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Effect of Different Substrates on Growth Parameters of *Zinnia* spp.

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Abstract

A study was carried out to assess the effectiveness of various substrates in promoting vegetative and reproductive growth of *Zinnia elegans*. The experiment was designed in CRD with three replications and eight treatments: control, peat, coco coir, and conventional substrate (soil + silt + leaf mould, 1:1:1, v/v/v) alone or in varied combinations. The addition of coco coir to peat or peat alone enhanced plant height, leaf area, stem length, and fresh and dry weight of the stem. Plant height and stem length were considerably greater in coco coir-based substrates (P-0.0001 and P-0.0001, respectively). In peat-based and peat + coco coir-based substrates, growth and floral parameters were much higher. The findings demonstrated that coco coir, either alone or in combination with peat, had a beneficial influence on the productivity and quality of speciality cut flower zinnia crops.

Key words : Cut flowers, Coco coir, Peat, Media, Zinnia.

Zinnia elegans is one of the most beautiful summer flowers. It is endemic to Mexico and Central America and is a member of the compositae family. Zinnia is a genus comprising 20 species known for their solitary nature. It is simple to grow, thrives in full light, and can

withstand extreme heat. It also produces stunning cut flowers with a broad range of colour and form variation. The blooms have bright colours, strong stems, and a relatively long vase life, which has earned them a reputation as a speciality cut flower. The blooms, which range in colour from light to medium green and appear in a variety of brilliant colours, have a form that

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varies from linear to ovate. Flowers come in a variety of shapes and sizes, from a single row of petals to a dome shape, and are available in a variety of colours, including white, chartreuse, yellow, orange, red, purple, and lilac. Zinnias are a popular garden flower with a variety of uses, including borders, beds, edges, and cut flowers, as well as being a good source of international exchange.

In the cultivation of high-quality decorative crops, growing substrates play a crucial role. A suitable growth substrate influences the development of a large root system, offers enough plant anchoring, and allows for gaseous exchange between plant roots and the surrounding environment (Abad *et al.*, 2002). Physical qualities of the growing substrate should be favourable for plant growth and development. The usage of soil has been reduced as a result of rising waste volumes, and organic leftovers have become more popular in agriculture (Papafotiou *et al.*, 2004). The use of soilless substrates for container grown plants and greenhouse cut flower manufacturing is becoming more common with the passage of time. Plant production depends on choosing the optimum substrate (Paradiso and De Pascale, 2008). The physico-chemical characteristics of soilless substrates are crucial for supplying enough support and nutrients to plants, but they must be light, porous, and well-drained (Noguera *et al.*, 2003). Coco coir, which is made from the husk of a coconut, has outstanding physical properties and may be used to grow plants in containers (Caron *et al.*, 2005). The numerous similarities between peat and other agricultural by-products and organic wastes, there is a growing tendency to use them as fertiliser sources for decorative container grown plants (Mikkelsen, 2003). Due to, its superior physical and chemical qualities, peat has been widely utilised as a growth substrate, but its resources are depleting, it is prudent to seek for

alternatives (Wilson *et al.*, 2006; Michel *et al.*, 2015). For the production of beautiful potted plants and cut flowers, coco coir is most commonly used as a growth substrate alone or in combination with perlite or other elements (Kim, 2007; Islam, 2008; Ahmad *et al.*, 2015).

In India, floriculture is becoming more and more of a business. People's aesthetic perceptions are improving, the nursery and flower sector is growing every day. In nurseries and specialist cut flower farms, nursery rearing and potting of annuals are essential activities. However, dirt, silt, and farmyard/leaf manure are still used as customary substrates by nurserymen and flower producers in India. Because of its increased use in other agricultural and energy-producing activities, farmyard manure is becoming less available. Deforestation and reduced planting in cities, on the other hand, are reducing the supply of high-quality leaf manure. Furthermore, farmyard waste and leaf manure are key weed sources, with the latter being linked to allelopathic effects generated by the leaves of particular plants, such as eucalyptus. Peat, which is accessible in extremely limited amounts but at very expensive prices in India, is likewise available in very limited numbers but at very exorbitant rates in the United States. As a result, there was a need to develop alternatives to these traditional media components for nurserymen and flower farmers. Coconut coir (coconut fibre) has gained appeal in recent years due to its features that are comparable to those of peat (Hernandez Apaolaza *et al.*, 2005; Ahmad *et al.*, 2012). In all major cities, it is accessible in varying quantities. As a result, the use of zinnia as a summer annual flower was examined as an alternative to peat and traditional substrate (CS: soil + silt + leaf manure).

The greatest quality cut flowers in the world are usually grown on soilless surfaces. In India, however, traditional substrate is widely employed

for cut flower manufacturing. There was a pressing need to analyse possible speciality cut flower species with various substrates due to rising demand for cut flowers and the introduction of new specialty cut flowers. The purpose of this study was to compare the performance of zinnia grown on coco coir, peat, and standard media. The study's particular goals were to standardise growing substrates for the finest quality specialised cut flowers and to evaluate the appropriateness of coco coir and peat to traditional flower-growing substrates.

Material and method

Present study was conducted at Natura Greentech Landscaping and Nursery, Farrukh Nagar (Gurugram). Peat as a substrate was used to establish the nursery in 98 Cell propagation plastic trays. Zinnia was grown during summer using substrates under natural temperature and light conditions. Coco coir and peat were used individually and in different combinations mixed with conventional substrate [CS; soil + silt + leaf manure, (1:1:1, v/v/v)] to prepare different substrates. Treatments included control (100%), conventional substrate (CS), peat (P), coco coir (CC), CS + CC (1:1, v/v), CS + peat (1:1, v/v), CC + peat (1:1, v/v) and CS + CC + peat (1:1:1, v/v/v). Pots of 30 cm size were thoroughly filled with substrates according to treatments and three week old seedlings were transplanted individually in the pots. Experiment was laid out according to CRD with three replications, each containing five plants of each treatment. All cultural practices such as hoeing, weeding, fertilization, irrigation, IPM, etc. were similar for all treatments during the entire period of study.

Using normal procedures, data on growth and flowering parameters were obtained. At harvest, plant height was measured from the substrate surface to the top of the plant. To calculate leaf area, two healthy and mature

leaves were picked from each replication within a treatment and estimated from the recently mature leaves. Flower diameter (zinnia) was measured using a digital calliper during harvest. Fresh and dried weights of stems were measured. Flower quality was assessed using a method provided by Cooper and Spokas (1991), which used a scoring system of 1-9, with 9 being the best quality, 5 representing moderate quality, and 1 representing poor quality flowers.

Result and discussion

Effect of growing medium on growth parameters : Zinnia plants grown in coco coir exhibited maximum plant height (105.52 cm), stem length (62.98 cm), and followed by when plants grown in CS+CC (103.44 cm and 55.61 cm) respectively, while stem diameter (7.83 mm), leaf area (23.09 cm²) and fresh (19.54 g) and dry (4.66 g) weight of stem was highest for plants grown in peat (Table 2) were significantly higher than plants grown in other growing substrates. Coco coir grown plants also took minimum time (58.34 days) to reach harvesting stage (Table 2).

Floral characters in response to growing substrates : Flowers quality from plants grown in substrates other than control (6.21), CS (7.29) and CS + CC (6.59) was statistically similar and better than the flowers

Table 1. Effect of growing medium on growth parameters

Treatments	Plant height (cm)	Stem length (cm)	Stem diameter (mm)
T ₁ Control (100%)	50.39	23.45	3.24
T ₂ Soil+silt+leaf manure (CS)	77.95	50.21	5.15
T ₃ Peat (P)	95.64	54.26	7.83
T ₄ Coco coir (CC)	105.52	62.98	5.01
T ₅ CS+P (1:1)	84.68	42.40	5.17
T ₆ CS+CC (1:1)	103.44	55.61	5.95
T ₇ CS+P+CC (1:1:1)	85.57	40.91	6.16
C.D. at 5%	1.48	0.69	0.54

from control, CS and CS + CC substrate (Table 3). Flower diameter of zinnia plants was highest (8.88 cm) in peat grown plants compared to the plants grown in other growing substrates, and followed by plants grown in CC (7.61cm) (Table 3). Good quality flowers (8.84) of zinnia were observed in plants grown in peat compared to other studied substrates (Table 3) and it was followed by the plants grown in CS+P (8.60).

Discussion

All growing substrates increased growth and flowering traits in both annual cut flowers compared to the conventional substrates (CS) and control. All vegetative (plant height, stem length, fresh and dry weight of flower stem), and floral characteristics (florete diameter), stock plants were improved when grown in peat followed by CS+CC, CS+P, CC alone and CS+CC+P in descending order. Zinnia plants had maximum height and stem diameter in CC medium. While, stem diameter, fresh and dry weight of stems, flower diameter and quality were higher in peat followed by various combinations of CC and P with each other or with CS, but were superior to CS. This enhanced growth and flowering behavior of both flowers in peat, coco-coir or their combination with each other or with CS can be attributed to the physicochemical properties of the growing substrates (Riaz *et al.*, 2008). Moreover, CS+CC also provided better results than CS and CC alone as evident from previous results of tuberose (Ikram *et al.*, 2012), gerbera (Ahmad *et al.*, 2012), dahlia (Tariq *et al.*, 2012), Pinus pinea, Cupressus arizonica and C. sempervirens (Hernandez Apaolaza *et al.*, 2005). Thus, physico-chem properties of CC medium can be improved by using CS and CC in 1:1 ratio, as concluded earlier by Awang *et al.* (2009). Supplementation of CC with other substrates such as CS enhanced the air-filled porosity of the substrate (Awang *et al.*, 2009) that increased growth and flowering of zinnia in CS+CC than

Table 2. Effect of growing medium on growth parameters

Treatments	Fresh weight of stem (g)	Dry weight of stem (g)	Leaf area (cm ²)
T ₁ Control (100%)	5.55	1.86	18.60
T ₂ Soil+silt+leaf manure (CS)	13.28	3.17	20.03
T ₃ Peat (P)	19.54	4.66	23.09
T ₄ Coco coir (CC)	12.34	3.30	21.12
T ₅ CS+P (1:1)	12.27	3.50	20.70
T ₆ CS+CC (1:1)	12.38	3.03	20.28
T ₇ CS+P+CC (1:1:1)	9.73	2.16	20.06
C.D. at 5%	1.02	0.30	1.74

Table 3. Effect of growing medium on floral parameters

Treatments	Days to harvest (days)	Flower diameter (cm)	Flower quality
T ₁ Control (100%)	77.07	5.02	6.21
T ₂ Soil+silt+leaf manure (CS)	73.29	6.40	7.29
T ₃ Peat (P)	63.84	8.88	8.84
T ₄ Coco coir (CC)	58.34	7.61	7.35
T ₅ CS+P (1:1)	64.28	7.49	8.60
T ₆ CS+CC (1:1)	65.81	7.54	6.59
T ₇ CS+P+CC (1:1:1)	72.67	7.62	7.19
C.D. at 5%	0.67	0.46	0.11

CC alone. CC increased water holding capacity, organic matter of the growing medium and also supplied NPK at higher rate (Abad *et al.*, 2002; Chavez *et al.*, 2008; Ahmad *et al.*, 2012) compared to CS, but slightly less than peat and CS+P and therefore can substitute peat in India.

Conclusions

Results revealed positive effect of coco coir and peat for improvement of growth and quality of Zinnia species. Peat alone and in combination with coco coir produced the best results regarding most of vegetative and reproductive parameters and proved better than conventional substrate used. Moreover, CC+CS also proved

better (2nd to peat + CC) than CS alone. Therefore, growers can use CC+CS as a cheaper substitute to peat or can combine peat with coco coir for commercial production of zinnia and to get taller, sturdy stems to get higher returns at substantially lower cost of production.

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