REVIEW ARTICLE

Role of Growing Medium in Yield and Quality of Anthurium: A Review

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Abstract

Anthurium belongs to family Araceae and is highly praised flowering plant for its colorful long-lasting, unique flower and shining foliage. It is also an excellent plant for interior and as cut flower, especially for flower arrangement. The most suitable part of anthurium is the modification of the leaf and botanically known as 'spathe'. Heart-shaped spathe emerges on the long flower stalk with a spadix. This plant blooms almost continuously under suitable conditions. It is epiphytic with climbing, creeping and arboreous stems including many aerial roots that aid in taping water and nourishment. Quality and productivity of anthurium flowers depend on the growing medium. Most of the anthurium growers prepare to own their growing media, but they do not know that the low productivity and quality might come from a poor potting mixture that they are using. One of the most important components of anthurium cultivation is the choice of growing substrate or medium. It is known to grow best in a well-aerated medium with good water retention capacity and drainage. A good medium needs to be able to anchor the roots and stems so that the plant will not topple over as it grows larger, yet it should provide sufficient moisture, nutrient, and aeration to the plant. The objective of this review is to present a summary of the influence of the various growing medium on the growth, flowering, productivity, and quality of anthurium grown in protected conditions. The results from the literature prove that the productivity of anthurium tends to be more in those plants which grown in the different growing medium compared to soil-grown plants.

Key Words: Anthurium, Cocopeat, Growing media, Saw dust, Vegetative growth

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Introduction

Anthurium belongs to the family 'Araceae' and is a native of Central and South America (Gantait *et al*. 2008), consists of 108 genera and approximately 3750 monocotyledonous species (Gantait and Mandal, 2010). Among the species available, the most leading and economically significant species are *Anthurium andreanum* and *Anthurium scherzerianum*, which have attractive and long-lasting inflorescence.

In India, growing of anthurium has been a hobby earlier, but at present, this crop has become an important export-oriented crop. It requires a totally organic and well-aerated growing medium with excellent water retention capacity. However, the secret of success for commercial cultivation is to have good drainage in the medium used. Growing mediums are the materials other than soils in which plants are grown *in situ*. In these materials include organic materials like compost, peat, cocopeat, tree bark, coco coir, sawdust, poultry feathers and inorganic materials like vermiculite, mineral wool, perlite and clay (Grunert *et al.,* 2008; Nair *et al*., 2011 and Vaughn *et al*., 2011). The major functions of growing media are physical support to plant, allow to maximum root growth, and provide aeration and water to plant. Various materials have been used for the preparation of growing media for anthurium cultivation. Worldwide, the raw materials for growing media to be used differ according to their availability in the local market (Schmilewski, 2009). These raw materials may be organic or inorganic, but media are often prepared from a mixture of various raw materials in order to get the proper balance of water holding capacity and air for the plants to be grown as well as for the sustainability of the growing medium (Bilderback *et al.,* 2005; and Nair *et al*., 2011). A good quality growing media needs to be capable to anchor the roots and stems so that the plants will not fall over as it grows bigger. It should also make available adequate aeration, moisture, and nutrient to the plant. Soilless media are easy to handling and may provide an excellent growing environment to the plants as compared to the soil (Bilderback *et al*., 2005 and Mastouri *et al.,* 2005). The literature on this aspect under Indian conditions is very scarce and is also not based on the cheap and locally available materials which can be used and recommended for anthurium cultivation. In this paper, an attempt has been made to review the available literature

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on the influence of growing medium on growth, flowering, and yield of anthurium is reviewed under appropriate heads.

Effect of various growing mediums on vegetative growth

A trial was conducted with brown coal media for anthurium in Poland and observed that growth of root was found better in coal media as compared to the soil (Guminska *et al.,* 1973). Pot trials conducted using different substrates comprising of low peat, high peat, sand, loam, crushed bricks, sphagnum moss and perlite in different combination and proportions showed that the best substrates for anthuriums were generally those in which the basic component was high peat. The tallest plants with the highest number of leaves were observed in a treatment combination of high peat, perlite, and sphagnum moss in 2: 1: 1 ratio (Turski *et al*., 1983). Holcroft and Laing (1995) reported that among the different grade of pine bark available in South Africa, anthurium grown in coarse potting mix performed best. Among the media soilrite is the best for *in-vitro* establishment of anthurium plantlets (Ajithkumar and Nair, 1996).

Jawaharlal *et al*. (2001) tried six types of potting media like farmyard manure (FYM), river sand, loam soil, leaf mold, cocopeat, and coconut fiber, and their combination for anthurium cv. temptation under net house. The plants are grown in cocopeat medium as well as in a combination of leaf mold and cocopeat produced the highest number of branches and suckers per plant. The potting media consisting of coffee cherry husk: FYM: Sand: Soil @ 2: 1: 1: 1 proportion is most suited for commercial production of anthurium cv. Singapore Hybrid, in terms of vegetative growth (Dhananjaya and Sulladmath, 2003). Many leaves per plant, plant height, and leaf area were highest when the plants were grown in coir pith medium. The number of suckers per plant during the second year of the experiment was highest in coir pith medium (Gowda *et al*., 2005). Coconut coir pieces produced a significantly maximum number of leaves/plant, while the leaf sheath length and leaf area were significantly higher in coconut coir pieces + brick piece + wooden characoal followed by coconut coir piece + wooden characoal. Brick piece and garden soil alone as substrate responded poorly in the anthurium cv. Tropical Red (Pawar *et al*., 2006). Coir pith resulted in the greatest number of leaves, plant height, number of leaves, length of leaf and width, canopy height and width, number of suckers. Soil was less suitable as a medium with regard to vegetative characters (Srinivasa, 2006). The coir pith produced a maximum number of leaves, suckers and leaf area and minimum number of leaves, suckers and leaf area per plant were produced in soil media in anthurium (Gowda and Ramakrishna, 2009). Four types of substrate viz. sand + coconut fiber, sand + cattle manure, sand + coconut fiber + manure and commercial substrate Plantmax were tested. The results showed that Plantmax and sand + coconut fiber + cattle manure had superior performance than sand + coconut fiber on the number of leaves/plant and average leaf area. The substrate that generated the best result was the commercial substrate (Plantmax), followed by a mixture of sand + coconut fiber + cattle manure (Freitas, 2010). Among the growing media treatments, sand + coir pith compost was recorded maximum plant height, leaf area, and petiole length at the fourth week after emergence (Basheer and Thekkayam, 2012).

Effect of Growing Medium on Flowering, Yield and Quality Parameters

Higaki and Poole (1978) suggested that sugarcane bagasse was the best media for stalk length, flower size and production of flowers, followed by wood shavings and black cinder for anthurium cv. 'Ozaki Red.' Nikolova and Zafirova (1980) reported that a medium containing peat, pine bark and perlite in the ratio 2: 1: 1 was the most suitable medium, producing top grade flower and higher yields. Higaki and Imamura (1985) reported that flower stem length and flower yield was higher in plants grown in sugarcane bagasse as compared to plants grown in cinder medium. The plants grown in cocopeat medium as well as in a combination of leaf mold and cocopeat produced number of flowers per plant, early flowering, and longest flower longevity. The flower quality characters like spathe length, spathe width, spadix length and flower stalk length were also significantly highest in the plants grown in cocopeat as well as its combination with leaf mold in anthurium cv. Temptation (Jawaharlal *et al*., 2001). The potting media consisting of coffee cherry husk: FYM: Sand: Soil @ 2: 1: 1: 1 proportion is most suited for commercial production of anthurium cv. 'Singapore Hybrid' in terms of the early flowering, longest flower stalk, maximum spathe area, and more yield flowers/plant(Dhananjaya and Sulladmath, 2003). Coir pith produced maximum number of flowers, stalk length and spathe size while soil media recorded significantly less number of flowers, shorter stalk length and smaller spathe size in anthurium cv. 'Lady Jane' (Gowda *et al*., 2005). The mean size of flower was recorded maximum in coconut coir pieces + wooden charcoal, while mean length of flower stalk were maximum in wooden charcoal and maximum vase life in the substrate coconut coir pieces in anthurium cv. 'Tropical Red' (Pawar *et al*., 2006). Coir pith resulted in the greatest spathe width, spadix length and girth and number of flowers (Srinivasa, 2006). Coir pith produced maximum flowers, stalk length and spathe size in anthurium (Gowda and Ramakrishna, 2009) and took minimum days to flower, the the highest number of flowers, biggest flower and longest flower stalk of anthurium were recorded in FYM + cocofibre media (Kalirana and Dubey, 2009). The minimum days to flowering were recorded in growing mixture of saw dust + brick pieces + wooden charcoal + soil + sand + FYM, while soil + sand + FYM required maximum days to flowering after planting. Flower quality parameters viz. length of stalk, length of spathe, width of spathe and maximum flowers/plant were observed in growing medium containing saw dust, brick pieces, wooden charcoal, soil, sand and FYM as compared to soil + sand + FYM medium combination (Singh, *et al.,* 2011)

Effect of Growing Medium on Longevity of Flower

Jawaharlal *et al*. (2001) tried different growing media and found that the coco peat in combination with FYM increased inflorescence longevity in anthurium. The maximum vase life (14.40 days) was noted in the substrate coconut coir pieces in anthurium cv. 'Tropical Red' (Pawar *et al*., 2006). Flowers with extended vase life (14.53 days) were recorded from anthurium plants grown in saw dust + brick pieces + wooden charcoal + soil + sand + FYM medium. Whereas, minimum vase life was observed in plants grown in soil + sand + FYM medium (Singh *et al*., 2011).

Effect of Growing Media Components on Physical and Chemical Properties of the Growing Medium

Mixing of pine bark in proportions of 25, 50 and 75% with sand resulted in a curvilinear increase in bulk density of the media. The sand coarse bark media containing 50 or 75 per cent sand had a greater bulk density than comparable media containing sand fine bark (Brown and Pokorny 1975). The different organic wastes as components in pot mixture and found that saw dust medium had the lowest soluble salt concentration and noticed an increase in aeration by the addition of saw dust to soil media (Goh and Hayens , 1977). Coir pith addition had pronounced effect on Electric conductivity (EC). Addition of coir pith had brought down the EC from 3.2 to 0.7 dSm^{-1} in saline alkali soil (Clarson *et al*., 1983). Reduction in soil pH was noticed with the addition of raw coir pith in saline alkali soils (Ramaswamy *et al.,* 1983).

EC value of 1.6, 1.7 and 1.4 dSm^{-1} for coir sedge peat and sphagnum peat respectively and reported that there was no difference in pH between the sedge and Coir based media used for growing of ornamentals (Meerow 1994 and the uncomposted bark and half composted bark had superior physical properties for anthurium production (Holcroft and Laing 1995). Saravanan and Nambisan (1995) observed that the addition of coir pith, the bulk density decreased and this would result in an increase in aeration and porosity of media. The bulk density and pH of medium decreased as the content of rice hulls increased in the medium (Song CheonYaung *et al*., 1996). There was an increase in pH when peat was replaced with composted waste or rubber tyre chips and the increase in pH was proportion to the amount of peat replaced(Jaruis *et al*., 1996). Saravanan and Baskar (1997) stated that the inclusion of Coir pith in potting media increased water holding capacity. They found that the water holding capacity of pure coir pith was 863 per cent on dry weight basis. The superior performing potting media coffee cherry husk: FYM: soil: sand in 2: 1: 1: 1 ratio for anthurium recorded a pH of 5.2 (acidic) reported by Dhananjaya and Sulladmath, 2003. Use of compost remarkably affected all the physical and chemical attributes of growing media. The EC, pH and Bulk density generally increased with increasing compost content in growing medium (Grigatti *et al*., 2007). Leaf manure mixture (silt + leaf manure + coconut compost in 1:1:1 ratio) had the most appropriate physical properties while, leaf manure had high EC i.e. salinty (Riaz *et al*., 2008). Among the various combinations of growing medium, significantly lowest bulk density and maximum pore space were recorded in cocopeat + brick pieces + wooden charcoal + soil + sand + FYM (Singh *et al*, 2011).

Effect of Growing Medium on Nutrient Availability

According to Ramaswamy *et al.* (1983) incorporation of coir pith improves the total N and N balance in the soil. Improvement in total nitrogen in sodic soil by the addition of coir pith was also reported by Ramaswamy and Kotharadaraman (1985). Compost amended growing media offered clear advantages for improved plant nutrition while, evaluating four media *viz*. Rockwool, white peat, rice chaff and compost (Pinamonti *et al*.,1997).Baskar and Saravanan (1997) reported that increasing proportions of coir pith addition to soil in the preparations of potting mixtures increased the N content of the media. The organic substances were higher in nutrient content then inert substances used for experiment. Among all the substances (saw dust, flyash, bagasse, poultry litter, scum, Rock sand and chipping 3/8), poultry litter was recorded highest phosphorus level when evaluated by Nowbuth, 2001. Dhananjaya and Sulladmath (2003) carried out an experiment to assess the effect of various growing media and their nutrient status on growth of anthurium cv. 'Singapore Hybrid'. The best growing media for improved suckering and early flowering possessed highest P_2O_5 (163.27 kg/acre), iron (Fe^{2+}) content (87 ppm) and moderate manganese level (27 ppm). Nutrient contents increased with increased cocopeat proportion (Aswath and Pillai, 2004). Leaf manure mixture viz. silt + leaf manure + coconut compost had a high level of nutrition (NPK).(Riaz *et al*., 2008). All the amendments (garden soil, FYM, vermicompost, Samridhi (soil conditioner) and saw dust) showed the increasing trend in available N, P and K content in all the growing media (Sindhu *et al.* , 2008).

Conclusion

The present study validates the fact that appropriate selection of growing medium contents for anthurium cultivation is very essential for growth, flowering, yield and marketing point of view. Growing medium must be cost effective and easily available in local market and ensure quality of produce. Anthurium performed well in organic materials containing growing media (coco husk, cocopeat, leaf mould, saw dust, wooden charcoal etc.) as compared to soil in terms of plant growth, flowering, yield and quality.

References

Ajithkumar, P.V. and Nair, S.R. (1996). Establishment and hardening of *in-vitro* derived plantlets of Anthurium andreanum. Journal of Ornamental Horticulture, 4 (1-2): 9-12.

Aswath, C. and Pillai, P. (2004). Effect of cocopeat medium and electrical conductivity on production of gerbera. Journal of Ornamental Horticulture, 7 (1): 15-22.

Basheer, S.N. and Thekkayam, S.G. (2012). Effect of growing media and organic nutrition on vegetative growth in Anthurium

plants (Anthurium andreanum cv. Tropical). Asian Journal of Horticulture, 7(2): 354-358.

Baskar, M. and Saravanan, A. (1997). Effect of coir pith based potting mix and methods of fertilizer application on tomato. Madras Agric J., 84 (8): 476-480.

Bilderback, T.E.; Warren, S.L.; Owen Jr., J.S. and Albano, J.P. (2005). Healthy substrates need physicals too. Hort. Technology, 15: 747–751.

Brown, E.F. and Pokorny, F.A. (1975). Physical and chemical properties of media composed of milled pine bark and sand. J. Amer. Soc. Hort. Sci., 100: 119-121.

Clarson, D.; Ramaswamy, P.P. and SreeRamulu, U.S. (1983). Efficient utilization of farm and industrial based waste materials for reclamation of saline sodic soils. In: Proceeding National seminar on utilization of organic wastes. AC and RI, Madurai, pp. 117-119.

Dhananjaya, M.V. and Sulladmath, V.V. (2003). Assessment of substrate media among tissue culture derived plants of Anthurium andreanum cultivar 'Singapore Hybrid'. Journal of Ornamental Horticulture, 6 (4): 310-315.

Freitas, R. M. O., Silva Neto, R. V.; Dombroski, J. L. D.; Nogueira, N. W. and Camara, F. A. (2010). Test of different substrates for growing seedlings of anthurium affin Schott. Green Journal of Agroecology and Sustainable Development, 5 (1): 96-100.

Ganait, S. and Mandal, N. (2010). Tissue culture of Anthurium andreanum: A significant review and future prospective. International Journal of Botany, 6(3): 207-219.

Gantait, S.; Mandal, N.; Bhattacharyya, S. and Das, P.K. (2008). *In-vitro* mass multiplication with pure genetic identity in Anthurium andreanum L. Plant Tissue Culture Biotech, 18:113-122.

Goh, K.M. and Haynes, R.J. (1977). Evaluation of potting media for commercial nursery production of container grown plants. New Zealand J. Agric. Res., 20: 363-370.

Gowda, C.J.V.N. and Ramakrishna, B.M. (2009). Evaluation and effect of growing media, biofertilizers and growth regulator on growth and flowering in anthurium. Book of abstract, National Conference on Floriculture for Livelihood and Profitability on 16-19 March, 2009 at IARI, New Delhi, pp. 1-5.

Gowda, C.J.V.N.; Gowda, M.C. and Gowda, A.P.M. (2005). Standardization of growing media for flower production and flower characteristics in anthurium cv. 'Lady Jane'. Crop Research, 30 (3): 414-41.

Grigatti, M.; Giorgioni, M. E.; Cavani, L. and Ciavatta, C. (2007). Vactor analysis in the study of the nutritional status of Philodendron cultivated in compost-based. Scientia Horticulturae, 112: 448-455.

Grunert, O.; Perneel, M. and Vandaele, S. (2008). Peat-based organic growbags as a solution to the mineral wool waste problem. Mires and Peat, 3: 1–5.

Guminska, Z.; Graoz, N.M.; Lukasiewicz, B. and Slawska, M. (1973). The suitability of brown coal from Turow and Konin mines as a substrate in hydroponic culture. Acta Agrobotanica, 26 (1): 63-88.

Higaki, T. and Imamura, J.S. (1985).Volcanic black cinder as a medium for growing anthuriums. Hort. Science, 20 (2): 298-300.

Higaki, T. and Poole, R.T. (1978). A media and fertilizer study in anthurium cv. Ozaki Red. J. Amer. Soc. Hort. Sci., 103 (1): 98-100.

Holcroft, D.M. and Laing, M.D. (1995). Evaluation of pine bark as a substrate for anthurium production in South-Africa. Acta Horticultrae, 401 : 177-184.

Jaruis, B.R.; Calkins, J.B. and Swanson, B.T. (1996). Composted and rubber type chips as peat substitutes in nursery container media: effects of chemical and physical media properties. Journal of Environmental Horticulture, 14 (3): 122-129.

Jawaharlal, M; PremJoshua, J.; Arumugam, T.; Subramanian, S. and Vijaykumar, M. (2001). Standardization of growing media for anthurium (Anthurium andreanum) cv. 'Temptation' under shade net house. South Indian Horticulture, 49: 323-325.

Kalirana, K and Dubey, P. (2009). Effect of some substrate mixtures on growth and flower production in anthurium grown under protected structure with partially controlled environmental condition. Book of Abstract, National Conference on Floriculture for Livelihood and Profitability on 16-19 March, 2009 at IARI, New Delhi, pp. 132-133.

Mastouri, F., Hassandokht, M. R., Padasht Dehkaei, M. N. (2005).The effect of application of agricultural waste compost on growing media and greenhouse lettuce yield. Acta Horticulturae, 697: 153–158.

Meerow, A.W. (1994). The potential of coir (coconut mesocarp pith) as a peat substitute in container media. Hort. Science, 29 (5): 237-239.

Nair, A.; Ngouajio, M. and Biernbaum J. (2011). Alfalfa-based organic amendment in peat-compost growing medium for organic tomato transplant production. Hort Science, 46: 253–259.

Nikolova, N. and Zafirova, P. (1980). Use of different substrates in Anthurium andreanum growing. Nauchnitrudove, Vissh-Selskostopanski Institute, Vasilkolasov, 25 (2): 99-103.

Nowbuth, R. (2001). Alternate substrates for anthurium production. AMAS 2001, Food and Agricultural Research Council, Reduit, Mauritius, pp. 45-51.

Pawar, G.M.; Patil, M.T. and Gaikwad, A.M. (2006). Effect of different substrates on Anthurium andreanum. Abstract of National Symposium on Ornamental Bulbous Crops on 5-6 December, 2006, SVBPUAT, Meerut, pp. 54.

Pinamonti, F.; Zanella, T. and Zorzi, G. (1997). Composts and jute sacks for soilless cultivation. Informatore Agario, 52: 38-46.

Ramaswamy, P.P. and Kotharadaraman, G.V. (1985). Role of coir pith on yield and uptake of rice in a sodic soil. Proceeding Workshop on Coir Research, Coir house, Cochin

Ramaswamy, P.P.; SreeRamulu, U.S. and Kothandaraman, G.V. (1983). Coir and sugar factory wastes in the reclamation of sodic soils. In: Proceeding of National Seminar on Utilization of Organic Wastes, AC and RI, Madurai, pp. 120-122.

Riaz, R.; Arshad, M., Younis, A.; Raza, A. and Hameed, M. (2008). Effect of different growing media on growth and flowering of Zinnia elegans Cv. 'Blue point'.Pak. J. Bot., 40 (4): 1579-1585.

Saravanan, A. and Baskar, M. (1997). Changes in the properties of the potting medium and yield of vegetable cowpea as influenced by coir pith and methods of fertilizer application. Madras Agriculture Journal, 84 (8): 471-475.

Saravanan, A. and Nambisan, K. M. P. (1995). Uttilization of coir pith as pot culture medium for Begonia semperflorens. Madras Agriculture Journal, 82 (11): 587-589.

Schmilewski, G. (2009). Growing medium constituents used in the EU. Acta Horticulturae, 819:3345.

Sindhu, S.S.; Gholap, D.B. and Singh, M. R. (2008). Effect of media amendment on physico-chemical properties and leaf nutrient concentration on gerbera cv. 'Tesrina'. In: Book of Abstracts,

National Symposium on Recent Advances in Floriculture on 4-6 March, 2008 at NAU, Navsari, Gujarat, pp. 53.

Singh, P., Dhaduk, B. K. and Chawla, S. L. (2011). Standardization of growing medium for anthurium cv. Flame under protected conditions. Indian Journal of Horticulture, 68 (1): 86-90.

Song-Cheon Young; Park-Jinmyeon; Choi-JongMyung; Bang-Changseok and Lee-Jeongsik (1996). Effect of composted rice hull on physico- chemical properties of growing media and growth of Petunia hybrida. Journal of the Korean Society for Horticultural Science,37 (3): 451-454.

Srinivasa, V. (2006). Effect of media on growth and flowering of Anthurium andreanum. Environment and Ecology, 24 (Special 2): 257-259.

Turski, R.M.; Flis-Bujak, M. and Martyn, W. (1983). Effect of different contents of organic matter on substrate properties and growth of Anthurium andreanum. Praceistitutu Sadownictwa, Kwiaciarstwawskierniewlcach, 8: 123-132.

Vaughn, S. F.; Deppe, N. A.; Palmquist, D. E. and Berhow, M. A. (2011). Extracted sweet corn tassels as a renewable alternative to peat in greenhouse substrates. Industrial Crops and Products, 33: 514–517.