survey.

Data showed that significant differences (P<5%) in the gerbera vase life grown on media with varying substrate (table 2). In medium 7, has the longest gerbera vase life as 13.6 days (table 3). The vase life is directly related to dry matter production as well as size of flowers. This finding is in agreement with Manins *et al.,* (1995) findings which showed significant differences between different substrates on gerbera vase life. De Jong (1978) found that gerbera flowers with strong stem were less likely to fold in the vase due to turgor pressure maintained. As the vegetative growth was found to be better in coco peat combinations, the flower set was early, producing high quality cut flowers.

The recent study confirms the fact that selection of the appropriate medium of growth for cut flowers (in this case gerbera jamesonii L.) was very important from yield and quality point of view. The medium must ensure the production of plants of the required quality on cost effective basis. In the present study, perlite + peat + expanded clay mix (%25 + %70 + %5) produced significantly the maximum number of flowers per plant and other quality characteristics among different media.

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Tables

Table 1. Physical and chemical properties of substrates used in this experiment

substrates	Porosity (%)	CEC (Cmol(+)/ kg)	EC (dS/m)	pH (1:2)
1) Fine sand	40	0.75	1.04	6.91
2) Peat + Fine Sand (25%+75%)	41.1	3.5	1.02	6.87
3) Peat + Fine Sand (50% +50%)	42.7	7.7	0.99	6.82
4) Perlite + Peat (75% + 25%)	73.7	26.5	0.84	6.54
5) Perlite + Peat (50% + 50%)	79.4	57.2	0.65	6.15
6) Perlite + Peat (25% + 75%)	86.3	94.9	0.41	6.65
7) Perlite + Peat + E.C. (25% + 70% + 5%)	80.7	80.3	0.34	6.17
8) Perlite + Peat + E.C. (50 %+ 25%+ 25%)	62.7	22.4	0.49	7.75
9) Perlite + Peat + E.C. (25%+ 50% + 25%)	66.2	43.5	0.39	6.51
10) Perlite + E.C. (50% + 50%),	59	35.3	0.18	8.29
11) Coco peat	90	75	0.5	5.29
12)Coco peat + Perlite (75 %+ 25%)	84.1	54	0.64	5.75
13) Coco peat + Perlite (50% + 50%)	78.6	34.5	0.77	6.17
14) Coco peat + Perlite + E.C. (50% +25%+25%)	66.3	27.6	0.45	7.48

(Treatments mix by (v/v) of substrates), E.C.: Expanded Clay

Table 2. Analysis of variance of gerbera quality and quantity characteristics

S.O.V.	df	Flower number	Flower diameter	Stem diameter	Stem neck diameter	Flower height	Vase life
Replication	2	101.3 ns	0.32 ns	0.001 ns	0.001 ns	30.24 ns	0.104 ns
Substrates	13	1211.2 **	5.47 **	0.004 *	0.001 *	369.2**	2.23*
Error	26	489.3	2.27	0.001	0.001	123.05	0.823
CV		20.7	2.6	5.25	4.93	4.29	8.22

ns, * and ** indicate no significant difference, significant at 5% and 1%, respectively

Table 3. Effect of different substrates on the yield and growth of gerbera

Treatment	Flower number		Flower disc. diameter (cm)		Stem diameter (cm)		Stem neck diameter (cm)		Flower height (cm)		Vase life (days)	
T1	11.33	d	10.88	d	0.66	b	0.49	b	48.4	bc	10.6	b
T2	11.67	d	11.63	b	0.69	b	0.52	b	51.3	ab	11.4	b
T3	17.00	cd	11.07	bcd	0.66	b	0.52	b	50.4	ab	10.7	b
T4	23.67	abc	11.02	cd	0.65	b	0.49	b	44.9	c	11.6	b
T5	22.33	bc	11.13	bcd	0.64	b	0.51	b	51.6	ab	10.8	b
T6	23.33	abc	11.47	bc	0.67	b	0.50	b	53.0	a	10.3	b
T7	31.00	a	12.35	a	0.79	a	0.58	a	54.5	a	13.6	a
T8	23.67	abc	11.02	cd	0.68	b	0.49	b	48.4	bc	11.3	b
T9	27.67	ab	11.18	bcd	0.68	b	0.51	b	48.2	bc	11.1	b
T10	23.67	abc	11.18	bcd	0.69	b	0.51	b	46.0	c	11.3	b
T11	16.67	cd	11.12	bcd	0.69	b	0.51	b	51.0	ab	10.6	b
T12	20.00	bc	11.28	bcd	0.69	b	0.51	b	54.3	a	10.7	b
T13	18.00	cd	11.25	bcd	0.69	b	0.50	b	54.2	a	10.3	b
T14	23.33	abc	10.94	cd	0.70	b	0.49	b	53.2	a	10.1	b