

Influence of different potting media on growth, flowering and yield of *Chrysanthemum (Dendranthema grandiflora) cv. Yellow Liliput*

ABSTRACT

The present investigation was laid out in Completely Randomized design (CRD) with nine treatments and each replicated thrice. The treatment T₂ i.e., Soil + Sand + Perlite + Farm yard manure 1:1:1 reported significantly better Performance in terms of Growth parameters like plant height (60.50 cm), Number of leaves per plant (64.00), plant spread (27.80 cm), leaf length (7.60 cm); Flowering parameters like days to first flower bud appearance (84.00 days), days to 50% flowering (120.00 days), flowering duration (74.00 days), flower diameter (5.70 cm), stalk length (11.50 cm) and Yield parameters like number of flowers per plant (72.00), Individual flower weight (3.20 g), flower yield per plant (152.00 g), flower yield per 100 pots (15.20 kg).

Key words: *Chrysanthemum, cv. Yellow Liliput, Soil + Sand + Perlite + FYM (1:1:1), media, yield, Value-added products.*

INTRODUCTION

“*Chrysanthemum (Dendranthema grandiflora)* occupies a prominent place in ornamental horticulture, and it is one of the commercially exploited flower crop. In many countries, including the United States and Japan, it is considered as the number one crop. While in other countries, it ranks next to rose (*Rosa sp.*) in value of the crop produced. *Chrysanthemum* belongs to the family *Asteraceae* and is known as 'Queen of the East' and 'Glory of the East' having diploid chromosome number 2n-18. It is commonly known as 'Gaul e Dhaudi' and 'Sevanti' in Hindi and Gujrati, respectively. *Chrysanthemum* word derived from Greek word chryso- golden and anthemon- flower. It is popular commercial flower grown for cut as well as a pot plant in different parts of the world. *Chrysanthemum* ranked third as a cut flower after rose and carnation and fifth as a pot plant during 2014” (Anonymous, 2015).

The limited flowering period of *Chrysanthemum* is the main bottleneck for the commercialization of this crop (Singh R and Bala M., 2018). The current trend in the *Chrysanthemum* industry is focused on improving the quality of flowers and creating an environmentally friendly production system. In order to achieve these goals and accelerate the production of *Chrysanthemums*, further innovations are needed in improving the

fertilization system and other production technologies (ji *et al.*, 2017). Potting media is one of the most important factors required for the production of good quality pot mum (Dubey *et al.*, 2013). Growth medium is known to have effect of value of potted ornamental plants and plays an important role in germination rate and many other physiological parameters including plant height, number of leaves, spike length, number of florets per spike, spike diameter and yield etc., (Ikram *et al.*, 2012).

With increased demand of potted ornamentals, the need for a light weight soilless growing medium has become more desirable due to their easy mobility and display during exhibitions and flower shows (Dubey *et al.*, 2013). The various soilless media i.e. Cocopeat, farmyard manure, Vermicompost etc. altered the physico-chemical characteristics of the growing mixtures and affect the plant growth, nutritional status (Beckmann-Cavalcante *et al.*, 2009) and value of potted ornamental (Vendrame *et al.*, 2005). Synthetic aggregates (SA) were also developed as alternative potting media for ornamental plant production (Jayasinghe 2012). The aeration and water retention status of growing media were essential to maintain equilibrium between moisture content and gaseous exchange as well as for maintaining keeping quality of chrysanthemum in a limited volume of a pot (Kukul *et al.*, 2012). Therefore, it becomes pertinent to formulate a soilless growing mixture amended with optimum proportions of media for growing plants in limited volume of containers. Cocopeat had been used as a light weight media constituent to raise ornamental potted plants of acceptable quality (Jeyaseeli and Raj 2010; Duggan-Jones *et al.*, 2013). Thus, this experiment was conducted to study the effect of different potting media on growth, flowering, yield and value added products of chrysanthemum as well as to work out the economics of different treatments.

MATERIALS AND METHODS

The experiment was conducted in Horticultural research field, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) which is located at 25°39' 42''N latitude, 81°67'56'' E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the Yamuna River by the side of Prayagraj - Rewa road about 12 km from the city. The potting media used during this experiment was soil, sand, Vermicompost, Farm yard manure, Cocopeat, perlite. The experiment was laid out in Completely Randomized Design with nine treatments i.e., T₀-Soil (control), T₁-Control (Soil + Sand + Cocopeat + FYM (1:1:1:1)), T₂- (Soil + Sand + Perlite + FYM (1:1:1:1)), T₃- (Soil + FYM (1:1)), T₄-(Soil + Vermicompost (1:1)), T₅- (Soil + Sand + FYM (1:1:1)), T₆-(Soil +

Sand + Vermicompost (1:1:1)), T₇-(Soil + Sand + Cocopeat + Vermicompost (1:1:1:1)), T₈-(Soil + Sand + Perlite + Vermicompost (1:1:1:1)), each replicated thrice. The treatment means were compared using Duncan Multiple Range Test (DMRT) at 5% level of Significance (Duncan 1995).

RESULTS AND DISCUSSION

1. Growth parameters

1.1 Plant height

The maximum plant height at 90 days after transplanting was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (60.50 cm), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (59.60 cm) While, minimum plant height was observed in T₀ – soil (48.70 cm).

“The increase in plant height in T₂ - Soil + Sand + Perlite + FYM (1:1:1:1) provide more nutritive media resulted in increment to plant height. which might be due that potting media combination T₂ alone had lower down clay content, pH, compactness, which improve drainage, aeration, water holding capacity and highest nutrients uptake by root system respectively”. Sujatha and Usha(2015) and Bala and Singh (2013).

1.2 Number of leaves per plant

The maximum number of leaves per plant at 90 days after transplanting was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (64.00), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (63.00) While, minimum number of leaves per plant was observed in T₀ – soil (48.00).

“Major food manufacturing units in plants are leaves that are influenced by environmental conditions and soil is one of the factors which have prime importance in this regard. More number of leaves in plants reflects its good vigour and suitability of environment”.

Mehmood *et al.* (2013).

1.3 Plant spread

The maximum plant spread at 90 days after transplanting was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (27.80 cm), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (27.00 cm) While, minimum plant spread was observed in T₀ – soil (18.60 cm).

“The plant spread was increased was mainly due to production of increased number of branches and wider angles from point of origin. Greater plant spread shows better vegetative growth of plants”. **Kala et al. (2020)**.

1.4 Leaf length

The maximum leaf length at 90 days after transplanting was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (7.60 cm), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (7.20 cm) While, minimum leaf length was observed in T₀ – soil (3.60 cm).

“The increasing leaf length might be due to the fact that growth substrate having good favourable physicochemical properties and high nutrient content that supported proper plant growth. If any nutrient in the selected growing medium is absent or in less amount then it reduced the plant growth and development”. **Chavada et al. (2017)**.

2. Flowering parameters

2.1 Days to first flower appearance

The minimum days to first flower appearance was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (84.00 days), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (85.00 days) While, maximum days to first flower appearance was observed in T₀ – soil (97.00 days).

This might be due to vigorous growth of the plant growing in the media and the rapid uptake of nutrients and water has a pronounce effect on early production. Similar results were observed by (**Gupta et al., 2004**) in Gerbera and (**Jawaharlal et al., 2001**) in Anthurium.

2.2 Days taken for 50% flowering

The minimum days taken for 50% flowering was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (120.00 days), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (126.50 days) While, maximum days taken for 50% flowering was observed in T₀ – soil (142.00 days).

This might be due to vigorous growth of the plant growing in the media and the rapid uptake of nutrients and water has a pronounce effect on early production. Similar results were observed by (**Gupta et al., 2004**) in Gerbera and (**Jawaharlal et al., 2001**) in Anthurium.

2.3 Flower duration

The maximum flower duration was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (74.00 days), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (73.00

days) While, minimum flower duration was observed in T₀ – soil (59.00 days). “Soil based media is rich in minerals and micronutrients as compared to most soil-less media which provides limited or no nutrients. This might be the reason for the maximum flowering duration in the soil based potting media combination”. (Sujatha A. Nair and T. Usha Bharathi 2015).

2.4 Flower diameter

The maximum flower diameter was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (5.70 cm), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (5.40 cm) While, minimum flower diameter was observed in T₀ – soil (2.50 cm). Increase in flower diameter is mainly due to the genetic make-up and which might have been further modified by prevailing environmental conditions and potting media combination Soil + Sand + Perlite + FYM (1:1:1:1). It helps in more accumulation of photosynthates in the sink (flower) from source (leaves). Continuous availability of photosynthates, cell division, cell elongation & cell enlargement remain on peak resulted in higher flower diameter. Similar results were also obtained by Kala *et al.* (2020).

2.5 Stalk length

The maximum stalk length was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (11.50), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (11.00) While, minimum stalk length was observed in T₀ – soil (6.30).

This might be due to growing substrate with excellent nutrient quality influences plant growth. Availability of P contents in soil has positive relationship with flowering indices. Treder (2008) reported that “plants have long stem in growing media with optimum phosphorus contents. Potting media comprising FYM showed maximum amount of P content”.

3. Yield parameters

3.1 Number of flowers per plant

The maximum number of flowers per plant was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (72.00), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (69.00) While, minimum number of flowers per plant was observed in T₀ – soil (55.00).

An increase in number of flowers per plant could be attributed to overall vegetative growth of chrysanthemum plants grown in these substrates greater carbohydrate accumulation due to increased photosynthesis might have caused the production of more number of flowers per plant which turn might have been caused due to the optimum balance and supply of plant

nutrients in the substrate. Similarly, increased availability of essential elements at critical growth stages could have led to increase in number of flowers. These results are in corroboration with the findings of **Bisht *et al.* (2012)**, **Singh *et al.* (2009)**, **Madhu and Kushal (2013)** in chrysanthemum and **Jawaharlal *et al.* (2001)** in Anthurium.

3.2 Individual flower weight

The maximum individual flower weight was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (3.80 g), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (3.40 g) While, minimum individual flower weight was observed in T₀ – soil (1.30 g).

Reason of maximum flower weight might be due to more availability of nutrients, media and genetic make-up. Similar finding have been reported by **Chauhan *et al.* (2014)** in gerbera.

3.3 Flower yield per plant

The maximum flower yield per plant was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (152.00 g), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (136.00 g) While, minimum flower yield per plant was observed in T₀ – soil (52.00 g).

“An increase in flower yield per plant could be attributed to overall vegetative growth of chrysanthemum plants grown in these substrates grater carbohydrate accumulation due to increased photosynthesis might have caused the production of more number of flowers per plant which turn might have been caused due to the optimum balance and supply of plant nutrients in the substrate. Similarly, increased availability of essential elements at critical growth stages could have led to increase in number of flowers”. **Bisht *et al.* (2012)**.

3.4 Flower yield per 100 pots

The maximum flower yield per 100 pots was observed in the treatment T₂ – Soil + Sand + Perlite + FYM (1:1:1:1) (15.20 kg), followed by T₁- Soil + Sand + Cocopeat + FYM (1:1:1:1) (13.60 kg) While, minimum flower yield per 100 pots was observed in T₀ – soil (5.20 kg).

“An increase in flower yield per 100 pots could be attributed to overall vegetative growth of chrysanthemum plants grown in these substrates grater carbohydrate accumulation due to increased photosynthesis might have caused the production of more number of flowers per plant which turn might have been caused due to the optimum balance and supply of plant nutrients in the substrate. Similarly, increased availability of essential elements at critical growth stages could have led to increase in number of flowers”. **Bisht *et al.* (2012)**.

Conclusion

From the Present investigation, it is concluded that treatment T₂ i.e., (Soil + Sand + Perlite + FYM (1:1:1:1)) performed best in terms of plant height, number of leaves per plant, plant spread, leaf length, days to first flower appearance, days to 50% flowering, flower duration, flower diameter, stalk length, number of flowers per plant, plant, Individual flower weight, flower yield per plant (g), flower yield per 100 pots.

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UNDER PEER REVIEW

Table 1. Growth parameters of Different Potting Media on Chrysanthemum (*Dendranthema grandiflora*) cv. Yellow Liliput.

Notation	Treatments	plant height (cm)	Number of leaves per plant	Plant spread (cm)	Leaf length (cm)
T₀	Soil (control)	48.70	48.00	18.60	3.60
T₁	Soil + Sand + Cocopeat + FYM (1:1:1:1)	59.60	63.00	27.00	7.20
T₂	Soil + Sand + Perlite + FYM (1:1:1:1)	60.50	64.00	27.80	7.60
T₃	Soil + FYM (1:1)	55.00	58.00	22.70	5.00
T₄	Soil + Vermicompost (1:1)	53.80	57.50	21.00	4.70
T₅	Soil + Sand + FYM (1:1:1)	57.00	60.50	24.00	6.00
T₆	Soil + Sand + Vermicompost (1:1:1)	56.40	59.00	23.40	5.60
T₇	Soil + Sand + Cocopeat + Vermicompost (1:1:1:1)	58.50	62.00	25.50	6.40
T₈	Soil + Sand + Perlite + Vermicompost (1:1:1:1)	59.00	62.50	26.00	6.80
F-Test		S	S	S	S
S.ED		0.73	0.66	0.57	0.52
CD (5%)		1.54	1.21	1.39	1.11

Table 2. Flowering parameters of Different Potting Media on Chrysanthemum (*Dendranthema grandiflora*) cv. Yellow Liliput.

Notation	Treatments	First flower appearance (days)	50% flowering (days)	Flower duration (days)	Flower diameter (cm)	Stalk length (cm)
T ₀	Soil (control)	97.00	142.00	59.00	2.50	6.30
T ₁	Soil + Sand + Cocopeat + FYM (1:1:1:1)	85.00	126.50	73.00	5.40	11.00
T ₂	Soil + Sand + Perlite + FYM (1:1:1:1)	84.00	120.00	74.00	5.70	11.50
T ₃	Soil + FYM (1:1)	90.00	135.50	65.00	3.50	8.00
T ₄	Soil + Vermicompost (1:1)	92.00	137.00	64.00	3.00	7.50
T ₅	Soil + Sand + FYM (1:1:1)	88.50	132.00	68.00	4.20	9.00
T ₆	Soil + Sand + Vermicompost (1:1:1)	89.00	134.00	67.00	3.90	8.60
T ₇	Soil + Sand + Cocopeat + Vermicompost (1:1:1:1)	87.00	130.50	70.00	4.80	9.80
T ₈	Soil + Sand + Perlite + Vermicompost (1:1:1:1)	86.50	129.00	71.00	5.00	10.40
F-Test		S	S	S	S	S
S.ED		1.14	1.11	1.00	0.27	0.36
CD (5%)		2.42	2.34	2.12	0.57	0.76

Table 3. Yield parameters of Different Potting Media on Chrysanthemum (*Dendranthema grandiflora*) cv. Yellow Liliput.

Notation	Treatments	Flowers per plant	Individual flower weight (g)	Flower yield per plant (g)	Flower yield per 100 pots (kg)
T₀	Soil (control)	55.00	1.30	52.00	5.20
T₁	Soil + Sand + Cocopeat + FYM (1:1:1:1)	69.00	3.40	136.00	13.60
T₂	Soil + Sand + Perlite + FYM (1:1:1:1)	72.00	3.80	152.00	15.20
T₃	Soil + FYM (1:1)	60.00	2.00	80.00	8.00
T₄	Soil + Vermicompost (1:1)	58.00	1.80	72.00	7.20
T₅	Soil + Sand + FYM (1:1:1)	64.00	2.70	108.00	10.80
T₆	Soil + Sand + Vermicompost (1:1:1)	62.00	2.40	96.00	9.60
T₇	Soil + Sand + Cocopeat + Vermicompost (1:1:1:1)	65.00	3.00	120.00	12.00
T₈	Soil + Sand + Perlite + Vermicompost (1:1:1:1)	67.00	3.20	128.00	12.80
F-Test		S	S	S	S
S.ED		0.95	0.16	6.39	0.64
CD (5%)		2.02	0.34	13.56	1.36