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STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT IN *CYMBIDIUM GIGANTEUM* UNDER SHEVAROYS CONDITION

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ABSTRACT
An investigation was carried out during 2008 -2013 to study the effect of Integrated Nutrient Management in *Cymbidium giganteum* under Shevaroy condition. The results revealed that in *Cymbidium giganteum*,the treatment thus increased the plant height (65.7 cm) and number of leaves per plant (34.6 nos).Among the treatments maximum number of pseudobulbs per plant (4.4),maximumof Stalk length (96.6 cm), pedicel length (2.7 cm), floret size or flower diameter (2.0 cm), number of flowers per spike(14.8 Nos), number of spikes per plant(3.0 Nos), longevity of flowers in plants (31.3 days) and the vase life in water (25.8 days) were recorded in treatment T_{13}.Thus it can be concluded from the findings that application of Common basal dose (N:P:K 30:10:10), FYM 1.0 Kg per pot + Decomposed Coir Compost 100g per pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g per pot) + 3% Panchakavya + 3% Manchurian tea can be recommended for *Cymbidium giganteum* under Shevaroy hill of Eastern Ghats.

INTRODUCTION

Orchids are one of the most pampered plants and occupies top position among all flowering plants valued for cut flower production as potted plants, which fetches a very high price in the international market. India is endowed with very rich flora and fauna and it harbours more endemic species of plants than any other region of the world. In orchid *Cymbidium* genus with 44 species are spread throughout India. China, Japan, Malaysia and parts of Australia is known for the superior hybrids seen at orchid show in autumn and spring seasons**.** Now-a-days, the application of nutrients through fertigation in Cymbidium cultivation is gaining popularity on account of higher cut flower and better plant health Barman *et al*. (2008). The increasing in the cost of water soluble fertilizers prevent their use by poor farmers (Adhikary and Gankeyat, 2012). On the other hand, continous use of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing inefficiency, damage to the environment and in certain situations, harms the plants themselves and also to human being who consumes them. Therefore, integrated nutrient management is the most appropriate approach for managing the nutrient input. This calls for moving away from chemical agriculture and embracing organic matter management, which improves all soil properties and brings nitrogen through organic manures. In soil by adding organic manures and microbial agents make easy uptake of nutrients when crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy, 2014). The use of manures as an organic source occupy an important place as they provide a scope for reduction in use of costly chemical fertilizers which can pollute soil in long term use (Sharma, 2005). Keeping in this view, experiment was formulated to study effect of Integrated Nutrient Management in *Cymbidium giganteum* under Shevaroy condition.

MATERIALS AND METHODS

The present investigation was carried out during the year 2008 -2013to study the influence of Integrated Nutrient Management in *Cymbidium giganteum* orchid under Shevaroys condition. The experiment was conducted in the protected condition at Horticultural Research Station,Yercaud, Salem district, which is located at 11º4' to 11º5′N Latitude, 78º50' to 78º23′ E Longitude and at an Altitude of 1500 m above Mean Sea Level. The mean annual rainfall of Yercaud is 1572.0 mm with 47 rainy days. The average maximum and minimum temperature is 31.0ºC and 12.4ºC respectively. The average relative humidity is 75 per cent. The Cymbidium orchids were planted in the vented earthern pots of size 6" x 4" and the potting media was prepared with a mixture of sola soil, broken bricks and charcoal in equal quantity. The irrigation was made twice a day for the plants during warmer months and once a day during cooler periods. Besides, water was also sprinkled once a day and under cover is filled with coirpith to maintain conducive temperature and humidity inside the net house. The experiment was laid out in a Randomized Block Design (RBD) with sevenenteen treatments

replicated thrice and treatment details are furnished below in Table 1.

Biostimulants preparation

Panchagavya

Panchagavya is a biostimulant consisting of a combination of five products obtained from cow, which includes cow dung, cow urine, cow milk, curd and ghee. The term panchagavya represents 'Pancha'-five, 'Gavya'-produce from cow.

It acts as an immuno stimulant that promotes growth, increases the overall yield and also renders resistance to diseases and pests. Panchagavya was prepared by a modified method of Vriksha Ayurveda, a standardized method (Natarajan, 2002). The materials required and the methodology involved in the preparation of Panchagavya are furnished below.

1. Cow dung	- 10 kg
2. Cow urine	- 3 litres
3. Cow milk	- 2 litres
4. Curd	- 1 litre
5. Ghee	- 1 litre
6. Jaggery 500 g in 3 lit water	- 3 litres
7. Tender Cocountwater	- 3 litres
8. Ripe banana (cv. Poovan)	- 12 numbers
9. Coconut Toddy	- 2 litres

Fresh cow dung (5kg) and one litre of ghee were mixed well and retained in a plastic bucket for three days under shade. It was stirred well twice a day, then on fourth day, the remaining ingredients were added to the mixture. The slurry was mixed well three (or) more times a day up to 15th day. Thus panchagavya was ready for use in a period of 15 days which was later diluted to 3 per cent and then sprayed. Other than cow's products, the added materials like ripe banana, act as fermenting agents and preservators to panchagavya.

Vermiwash

Vermiwash is the spent wash collected at the passage of water through a column of earthworm culture. The spent wash was collected through a drainage pipe provided at the bottom of the vermicompost pit. The wash is a collection of excretory products and excess secretions of earth worms along with micronutrients from soil organic molecules (Yuvaraj, 2007). The biochemical properties of vermiwash are furnished below.

S.No	Properties	Quantity
1	p^H	7.07
2	EC (dsm^{-1})	0.28
3	Total nitrogen (ppm)	150
4	Total phosphorus (ppm)	65
5	Total potassium (ppm)	138
6	Sodium (ppm)	127
7	Organic carbon (%)	0.008
8	Bacteria (CFU/ml)	2×10^6
9	Fungi (CFU/ml)	2×10^3

Manchurian mushroom tea or kombucha

Manchurian tea or traditional fermented tea that has gained popularity among the tribes in Manchuria due to its health promoting effects, is mainly cultivated on black tea with sugar to produce a slightly acidic effervescent beverage. The kombucha mushroom is not really a mushroom, or even related to mushrooms; in reality it is a symbiotic relationship between bacterium (*Lactobacillus xylinum*) and yeast (*Saccharomyces ludwigii*). The "mushroom" itself is never eaten; instead the liquid protein is drunk. The tea mushroom feeds on the sugar and in exchange, produces other valuable substances which change into the drink; glucuron-acid, lactic acid, vitamins, amino acids, antibiotic substances and other products. The tea-mushroom is, therefore, a real, tiny biochemical factory. The pH of the kombucha tea drops from near neutral at make up to an acidic range of 2.0-3.0 after growth. Alcohol content, a product of yeast fermentation ranges from 0.5-1.5%. Manchurian tea contains some of the metabolites like 1% ethyl acetate , 3% acetic acid, lactate, tartrate, fructose, sucrose, various amino acids, biogene amine (ethyl amine, choline, adenine) and carbon dioxide. The ratios of these compounds appeared to be related to the ratio of yeast to bacterium. Selvaraj*et al.*,(2006) reported the presence of folic acid, glucoronic acid, 1-lactic acid, usnic acid and vitamins B_1, B_2, B_3, B_6 and B_{12}.

Each replication consisted of five plants. Five plants from each replication of orchid were used for recording biometrics observations on plant height (cm), no of leaves, leaflength (cm), leaf width (cm), days to flowering,number of spikes per plant, number of flowers per spike,flower diameter (cm), stalk length (cm), pedicellength (cm), number of pseudo bulbs, longevity of spikes in plants (d) and vase life in water (d).The data generated during the course of study was subjected to statistical analysisas prescribed by Panse and Sukhatme (2000).

RESULTS AND DISCUSSION

The vegetative characters of orchid are very much important as they play a key role in deciding the ultimate crop yield. These parameters significantly differed among the various treatments and the results indicated that significant variation was observed among the treatments for all the characters studied and the results are presented in table 2.

The application of different biostimulants had significantly influenced the plant growth and thus progressively increased the yield its mainly due to the overall treatments effect. The plant height was ranged from 51.9 to 65.7 cm. The highest plant height was noticed in T_5 and maximum plant height of 65.7 cm followed by T_{12} - 65.6 cm andT_{13} of 65.5. Maximum plant height may be attributed because accumulation of greater photosynthates leading to better growth parameters.These results may be because of accumulation of greater photosy nthates. This findings are in accordance with the findings of Kumar Rakesh and Kumar Prabhat (2011). Number of leaves per plant is one of the most important characters, since it has an important role in photosynthetic capacity for carbohydrate metabolism and photosynthates accumulation and partitioning. Higher number of leaves per plant were noticed in T_5 - (34.6 nos), followed by T_{11} & T_{12}-(33.1nos),T_{17} (32.3nos) and T_9 (31.9 nos). Increase in plant height and number of leaves might be due to easy absorption of nutrients, which would promote protein synthesis from reserved carbohydrate leading to production of more number of leaves .These findings are also in confirmation with findings of Kumar *et al.*, (2010 a).

Table 1: Treatment details

T1	Control :Inorganic fertilizers N:P:K at ratio of 30:10:10 at 0.2 % twice a week and FYM fermented for 4 -5 days and diluted in 1: 10 ratio and sprayed once in two weeks
T2	50% Recommended doses of fertilizers (15:5:5 N:P:K)
T3	50% Recommended doses of fertilizers (15:5:5 N:P:K) + 3% Manchurian Tea
T4	50% Recommended dose of fertilizers (15:5:5 N:P:K) + 3% Panchakavya
T5	50% Recommended dose of fertilizers (15:5:5 N:P:K)+ 3% Panchakavya +3% Manchurian Tea
T6	50% Recommended dose of fertilizers (15:5:5 N:P:K) + 3% Vermiwash
T7	50% Recommended dose of fertilizers (15:5:5 N:P:K) + 3% Vermiwash + 3%Manchurian Tea
T8	50% Recommended dose of fertilizers (15:5:5 N:P:K) + 3% Vermiwash + 3% Panchakavya
T9	50% Recommended dose of fertilizers (15:5:5 N:P:K) + 3% Vermiwash + 3% Panchakavya + 3% Manchurian Tea
T10	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot)
T11	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot) + 3% Manchurian Tea
T12	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot) + 3% Panchakavya
T13	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot) + 3% Panchakavya + 3% Manchurian tea
T14	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot)+ 3% Varmiwash
T15	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot)+ 3% Varmiwash + 3% Manchurian tea
T16	Common basal dose N:P:K 30:10:10 FYM 1.0 Kg/pot + Decomposed coir compost 100g/pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g/pot)+ 3% Varmiwash + 3% Panchakavya
T17	Common basal dose + 3% Varmiwash + 3% Panchakavya +3% Manchurian Tea

Table 2: Influence of biostimulants on Vegetative parameters of *Cymbidium giganteum*

Treatment	Plant height (cm)	No of Leaves	Leaf Length (cm)	Leaf width (cm)	Days to flowering	No. of pseudo bulbs /plant (no.)
T1 – Control	51.9	25.9	13.2	2.1	1041.5	2.2
T2- 50% Recommended doses of fertilizers	60.9	31.6	15.7	2.8	1036.5	3.0
T3- 50% Recommended doses of fertilizers+3% Manchurian Tea	62.5	31.6	19.2	2.7	1037.0	3.3
T4- 50% Recommended dose of fertilizers+3% Panchakavya	64.5	29.1	18.7	2.7	1027.5	2.8
T5-50% Recommended dose of fertilizers+3% Panchakavya +3%Manchurian Tea	65.7	34.6	19.2	2.5	1030.5	3.6
T6- 50% Recommended dose of fertilizers+3% Vermiwash	59.2	33.3	16.6	2.5	1032.0	3.2
T7- 50% Recommended dose of fertilizers+3% Vermiwash+3%Manchurian Tea	60.1	27.8	11.3	2.3	1034.0	3.2
T8- 50% Recommended dose of fertilizers+ 3% Vermiwash+3%Panchakavya	56.5	28.8	15.5	2.3	1029.0	3.0
T9- 50% Recommended dose of fertilizers+3% Vermiwash + 3%Panchakavya + 3% Manchurian Tea	65.1	31.9	16.3	2.6	1027.5	3.6
T10- Common basal dose*	54.1	29.1	15.3	2.7	1024.5	2.6
T11- Common basal dose + 3% Manchurian Tea	53.1	33.1	14.7	2.6	1027.5	3.3
T12- Common basal dose + 3% Panchakavya	65.6	33.1	17.6	2.7	1037.0	3.8
T13- Common basal dose + 3% Panchakavya + 3% Manchurian tea	65.5	31.8	21.2	3.5	1021.0	4.4
T14- Common basal dose + 3% Vermiwash	62.0	29.9	20.1	2.6	1030.5	3.0
T15- Common basal dose + 3% Vermiwash + 3% Manchurian tea	63.1	28.0	21.0	2.7	1037.5	2.8
T16- Common basal dose + 3% Vermiwash + 3% Panchakavya	63.0	27.1	13.2	2.4	1032.0	3.6
T17- Common basal dose + 3% Vermiwash + 3% Panchakavya +3% Manchurian Tea	62.8	32.3	14.5	2.6	1033.0	3.3
CD(P=0.05)	4.69	0.1	1.49	0.13	9.65	0.32
SE.d	2.21	0.47	0.73	0.62	4.55	0.15

Maximum leaf length of 21.2 cm was observed in T_{13}, followed by T_{15}which registered 21.0 cm and 20.1 cm by T_{14} whereas the treatment T_{7} recorded the lowest leaf length of 11.3 cm.With respect to leaf width,the lowest value was recorded in the treatment T_1 (control) 2.1 cmand the highest was recorded in T_{13}(3.5 cm). The increase in leaf breadth is due to enhanced levels of cytokinin, thereby causing manifold increase in cell division resulting in enhanced leaf width. Similar observations were earlier reported by Suguna (2005).

Naik *et al*. (2010) reported that the pseudobulb of Cymbidium hybrid functions as water, minerals, and carbohydrate storage device and for the maturity of pseudobulb, less Nitrogen and

Table 3: Influence of Biostimulants on floral parameters of *Cymbidium giganteum*

Treatment	Stalk length (cm)	Pedicel length (cm)	Flower dia (cm)	Flowers /spike (No.)	Spikes/ plant (No.)	Longevity of spikes inplants (d)	Vase life inwater (d)
T1 – Control	61.3	2.1	1.1	9.6	1.5	30.0	23.9
T2- 50% Recommended doses of fertilizers	71.9	2.4	1.5	10.1	1.0	30.6	24.1
T3- 50% Recommended doses of fertilizers + 3% Manchurian Tea	87.1	2.5	2.2	12.0	2.0	31.1	24.1
T4- 50% Recommended dose of fertilizers + 3% Panchakavya	85.6	2.4	2.8	11.8	1.0	29.6	22.8
T5-50% Recommended dose of fertilizers + 3% Panchakavya + 3% Manchurian Tea	77.2	2.2	3.4	13.0	1.5	28.6	22.8
T6- 50% Recommended dose of fertilizers + 3% Vermiwash	86.1	2.2	2.2	13.1	2.0	29.1	23.8
T7- 50% Recommended dose of fertilizers + 3% Vermiwash + 3% Manchurian Tea	83.7	2.5	2	12.8	1.4	30.4	25.1
T8- 50% Recommended dose of fertilizers + 3% Vermiwash + 3% Panchakavya	77.0	2.6	2.7	11.8	2.0	30.8	23.1
T9- 50% Recommended dose of fertilizers + 3% Vermiwash + 3% Panchakavya + 3% Manchurian Tea	74.9	2.5	1.4	11.3	1.0	30.8	24.8
T10- Common basal dose*	63.3	2.6	1.2	10.3	1.5	31.0	25.4
T11- Common basal dose + 3% Manchurian Tea	78.0	2.5	1.4	11.0	1.0	30.6	23.8
T12- Common basal dose + 3% Panchakavya	91.6	2.4	2.6	12.0	2.1	29.3	23.0
T13- Common basal dose + 3% Panchakavya + 3% Manchurian tea	96.6	2.7	2.0	14.8	3.0	31.3	25.8
T14- Common basal dose + 3% Vermiwash	81.7	2.2	2.4	12.8	1.0	30.3	23.6
T15- Common basal dose + 3% Vermiwash + 3% Manchurian tea	84.4	2.3	2.2	13.8	2.0	29.3	23.6
T16- Common basal dose + 3% Vermiwash + 3% Panchakavya	84.1	2.4	2.7	11.0	1.0	29.8	22.4
T17- Common basal dose + 3% Vermiwash + 3% Panchakavya +3% Manchurian Tea	77.0	2.4	2.0	12.0	2.0	29.1	23.8
CD(P=0.05)	0.56	0.08	0.10	0.65	0.25	0.7	0.56
SE.d	0.25	0.04	0.48	0.31	0.09	0.33	0.27

more of phosphorus and potassium is required. The above findings are in confirmity with our present investigations and confirm that number of pseudobulbs per plant was observed in the treatment T_{13} which showed the maximum of 4.4 per plant was closely followed by T_{12} which recorded 3.8. The least number of pseudobulbs (2.20) was observed in the treatments T_1.

The ultimate aim of research in flower crop is to get early flowering and increase in yield. The *Cymbidium* orchid flower is very showy and there can be as many as 20-30 blooms or more on a single spike. The earliness in flowering was noticed in T_{13} (1021 d) followed by T10 (1024.5d). The longest number of days for flowering was taken by T_{10} (1041.5 d). The application of exogenous cytokinins on plants have been shown to induce or promote earlier flowering in several species, generally under environmental conditions that are just above the threshold for flower induction.These findings are also in confirmation with the findings of Bhalla Rajesh *et al*. (2006).

The floral characters like stalk length (cm), pedicel length (cm), floret size or flower diameter (cm), number of flowers per spike and number of spikes per plant were significantly influenced by the application of bio stimulants (Table 3).The longest stalk length was recorded in treatment T_{13} 96.6 cm followed by treatments T_{12} which showed 91.6 cm. While T_1 (control) recorded the shortest spike length of 61.3cm. It may due to the fact that presence of macro and micro-nutrients in the media and their efficient absorption due to presence of the VAM in the media.These results are similar to the work of Thane *et al*. (2007).The pedicel size differed significantly among the treatments and ranged from 2.1 to 2.7 cm. The maximum pedicel size of (2.7 cm) was registered in the T_{13} followed by T_{10} and T_8 (2.6) while T_1 recorded the lowest pedicel size of (2.1 cm). Similar results were also reported by Naik *et al*. (2013) in Cymbidium orchids, Bhalla *et al*. (2006) in Gladlious.

Among the treatments, T_5 had recorded the largest floret sizeof 3.4 cm followed by treatments T_{15} which recorded 2.7 cm,whereas the treatments T_1 (control) registered the smallest floret sizeof 1.1 cm.Number of florets produced per spike is important in the cut flower trade of *Cymbidium* orchids. Spikes with more than 10 florets are regarded as the best for export. In the present work, application of stimulants had significantly promoted number of florets per spike. Treatment T_{13} had the highest number of florets per spike (14.8) followed by treatments T_{15} (13.8) and T_5 (13.0) whereas, the treatment T_1 (control) was found to be the lowest number of florets per spike (9.6). Among the treatment T_{13} had the highest number of spikes per plant (3.0 No). Maximium number of florets and number of flowers per plant might be due to presence of growth promoting substances like essential plant nutrients, vitamins, enzymes and antibiotics in Farmyard manure coupled with wide spread mycelia network of VAM which penetrates deeply in soil,thus widening the root zone for improving the availability of P and enchancing the uptake of certain minerals (Zn and S) including P and water. The results of the present investigation were in agreement with the findings of Patel *et al.,* 2011 in African marigold Kumar *et al.,* (2010 b) in Gladiolus and Mamta Bohra and Ajit Kumar (2014) in Chrysanthemum.

In the present work, application of biostimulants had significantly influenced the vase life. The treatment T_{13} resulted in the longevity of flowers in plants was 31.30 days and

recorded the highest vase life in water 25.80 days. This observation is an indication of the fact that vase life is also governed by pre harvest factors particularly fertilizer application. The results of the present study indicated that flower characters in orchid genus *Cymbidium* are considerably influenced by nutrients. *Cymbidium* being epiphytic can be easily turned to vegetative or flowering phase by changing the concentration of nutrients.The flowers that received more nutrients would have thickened cells and thereby shows the increased shelf life. The thickened cells are supposed to prolong life of cut flowers. These results are in corroboration with the findings of Venkatesan (2012) inCymbidium orchids.

The results of the present investigation thus revealed that among the treatments the combination of Common Basal Dose N:P:K 30:10:10, FYM 1.0 Kg per pot + Decomposed Coir Compost 100g per pot + Biofertilizers (VAM + Azospirillum + Trichoderma viride 20g per pot) + 3% Panchakavya + 3% Manchurian tea performed better in terms of vegetative and floral characters for Cymbidium orchid under Shevaroy hill of Eastern Ghats.

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