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Effect of fertigation on nutrient uptake on anthurium

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ABSTRACT

An investigation was carried out in the Experimental Farm, Department of Horticulture, AAU, Jorhat under agro-shade net house during 2007-2008, to study the nutrient uptake by anthurium plants under fertigated condition. The experiment was conducted in Strip Plot Design with four replications. The treatments consisted of four levels of fertigation, *viz.*, 100% (F_1), 75% (F_2) and 50% (F_3) fertilizer dose of N & K (200 kg N/ha & 250 kg K/ha) through drip and 100% (F_0) fertilizer dose of N & K (200 kg N/ha & 250 kg K/ha) as broadcasted with two varieties, *viz.*, Fire (V_1) and Carnival (V_2). Among the fertigation levels, F_1 resulted in highest N (0.86, 2.29) g/m², P (0.136, 0.251) g/m² and K (1.58, 3.11) g/m² uptake, whereas F_2 recorded in highest Ca uptake (0.83, 2.28) g/m² by plants in vegetative and blooming stages respectively. Similarly, highest dry matter production (18.95 and 26.76) g/pl by plants in both stages and flower (13.97g/pl) was revealed in F_1 levels and was significantly superior to other levels. N, P, K and Ca uptake in flower (0.85, 0.111, 1.14 and 0.59 g/m²) was also significantly highest in F_1 level. Among the interactions, F_1V_2 showed the highest P uptake (0.255 g/m²) in plants and N, P, K, Ca uptake (1.07, 0.126, 1.31 and 0.71 g/m², respectively) in flowers, whereas the highest dry matter production (16.3 g) was exhibited by F_1V_1 available N, P_2O_5 and K_2O in the growing media was recorded highest in F_1 level. Among the treatment combinations, F_1V_1 resulted in high N content (0.063 g/100 g) whereas F_1V_2 resulted in highest P_2O_5 content (0.0079 g/100 g) and K_2O content (0.24 g/100 g) of the growing media.

Key words: Anthurium, fertigation, nutrient uptake, growing media.

INTRODUCTION

Anthurium is an important tropical ornamental plant grown for its colourful spathe and attractive foliage. They are very popular as cut flowers for their beauty, bold and long lasting qualities which are essential pre-requisites for any floral arrangement. Due to the increasing popularity it occupies 9th position among the cutflowers in the international market with global trade valued US$ 50 million (Rajeevan *et al.*, 5).

Anthurium andreanum is perennial, semi-terrestrial, evergreen and herbaceous plants with oblong, heart shaped leaves and spathe. The 'flower' consists of a colourful modified leaf called the spathe and hundreds of small spirally arranged bisexual flowers on a pencil like structure called spadix, arising from the base of the spathe. These plants require generous watering and adequate amount of nutrients for its proper growth and flowering. Deficiencies of nutrients are associated with low yield, reduced stem length and small flowers. Fertigation is the technique of applying nutrients along with irrigation water directly at the site of active root zone resulting in quality production. Thus, keeping in view the present investigation was conducted to study the nutrient uptake by the plants under fertigated conditions.

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MATERIALS AND METHODS

The experiment was conducted at experimental farm of Department of Horticulture, AAU, Jorhat under Agro shade net house, each having a size of 100 m² during the year 2007-08. Six-month-old tissue cultured plantlets were grown at a spacing of 45 cm × 45 cm in the substrate consisting of 2 parts of coco peat 1 part coconut husk, 1 part charcoal and 1/4th part brick pieces laid on to the bottom of the bed. The experiments was laid in strip plot design and replicated four times. The treatment consisted of four levels of fertigation: 100% (F_1), 75% (F_2) and 50% (F_3) of fertilizer dose of N and K as broadcast (220 kg N/ha or 20 g/m²) and 250 kg/ha or 25 g/m² with two varieties V_1 (Fire) and V_2 (Carnival). Uniform application of P (100 kg/ha or 10 g/m²) and $CaCO_3$ (5 g/pl) was applied per month. Fertigation was given per week through drip system one month after planting and irrigation was given daily by replenishing 100% of the previous day evaporation (on the basis of USWB pan evaporimeter). In the drip irrigation system, 12 mm diameter LLDPE (Linear low density polyethylene) pipes were used as laterals where pressure compensating type, 2 lph size dripper were fitted. The laterals were fitted around each plant. Single dripper was used to irrigate each plant. The growing media was analyzed initially before planting and after planting using standard analytical methods. Leaf and flower nutrient analysis were determined by

micro-Kjeldahl method for total N, Vanado molybdate method for total P and flame photometric method for total K and Ca. The initial physico-chemical properties of the growing media are presented in Table 1.

RESULTS AND DISCUSSION

From the data presented in Table 2, it is seen that different levels of fertigation and varieties significantly influenced the N uptake by plants. In vegetative stage among the fertigation levels, F_1 (0.86 g/m^2) recorded maximum N uptake, which was significantly superior the to others. In blooming stage also F_1 (2.29 g/m^2) recorded the highest value. On other hand among the varieties, in both the stages, V_2 (0.63 and 1.63 g/m^2) were significantly higher than V_1 (0.49 and 1.41 g/m^2) respectively. However, their interaction effect was non-significant in both vegetative and blooming stage. This increase in N uptake might be due to increase in levels of N in fertigation that envisages the plant to grow better and produce higher yield.

The data with respect to P uptake by plant revealed that in both the stages P uptake was significantly influenced by difficult fertigation level and varieties. Among the fertigation levels, F_1 (0.136 g/m^2) differ significantly with other levels. Similarly at blooming stage also F_1 (0.251 g/m^2) resulted in higher P uptake. Among the varieties, V_2 (0.101 and 0.171 g/m^2 was significantly higher than V_1 (0.084 and 0.162 g/m^2) respectively. Again among the fertigation treatments, F_1V_2 (0.146 g/m^2) differ significantly from the interactions during vegetative stage. At blooming stage F_1V_1 (0.247 g/m^2) and F_1V_2 (0.255 g/m^2) were at par with each other. This might be attributed to the desirable pH due to the Ca application thereby increasing the available and uptake of P.

The highest K uptake by plant was recorded in F_1 (1.58 g/m^2) during vegetative stage, which was significantly superior to other fertigation levels. Similarly, during blooming stage F_1 (3.11 g/m^2) recorded maximum K uptake, which was also significantly higher to other levels. Between the varieties and among the interactions no significant effect was observed at both the stages (Table 3). This might be attributed due to the increase in the K levels in fertigation resulting in better utilization of K due to most effective soluble form.

Data from the Table 2, revealed that among the fertigation levels, F_2 (0.83 and 2.28 g/m^2) recorded the highest Ca uptake, which was at per with F_1(0.80 and 2.12 g/m^2) in both the stage respectively. Between the varieties, V_2 (0.62 g/m^2) was significant superior to V_1 (0.54 g/m^2) and among interactions F_1V_2 (0.95 g/m^2) recorded the maximum value in vegetative stage. On other hand, no significant difference was observed due to the varieties and their interactions with different fertigation levels.

Table 2 again indicates that the dry matter production by the plant and the flower is significantly in influenced by fertigation. Similar results were also observed by Ashok and Rengasamy (1) in rose and Treder (3) in Oriental lily.

The highest dry matter production by plant was revealed in F_1 levels (18.95 and 26.76 g/pl) at vegetative and blooming stages. Between the varieties, V_2 (14.96 and 22.16 g/pl) recorded significantly higher value than V_1 (12.63 and 20.23 g/pl) in both the stages. However their interactions were not significant. Again the dry matter production by flower was greatly influenced by different levels of fertigation but not by varieties. Among the fertigated plants, F_1 (13.97 g/pl) showed highest dry matter production, which was significantly superior to other levels.

Among the interactions, F_1V_1 (16.30 g/pl) recorded the highest dry matter production in the flower. The influence of fertigation on dry matter production

Table 1. Physico-chemical properties of growing media.

Particulars	Growing media depth (cm)	
	0-15	15-30
Maximum water holding capacity (%)	618.45	607.31
Bulk density	0.308	0.322
Porosity (%)	79.78	79.09
Particle density (g/m^2)	1.523	1.540
pH	6.220	6.210
Organic carbon (%)	0.663	0.620
Available N (%)	0.0168	0.0163
Available P_2O_5 (%)	0.0034	0.0031
Available K_2O (%)	0.051	0.052

Table 2. Dry matter production and nutrient uptake by anthurium.

Treatment	Dry matter production (g/pl)			N uptake (g/m^2)			P uptake (g/m^2)			K uptake (g/m^2)		
	Vegetative stage	Blooming stage	Full bloom stage	Vegetative stage	Blooming stage	Full bloom stage	Vegetative stage	Blooming stage	Full bloom stage	Vegetative stage	Blooming stage	Full bloom stage
Fertigation Level												
F_0	11.54	18.58	6.01	0.42	1.16	0.31	0.074	0.130	0.032	0.65	1.68	0.36
F_1	18.95	26.76	13.97	0.86	2.29	0.85	0.136	0.251	0.111	1.58	3.11	1.14
F_2	14.91	22.49	9.12	0.64	1.72	0.53	0.107	0.180	0.061	1.14	2.40	0.67
F_3	9.78	16.97	4.87	4.33	0.89	0.22	0.054	0.107	0.022	0.47	1.22	0.24
CD at 5%	0.92	0.92	0.75	0.05	0.08	0.06	0.009	0.010	0.006	0.13	0.09	0.08
Variety												
V_1	12.63	20.23	8.62	0.49	1.41	0.04	0.084	0.162	0.052	0.90	2.06	0.52
V_2	14.96	22.16	8.37	0.63	1.63	0.56	0.101	0.171	0.060	1.02	2.14	0.68
CD at 5%	1.04	0.48	NS	0.08	0.03	0.03	0.008	0.006	0.002	NS	NS	0.03
Interaction												
F_0V_1	10.52	17.70	5.30	0.36	1.07	0.27	0.068	0.128	0.034	0.64	1.65	0.31
F_1V_1	17.59	25.80	16.30	0.78	2.16	0.63	0.127	0.247	0.095	1.48	3.06	0.97
F_2V_1	13.25	21.43	8.91	0.54	1.63	0.51	0.090	0.168	0.060	1.03	2.29	0.64
F_3V_1	9.16	15.99	3.95	0.29	0.78	0.18	0.053	0.107	0.020	0.47	1.26	0.18
F_0V_2	12.55	19.45	6.72	0.47	1.26	0.35	0.080	0.132	0.031	0.67	1.70	0.42
F_1V_2	20.32	27.71	11.65	0.94	2.42	1.07	0.146	0.255	0.126	1.68	3.17	1.31
F_2V_2	16.57	23.55	9.33	0.75	1.82	0.55	0.124	0.192	0.061	1.26	2.51	0.70
F_3V_2	10.40	17.94	5.80	0.37	1.01	0.26	0.056	0.107	0.024	0.47	1.19	0.30
CD at 5%												
V × F	NS	NS	1.06	NS	NS	0.07	0.014	0.011	0.008	NS	NS	0.08
F × V	NS	NS	1.08	NS	NS	0.08	0.014	0.012	0.009	NS	NS	0.10

Table 3. Nutrient status of the growing media post harvest of anthurium.

Treatment	pH of the growing media	Organic carbon content (%)	Available N (g/100 g)	Available P_2O_5(g/100 g)	Available K_2O (g/100 g)
Fertigation Level					
F_0	6.41	1.77	0.048	0.0054	0.17
F_1	6.35	1.82	0.061	0.0073	0.22
F_2	6.39	1.82	0.059	0.0071	0.19
F_3	6.44	1.76	0.036	0.0048	0.11
CD at 5%	0.02	0.03	0.0006	0.00020	0.005
Variety					
V_1	6.39	1.80	0.052	0.0058	0.16
V_2	6.35	1.79	0.050	0.0065	0.18
CD at 5%	NS	NS	0.0004	0.0024	0.004
Interaction					
F_0V_1	6.41	1.78	0.048	0.0053	0.16
F_1V_1	6.35	1.83	0.063	0.0067	0.21
F_2V_1	6.39	1.83	0.061	0.0065	0.17
F_3V_1	6.43	1.76	0.035	0.0046	0.11
F_0V_2	6.41	1.77	0.047	0.0056	0.18
F_1V_2	6.36	1.82	0.059	0.0079	0.24
F_2V_2	6.39	1.81	0.057	0.0076	0.20
F_3V_2	6.44	1.76	0.036	0.0049	0.11
CD at 5%					
V × F	NS	NS	0.009	0.00029	0.004
F × V	NS	NS	0.009	0.00028	0.006

might be due to better root and shoot growth, improved photosynthetic efficiency and in turn shigher accumulation of carbohydrates in plants.

Results with respect to N uptake by flower (Table 2) it is seen that the among the fertigated plants F_1 (0.85 g/m^2) recorded maximum and significantly higher value. Between the varieties, V_2 (0.56 g/m^2) showed higher N uptake by flower than V_1 (0.40 g/m^2). Among the interactions, F_1V_2 (1.07 g/m^2) observed highest N uptake. The data recorded on P uptake by flower reveal that F_1 (0.111 g/m^2) resulted in significantly higher value. Between the varieties V_2 (0.06 g/m^2) was maximum within fertigation treatments, F_1V_2 (0.126 g/m^2) differed significantly. The highest K uptake by flower was revealed in F_1 levels (1.14 g/m^2) as compared to other levels. Between the varieties, V_2 (0.68 g/m^2) was significantly higher than V_1 (90.52 g/m^2) in K uptake. Among the interactions, F_1V_2 (1.31 g/m^2) was significantly higher than F_1V_1 (0.97 g/m^2).

There was significant difference in Ca uptake as influenced by fertigation but no significant difference was observed due to varieties. Among the fertigation level, F_1 (0.59 g/m^2) recorded highest Ca uptake, which differed significantly from other levels. Within the interactions, F_1V_2 (0.71 g/m^2) exhibited significantly higher Ca uptake. This might be due to higher dry matter production in flower by F_1 level of fertigation. Similar results were also recorded by Waly *et al.* (6) in gladiolus, and Treder *et al.* (4) in oriental lily.

The pH of the growing media as referred in the Table 3. Was significantly influenced by different level of fertigation but not by varieties and their interactions. Among the fertigation level F_3 (6.44) recorded the maximum pH of the growing media followed by the control, F_0 (6.41) and the lowest was revealed in F_1 (6.35). Incase of organic carbon content, among the fertigation level, F_1 (1.83%) recorded highest organic carbon content, which was at par with F_2 (1.82%), both being significantly superior to other levels. Significant difference was also observed due to varieties and the interactions.

Available N in growing media (Table 3.) was significantly, influenced by fertigation and varieties as well as their interactions. Among the fertigation

level, F_1 recorded higher value of av. N (0.061 g/100 g). Between the varieties, V_1 (0.052 g/100 g) was significantly higher than V_2 (0.050 g/100 g). Among the interactions, F_1V_1 (0.063 g/100 g) recorded the highest value. Both fertigation and variety as well as their interaction had significant effect on available P_2O_5 of the growing media. Within the fertigation levels, F_1 (0.0073 g/100 g) was significantly higher than other levels. Between the varieties, V_2 (0.0065 g/100 g) recorded higher available P_2O_5 content than V_1 (0.0058 g/100 g). Among the interactions, all levels of fertigation V_2 interacted significantly higher for P_2O_5 content than interactions with V_1 (Table 3.).

Available K_2O in the media was significantly influenced by fertigation was varieties and their interaction (Table 3.). Among the fertigation levels, F_1 recorded higher available K_2O content (0.22 g/100 g). Between the varieties V_2 (0.18 g/100 g) recorded significantly higher value than V_1 (0.16 g/100 g). Within the interactions, it was revealed that in F_1 and F_2 levels of fertigation, V_2 had significantly higher K_2O content than interactions with V_1 in which both were at per with each other.

In the present investigation there was an increase in the availability of NPK and organic carbon content in the growing media. The increase could be attributed to the conducive environment of the growing media created by maintaining high moisture level, which might have increased the solubility of these nutrients. The decomposition and release of nutrients by the high organic matter containing substrates coupled with external fertilizer retention leads to higher nutrient availability. Similar trends were also observed by Chen *et al.* (2). From the results of the present investigation, it can be inferred that the fertigation with 100% fertilizer dose of N & K through drip (F_1) proved to be superior for authurium production

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