The Pharma Innovation Journal 2022; SP-11(4): 629-632

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(4): 629-632

www.thepharmajournal.com
Received: 18-02-2022
Accepted: 27-03-2022

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Optimization of media for cut flower production in anthurium cv. tropical red

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Abstract
An experiment entitled "Optimization of media for cut flower production in anthurium cv. Tropical Red" was conducted at Hi - Tech Unit, College of Horticulture, Dapoli (M.S.) with seven treatment combinations in Randomized Block Design. The treatments comprised of different growing media *viz.*, T_1- coconut husk + charcoal (3:1), T_2- sand+ FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1), T_3- cocopeat + coconut husk + brick, pieces + charcoal (1:1:1:1), T_4- cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1), T_5- Brick pieces + wood shavings + sand+ FYM+ coconut husk + charcoal (1:1:1:1:1:1), T_6- Saw dust+ wood shavings + sand+ FYM+ brick pieces + charcoal (2:1:1:1:1:1), T_7- Sand+ cowdung clumps+ coconut husk + wood shaving+ charcoal+ earthen crocks+ brick pieces+ cocopeat (2:1:2:1:0.5:0.5:1:1). The results revealed that, significantly maximum survival percentage (%), plant height, number of leaves per plant, length of leaf, breadth of leaf, leaf area, number of suckers, chlorophyll a, chlorophyll b and total chlorophyll was registered in treatment T_2 i.e. Sand+ FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) which was followed by T_5 i.e. Brick pieces + wood shavings + Sand+ FYM+ coconut husk + charcoal (1:1:1:1:1:1).

Keywords: Anthurium, brick pieces, media, coconut husk

Introduction
Anthurium (*Anthurium andreanum* L.) is a herbaceous perennial ornamental plant which belongs to Araceae family. It is native to Central and South America. Anthurium is tropical plant and mainly grown for its attractive foliage and showy cut flowers. It is commonly called as tail flower and is very famous among florists due to its eye-catching bloom, elegance, smoothness, variety of dazzling colours and long lasting vase life. The anthurium plant possesses adventitious aerial roots system which helps in good anchorage. Anthurium cut-flower comprises an inflorescence (spadix) subtended by a modified leaf (Spathe) borne on a long stalk (peduncle). Heart shaped colourful attractive Spathe of this high valued flower attracts spectators. These special characters of anthurium have created high demand in domestic as well as international markets.

Anthurium plants growth depends on many factors such as good media, proper shade, nutrients. It is an epiphytic plant, therefore, growing medium plays vital role in growth, flowering, yield and quality of anthurium. Choice of good growing media is directly correlated with successful growth and production of export quality flowers in anthurium. It requires proper growing medium which has good physical characteristics like aeration and water holding capacity are probably the most important factors while, among the chemical characteristics, nutritional status, and good drainage also have a crucial role on plant development (Dewayne *et al*. 2003) [1]. In order to meet the ever increasing demand for fresh cut flowers, efforts are being made to increase the area under anthurium by improving agro-techniques, cultivation aspects such as suitable growing media. Hence, the present investigation was carried out to find suitable growing media to obtain maximum growth of Anthurium cv. 'Tropical Red'.

Materials and Methods
The investigation was carried out at Hi – Tech Unit, College of Horticulture, Dapoli from March, 2019 to April, 2021 with seven treatments and three replications in Randomised Block Design. The treatments comprised of different growing media *viz.*, T_1- coconut husk + charcoal (3:1), T_2- Sand+ FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1), T_3- cocopeat + coconut husk + brick, pieces + charcoal (1:1:1:1), T_4- Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1), T_5- Brick pieces + wood shavings + Sand+ FYM+

coconut husk + charcoal (1:1:1:1:1:1), T_6- Saw dust+ wood shavings + sand+ FYM+ brick pieces + charcoal (2:1:1:1:1:1), T_7- Sand+ cowdung clumps+ coconut husk + wood shaving+ charcoal+ earthen crocks+ brick pieces+ cocopeat (2:1:2:1:0.5:0.5:1:1). Experiment was carried out at under 75% shade. All the material required for the experiment i.e sand, cowdung clumps, cocopeat, coconut husk, wood shavings, charcoal, earthen crocks, brick pieces and saw dust was washed with good quality of water to remove excess soluable salts and then sun dried for sterilization. Potting mixture of different ratio was made by mixing of material by volume (v/v) basis manually. After preparation media were dipped in fungicide solution (Bavistin 0.2%) for 5 minutes before filling the pots. Media was filled ¾ the volume of the pots and then they were arranged in 50% shade net for 3 weeks as per the different treatments and replications for decomposition of the media. The Anthurium tissue culture plants of the variety "Tropical red" were obtained from A.V Thomas Company, Kerala and planted in pots.

Results and Discussion

Growth

The data presented in Table 1 revealed that, different treatments of growing media had significant effect on sprouting percentage, plant height, length of leaf, breadth of leaf, leaf area, Number of suckers, chlorophyll a, chlorophyll b and Total chlorophyll in anthurium. Maximum sprouting percentage of plants was recorded in treatment T_2 i.e., Sand+ FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) (95.33%) which was found to be at par with the treatments T_5 i.e., brick pieces + wood shavings + sand+ FYM+ coconut husk+ charcoal (1:1:1:1:1:1) (94.67%) and T_3 i.e., Cocopeat +coconut husk + brick pieces + charcoal (1:1:1:1) (93.33%), whereas, the treatment T4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum survival percentage (89.33%). This might be due to the potting material used in the potting medium which supported plantlets and provided nutrients and water to roots of plantlets. Results are in line with Sabareeswaran *et al*. (2018) [3] and Lakshanthi and Seran (2019) [2] in Dendrobium orchids.

The maximum plant height in anthurium were noted with the treatment T_2 i.e., Sand+ FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) recorded significantly maximum plant height (40.99 cm), whereas, minimum height of plant was recorded by the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) (31.13 cm). It might be due to anthurium is epiphytic in nature, optimum water holding capacity, better drainage and aeration in growing media is required for better growth which provides congenial conditions for the roots to anchor and further plant establishment and growth. These results are in concurrence with the findings of Basheer and Thekkayam (2012) [5] and Kapane *et al*. (2015) [4] in anthurium. Number of leaves per plant were recorded maximum in treatment T_2 i.e., sand + FYM + coconut husk + brick pieces + charcoal (1:1:1:1:1) (9.80) and it was found statistically at par with rest of the treatments except T_4 whereas, significantly minimum number of leaves were recorded by T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) (7.13 cm). This can be attributed to the fact that the coconut husk as growing medium improves aeration and maintains moisture level in root zone as desired by anthurium whereas charcoal and brick pieces helps in absorption of dissolvable salts and other impurities that could damage the root systems of the plant that allows free air movement, retains moisture and nutrients for growth of plants and delays senescence of the leaves present on the plant when used in combination with other growing media. Similar results were found by Santiago and Santiago (1989) [6] and Tatte *et al*. (2019) [7] in anthurium.

Length of leaf was recorded maximum in treatment T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) (15.00 cm) and it was statistically at par with the treatments T_5 i.e., brick pieces + wood shavings + Sand + FYM + coconut husk + charcoal (1:1:1:1:1:1) (14.93 cm), T_3 i.e., cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (14.69 cm), T_6- saw dust+ wood shavings + sand+ FYM+ brick pieces + charcoal (2:1:1:1:1:1) (13.91 cm) and T_1- coconut husk + charcoal (3:1) (13.76 cm), however, treatment T_4 i.e., cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum length of leaf (12.81 cm). This might be due to most of the light weight, soilless media are combinations of two or more components formulated to achieve desirable physical and chemical properties which result in optimum vegetative growth of plants. Similar results were reported by Muraleedharan and Karuppaiah (2015) [8] in anthurium.

Maximum breadth of leaf was recorded in treatment T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) (9.65 cm) and it was statistically at par with the treatments T_5 i.e., brick pieces + wood shavings + Sand+ FYM+ coconut husk+ charcoal(1:1:1:1:1:1) (9.43cm), T_3 i.e., cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (9.40cm), T_6- saw dust + wood shavings + sand+ FYM+ brick pieces + charcoal (2:1:1:1:1:1) (9.30cm), T_1- coconut husk + charcoal (3:1) (9.10cm) and T_7 i.e., Sand+ cowdung clumps+ coconut husk + wood shaving + charcoal + earthen crocks + brick pieces+ cocopeat (2:1:2:1:0.5:0.5:1:1) (8.85 cm), however, treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum breadth of leaf (7.89cm). Leaf area was recorded maximum in the treatment T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) (176.33 cm^2), whereas, the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum leaf area (160.21 cm^2). Significantly increase in leaf area can be attributed to favorable Physico-chemical properties that supported proper growth of plants. coconut husk, brick pieces and sand helped in proper drainage, whereas charcoal helps to improve the Cation Exchange Capacity and porosity of a substrate, which provided favourable growing conditions for root development and more no. of leaves per plant that facilitate well establishment of plant growth. These results are in line with those of Jackson (1973) [13], Gowda and Ramakrishna (2009) [14] and Tatte *et al*. (2019) [7] in anthurium.

The treatment T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) recorded significantly maximum number of suckers per plant (3.87) which was found statistically at par with the treatment T_5 i.e., brick pieces + wood shavings + sand+ FYM+ coconut husk+ charcoal (1:1:1:1:1:1) (3.73) and T_3 i.e., Cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (3.60), however, the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum number of suckers per plant (2.60). This might be due to media which provided sufficient anchorage or support to the plant, served as reservoir for optimum moisture and aeration which allowed

gaseous exchange between the roots and atmosphere outside the root substrate which resulted in growth and development of plants. The results are in line with those of Jawaharlal *et al*., (2001) [9] and Dhananjaya and Sulladmath (2003) [10] in anthurium.

Maximum chlorophyll a (2.16 mg/g) was registered by T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) which was followed by T_5 i.e., brick pieces + wood shavings + sand+ FYM+ coconut husk+ charcoal (1:1:1:1:1:1) (2.10 mg/g) and T_3 i.e., cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (2.05 mg/g), however, the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum chlorophyll a (1.87mg/g). Maximum chlorophyll b (1.33 mg/g) was registered by T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1)which was at par with T_5 i.e., Brick pieces + wood shavings + Sand+ FYM+ coconut husk+ charcoal (1:1:1:1:1:1) (1.31 mg/g) and T_3 i.e., Cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (1.29mg/g), however, the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum chlorophyll a (1.15mg/g).

Total chlorophyll (3.49 mg/g) was registered maximum in treatment T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) which was followed by T_5 i.e., brick pieces + wood shavings + sand + FYM + coconut husk + charcoal (1:1:1:1:1:1) (3.41 mg/g) and T_3 i.e., cocopeat + coconut husk + brick pieces + charcoal (1:1:1:1) (3.33 mg/g), however, the treatment T_4 i.e., Cocopeat + wood shavings +FYM+ brick pieces + charcoal (2:1:1:1:1) recorded minimum total chlorophyll (3.03 mg/g). This might be due to; magnesium which is essential for chlorophyll synthesis is present in coconut husk resulted in increase of chlorophyll content. These results are in agreement with the reports of De *et al*. (2018) [11] in cymbidium orchids and Sanghamitra *et al*. (2019) [12] in orchids.

Table 1a: Effect of growing media on growth of Anthurium cv. Tropical Red

Treatments No.	Survival percentage (%)	Plant height (cm)	Number of leaves per plant	Length of leaf (cm)	Breadth of leaf (cm)	Leaf area (cm^2)
T_1	92.00	33.17	8.60	13.76	9.10	165.87
T_2	95.33	40.99	9.80	15.00	9.65	176.33
T_3	93.33	37.86	9.00	14.69	9.40	170.83
T_4	89.33	31.13	7.13	12.81	7.89	160.21
T_5	94.67	38.41	9.13	14.93	9.43	172.33
T_6	91.33	35.53	8.80	13.91	9.30	168.01
T_7	90.00	32.23	8.53	13.43	8.85	162.70
F Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE(m) ±	0.83	0.56	0.40	0.43	0.45	0.38
CD at 5%	2.49	1.71	1.22	1.31	1.38	1.16

Table 1b: Effect of growing media on growth of Anthurium cv. Tropical red

Treatments No.	Number of suckers	Chlorophyll a	Chlorophyll b	Total chlorophyll
T_1	3.00	1.95	1.21	3.16
T_2	3.87	2.16	1.33	3.49
T_3	3.60	2.05	1.29	3.33
T_4	2.60	1.87	1.15	3.03
T_5	3.73	2.10	1.31	3.41
T_6	3.20	2.00	1.24	3.24
T_7	2.80	1.91	1.19	3.10
F Test	Sig.	Sig.	Sig.	Sig.
SE(m) ±	0.14	0.02	0.01	0.02
CD at 5%	0.42	0.05	0.04	0.06

Conclusion

Among all the growing media combinations studied, T_2 i.e., Sand + FYM+ coconut husk + brick pieces + charcoal (1:1:1:1:1) various was found best for vegetative parameters like survival percentage, plant height, number of leaves per plant, length of leaf, breadth of leaf, leaf area, number of suckers, chlorophyll a, chlorophyll b and total chlorophyll of anthurium cv. Tropical.

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