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A Study on Yield and Economics of Growth Regulators Application in *Anthurium andreanum* var. Tropical under Naturally Ventilated Polyhouse

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ABSTRACT

Flower farming is a rosy business sector in India due to liberalization and globalization of economy. Since its potency in the international market is getting raised year after year, most of the farmers in India switching towards flower cultivation. Considering the above condition growing of cut flowers for export purpose gradually increasing from decades. To achieve good plant health and flower quality an experiment was conducted at COH, Mudigere (UAHS, Shivamogga) during 2016-17. Growth regulators viz., BA, GA_3, MH and CCC are applied at monthly intervals to check its effects on plant growth, flower quality and flower yield of Anthurium andreanum var. Tropical. Meanwhile a comprehensive study on Economics of growth regulators application in Anthurium andreanum var. Tropical were analysed by calculating its B:C ratio. The treatment T_3-BA @ 750 ppm obtained the highest net income and benefit: cost ratio (₹ 8,07,473.61 and 1:2.89, respectively) compare to other treatments.

Key words: *Economics of Anthurium cultivation, BA, GA_3, MH, CCC, UAHS*

INTRODUCTION

Cut flowers industry in India is emerging as a money spinning sector due to its immense value from international cut flower trade. Among cut flower, Anthurium ranks eleventh position in the flower commerce. In India, anthurium production is 3230 tonnes whereas, highest anthurium production recorded from Assam 2050 tonnes and Meghalaya 740 tonnes. Karnataka with the production of 60 tonnes, positioned at 4th in the anthurium cut flower production. In Karnataka, there are export units from Kodagu district and chikkamagaluru district (Mudigere taluk). Where in Kodagu district of Karnataka declared as an "agri-export zone" for anthurium as there are around 45 anthurium growers and around 15,000 flowers exported every day in Kodagu[1].

Anthurium is a stemless and tropical plant which requires shade for its cultivation. Unlike other commercial flowers anthurium bears bright and showy spathe (modified leaf) and spadix (an infloroscence). It has got long vase life of about 13-15 days, so widely used in flower arrangements, bouquet preparation and indoor decoration. Meanwhile, anthurium as a potted plant have a colossal demand for interioscaping.

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And ranked at top 4th in top 25 indoor plant sold. The anthurium flower trade became Hawaii's biggest source of income and this flower is famed as the national flower of Mauritius.

Anthurium grows well in warm humid areas with tropical and subtropical climate. They require 50-80 per cent of relative humidity. The ideal temperature for optimum growth and flowering is between 18 to 27° C and about 20 to 25 per cent of sunlight for their growth. They are shade loving plants require 75 to 80 per cent shade. Bright red and bright orange are the colours for which greatest demand exists all over the world, followed by white and lastly pink. Double coloured varieties are also gaining importance for decoration purpose[1].

The anthurium plant produces flowers throughout the year. Six to eight flowers are obtained per plant per year from the axil of every leaf. One flower emerges from each leaf axil. Anthuriums give opportunity to get revenue from vegetative propagation through suckers, which arise around the base of the stem. The suckers are identical to the mother plant and to each other[1]. Commercial cultivars of anthurium do not produce suckers or produce very few. One such best example is a variety Tropical. This variety grabbed prominent position in the international flower market due to its brilliant showy red colour and its long lasting feature, but it has got least sucker production[5].

Non availability of sufficient planting material of commercially cultivated varieties of anthurium like Tropical at reasonable rates is the major constraints that led to the loss of interest in many growers. The ability to produce suckers capacity can be improved by exogenous application of growth regulators at frequent intervals[7].

Among the different management practices in flower crops, plant growth regulators have a great bearing in influencing the growth and flowering attributes. Now-a-days these growth regulators can be easily available in the market and use of them have contributed a great deal in flower crops and have been effectively utilized in regulating or modulating various plant processes and thus boosting the flower productivity directly or indirectly. The role of growth promoters is a milestone in horticulture especially, gibberellins and cytokinins.

In India, anthurium industry is still in a pace of snail walk. Until now limited comprehensive research work has been carried out on systematic cultivation of anthurium with respect to foliar application of plant growth regulators and their economics under naturally ventilated polyhouse. As Anthuriums were grown under protected cultivation the cost involved for erection of naturally ventilated polyhouse were calculated.

Economics is the need for the farmers while taking a decision regarding the adoption of a new technique in greenhouses. Hence, the gross income, net income and cost benefit ratio was computed for different growth regulator treatments.

MATERIAL AND METHODS

The detailed research work conducted at the College of Horticulture, Mudigere during 2016-2017. The experiment was laid out in a naturally ventilated polyhouse. Its frame is made up of galvanized iron pipe and covered with 200 µ UV stabilized polyethylene film. The shade net with 75 per cent shade was provided above the headspace inside the polyhouse to manage the light intensity and temperature during summer. Both sides are covered with 60 mesh size plastic net for natural ventilation. In addition to the plastic net, the side walls have also been provided with a rollable flap of polyethylene sheet from outside the plastic net to regulate the requirements of temperature and humidity, depending upon the season and weather conditions.

Statistically experiment was designed with completely randomized block design (RCBD) with 13 treatments including control and 3 replications. The treatments were foliar application of benzyl adenine (250 ppm, 500 ppm and 750 ppm), Cycocel (1000 ppm, 1500 ppm and 2000 ppm), Gibberellic acid (100 ppm, 150 ppm and 200 ppm) and Maleic hydrazide (100 ppm, 150 ppm and 200 ppm) at three months after planting.

The economics of anthurium cultivation in polyhouse (500 m^2) was worked out by considering the present price of fertilizer like urea, rock phosphate, MOP, 19:19:19 and other inputs like growth regulators (BA, CCC, GA_3 and MH). Finally, calculated it for one year using standard method suggested by NCPA (National council for use of plastic in agriculture)[2]. The details of the economics are presented in the Appendix-1.

The different growth regulators significantly influenced the B: C ratio, which are presented in Table-1 and the details of cost of cultivation of growth regulator in anthurium is flourished in Appendix 2 and Appendix 2.

Gross income (₹): Gross income was calculated by adding the present cost of single anthurium flower and cost of sucker (planting material).

Net returns (₹): Net returns was calculated by using the formula mentioned below

Net returns (₹ /500 m^2) = Gross returns (₹/500 m^2) – cost of cultivation (₹/500 m^2)

Benefit cost ratio (BCR): Cost benefit ratio was calculated by using the formula mentioned below

$$\text{Benefit: Cost ratio} = \frac{\text{Net returns}}{\text{Cost of cultivation}}$$

RESULTS AND DISCUSSION

Protected cultivation of commercial grown flowers *viz.*, anthurium requires high initial investments. One of the major cause for increase in cost of cultivation is planting material, which demands high monetary value. In order to put down the cost of cultivation, farmer has to be able to produce planting material from his own farm. In anthurium, suckers can be used as planting material which even generates more income to the grower apart from flower itself. Hence, present investigation also throws light on economics of growth regulator application in anthurium which has been represented in Table-1.

Total cost of cultivation of plant treated with BA @ 750 ppm was ₹ 2, 79, 801.00 and revenue (25,865.00 flowers/500m^2/years @ ₹15/flower + 11,655 suckers/500 m^2/year@ ₹60/sucker) was ₹ 10, 87,275. Net profit was ₹ 8, 07, 473.61 for 500 m^2 area. The maximum benefit cost ratio was recorded in BA @ 750 ppm (1:2.89) and minimum in untreated plants (1:0.37). These findings are in agreement with the reports of Beena[4]. in anthurium.

Table 1. Economics of anthurium (one year) as influenced by application of growth regulators under naturally ventilated polyhouse (500 m^2/year)

Sl. No.	Particulars	Total cost (₹)	Depreciation cost (₹) (per year)
I.	Non-recurring contingency (NRC) (for a life span of 10 years)		
a.	Construction of polyhouse @ ₹ 935/m^2 Top : UV stabilized polyfilms Side: 75 % agro shade net	4,67,500.00	46,750.00
b	Irrigation system including foggers and 2 HP motor	1,60,000.00	16,000.00
	Total of NRC	**627500.00**	**62750.00**
II.	Recurring contingency (RC) (for a life span of 10 years)		
a.	Planting materials @ ₹ 125/plant (3500 plants / 500 m^2) (7 plants/m^2)	4,37,500.00	43,750.00
	Total	**4,37,500.00**	**43,750.00**
b.	Bed preparation (tiles, bricks, coconut husk, coffee hull, coir pith, FYM, fertilizers)	23,915.81	2,391.58
c.	Management cost		
	Supervision, maintenance and harvesting (1 labor per unit for 1 year @ ₹ 5,400 / month)	64,800.00	64,800.00
d	Packaging, Grading, Transportation	30,000.00	30,000.00
e	Fertilizer	6,388.39	6,388.39.00
f	Plant protection	3,571.42	3,571.42
	Total of RC		**150901.39**
	Grand total (NRC + RC)		**2,13,651.39**

Appendix I

Treatment		Total cost of cultivation (/500 m²)	Flower yield per m² (Nos.)	Flower yield per 500 m² (Nos.)	Sucker yield per m² (Nos.)	Sucker yield per 500m² (Nos.)	Gross income (/500m²)	Net income (/500 m²)	B:C ratio
No.	Details								
T_1	BA @ 250 ppm	2,35,701.00	44.80	22400.00	11.20	5600.00	672000.00	436298.61	1:1.85
T_2	BA @ 500 ppm	2,57,751.00	49.06	24530.00	14.70	7350.00	808950.00	551198.61	1:2.14
T_3	BA @ 750 ppm	2,79,801.00	51.73	25865.00	23.31	11655.00	1087275.00	807473.61	1:2.89
T_4	CCC @ 1000ppm	2,22,839.00	42.13	21065.00	0.00	0.00	315975.00	93136.11	1:0.42
T_5	CCC @ 1500ppm	2,27,433.00	43.20	21600.00	6.51	3255.00	519300.00	291867.36	1:1.28
T_6	CCC @ 2000ppm	2,32,026.00	43.20	21600.00	8.61	4305.00	582300.00	350273.61	1:1.51
T_7	GA_3 @ 100ppm	2,23,714.00	45.33	22665.00	0.00	0.00	339975.00	116261.11	1:0.52
T_8	GA_3 @ 150ppm	2,28,811.00	47.46	23730.00	0.00	0.00	355950.00	127139.235	1:0.56
T_9	GA_3 @ 200ppm	2,33,864.00	48.00	24000.00	9.10	4550.00	633000.00	399136.11	1:1.71
T_{10}	MH @ 100ppm	2,22,839.00	42.66	21330.00	0.00	0.00	319950.00	97111.11	1:0.44
T_{11}	MH @ 150ppm	2,27,433.00	43.73	21865.00	0.00	0.00	327975.00	100542.36	0.44
T_{12}	MH @ 200ppm	2,32,026.00	44.80	22400.00	0.00	0.00	336000.00	103973.61	0.45
T_{13}	Control	2,13,651.00	38.93	19465.00	0.00	0.00	291975.00	78323.61	0.37

* Flower cost: 15 Rs/flower *sucker cost: 60 Rs/ plants

Economics of anthurium cultivation under naturally ventilated polyhouse (500 m²/year)

Appendix 2.

Economics of growth regulators of anthurium var. Tropical under naturally ventilated polyhouse (500 m²/year)

Treatment		Cost of growth regulators per 500 sq. meter / year ( )				Production cost ( )	Total cost of cultivation ( )/ha
No.	details	Benzyl adenine	Cycocel	Gibberellic acid	Maleic hydrazide		
T_1	**BA @ 250 ppm**	22,050.00	-	-	-	2,13,651.39	2,35,701.00
T_2	**BA @ 500 ppm**	44,100.00	-	-	-	2,13,651.39	2,57,751.00
T_3	**BA @ 750 ppm**	66,150.00	-	-	-	2,13,651.39	2,79,801.00
T_4	**CCC @ 1000ppm**	-	9,187.50	-	-	2,13,651.39	2,22,839.00
T_5	**CCC @ 1500ppm**	-	13,781.25	-	-	2,13,651.39	2,27,433.00
T_6	**CCC @ 2000ppm**	-	18,375.00	-	-	2,13,651.39	2,32,026.00
T_7	**GA_3 @ 100ppm**	-	-	10,062.50	-	2,13,651.39	2,23,714.00
T_8	**GA_3 @ 150ppm**	-	-	15,159.38	-	2,13,651.39	2,28,811.00
T_9	**GA_3 @ 200ppm**	-	-	20,212.50	-	2,13,651.39	2,33,864.00
T_{10}	**MH @ 100ppm**	-	-	-	9,187.50	2,13,651.39	2,22,839.00
T_{11}	**MH @ 150ppm**	-	-	-	13,781.25	2,13,651.39	2,27,433.00
T_{12}	**MH @ 200ppm**	-	-	-	18,375.00	2,13,651.39	2,32,026.00
T_{13}	**Control**	-	-	-	-	2,13,651.39	2,13,651.00

*Growth regulator cost- Benzyl adenine (99%) - 3360/25g; Gibberellic acid - 1540/10g;
Maleic hydrazide (98.0%) - 308/100g; Chlorocholine chloride (50%)- 700/100ml

CONCLUSION

Thus, from the present study it has been noticed that the gross returns, net returns and BC ratio found maximum with the application of BA @ 750 ppm and thus it generates more income compare to untreated plants.

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