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Effect of GA_3 and foliar nutrients along with biofertilizers on flower quality,vase life and sucker production of anthurium (*Anthurium andreanum* Lind.) cv. TROPICAL RED

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ABSTRACT : An experiment was conducted to investigate the effect of GA_3 and foliar nutrients along with bio-fertilizers on flower quality, vase life and sucker production of Anthurium cv. TROPICAL RED. Results showed that NPK @ 30:10:10 at 0.2 per cent foliar spray and GA_3 at 100 ppm along with bio-fertilizers (*Azospirillum*, Phospho-bacteria and VAM each at 2 g per plant) significantly influenced the flower quality, vase life and sucker production of Anthurium.

KEY WORDS : Anthurium, GA_3, NPK, *Azospirillum*, Phospho-bacteria, VAM

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Anthuriums are tropical ornamental plants of great beauty, elegance and variety of colors, grown for their showy cut flowers and foliage. Anthurium belongs to the family Araceae and native to tropical zones of the central and South America. At present, the productivity and quality of flowers are not much encouraging due to lack of proper nutrition and other scientific practices. To ensure maximization of productivity in crop, nutrient supply is an important factor. Gibberellins are used in ornamental crops extensively for modifying the developmental processes. The major areas where GA_3 have successfully played their role in commercial flowers are growth control, prevention of bud dormancy, promotion of flowering, prolonging the vase life of flowers and retarding their senescence. In recent years bio-fertilizers have a potential use in horticulture. These bio-fertilizers, benefit crop production by supplying nutrients. Common bio-fertilizers used in horticultural crops are *Azospirillum, Azotobacter,* phosphate solublizing bacteria and VAM fungi.

RESEARCH METHODS

The experiment was carried out during the year 2009 – 2010 in 70% shade net structure situated in Model Floriculture Nursery at Zonal Agricultural Research Station, Department of Horticulture, GKVK, UAS, Bangalore. There were 11 treatments including control, with three replications. The trial was laid out in Completely Randomized Design. The treatments included foliar application of NPK at 0.2% with varying levels(ratios) of N and P with K as constant (30:10:10 and15:0:10, respectively) along with bio-fertilizers @ 2 g each per plant (*Azospirillum*, phospho-bacteria and VAM) and GA_3 at 0, 50, 100, 200 and 300 ppm. Control plots did not receive any bio-fertilizers, GA_3 spray and foliar nutrients.

Nitrogen was applied in the form of ammonium nitrate, phosphorus in the form of ortho phosphoric acid and potassium in the form of potassium nitrate (bi-weekly spray).

Six months old tissue cultured Anthurium plants were used for the experiment and soil media used contained sand, vermin-compost and coconut husk as per package of practices for Anthurium. The bio-fertilizers *viz.*, *Azospirillum*, phospho-bacteria and VAM, each at 2 g/plant was given as a root dip treatment by preparing slurry except VAM which was applied as such at the root zone. The NPK dose of

30:10:10 and 15:0:10 at 0.2 per cent was sprayed at fortnight interval. Different concentrations of GA_3 were applied to the plants twice at monthly interval. Regular observations were recorded on flower quality, vase life and sucker production and the data generated were statistically analysed.

RESEARCH FINDINGS AND DISCUSSION

The data pertaining to flower quality parameters like spathe length, spathe width, spadix length and girth, flower stalk length, stalk girth, vase life and no. of suckers per plant, average root length(cm), average root volume(cm^3), fresh weight (g) and dry weight (g) of anthurium cv. TROPICAL RED as influenced by GA_3, foliar nutrients along with bio-fertilizers are presented in the Table 1 and 2.

Highest spathe length and spathe width (7.1 and 7.96 cm, respectively) were observed in the treatment T_3 (NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers) which was at par with the treatment T_8 (NPK 15:0:10 at 0.2% spray + *Azospirillum* + Phosphobacteria + VAM+ GA_3 at 100 ppm) (6.73 and 7.50 cm, respectively). Whereas the minimum spathe length and width (4.13 and 5.00 cm, respectively) were recorded in control (T_{11}). Highest spadix length and spadix girth (6.73 and 1.22cm, respectively) were observed in the treatment T_3 (NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers) followed by treatment T_8 (NPK 15:0:10 at 0.2% spray + *Azospirillum* + Phosphobacteria +VAM+GA_3 at 100 ppm) (6.46and 1.10 cm, respectively). Whereas the minimum spadix length and spadix girth (3.5 cm and 0.49cm) was recorded in control (T_{11}). Maximum average stalk length and stalk girth (26.83 and 0.48 cm, respectively) at harvesting stage was found to be superior in treatment T_3 (NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers) over the other treatments. While the minimum average stalk length and stalk girth (16.16 and 0.17cm, respectively) were recorded in control. The maximum vase life (19.33 days) was recorded in T_3 (NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers) which was at par with the treatments T_8(NPK 15:0:10 at 0.2% spray + *Azospirillum* + Phosphobacteria + VAM+ GA_3 at 100 ppm) (17.33 days), T_2 (NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 50 ppm) (16.33 days) and T_4 (NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 200 ppm) (15.33 days) while the minimum vase life (9.00 days) was recorded in control (T_{11}).

The highest number of suckers per plant was found in the treatment T_3 which was treated with NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers (3.50) which were statistically at par with the treatments T_4 which was treated with NPK 30:10:10 at 0.2% spray + Azospirillum+ phosphobacteria + VAM +GA_3 at 200 ppm

Table 1 : Effect of GA_3 and foliar nutrients along with biofertilizers on spathe length (cm), spathe width (cm) spadix length (cm), spadix girth (cm) stalk length (cm), stalk girth (cm) and vase life of flowers of Anthurium (*A. andreanum*) cv. TROPICAL RED

Treatments	Spathe length (cm)	Spathe width (cm)	Spadix length (cm)	Spadix girth (cm)	Stalk length (cm)	Stalk girth (cm)	Vase life (days)
T_1:NPK 30:10:10 at 0.2% spray + *Azospirillum* + Phospobacteria +VAM+GA_3 at 0 ppm	5.10^{gh}	5.70^{gh}	4.80^{cd}	0.61^{ghi}	18.33^{fg}	0.25^{h}	11.33^{bc}
T_2: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 50 ppm	5.43^{fg}	6.33^{ef}	5.20^{cd}	0.72^{efg}	19.66^{ef}	0.29^{g}	16.33^{ab}
T_3: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 100 ppm	7.10^{a}	7.96^{a}	6.73^{a}	1.22^{a}	26.83^{a}	0.48^{a}	19.33^{a}
T_4: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 200 ppm	6.46^{bc}	7.13^{bc}	6.36^{ab}	1.00^{bc}	23.93^{bc}	0.41^{c}	15.33^{abc}
T_5: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 300 ppm	5.86^{de}	6.63^{de}	5.86^{abc}	0.85^{de}	21.63^{cde}	0.35^{e}	11.66^{bc}
T_6: NPK 15:0:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 0 ppm	4.90^{h}	5.50^{h}	4.60^{d}	0.57^{hi}	18.00^{fg}	0.22^{i}	11.00^{bc}
T_7: NPK 15:0:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 50 ppm	5.26^{fgh}	5.96^{fg}	5.10^{cd}	0.67^{fgh}	19.16^{ef}	0.27^{gh}	12.00^{bc}
T_8: NPK 15:0:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 100 ppm	6.73^{ab}	7.50^{b}	6.46^{ab}	1.10^{ab}	25.00^{ab}	0.44^{b}	17.33^{ab}
T_9: NPK 15:0:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 200 ppm	6.23^{cd}	6.96^{cd}	5.80^{abc}	0.93^{cd}	23.00^{bcd}	0.38^{d}	15.33^{abc}
T_{10}: NPK 15:0:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 300 ppm	5.66^{ef}	6.56^{de}	5.43^{bcd}	0.78^{ef}	20.50^{def}	0.32^{f}	13.00^{abc}
T_{11}: Control	4.13^{i}	5.00^{i}	3.50^{e}	0.49^{i}	16.16^{g}	0.17^{j}	9.00^{c}
F-test	*	*	*	*	*	*	*
S.E.±	0.13	0.14	0.34	0.04	0.89	0.008	2.09
C.D. (P=0.05)	0.38	0.43	1.01	0.12	2.62	0.02	6.15

Note: * Significant Note: Mean values followed by the same alphabet in the columns do not differ significantly by DMRT at 5% level

Table 2 : Effect of GA_3 and foliar nutrients along with biofertilizers on no. of suckers, average root length (cm), root volume (cm^3), fresh weight (g) and dry weight (g) of Anthurium (*A. andreanum*) cv. TROPICAL RED

Treatments	No. of suckers	Average root length (cm)	Average root volume (cm^3)	Fresh weight (g)	Dry weight (g)
T_1: NPK 30:10: 10 at 0.2% spray+*Azospirillum* + Phospobacteria +VAM+GA_3 at 0 ppm	1.5^{efg}	36.66^{g}	10471.66^{f}	54.8^{f}	7.13^{g}
T_2: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 50 ppm	2.06^{cde}	45.66^{de}	11695.00^{e}	62.93^{de}	8.39^{ef}
T_3: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 100 ppm	3.50^{a}	57.67^{a}	15693.33^{a}	81.10^{a}	20.12^{a}
T_4: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 200 ppm	2.93^{ab}	48.70^{bc}	14380.00^{ac}	72.36^{b}	12.50^{c}
T_5: NPK 30:10:10 at 0.2% spray + *Azospirillum*+ phosphobacteria + VAM +GA_3 at 300 ppm	2.30^{bcd}	46.60^{cde}	12193.33^{d}	65.03^{cd}	9.82^{de}
T_6: NPK 15:0:10 at 0.2% spray + *Azospirillum*+phosphobacteria + VAM +GA_3 at 0 ppm	1.36^{fg}	27.34^{h}	8887.00^{g}	46.33^{g}	5.62^{gh}
T_7: NPK 15:0:10 at 0.2% spray + *Azospirillum*+phosphobacteria + VAM +GA_3 at 50 ppm	1.66^{efg}	39.56^{f}	11466.66^{e}	50.06^{g}	7.86^{f}
T_8: NPK 15:0:10 at 0.2% spray + *Azospirillum*+phosphobacteria + VAM +GA_3 at 100 ppm	2.93^{ab}	49.89^{b}	14725.00^{b}	76.40^{b}	15.18^{b}
T_9: NPK 15:0:10 at 0.2% spray + *Azospirillum*+phosphobacteria + VAM +GA_3 at 200 ppm	2.60^{bc}	47.96^{bcd}	14040.66^{c}	67.82^{c}	10.82^{cd}
T_{10}: NPK 15:0:10 at 0.2% spray + *Azospirillum*−phosphobacteria + VAM +GA_3 at 300 ppm	1.93^{def}	44.76^{e}	11814.33^{de}	60.46^{e}	8.55^{ef}
T_{11}: Control	1.16^{g}	24.47^{i}	8730.00^{g}	35.16^{h}	4.68^{h}
F-test	*	*	*	*	*
S.E.±	0.20	0.88	130.97	1.45	0.57
C.D. (P=0.05)	0.59	2.58	384.15	4.26	1.68

Note: * Significant , Mean values followed by the same alphabet in the columns do not differ significantly by DMRT at 5% level

(2.93) and T_8 which was treated with NPK 15:0:10 at 0.2% spray + *Azospirillum* + Phosphobacteria +VAM+ GA_3 at 100 ppm (2.93). The least number of suckers per plant (1.16) were observed in control (T_{11}). The maximum root length and root volume (57.67cm and 15693.33 cm3, respectively) were recorded in the treatment T_3(NPK 30:10:10 at 0.2 per cent spray, GA_3 at 100 ppm along with bio-fertilizers) There was significant increase in fresh weight and dry weight of plants (81.10g and 20.12g, respectively) which was recorded in treatment T_3, followed by the treatments T_8 (76.40g and 15.18g, respectively) and T_4(72.36g and 12.50g, respectively). The least fresh weight and dry weight (35.16g and 4.68g, respectively) were recorded in control (T_{11}) (Table 2).

The increased spathe length and width with GA_3 application can be attributed to active cell division and cell elongation in the flowers to increase the sink strength of the actively growing parts. Action of gibberellic acid has been reported to induce an entire developmental program by activation of master regulatory genes in the later stages of corolla development as observed by Preethi (1990) in rose. Maximum spadix length, spadix girth, stalk length and stalk girth might be due to favorable conditions near root zone for increased water and nutrient uptake and also GA_3 might have helped in the better supply of photosynthates to the developing sinks as reported by Sujatha *et al.* (2002) in gerbera. Similar findings were recorded by Padmadevi *et al.* (2004), Srinivasa (2005) and Dhaduk *et al.* (2007) in Anthurium. This increased vase life might be due to the application of GA_3 in field that might have influenced the continuity in the water conductance by the tissues without any blockage and GA_3 might have also increased the osmatically driven water uptake by the flower stalks. Although shelf- life of the cut flowers depends on genetic makeup and water quality, the major factor contributing to deterioration of cut flowers is vascular blockage (Chandrashekaraiah, 1973). Similar results were also found by Narasimha and Haripriya (2001), Sujatha *et al.* (2002)and Khan and Tewari (2003) in crossandra, gerbera and dhalia, respectively.

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