



Media for growth and yield of calla lily (*Zantedeschia elliotiana*) in Andaman and Nicobar Islands

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The Calla lily belongs to the family Araceae and is a flowering plant grown commercially under protected condition throughout the world for its cut flowers and also as an ornamental potted plant. The most attractive part of calla lily is coloured corolla which is the modification of leaf and botanically known as 'spathe'. The flower is very popular among flower arrangers due to its bold effect and long lasting nature. *Zantedeschia* flowers are conspicuous for their shape, colour and exceptionally long vase-life and can be transported 3–4 days without water. It is one of the top 20 cut flowers of the world. The success for commercial cultivation of cut flowers under protected cultivation needs good combination of growing media which has most important role for proper growth and development of plants. Continuous cultivation of cut flowers in soil may limit the productivity of crops due to fertility loss and occurrence of soil borne diseases. Therefore, utilizing substrate based cultivation is a logical alternative to the current soil based production system. Calla lily is sensitive to many diseases especially bacteria such as *Pectobacterium carotovaorum* (Figuiredo *et al.* 2017), if there is lack of aeration as well as drainage. The most important physical properties of a medium for suitability are good aeration, drainage, optimum water retention, high water conductivity and low bulk density (Cabrera 2003). The successful and cost effective cut flower production in Andaman and Nicobar Islands depends on utilizing the locally available growing media. Considering the above facts, the present experiment was conducted to find suitable growing media for improving the growth, yield and quality of calla lily under naturally ventilated polyhouse under Bay Island conditions.

The experiment was conducted for two consecutive years 2012–13 and 2013–14 during October–March under

naturally ventilated polyhouse at the research farm of ICAR-Central Island Agricultural Research Institute (CIARI), Port Blair, Andaman and Nicobar Islands, India, which is situated at the Eastern coast of India in Bay of Bengal (10°30' and 13°42' N latitude and 92°14' and 90°16' E longitude) having a typical tropical and humid climate with annual precipitation of 3086 mm and the recorded relative humidity is about 82%. The congenial climatic conditions of Andaman and Nicobar Islands are well suited for flower cultivation. During the crop period of investigation the minimum and maximum temperatures under naturally ventilated polyhouse recorded from 22–32°C and the relative humidity from 69–80%. The relative humidity starts decreasing and temperature start increasing from January. Commercially calla lily is propagated through tubers. Healthy and uniform size (12–14 cm circumference) tubers of variety 'Mango' were procured from a grower at Ooty, Tamil Nadu and dipped in solution of copper oxychloride (2 g/l) + Streptomycin (0.1 g/l) for 10 min and dried in shade for a day. Then tubers were treated with GA₃, 125 ppm solution to break the dormancy, avoid flower deformities and uniform flowering. After 24 h of shade drying, tubers were planted in the bed. Before planting the field was prepared with nine different media combination treatments, viz. T1- Soil: FYM: Poultry manure :Vermicompost (2:1:1:1 v/v); T2- Soil: FYM: Vermicompost:Coir compost (2:1:1:1 v/v); T3- Soil: Sawdust: Vermicompost:Coir compost ((2:1:1:1 v/v); T4- Soil: Sawdust: Vermicompost: Rice husk (2:1:1:1 v/v); T5- Soil: Sand: Coir compost: Vermicompost (2:1:1:1 v/v); T6- Soil: Poultry manure: Vermicompost: Coir compost: Sawdust (2:1:1:1 v/v); T7- Soil: Vermicompost: Poultry manure: Coir compost: Sand: Sawdust: Ricehusk (2:1:1:1:1:1 v/v); T8- Soil: Vermicompost: Sand: Coir compost: Sawdust: Rice husk ((2:1:1:1:1:1 v/v) and Control (Soil) replicated thrice and laid out in a randomized block design. The treated tubers were planted in the different treatment combinations at the spacing of 30 cm × 30 cm at 10 cm depth. After planting the beds were irrigated immediately and continued at an interval of 3 days.

The observations were recorded on important growth and flowering characteristics of calla lily. After the harvest

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of flowers, the tubers were allowed to mature. After 35–50 days of flowering, the tubers were harvested when leaf drying symptoms were observed. The physico-chemical properties of medium were analyzed at the initial of experiment and also at the end of the crop harvest. The data collected were subjected to statistical analysis.

Among the different combinations of growing media, soil: sand: coir compost: vermicompost @2:1:1:1 (T5) recorded maximum plant height (72.10 cm). The significant results of these growing media were apparently related to the retention of optimum moisture and good aeration in the root zone and hence able to supply ample quantities of nutrients to plants in order to sustain the growth and development. The total number of leaves was higher in the treatment T5 (8.35) thus showing that the total green matter produced had a positive influence on flower production. Early sprouting (18.6 days) was recorded in the growing media containing soil: sand: coircompost: vermicompost @2:1:1:1 (T5). This may be due to the ability of growing media to supply ample quantity of nutrients to plants and also due to the optimum pH and EC of this media combination (Table 1). Treatment T5 (soil: sand: coir compost: vermicompost @2:1:1:1)

produced significantly maximum number of shoots per plant (3.93) (Table 2). The pH of this media (Table 1) has played major role for influencing the plant growth by aiding in absorption of nutrients by the plants. This in turn helped in initial vigour and better metabolic activities especially with the production of photo assimilates, which would have favoured more production of shoots. These results corroborate the findings of Dhananjaya and Sulladmath (2003) in anthurium and Gupta *et al.* (2004) in gerbera.

Early flowering (72.02 days) was recorded in the treatment T5 (soil: sand: coir compost: vermicompost @2:1:1:1) when compared to control (123.5 days). The combinations of growing media with different nutrient combinations have helped in the vigorous vegetative growth of plants resulting in early flower emergence as compared to the control (T9). Flower quality parameters, viz. stalk length and flower diameter were found maximum (52.02 cm and 16 cm respectively) in the growing media containing soil: sand: coir compost: vermicompost @2:1:1:1 (T5). The increase in the size of flower might be due to the cumulative effect of all growing media such as coir compost combined with vermicompost with increased water

Table 1 Physico- chemical properties of growing media of Calla lily

Treatment	pH	ECS (ds/m)	OC (%)	N (kg/ha)	K (kg/ha)	pH	ECS (ds/m)	OC (%)	N (kg/ha)	K (kg/ha)
Before start of the experiment						After completion of the experiment				
T1	6.9	0.3	1.9	2032.1	556	6.7	0.4	1.80	1849.2	543.0
T2	6.9	0.2	1.9	1166.6	224	6.6	0.2	1.82	1061.6	203.8
T3	6.5	0.1	2.7	1455.1	220	6.3	0.2	2.59	1367.8	200.2
T4	6.8	0.2	1.2	1241.9	234	6.6	0.3	1.15	1167.4	212.9
T5	6.5	0.2	1.8	1078.8	223	6.3	0.2	1.67	981.7	202.9
T6	6.2	0.3	1.4	2395.9	264	6.1	0.3	1.30	2180.3	240.2
T7	6.7	0.2	1.4	1154.0	248	6.5	0.2	1.32	1107.8	225.7
T8	6.7	0.3	3.6	1517.8	228	6.4	0.2	3.46	1457.1	207.5
T9 (Control)	7.0	0.1	0.1	276.0	142	6.8	0.2	2.10	270.5	139.0

Table 2 Effect of growing media on vegetative, flowering and tuber growth parameters of Calla lily

Treatments	Plant height (cm)	Number of leaves per plant	Days taken for 50% sprouting	Number of shoots per plant	Days taken for first flowering	Stalk length (cm)	Number of flowers per plant	Duration of flowering (days)	Flower diameter (cm)	Number of tubers per plant	Weight of tuber (g)	Tuber size (cm)
T1	65.6	4.17	11.6	2.84	94.30	47.18	2.17	9.92	10.4	2.32	109.5	12.28
T2	59.9	4.45	11.5	2.09	103.3	40.53	2.20	9.08	9.23	2.03	97.83	11.10
T3	69.1	6.63	9.50	3.35	83.00	49.03	2.38	13.2	10.5	2.75	127.7	13.38
T4	68.8	4.70	16.2	1.97	95.47	45.00	2.23	9.67	10.5	2.33	122.5	13.83
T5	72.1	8.35	8.00	3.93	72.02	52.02	4.32	15.5	16	3.27	130.5	14.25
T6	56.9	5.43	10.5	2.32	90.67	41.58	2.93	12.5	10.3	2.05	126.5	12.88
T7	63.8	5.05	12.6	1.94	103.8	39.17	2.13	10.9	9.87	2.47	110.8	12.15
T8	60.7	4.05	13.7	1.92	112.5	36.37	1.83	12.3	11.3	2.63	120.4	12.58
T9	50.4	2.58	18.6	1.42	123.5	30.18	1.08	7.03	7.05	1.28	75.67	8.35
CD	4.94	1.37	4.38	0.58	8.63	3.61	0.86	2.3	1.36	0.60	10.87	1.18

holding capacity, high porosity (95%), nutritive value and slightly acidic nature (Noguera *et al.* 2000). Vermicompost contains most nutrients in available form such as nitrates, phosphates, exchangeable calcium, soluble potassium etc. and has large particular surface area that provides many microsites for microbial activity and the strong retention of nutrients (Sharma *et al.* 2005). Vermicompost is reported to have bioactive principles which are considered to be beneficial for root growth and increased biomass that enhances growth (Bachman and Metzgar 2008) and also balances composition of nutrients (Zaller 2007). Maximum flower duration (15.50 days) was recorded in the treatment T5 (soil: sand: coir compost: vermicompost @2:1:1:1) when compared to control (7.03 days). This might be due to the fact that organic substrates contain optimum levels of essential nutrients that produce quality flowers which gives superior longevity of inflorescence on plant. The results are in line with findings of Jawaharlal *et al.* (2001) in anthurium and Arumugam, and Jawaharlal (2004) in Dendrobium orchids. Maximum number of flowers per plant (4.32) was recorded in the treatment T5 (soil: sand: coir compost: vermicompost @2:1:1:1), whereas minimum was recorded in control (1.08). The variation in number of flowers per plant may be due to the physico-chemical properties of the substrates and the influence of media in nutrient uptake. The coir compost is low in nutrients and when mixed with vermicompost provides a better growth medium for plant establishment (Campostoma *et al.* 2009). These results are in accordance with the findings of Barretos and Jagtap (2006) in Gerbera and Abirami *et al.* 2010. Maximum number of tubers per plant, weight and size of tuber (3.27, 130.5 g and 14.25 cm respectively) were recorded in the growing media containing soil: sand: coir compost: vermicompost @2:1:1:1 (T5). This may be due to optimum water holding capacity, better aeration and porosity of the growing media which might have helped in better development and establishment of tuber thereby helping the tuber to grow healthy. Control recorded minimum tuber growth due to compactness and poor aeration of soil that hinders the growth and development of tuber.

SUMMARY

Calla lily (*Zantedeschia elliottiana* W. Wats.) is an attractive cut flower and a popular pot plant in commercial floriculture industry. This is an introduced crop in Andaman and Nicobar Islands and the use of growing media as substrate showed potential influence on growth and yield of cut flowers when compared to soil media. The growing media containing soil: sand: coir compost: vermicompost @2:1:1:1 recorded early sprouting (18.6 days), maximum number of shoots per plant (3.93), maximum number

of leaves per plant (8.35), maximum stalk length (52.02 cm), flower diameter (16.0 cm), flower duration (15.5 days), number of flowers per plant (4.32), early flowering (72.02 days), maximum number of tubers per plant (3.27), maximum tuber weight (130.5 g) and maximum size of tuber (14.25 cm).

Thus for commercial cultivation of calla lily the use of substrate media containing soil: sand: coir compost: vermicompost @2:1:1:1 (T5) was the best over soil for better vegetative, flowering and tuber growth.

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