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Effect of Growing Conditions on Growth and Flowering of Calla Lily (*Zantedeschia* spp.) Cultivars

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ABSTRACT: The present investigation on "studies on the effect of growing conditions on growth, flowering of calla lily (*Zantedeschia* spp.) cultivars" was under taken to determine the best treatment. In this experiment three cultivars were grown under different growing conditions in completely randomized design with factorial concept with nine treatments and three replications during 2021-22 & 2022-23. From the results, it was observed that the maximum plant height at 30, 60 & 90 days after planting (37.46 cm, 51.00 cm & 63.63 cm), minimum days to first flower (62.61 days), stalk length (43.57 cm), stalk diameter (5.87 mm), spathe width (4.89 cm), spadix length (4.91 cm). Whereas, maximum spathe length (12.79 cm) was observed in cv. Piccaso under shade net condition.

Keywords: Growing conditions, cultivars, calla lily.

INTRODUCTION

The calla lily (*Zantedeschia* spp) or arum lily is a species of Araceae family and the word 'Calla' is derived from the greek which means '*beautiful',* is native to South West Africa. The natural habitat of calla lily is in streams and ponds or on the banks of the rivers. It has arrow shaped leaves and grows to a height of 0.6-1.0m tall. *Zantedeschia* is a herbaceous perennial plant and it has a triggered significant economic growth in the flower and ornamental plant industry due to its showy inflorescences and ornamental leaves. Leaves of calla lily are solid green or green with silver or white flecks and are integral, compact, carried along the stem. The inflorescence consists of a yellow spike in the center of the flower called spadix with true flowers surrounded by the outer part or petal called spathe (Cantor and Pop 2005). The flowers of calla lily appear in various colors of white, yellow, orange, pink, rose, lavender and dark maroon.

Zantedeschia requires mild climate for its growth and development. Best growth can be obtained under low temperature as plants develop less luxuriantly and become tougher when temperature is too high. The maximum day and night temperature required is 18°C to 24°C and 15°C to 18°C. Lower temperature is required at the flowering stage as it promotes more intense color in the flowers. High temperature must be avoided after flowering, during rhizome growth. It grows well under 60 to 75 per cent relative humidity and requires light intensity of about 4000 lux. Therefore, during summer months, shade net can be used to cut off 75 per cent light and 50 per cent during winter season. (www.Kfbioplants.com)

Diversification of crops encourages to introduce new crops to a particular location depending on their commercial significance. However, before their recommendation to the growers the feasibility and adaptability of crop should be studied systematically. In order to promote calla lily in Telangana region, its suitability to environment need to be assessed. This adverse climatic conditions also makes difficulty in the managing crop and the quality is also affected. Environmental control and crop productivity is limited in traditional cultivation practices. Modification of crop microclimate through structural and agronomic interventions that improve plant growth and yield through optimization of soil and air temperatures is very important for promoting cultivation and quality production in any crop. Protected cultivation one such method is extensively used to provide favourable conditions suitable for optimal flower production (Singh and Sirohi 2006). Besides it also enhances the produce quality and ensures off-season availability. The economic returns are also 10 to 15 times higher under protected structures when compared with open-field cultivation (Panda *et al*., 2008). Further the crops can also be managed successfully throughout the year. Apart from this protected conditions also provide favourable environment for the growth of the plants by

protecting the crop from heavy winds, pests, diseases. Calla lily is one of the flower crops suited for protected cultivation with standard cultivation practices are employed.

MATERIAL AND METHODS

The experiment was conducted at Floricultural Research Station, Rajendranagar, Hyderabad during the year 2021-22 and 2022-23. The experiment was laid out in factorial randomized block design (FRBD) with nine treatments and three replications. The treatments used in the experiment are as follows,

Factor 1 : Growing conditions (G)
G_1 : Open conditions
G_2 : Shade net conditions
G_3 : Poly house conditions
Factor 2 : Cultivars (V)
V_1 : Captain Murano
V_2 : Picasso
V_3 : Captain Brunello
Treatment combinations :
G_1V_1 : Open conditions + Captain Murano
G_1V_2 : Open conditions + Picasso
G_1V_3 : Open conditions + Captain Brunello
G_2V_1 : Shade net conditions + Captain Murano
G_2V_2 : Shade net conditions + Picasso
G_2V_3 : Shade net conditions + Captain Brunello
G_3V_1 : Polyhouse conditions + Captain Murano
G_3V_2 : Polyhouse conditions + Picasso
G_3V_3 : Polyhouse conditions + Captain Brunello

RESULTS AND DISCUSSION

Growth parameters. In the pooled data on growth characters (Table 1 & Plate 1) showed that growing conditions and cultivars affected plant height at 30, 60 and 90 days respectively. In the interaction cv. Captain Murano under shade net recorded maximum plant height (37.46 cm, 51.00 cm & 63.63 cm) at 30, 60 and 90 days after planting.

The significant increase in plant height was observed in shade house as well as polyhouse condition than open condition might be due to a modification of climatic condition throughout the crop growth period coupled with better assimilation of nutrients under shade net compared to polyhouse and open condition. Such type of difference in plant height was also reported by Rushd *et al*. (2010); Ranchana *et al*. (2013); Mahawer *et al*. (2013); Chaturvedi *et al*. (2014) in tuberose. Among the cultivars cv. Captain Murano recorded maximum plant height might be due to genetic constitution of the cultivar and genotypic potential and availability of nutrients in the soil, which were influenced by low light intensity and high relative humidity condition under shade net condition (Amin *et al*. (2010) in ginger).

Flowering parameters. From the Pooled data of both the years 2021-22 & 2022-23 on floral characters (table 2 & 3) revealed that days to first flower (62.61 days), stalk length (43.57 cm), stalk diameter (5.87 mm), spathe width (4.89 cm), spadix length (4.91 cm) was recorded in cv. Captain Murano whereas, maximum spathe length (12.79 cm) was recorded in cv. Picasso under shade net condition.

During both the seasons cultivars took less number of day to first flower when grown under shade net since the plants grown under shade net conditions produced more number of leaves resulting in higher photosynthetic rate and more accumulation of carbohydrates in plants. It is fact that, plants with more carbohydrate reserve will come to reproductive phase earlier. Similar results were reported by Swaroop *et al*. (2006) in chrysanthemum, Shiva and Dadlani (2002); Simmy (2015) in gladiolus. Similarly, maximum floral attributes could be attributed to favourable microclimatic conditions (e.g., soil moisture, soil and air temperature, relative humidity, etc.) and increased light intensity inside the green house, which resulted in increased leaf production in plants grown under shade net conditions, resulting in an increased rate of photosynthesis and increased supply of photosynthates from source to developing sink. Kandpal *et al*. (2003) observed similar findings in gerbera.

Table 1: Effect of growing conditions on growth parameters of calla lily cultivars.

Treatments	Pooled data (2021-22 & 2022-23)											
	Plant height (30 days after planting)				Plant height (60 days after planting)				Plant height (90 days after planting)			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
G_1 - Open condition	18.65	10.50	14.64	14.59	25.08	18.71	22.63	22.14	34.62	23.28	28.00	28.64
G_2 - Shade net condition	37.46	20.53	25.85	27.94	51.00	33.57	38.87	41.15	63.63	42.79	48.33	51.58
G_3 - Polyhouse condition	34.12	23.70	16.16	24.66	47.93	31.01	26.55	35.16	50.60	43.45	36.68	43.58
Mean	30.07	18.24	18.84		41.34	27.76	29.35		49.62	36.51	37.67	
	S.Em ±		CD (5%)		S.Em ±		CD (5%)		S.Em ±		CD (5%)	
G - Growing conditions	0.234		0.708		0.322		0.972		0.360		1.090	
V – Cultivars	0.234		0.708		0.322		0.972		0.360		1.090	
G × V	0.405		1.226		0.557		1.684		0.624		1.887	

Factor I : Growing conditions (G)
G_1 : Open conditions
G_2 : Shade net conditions
G_3 : Polyhouse conditions

Factor II : Cultivars (V)
V_1 : Captain Murano
V_2 : Picasso
V_3 : Captain Brunello

Table 2: Effect of growing conditions on flowering parameters of calla lily cultivars.

Treatments	Pooled data (2021-22 & 2022-23)											
	Days to first flower				Stalk length (cm)				Stalk diameter (mm)			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
G_1 - Open condition	69.18	79.26	85.01	77.82	26.86	19.75	12.19	19.60	4.16	4.07	2.87	3.70
G_2 - Shade net condition	62.61	65.41	73.24	67.08	43.57	32.23	23.35	33.05	5.87	4.95	3.94	4.92
G_3 - Polyhouse condition	65.34	74.81	77.92	72.68	33.40	29.71	18.90	27.34	5.33	4.37	3.42	4.38
Mean	65.71	73.16	78.72		34.61	27.23	18.15		5.12	4.46	3.41	
	S.Em ±		CD (5%)		S.Em ±		CD (5%)		S.Em ±		CD (5%)	
G - Growing conditions	0.666		2.015		0.230		0.695		0.045		0.137	
V – Cultivars	0.666		2.015		0.230		0.695		0.045		0.137	
G × V	1.154		3.490		0.398		1.203		0.078		0.237	

Table 3: Effect of growing conditions on flowering parameters of calla lily cultivars.

Treatments	Pooled data (2021-22 & 2022-23).											
	Spathe length (cm)				Spathe width (cm)				Spadix length (m)			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
G_1 - Open condition	8.43	8.25	5.36	7.35	4.06	3.75	3.42	3.74	4.85	4.65	4.64	4.71
G_2 - Shade net condition	8.76	12.79	9.33	10.29	4.89	4.40	4.31	4.53	4.92	4.76	4.63	4.78
G_3 - Polyhouse condition	7.91	11.72	6.60	8.74	4.70	4.30	3.57	4.19	4.62	4.73	4.78	4.71
Mean	8.37	10.89	7.09		4.55	4.15	3.76		4.79	4.71	4.69	
	S.Em ±		CD (5%)		S.Em ±		CD (5%)		S.Em ±		CD (5%)	
G - Growing conditions	0.064		0.193		0.034		0.104		0.027		NS	
V – Cultivars	0.064		0.193		0.034		0.104		0.027		NS	
G × V	0.111		0.335		0.059		0.180		0.047		NS	

Factor I : Growing conditions (G)

G_1 : Open conditions
G_2 : Shade net conditions
G_3 : Polyhouse conditions

Factor II : Cultivars (V)

V_1 : Captain Murano
V_2 : Picasso
V_3 : Captain Brunello

Plate 1. Influence of growing conditions in cv. Captain Brunello on plant height at 60 days after planting.

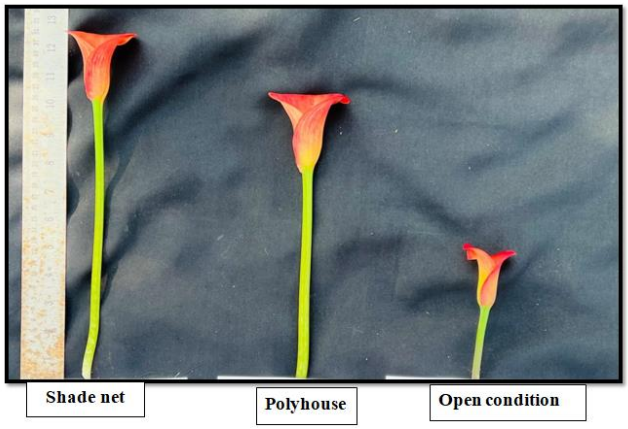

Plate 2. Influence of growing conditions on stalk length in cv. Captain Brunello.

CONCLUSIONS

Based on the above findings among the interactions in the pooled data cv. Captain murano grown under shade net had performed better with respect to growth and flowering parameters.

FUTURE SCOPE

In the continuation of the present investigation, the following further work can be proposed. The experiment can be conducted by comparing the performance of domestic cultivars with export cultivars under shade net conditions.

The experiment can be also be taken up on the sowing of rhizomes of different sizes and comparing the performance of calla lily cultivars in terms of growth, quality and yield with that of whole rhizome as rhizomes are expensive.

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