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RESPONSE OF TUBER DIVISION SIZE ON VEGETATIVE GROWTH OF CALLA LILY CV. CAPTAIN MURANO

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ABSTRACT

A study at the Floricultural Research Station in Rajendranagar, Hyderabad, in 2023–2024 was titled "Effect of Tuber Divisions as Propagules on Plant Growth of Calla Lily cv. Captain Murano." The purpose of the study was to determine how plant growth was impacted by tuber sizes. Using a Randomised Block Design (RBD), the experiment was conducted. Significantly, the study discovered that T₇: 7-8 cm tuber diameter resulted in the minimum number of days for sprouting (34.47 days), minimum number of days for full leaf emergence (49.27 days), the maximum plant height at 60 DAP (32.00 cm), 90 DAP (45.93 cm), 120 DAP (57.33 cm), the maximum number of leaves (39.20), the maximum absolute growth rate at 30-60 DAP (1.08 cm day⁻¹), 60-90 DAP (0.45 cm day⁻¹), and 90-120 DAP (0.38 cm day⁻¹) in comparison to other treatments. On the other hand, T₁: <2 cm diameter reported the maximum number of days for sprouting (54.27 days), maximum number of days taken for complete leaf emergence (89.80 days). Of all the treatments, T₁: <2 cm diameter reported minimum plant height at 60 DAP (13.33 cm), 90 DAP (24.40 cm) and 120 DAP (32.47 cm); minimum number of leaves at flowering (5.40); the minimum absolute growth rate at 30-60 DAP (0.45 cm day⁻¹), 60-90 DAP (0.36 cm day⁻¹) and 90-120 DAP (0.27 cm day⁻¹). From the results it can be concluded that, among all the treatments T₄: 4-6 cm tuber diameter to T₇: 7-8 cm tuber diameter recorded significantly maximum growth parameters.

Keywords : Calla lily, Captain Murano, Plant growth.

Introduction

A vital component of the horticulture sector, ornamental plants have a big influence on the global horticultural market (Azadi *et al.*, 2016). The Araceae family includes the calla lily (*Zantedeschia albomaculata* Bail.). With a horseshoe-shaped spathe, it is a perennial decorative flowering herbaceous bulbous plant. From the marshy plains of South Africa's coastline region to the mountainous areas of South-east Africa, it is indigenous to the tropical sections of the African continent (Sun *et al.*, 2023). It

comes from the word calla, which means "beautiful" in Greek. In 1826, Sprengel gave calla the name *Zantedeschia* in honour of Giovanni Zantedeschia, an Italian botanist (Letty, 1973).

It is currently gaining popularity in India because of its unusual flower shape, various flower colours (white, pink, golden, red lavender, black, yellow, orange, and dark purple), lovely foliage, and good flower preservation. It is cultivated as a border plant and outdoor garden plant (Dabral *et al.*, 2019). It is one of the cut flowers widely used in flower arrangements,

especially in wedding decorations (Landgraf *et al.*, 2017) and grown as potted flowering plant (Bailey and Bailey, 1960) and also be grown for container cultivation on balconies and terraces (Kulpa, 2016). Calla lilies are customarily propagated through rhizomes but economically using offsets. However, tuber division is conducted to increase the quantity of tubers of flowering size (Kumar and Dogra, 2020). Tuber size is one of the major flowering determinants in calla lily (Chen *et al.*, 2000). Only healthy tubers which are free from any infection, chalking or injuries of the best commercial varieties should be grown.

According to Laishram and Hatibarua (2013), the higher demand and exorbitant cost of gladiolus planting material can be solved by dividing corms into many pieces. He also underlined that another important consideration for producing high-quality cut flowers is the size of the planting material. Because of their distinctive shape and colour, calla lily blossoms command a high market value. However, the area under calla lily cultivation in India, especially in Telangana state, is extremely small due to the expensive cost of the tubers, which ranges from 150 to 200 rupees each, and the limited supply of tubers. Since tubers are used to commercially propagate calla lilies. After a single planting season, the harvested tubers range in size from 4 to 12 cm in diameter and have several growth points or sprouts. One practical way to increase planting material without sacrificing flower production quality and yield is to divide tubers into propagules of the ideal diameter.

Materials and Methods

The experiment was conducted during the year 2023-24 at Floricultural Research Station, ARI, Rajendranagar, Hyderabad, Telangana. The experiment site comes under semi-arid tropical climate located at an altitude of 542.3 m above sea level at latitude of 17.90° N and longitude of 78.23° E with an average rainfall of 614.9 mm. The field experiment was laid out in randomized block design (RBD) and three replications *i.e.* T₁ - < 2 cm diameter, T₂ - 2-3 cm diameter, T₃ - 3-4 cm diameter, T₄ - 4-5 cm diameter, T₅ - 5-6 cm diameter, T₆ - 6-7 cm diameter, T₇ - 7-8 cm diameter. Data on tuber parameters were recorded and subjected to statistical analysis, the test of significance (F-test) and critical difference (C.D.) at 0.05 probability (Panse and Sukhatme 1985).

Results and Discussion

Days taken for initiation of sprouting (days)

The data on days taken for initiation of sprouting was recorded by counting the days from the day of sowing the tuber till the emergence of the sprouts.

Among the treatments, the treatment T₇: 7-8 cm tuber diameter recorded significantly minimum number of days taken for initiation of sprouting (34.47 days) which was at par with T₆: 6-7 cm diameter (36.40 days), T₅: 5-6 cm diameter (38.67 days) and it was followed by T₄: 4-5 cm diameter (42.80 days). While, maximum number of days taken for initiation of sprouting was observed in T₁: <2 cm diameter (54.27 days) which was at par with T₁, T₂. The early sprouting in larger sized tubers *i.e.*, from 4 cm to 8 cm (T₄, T₇) may be attributed to the higher amount of stored food in the tubers and lesser dormancy. The results are in accordance with the views expressed by Sarkar *et al.* (2014) in gladiolus corms where larger corms have shorter dormant period than smaller ones which speeds up the plant emergence. Similar results are reported by earlier findings of Bhat *et al.* (2009), Kareem *et al.* (2013), Narayan *et al.* (2013), Jagtap *et al.* (2023) in gladiolus; Mane *et al.* (2006) in tuberose; Azimi *et al.* (2021) in calla lily.

Days taken for complete leaf emergence (days)

The data on days taken for complete leaf emergence was recorded by counting the days taken from sprouting to the complete leaf emergence.

Days taken for complete leaf emergence differed significantly among the treatments. The results revealed that minimum number of days taken for complete leaf emergence (49.27 days) was recorded in treatment T₇: 7-8 cm tuber diameter followed by T₆: 6-7 cm diameter (59.80 days), which was at par with T₅ and T₄. Whereas, maximum number of days taken for initiation of sprouting was recorded in T₁: <2 cm diameter (89.80 days), which was at par with T₂. The early emergence of leaves in larger tubers might be due to increased supply of photosynthates to the emerging sprouts thereby resulted in faster leaf emergence. Earliness in sprouting was also reported by Sarkar *et al.* (2014) in gladiolus.

Number of leaves

The number of leaves that emerged on a plant from the planting till the final harvest of tuber was counted and recorded.

All the treatments exhibited significant differences on this parameter and the data revealed that there was a gradual rise in number of leaves with every increase in the diameter of tuber. The treatment containing tuber diameter T₇: 7-8 cm diameter registered significantly maximum number of leaves (39.20) followed by T₆: 6-7 cm diameter (32.80). However, minimum number of leaves at flowering was recorded in T₁: <2 cm diameter (5.40), which was at par with T₂. The higher production of number of leaves

with increased size of tuber might be due to the higher reserved food and more number of active buds which resulted in increased production of leaves. Singh *et al.* (2017) also reported similar results in tuberose where he found progressive increase in vegetative parameters in bulb grades having larger bulb diameter. Similar

results were recorded by earlier findings of Ahmad *et al.* (2009), Yadav *et al.* (1984), Nadim *et al.* (2022), Patel *et al.* (2023) in tuberose; Akand *et al.* (2016), Shaji *et al.* (2022), Singh *et al.* (2021) in gladiolus; Alsaleh and Awadh (2020) in liliun; Qasim (2015) in calla lily.

Table 1: Response of tuber division sizes on days taken for initiation of sprouting (days), days taken for complete leaf emergence (days) and number of leaves of Calla lily cv. Captain Murano

Treatments	Days taken for initiation of sprouting (days)	Days taken for complete leaf emergence (days)	Number of leaves
T ₁ : <2 cm diameter	54.27	89.80	5.40
T ₂ : 2-3 cm diameter	51.93	82.93	8.53
T ₃ : 3-4 cm diameter	48.80	77.53	14.70
T ₄ : 4-5 cm diameter	42.80	67.53	24.33
T ₅ : 5-6 cm diameter	38.67	56.73	24.00
T ₆ : 6-7 cm diameter	36.40	59.80	32.80
T ₇ : 7-8 cm diameter	34.47	49.27	39.20
SEm ±	2.11	3.41	1.28
C.D at 5%	6.49	10.51	3.93

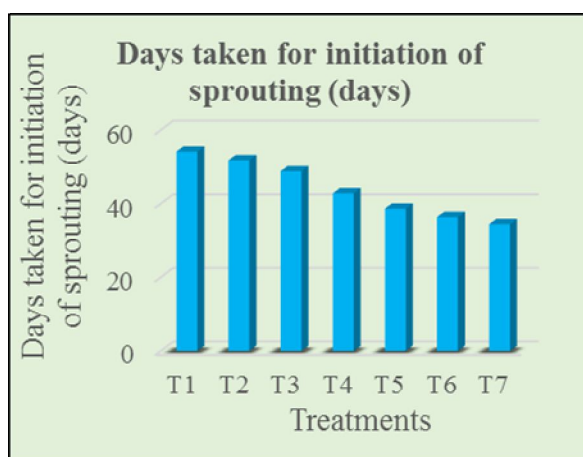


Fig. 1: Response of tuber division size on days taken for initiation of sprouting (days) and days taken for complete leaf emergence (days) of calla lily cv. Captain Murano

Plant height at 60, 90 and 120 DAP (cm)

The plant height at 60, 90 and 120 DAP was measured by meter scale from the ground level to the highest tip of each plant in centimetres and the average was worked out.

AT 60 DAP

There was significant difference noticed in the plant height at 60 DAP due to tuber divisions. Among the treatments, T₇- containing tuber diameter of 7-8 cm diameter recorded maximum plant height (32.00 cm) which was at par with T₆: 6-7 cm diameter (29.73) and it was followed by T₅: 5-6 cm diameter (26.00 cm). However, minimum plant height was observed in T₁: <2 cm diameter (13.33 cm) as compared to other treatments.

AT 90 DAP

The perusal of data revealed that among the treatments, treatment T₇: 7-8 cm diameter recorded maximum plant height at 90 DAP (45.93 cm) which was at par with T₆: 6-7 cm diameter (43.20) and it was followed by T₅: 5-6 cm diameter (38.80 cm). While, minimum plant height was observed in T₁: <2 cm diameter (24.40 cm).

AT 120 DAP

It is evident from the data that T₇: 7-8 cm diameter recorded maximum plant height at 120 DAP (57.33 cm) which was at par with T₆: 6-7 cm diameter (53.60) and it was followed by T₅: 5-6 cm diameter (49.20 cm). Whereas, minimum plant height was recorded in T₁: <2 cm diameter (32.47 cm).

The plant height was influenced by different sizes of tubers after 30 DAP till 120 DAP, where there was no sprouting till 30 DAP and then larger tubers emerged first and gradually the increasing trend in plant height was observed. However, the treatments T₇ and T₆ are found to be at par throughout the growth period. This could be due to the sufficient stored food materials in larger tubers for rapid vegetative growth. The results are in accordance with the findings of Hossain *et al.* (2021) in gladiolus, where they reported that larger sized corms supplied adequate nutrients for emerging plants. Similar results were also supported by Narayan *et al.* (2013), Gupta *et al.* (2013) in gladiolus; Singh *et al.* (2017), Zamin *et al.* (2020) in tuberose; Addai and Scott (2011) in liliun, Qasim (2015) in calla lily.

Absolute growth rate (AGR) at 30-60, 60-90 and 90-120 DAP (cm day⁻¹)

The observation was recorded by measuring the plant heights at different time intervals (i.e., 30-60, 60-90 and 90-120 DAP) and expressed in cm day⁻¹.

$$AGR = \frac{h_2 - h_1}{t_2 - t_1}$$

Here,

AGR- Absolute Growth Rate (Srivastava and Prasad, 2010)

h₁ and h₂ - plant heights at different intervals of time

t₁ and t₂ - different time intervals

AT 30-60 DAP

The perusal of data revealed that there was significant difference among the treatments with respect to absolute growth rate at 30-60 DAP. The results show that the treatment containing tuber diameter of 7-8 cm diameter noticed significantly maximum absolute growth rate (1.08 cm day⁻¹) which was at par with T₆: 6-7 cm diameter (0.99 cm day⁻¹) and it was followed by T₅: 5-6 cm diameter (0.87 cm day⁻¹). While, minimum absolute growth rate was registered in T₁: <2 cm diameter (0.45 cm day⁻¹) among all the treatments.

AT 60-90 DAP

It is apparent from the data that treatment T₇: 7-8 cm tuber diameter resulted in significantly maximum absolute growth rate (0.45 cm day⁻¹) which was at par with T₆: 6-7 cm diameter (0.42 cm day⁻¹), T₅: 5-6 cm diameter (0.42 cm day⁻¹), T₄: 4-5 cm diameter (0.40 cm day⁻¹), T₃: 3-4 cm diameter (0.39 cm day⁻¹) and it was followed by T₂: 2-3 cm diameter (0.38 cm day⁻¹). Whereas, minimum absolute growth rate was recorded in T₁: <2 cm diameter (0.36 cm day⁻¹).

AT 90-120 DAP

From the data enumerated, it is clear that absolute growth rate at 90-120 DAP was significantly affected with tuber divisions. Significantly maximum absolute growth rate (0.38 cm day⁻¹) was observed in T₇: 7-8 cm diameter which was at par with T₅: 5-6 cm diameter (0.35 cm day⁻¹), T₆: 6-7 cm diameter (0.36 cm day⁻¹) and it was followed by T₄: 4-5 cm diameter (0.32 cm day⁻¹). However, minimum absolute growth rate was noticed in the treatment T₁: <2 cm diameter (0.27 cm day⁻¹).

It is evident from the analyzed data that there was an increasing trend in absolute growth rate of plants with increase in the diameter of tuber from 30 DAP to 120 DAP. This can be attributed to increased supply of photosynthates by larger tubers enhanced the growth rate of plants. Further, perusal of data reveals that AGR was highest at 30-60 DAP and then gradually decreased from 60-90 DAP and 90-120 DAP across all the treatments. This trend signifies that the vegetative growth is faster during early vegetative growth stage reaches maximum leaf production and as the flower initiation starts the AGR tends to decrease due to diversion of photosynthates from source to sink i.e., flower spikes. The present results are supported by the earlier findings of Hossain *et al.* (2011) in gladiolus; Singh *et al.* (2017), AlSheikly (2014) in Iris; Ahmed *et al.* (2015) in gladiolus.

Table 2: Response of tuber division sizes on plant height (cm) and absolute growth rate (cm day⁻¹) of calla lily cv. Captain Murano

Treatments	Plant height (cm)			Absolute growth rate (cm day ⁻¹)		
	60 DAP	90 DAP	120 DAP	30-60 DAP	60-90 DAP	90-120 DAP
T ₁ : <2 cm diameter	13.33	24.40	32.47	0.45	0.36	0.27
T ₂ : 2-3 cm diameter	18.33	29.73	38.53	0.62	0.38	0.29
T ₃ : 3-4 cm diameter	20.27	31.93	41.27	0.68	0.39	0.31
T ₄ : 4-5 cm diameter	22.73	34.80	44.53	0.76	0.40	0.32
T ₅ : 5-6 cm diameter	26.00	38.80	49.20	0.87	0.42	0.36
T ₆ : 6-7 cm diameter	29.73	43.20	53.60	0.99	0.45	0.35
T ₇ : 7-8 cm diameter	32.00	45.93	57.33	1.08	0.45	0.38
SEm ±	1.07	1.69	2.14	0.04	0.02	0.02
C.D at 5%	3.31	5.22	6.58	0.11	0.06	0.05

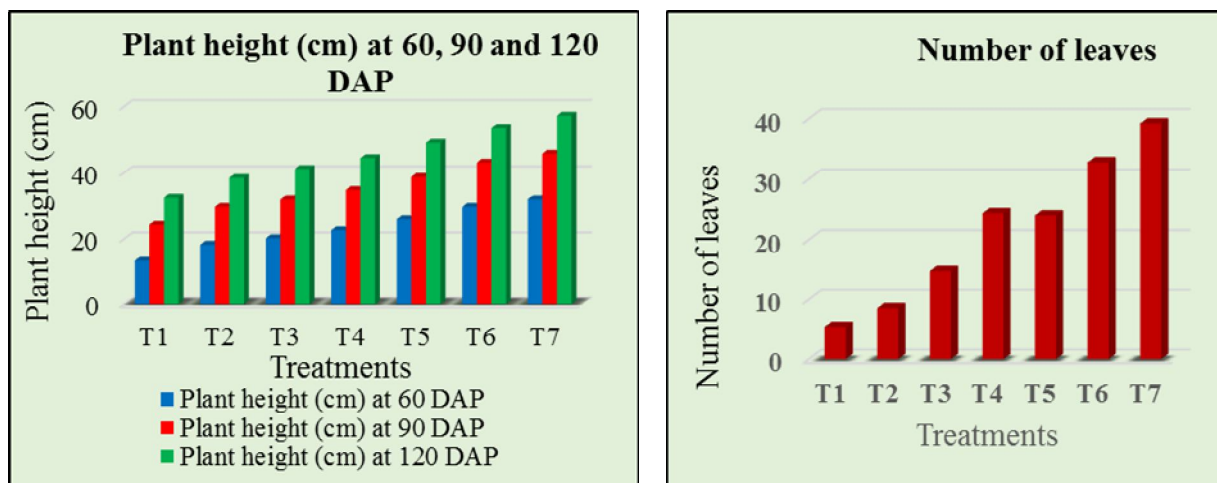


Fig. 2: Response of tuber division size on plant height at 60, 90 and 120 DAP (cm) and number of leaves of calla lily cv. Captain Murano

Conclusions

From the results it can be concluded that, among all the treatments T₄: 4-6 cm tuber diameter to T₇: 7-8 cm tuber diameter recorded significantly maximum plant growth parameters. Calla lily tubers can be divided into tuber sizes of 5-8 cm diameter and can be used for commercial cultivation. Tuber divisions of size 4-5 cm can be used for rapid multiplication of planting material by nursery farmers for tuber production and earn profits.

Future Scope

Since calla lily cv. Captain Murano is responding well with the tuber divisions as propagules in terms of plant growth. Further studies need to be worked out with different cultivars and species of calla lily. Studies on different seasons of planting need to be carried out to find out the best season of planting in calla lily for producing the optimum yields. Different growth regulators and NPK doses may be evaluated to increase the size and tuber yield in calla lily.

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