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A STUDY ON HOW NUTRIENTS AND SHADE AFFECT THE GROWTH OF ANTHURIUM CUT FLOWERS

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Abstract

The effect of shade, growth medium, and their interaction on anthurium cut flower output was investigated using a Factorial totally randomised block design with 3 replications. Three levels of shade (85%, 75%, and 65%) and four combinations of growing media (coco peat + coconut husk, coco peat + brick pieces, coconut husk + brick pieces, red earth + sand (control), and red earth + sand at a ratio of 1:1) were used as main factors in this experiment, with a total of twelve interaction treatments. The per se and interaction impacts of shade and growing medium on the development, physiology, flowering, yield, quality characteristics, and nutrient content of anthurium plants were substantially impacted by the treatments.

Keywords: *Nutrients, Shade Affect, Growth, Anthurium Cut Flowers.*

1. Introduction

Many nations cultivate flowers for commercial reasons, making floriculture a burgeoning and competitive business. Many nations now include it among their most lucrative agricultural sectors. Flowers are in high demand in both the domestic Indian market and abroad. Roses, chrysanthemums, carnations, gladiolus, lilies, orchids, grebera, and anthuriums are among the most sought-after blooms. The cultivation and sale of anthuriums has proven to be a successful business due to the plant's durability and the rising demand for export and local consumption.[1]

Because of their greater yields per area and their lovely, long-lasting blossoms, anthuriums are becoming more popular. They have become one of the world's most popular commercial decorative crops. Because of the strong impact and long-lasting features of flowers, they are often used by florists. In average circumstances, cut flowers retain their beauty for around two weeks. It's the symbol of the island country of Mauritius. United States, United Kingdom, Germany, Netherlands, and United Arab Emirates were the top five markets for Indian floriculture exports in 2013–14. About 66% of the world's total flower output is grown in the Netherlands, making it the world's greatest flower grower.[2]

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Anthurium is the biggest genus in the arum family, Araceae, with over 800 species. Mostly found in the tropics, its more than a thousand species span over a hundred different genera. The evergreen members of the genus Anthurium are indigenous to the tropical regions of Central America, South America, and the West Indies, where they thrive in a wide range of elevations and soil types. The genus is endemic to the Americas, namely the Caribbean and the northern sections of Mexico and Argentina. Heinrich Wilhelm Schott organised the 183 species then known to science into 28 categories in his work "Prodromus Systematis Aroidearum" published in 1860. The genus was reexamined in 1905, and its 18 divisions were described. The genus Anthurium gets its name from the Greek words for flower ('anthos') and tail ('oura'), which together allude to the spadix. For this reason, anthurium is also known as 'tail flower,' 'flamingo flower,' and 'laceleaf. 'Rat tail' is a common name for a subset of commercially cultivated anthurium plants distinguished by their inflorescences' long spadix and short, unremarkable spathe.[3-4]

There are two main families of anthuriums used in cultivation: Calomystrium and Porphyrochitonium. The best-known cultivated anthurium species, Anthurium andraeanum, belongs to the section Calomystrium. Anthurium is a slow-growing perennial that is planted for its magnificent cut flowers and lovely leaves in shaded, humid environments like those found in tropical woods. Flowers that have been cut off of their plants include the inflorescences or blossoms, as well as sometimes other portions of the plant that are still linked to it, but not the soil or the plant's roots.[5]

A vast number of pistils, each encircled by four stamens, characterise the 'real' blooms, which are only around 3 mm in diameter and form densely on a spike along a fleshy shaft called a spadix. There is a wide range of scents released by the blooms. The spadix initially produces a female phase, and then, after approximately a month, a male phase, making the blooms bisexual, protogynous, and hermaphrodite. Because of this, anthuriums need cross-pollination to produce fruit. In the wild, pollination is influenced by insects including bees, beetles, flies, and ants. Depending on the species, the infructescence may be pendent or erect, and the fruit will be a berry with one to numerous seeds. Six months following pollination, the spadix's bottom upward develops into colourful berries. Anthurium berries may be a variety of colours, including red, black, red and black, and even bicolor and variegated varieties. The seeds in the luscious berries may be sown to produce both homozygous and heterozygous offspring.[6-7]

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2. Literature review

Anburani, A. and H. Vidhyapriyadharshini. (2019) Numerous studies have been conducted on the enhancement, production, and use of anthurium cut flowers, cut foliages, and potted plants by botanists, floriculture scientists, and commercial enterprises. Anthurium cultivation for the pre- and post-floral phases requires proper formulation of shade, medium, nutrition, and growth management for new varieties, growing purpose, and geographic location to provide high-quality floricultural products.[8]

Arumugam, T and M. Jawaharlal. (2018) The ideal growing conditions for an Anthurium are a warm, damp greenhouse, away from direct sunshine. Maximum growth occurs between 18 and 21 degrees Celsius, while short-term exposure to temperatures below 10 degrees Celsius is not recommended. Anthuriums need high relative humidity in order to thrive and bloom. The ideal relative humidity is 80 percent. However, increased humidity had only a little impact on plant growth. It seems to reason that extensive blossoming requires bright yet filtered light.[9]

A.D. Ashok and P. Rengasamy. (2017) Anthuriums are shade-loving plants, meaning they thrive when exposed to between 70 and 85 percent shade, or between 18,000 and 25,000 Lux of light. They need a relative humidity of between 50 and 80%. The growth, development, and post-harvest behaviour of anthurium are all greatly impacted by temperature. The optimal growing conditions for this plant are between 18 and 28 degrees Celsius. Flowers bloom more profusely when exposed to bright, filtered light. The anthurium plant's flowering was significantly affected by the light, shadow, and temperature conditions.[10]

F.L. Olivares and R. Bressan Smith. (2016)coco peat's high nutrient and water retention capacities have made it a popular choice as a growing medium. The success of different plant varieties may be traced back to how their genes and the coco peat they were grown in interacted. Soilless culture has been utilised effectively for many decades with the goals of increasing output intensity, decreasing cultivation costs, and increasing agricultural profits. High porosity and adequate aeration and water retention are desirable qualities in a medium. Many different natural derivatives were tested in an attempt to economically cultivate anthurium.[11]

H.E.P. Martinez and V.H.A. Venegas. (2015) Coco peat is a byproduct of the coconut processing industry and is also known as coir pith, coir fibre pith, coir dust, and coir. Coir

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dust, also known as coir fibre pith, is extracted from coconut husk during the procedure that yields coco peat. The coco peat acts like a sponge and absorbs a lot of water. As a soilless substrate for plant cultivation or as a substitute for conventional peat in soil mixes, it is widely utilised. To successfully cultivate anthurium for commercial purposes, one must use optimal growth conditions.[12]

3. Methodology

The study was conducted at a floriculture farm in Kottarakara, Kollam Dist, Kerala state and it looked into the effect of shade, media, and nutrients on the production of anthurium cut flowers.

3.1 Materials

3.1.1 Location of the experimental area

The location of the experiments is in the Kollam district of Kerala state, India, around 72 kilometres from the capital city of Thiruvananthapuram at 9° 0' 0" North latitude and 76° 48' 0" East longitude, at an elevation of 41 metres above mean sea level.

3.1.2 Planting material

Anthurium (Anthurium andreanum L.) of the 'Tropical' variety was employed in the study. The spathe is a vibrant scarlet. Spathe has a slick, blistering, leathery, and undulating appearance. The spadix is a bright, sunny yellow. The Floratech floriculture unit was contacted, and 12 inch pots with four-month-old tissue cultivated plants of uniform size were obtained.

3.2. Methods

Experiment: I - Anthurium andreanum cv. Tropical yield affected by light levels, soil type, and environmental interactions.

3.2.1 Experimental design and details

Crop	:Anthuriumandreanum
Variety	: Tropical
Design	: Randomized whole block design with factors (FCRD)

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Factors 2

Replications 3

Plantsperreplication 5

Durationofstudy : 16months

Shade levels: 3

S_1 – 85 %shadeS_2 –
75 %shadeS_3– 65
%shade

Growing media: 4

M_1-Cocopeat+coconuthuskM_2-
Coco peat +brick pieces
M_3 - Coconut husk + brick piecesM_4
-Control (soil media)

3.3 Statistical analysis

The data was statistically analyzed using the prescribed methodology. The crucial difference was calculated at a 5% (0.05) level of confidence. Anthurium andreanum cv. Tropical growth and development in response to nutrient addition, growth regulators, and their interplay.

4. Results

The current research analysed data from two tests on a floriculture farm in Kottarakara, Kollam Dist, Kerala between 2018 and 2020.

4.1. Experiment I - effect of shade, growing media and their interaction on the production of anthurium andreanum cv. Tropical

Table 4.1 displays information collected at 120, 240, 360, and 480 days after planting on the effects of different levels of shadow and different growth medium on plant height.

Per se impacts of shade and growth medium considerably impacted the plant height of anthurium throughout all phases. Plants grown in S2 (75% shade) reached a maximum height of 15.28 cm at 120 DAP, 26.06 cm at 240 DAP, 32.64 cm at 360 DAP, and 44.83 cm at 480 DAP. S3 (65% shade) produced the shortest plants at 120 DAP (20.43 cm), 240 DAP (24.94 cm), 360 DAP (32.88 cm), and 480 DAP (32.88 cm).

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Table 4.1: Anthurium andreanum cv. Tropical plant height (in centimetres) as a function of shade, growth medium, and the relationship between the two

TREATMENTS	Plant height(cm)			
	120DAP	240DAP	360DAP	480DAP
Shade(S)Mean				
S_1-85%shade	13.53	23.49	29.13	39.38
S_2-75%shade	15.28	26.06	32.64	44.83
S_3-65%shade	11.44	20.43	24.94	32.88
SE(d)	0.19	0.27	0.37	0.59
CD(p=0.05)	0.39	0.56	0.77	1.21
Media(M)Mean				
M_1-Cocopeat+coconut husk	14.51	24.92	31.10	42.45
M_2-Cocopeat+brickpieces	13.92	24.06	29.91	40.62
M_3-Coconuthusk+brickpieces	13.10	22.87	28.28	38.06
M_4-Soilmedia	12.12	21.47	26.34	34.98
SE(d)	0.22	0.31	0.43	0.68
CD(p=0.05)	0.45	0.65	0.89	1.40
SxMInteraction				
$S_1 \times M_1$	14.80	25.37	31.69	43.35
$S_1 \times M_2$	13.90	24.03	29.87	40.56
$S_1 \times M_3$	13.10	22.87	28.28	38.07
$S_1 \times M_4$	12.30	21.70	26.67	35.55
$S_2 \times M_1$	16.55	27.91	35.19	48.82
$S_2 \times M_2$	15.70	26.67	33.49	46.16
$S_2 \times M_3$	14.82	25.39	31.72	43.39
$S_2 \times M_4$	14.04	24.27	30.18	40.97
$S_3 \times M_1$	12.18	21.49	26.41	35.19
$S_3 \times M_2$	12.16	21.46	26.38	35.16
$S_3 \times M_3$	11.39	20.34	24.83	32.73
$S_3 \times M_4$	10.03	18.45	22.16	28.42
SE(d)	0.38	0.54	0.75	1.17
CD(p=0.05)	0.77	1.12	1.55	2.42

Plant height was considerably impacted by the combination of shade and growth medium treatments (Table 4.1). S2 M1 (75% shade + coco peat & coconut husk) produced the tallest plants, measuring 16.55, 27.91, 35.19, and 48.82 cm at 120, 240, 360, and 480 DAP, respectively. This was followed by S2 M2 (75% shade + coco peat & brick fragments). Plants grown in S3 M4 (65% shade + soil medium) reached a minimum height of 10.03 cm at 120 DAP, 18.45 cm at 240 DAP, 22.16 cm at 360 DAP, and 28.42 cm at 480 DAP.

All treatments outperformed the control group significantly. 7Per se impacts of shade and growth medium greatly affected plant spread over the whole crop life cycle (Table 2). Maximum plant growth was seen in S2 (75% shade) at 120 DAP (31.75 cm2), 240 DAP (44.32 cm2), 360 DAP (52.02 cm2), and 480 DAP (67 cm2). S3 (65% shade) had the shortest plants, with a mean square footage of 22.47 cm2 at 120 DAP, 30.81 cm2 at 240 DAP, 36.88 cm2 at 360 DAP, and 50.26 cm2 at 480 DAP.

Table 4.2: Anthurium andreanum cv. Tropical plant growth (cm2) in response to shade, growing medium, and the interplay of the two

TREATMENTS	**Plantspread(cm^2)**			
	120DAP	**240DAP**	**360DAP**	**480DAP**
Shade(S)Mean				
S_1-85%shade	27.52	38.16	45.12	59.36
S_2-75%shade	31.75	44.32	52.02	67.00
S_3-65%shade	22.47	30.81	36.88	50.26
SE(d)	0.46	0.67	0.75	0.82
CD(p=0.05)	0.95	1.38	1.54	1.69
Media(M)Mean				
M_1-Cocopeat+coconut husk	29.91	41.65	49.02	63.65
M_2-Cocopeat+brickpieces	28.50	39.59	46.71	61.08
M_3-Coconuthusk+brickpieces	26.50	36.68	43.45	57.51
M_4-Soilmedia	24.07	33.13	39.49	53.25
SE(d)	0.53	0.77	0.86	0.94
CD(p=0.05)	1.09	1.59	1.78	1.95
SxMInteraction				
$S_1 \times M_1$	30.59	42.63	50.13	64.92
$S_1 \times M_2$	28.45	39.52	46.63	61.00

$S_1 \times M_3$	26.50	36.68	43.46	57.52
$S_1 \times M_4$	24.53	33.82	40.25	54.01
$S_2 \times M_1$	34.86	48.85	57.09	72.55
$S_2 \times M_2$	32.78	45.82	53.70	68.84
$S_2 \times M_3$	30.63	42.68	50.18	64.99
$S_2 \times M_4$	28.73	39.92	47.10	61.61
$S_3 \times M_1$	24.29	33.48	39.85	53.47
$S_3 \times M_2$	24.26	33.44	39.81	53.41
$S_3 \times M_3$	22.37	30.69	36.72	50.04
$S_3 \times M_4$	18.94	25.64	31.13	44.12
SE(d)	0.92	1.34	1.49	1.64
CD(p=0.05)	1.89	2.76	3.08	3.38

Table 4.3: Anthurium andreanum cv. Tropical flower visual quality as a function of shadow, growth medium, and their interaction

TREATMENTS	Visual scoring
Shade(S)Mean	
S_1-85%shade	6.67
S_2-75%shade	7.63
S_3-65%shade	5.52
SE(d)	0.10
CD(p=0.05)	0.21
Media(M)Mean	
M_1-Cocopeat+coconut husk	7.21
M_2-Cocopeat+brickpieces	6.89
M_3-Coconuthusk +brickpieces	6.43
M_4-Soilmedia	5.89
SE(d)	0.12
CD(p=0.05)	0.25
SxMInteraction	
$S_1 \times M_1$	7.37
$S_1 \times M_2$	6.88
$S_1 \times M_3$	6.43
$S_1 \times M_4$	5.99

$S_2 \times M_1$	8.34
$S_2 \times M_2$	7.87
$S_2 \times M_3$	7.38
$S_2 \times M_4$	6.95
$S_3 \times M_1$	5.93
$S_3 \times M_2$	5.92
$S_3 \times M_3$	5.49
$S_3 \times M_4$	4.72
SE(d)	0.21
CD(p=0.05)	0.43

4.2. Experiment II - effect of nutrients, growth regulators and their interaction on the production of Anthurium andreanum CV. Tropical

Table 4.4 displays information collected at 120, 240, 360, and 480 DAP on the effects of different nutrients, growth regulators, and their interaction treatments on plant height.

The per se effects of nutrients and growth regulators on anthurium plant height were substantial throughout all phases. The largest plant height was obtained in N3 (humic acid) at 120 DAP, followed by 39.25 cm at 240 DAP, 50.58 cm at 360 DAP, and 60.81 cm at 480 DAP. At 120, 240, 360, and 480 days after planting (DAP), N4 (control) plants were the shortest at 18.85, 31.64, 41.67, and 50.95 cm.

Maximum plant height was reported in G1 (gibberellic acid) at 120, 240, 360, and 480 DAP, with values of 25.47, 38.87, 50.14, and 60.32 cm, respectively. G3 (benzyladenine) was the second-highest-performing growth regulator. G4 (control) plants reached a minimum height of 16.75 cm at 120 DAP, 29.14 cm at 240 DAP, 38.66 cm at 360 DAP, and 47.53 cm at 480 DAP.

Table 4.4: Height (in centimetres) of Anthurium andreanum cv. Tropical as a function of nutrients, growth regulators, and their interaction

TREATMENTS	**Plantheight(cm)**			
	120DAP	**240DAP**	**360DAP**	**480DAP**
Nutrients(N)Mean				
N_1-Seaweedextract	21.43	34.38	44.84	54.43
N_2-Panchagavya	23.62	36.80	47.70	57.61
N_3-Humicacid	25.82	39.25	50.58	60.81

N_4-Control	18.85	31.64	41.67	50.95
SE(d)	0.26	0.28	0.33	0.36
CD(p=0.05)	0.53	0.57	0.66	0.73
Growthregulators(G) Mean				
G_1-Gibberellicacid	25.47	38.87	50.14	60.32
G_2-Naphthalene acetic acid	23.75	37.03	48.00	57.97
G_3-Benzyladenine	24.32	37.64	48.71	58.75
G_4-Control	16.75	29.14	38.66	47.53
SE(d)	0.52	0.56	0.65	0.72
CD(p=0.05)	1.07	1.14	1.33	1.46
NxGInteraction				
$N_1 \times G_1$	24.24	37.52	48.56	58.58
$N_1 \times G_2$	21.93	35.05	45.69	55.42
$N_1 \times G_3$	23.09	36.29	47.13	57.01
$N_1 \times G_4$	16.47	28.64	37.99	46.70
$N_2 \times G_1$	26.77	40.35	51.90	62.29
$N_2 \times G_2$	24.48	37.90	49.05	59.17
$N_2 \times G_3$	25.63	39.13	50.48	60.74
$N_2 \times G_4$	17.58	29.83	39.37	48.22
$N_3 \times G_1$	29.37	43.25	55.32	66.11
$N_3 \times G_2$	27.04	40.75	52.42	62.92
$N_3 \times G_3$	28.20	42.00	53.86	64.51
$N_3 \times G_4$	18.67	31.00	40.73	49.71
$N_4 \times G_1$	21.49	34.35	44.78	54.31
$N_4 \times G_2$	19.25	31.95	41.99	51.25
$N_4 \times G_3$	20.35	33.13	43.36	52.76
$N_4 \times G_4$	14.29	27.11	36.56	45.49
SE(d)	0.52	0.56	0.65	0.72
CD(p=0.05)	1.07	1.14	1.33	1.46

All treatments outperformed the control group significantly. Per se impacts of nutrients and growth regulators at all stages of the crop greatly impacted plant spread (Table 4.5). Maximum plant expansion was seen in N3 (humic acid) at 120, 240, 360, and 480 DAP, with values of 46.70, 60.79, 71.83, and 84.14 cm2 at each time point. At 120, 240, 360, and 480 days after planting (DAP), N4 (control) plants were the shortest at 37.78, 52.51, 61.27, and 74.22 cm2 correspondingly.

Maximum plant spread was seen in G1 (gibberellic acid) at 120, 240, 360, and 480 DAP, with values of 46.25, 60.38, 71.31, and 83.68 cm2; G3 (benzyladenine) was second.At 120, 240, 360, and 480 days after planting (DAP), G4 (control) plants spread the least, by 34.85, 49.45, 57.48, and 70.43 cm2 correspondingly.

Table 4.5: Tropical Anthurium andreanum's (Anthurium) growth and leaf area (in square centimetres) as a function of (a) nutrition (b) growth regulator (c)

TREATMENTS	Plantspread(cm^2)			
	120DAP	240DAP	360DAP	480DAP
Nutrients(N)Mean				
N_1-Seaweedextract	40.98	55.35	64.94	77.77
N_2-Panchagavya	43.83	58.06	68.37	80.94
N_3-Humicacid	46.70	60.79	71.83	84.14
N_4-Control	37.78	52.51	61.27	74.22
SE(d)	0.33	0.30	0.38	0.33
CD(p=0.05)	0.67	0.60	0.77	0.68
Growthregulators(G) Mean				
G_1-Gibberellicacid	46.25	60.38	71.31	83.68
G_2-Naphthalene acetic acid	44.10	58.44	68.81	81.48
G_3-Benzyladenine	44.81	59.08	69.64	82.21
G_4-Control	34.85	49.45	57.48	70.43
SE(d)	0.66	0.59	0.76	0.67
CD(p=0.05)	1.34	1.21	1.55	1.36
NxGInteraction				
$N_1 \times G_1$	44.67	58.91	69.43	81.98
$N_1 \times G_2$	41.78	56.30	66.08	79.03
$N_1 \times G_3$	43.24	57.61	67.77	80.51
$N_1 \times G_4$	34.24	48.58	56.47	69.54
$N_2 \times G_1$	47.99	62.09	73.45	85.72
$N_2 \times G_2$	45.13	59.51	70.14	82.80
$N_2 \times G_3$	46.56	60.80	71.80	84.27
$N_2 \times G_4$	35.64	49.84	58.08	70.96
$N_3 \times G_1$	51.39	65.35	77.58	89.56
$N_3 \times G_2$	48.47	62.72	74.20	86.59
$N_3 \times G_3$	49.92	64.03	75.88	88.07
$N_3 \times G_4$	37.00	51.07	59.67	72.36
$N_4 \times G_1$	40.95	55.18	64.76	77.45
$N_4 \times G_2$	38.15	52.65	61.51	74.59
$N_4 \times G_3$	39.52	53.89	63.11	76.00
$N_4 \times G_4$	32.51	48.31	55.69	68.84
SE(d)	0.66	0.59	0.76	0.67
CD(p=0.05)	1.34	1.21	1.55	1.36

5. Conclusion

Important factors in commercial anthurium production include the availability of enough shade, suitable growing material, sufficient nourishment, and adequate growth management. As a result, it is crucial to standardise shade management, growing medium, nutrients, and growth regulators to increase productivity, quality, and vase life of anthurium flowers. In light of the above, the current study consisted of two trials investigating the impact of different levels of shading, different medium and different nutrient levels on the yield of anthurium cut flowers.

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