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Standardization of Substrate Composition for Pot Plant Production of Tuberose var. Arka Sugandhi

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A B S T R A C T

Tuberose (*Polianthes tuberosa* L.) was grown on eight different substrate combinations in 6" plastic pots for two consecutive years at ICAR-IIHR, Bengaluru. The influence of the substrate on vegetative growth, spike production and quality were evaluated. Arka Fermented Cocopeat was used as the main component of all the substrates with different amendments. These were compared with the conventional soil based media. The substrate combination of Arka fermented cocopeat (AFC) + soil + sand + FYM (1:1:1:1 v/v) was found to be most suitable media for pot plant production of tuberose var. Arka Sugandhi with maximum number of spikes per plant (4.87) and longevity of spikes on the plant (35.42 days).

Introduction

Tuberose (*Polianthes tuberosa* L.) is one of the tropical bulbous ornamental plants belonging to the family '*Asperagaceae'*. It is popularly known as *Rajanigandha* or *Nishigandha.* It is used as cut flower, loose flower, in perfumery and aroma therapy. Tuberose can also be used for landscaping as bedding and pot plant. ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru released a dwarf tuberose variety Arka Sugandhi that is ideal for landscaping and pot culture. The flowers are very attractive with protruding stigma, upward looking with green tinged buds and the florets are compactly arranged on the stalk. Increase in the demand for flowering and foliage pots provides scope for introduction of new fragrant flowering pot plants. Pot plants of tuberose with attractive foliage and long-lasting scented flowers can be used as natural room freshener, as indoor air purifiers and green gift.

In ornamental plant production, the substrate plays a vital role in plant canopy regulation and thereby imparting the desired visual appearance. Vendrame *et al.,* (2005) observed that the growing media used for the pot plant

production has a considerable influence on the quality of pot plants. The ideal substrate should have proper aeration, ample nutrient supply, good water holding capacity and support the plants. Addition of organic manure to the inert substrate is essential to supply nutrients to the plants (Khan *et al.*, 2006). According to Sardoei *et al.,* (2014) selection of suitable media is essential for the flowering potted plants in order to improve the aesthetic value and marketing potential. Keeping in view the importance of substrates, the present study was conducted to standardize the growth, flowering and suitability of tuberose var. Arka Sugandhi as pot plant.

Materials and Methods

An experiment was conducted to study the influence of different substrate compositions on pot plant production of tuberose variety Arka Sugandhi under open conditions at the Division of Floriculture and Medicinal Crops, ICAR-Indian Institute of Horticultural Research, Bengaluru for two years from 2015-2017. The experiment was laid out in completely randomized design with three replications. Each replication consists of 20 plants each in black plastic pots of size 6". Uniform sized bulbs (2 cm in diameter) were planted in the centre of pot and standard cultural practices were followed throughout the study period. The experiment consisted of eight treatments with following combinations of substrates such as T_1 – Arka fermented cocopeat (AFC) alone, T_2- Arka fermented cocopeat (AFC) + soil + sand + FYM (1:1:1:1 v/v), T_3- Arka fermented cocopeat (AFC) + soil + sand + vermicompost (1:1:1:1 v/v), T_4- Arka fermented cocopeat (AFC)+ sand + FYM (1:1:1 v/v), T_5- Arka fermented cocopeat (AFC) + soil + FYM (1:1:1 v/v), T_6- Arka fermented cocopeat (AFC) + sand + vermicompost (1:1:1 v/v), T_7- Arka fermented cocopeat (AFC) + soil + vermicompost (1:1:1 v/v) and T_8- Control - soil + sand + FYM (1:1:1 v/v). The methodology for conversion of raw coir waste generated from coir industry into fermented cocopeat has been standardized at ICAR-IIHR, Bengaluru. Arka Fermented Cocopeat (AFC) is a substrate obtained by the bioconversion of coir pith in 30 days period. The media blends were prepared by mixing them thoroughly based on the volumes. Slow release fertilizer (19:19:19 of NPK) at the rate of 5 g per pot was applied to the substrate at quarterly intervals. The observations on growth and flowering parameters *viz*., plant spread (cm), number of leaves per plant, spike length (cm), rachis length (cm), no. florets per spike, no. florets open at a time, floret length (cm), total number of spikes per pot and longevity of spike on the plant(days). The pooled data was statistically analysed using SAS 9.3 software.

Results and Discussion

The substrate combinations had significant influence on growth, flowering and bulb parameters of tuberose var. Arka Sugandhi. The vegetative parameters were found superior for the plants grown on Arka fermented cocopeat alone as compared to other combinations (Table 1).

Plant spread EW (51.75 cm), plant spread NS (51.86 cm) and average plant spread (51.81 cm) were recorded maximum in Arka fermented cocopeat alone. The highest number of leaves per plant (73.28) was also recorded in plants grown on Arka fermented cocopeat alone and lowest number of leaves per plant (47.28) was observed in the control treatment with the media composition of soil + sand + FYM (1:1:1 v/v).

During the initial stages, AFC alone supplemented with inorganic nutrients provided by the slow release ferilisers might have supported the luxuriant growth of foliage and plant spread. Sardoei *et al.,* (2014) also

reported better plant growth of *Zinnia elegans* on media consist of coconut compost alone.

The results are in conformity with the findings of Nair and Bharathi (2015) in chrysanthemum who reported that the most of the flowering plants prefers acidic medium like cocopeat. Aswath and Pillai (2004) also reported that the exchangeable ions and DTPA extractable ion contents were higher in cocpeat medium. Production of quality pot plants in tuberose under soilless culture was also reported by Mahrose (1999).

The flowering parameters such as spike length, total number of spikes per pot and longevity of spike on the plant were found to be significantly influenced by the media (Table 2). The longest spike (31.83 cm) was produced in plants grown on Arka fermented cocopeat alone and was followed by the substrate combination of Arka fermented cocopeat (AFC) + soil + vermicompost (1:1:1 v/v). However, shortest spikes (24.15 cm) were produced in the plants grown on Arka fermented cocopeat (AFC) + soil + FYM (1:1:1 v/v). Ikram *et al.,* (2012) also reported that soil less media composition of coconut coir + FYM improved the spike length in tuberose.

Total number of spikes per plant (4.87) was recorded maximum in the substrate combination of Arka fermented cocopeat (AFC) + soil + sand + FYM (1:1:1:1 v/v) followed by the substrate combination consisting of soil + sand + FYM (1:1:1 v/v).

Table.1 Influence of substrate combination on growth of tuberose variety Arka Sugandhi

Treatments	Plant spread EW (cm)	Plant spread NS (cm)	Plant spread Average (cm)	Number of leaves per plant
AFC alone	51.75	51.86	51.81	73.28
AFC + Soil + Sand + FYM (1:1:1:1 v/v)	45.56	47.24	46.40	56.22
AFC + Soil + Sand + VC (1:1:1:1 v/v)	46.90	46.22	46.56	54.67
AFC + Sand + FYM (1:1:1 v/v)	47.68	47.76	47.72	59.22
AFC + Soil + FYM (1:1:1 v/v)	45.95	47.02	46.49	51.33
AFC + Sand + VC(1:1:1 v/v)	44.46	45.03	44.74	55.75
AFC + Soil + VC (1:1:1 v/v)	44.38	45.30	44.84	54.22
Control - Soil + Sand + FYM (1:1:1 v/v)	44.44	45.10	44.77	47.28
CV (%)	4.13	4.23	3.99	11.40
SE(d)	1.57	1.62	1.52	5.26
CD (*P=0.05*)	**3.36**	**3.48**	**3.26**	**11.28**

AFC – Arka fermented cocopeat, VC-Vermicmpost, FYM- Farm Yard Manure

Table.2 Influence of substrate combination on growth and flowering of tuberose variety Arka Sugandhi

Treatments	Spike Length (cm)	Rachis Length (cm)	No. florets per spike	No. florets open at a time	Floret length (cm)	Total number of spikes per pot	Longevity of spike on the plant (days)
AFC alone	31.83	15.40	37.44	9.42	5.39	3.86	32.57
AFC + Soil + Sand + FYM (1:1:1:1 v/v)	24.15	14.55	39.47	10.44	5.23	4.87	35.42
AFC + Soil + Sand + VC (1:1:1:1 v/v)	25.38	14.13	37.94	11.74	5.13	3.31	31.79
AFC + Sand + FYM (1:1:1 v/v)	27.21	15.48	39.24	11.35	5.25	3.41	33.68
AFC + Soil + FYM (1:1:1 v/v)	25.50	13.51	36.08	9.58	5.44	3.12	34.77
AFC + Sand + VC(1:1:1 v/v)	27.81	16.29	40.88	12.80	5.26	3.94	30.87
AFC + Soil + VC (1:1:1 v/v)	28.19	15.61	38.50	10.13	5.36	3.61	30.59
Control - Soil + Sand + FYM (1:1:1 v/v)-	27.04	16.33	42.41	11.00	5.28	4.37	32.16
CV (%)	8.26	7.85	9.30	17.28	2.40	4.66	5.08
SE(d)	1.83	0.97	2.96	1.52	0.10	0.14	1.36
CD (*P=0.05*)	**3.93**	**NS**	**NS**	**NS**	**NS**	**0.31**	**2.91**

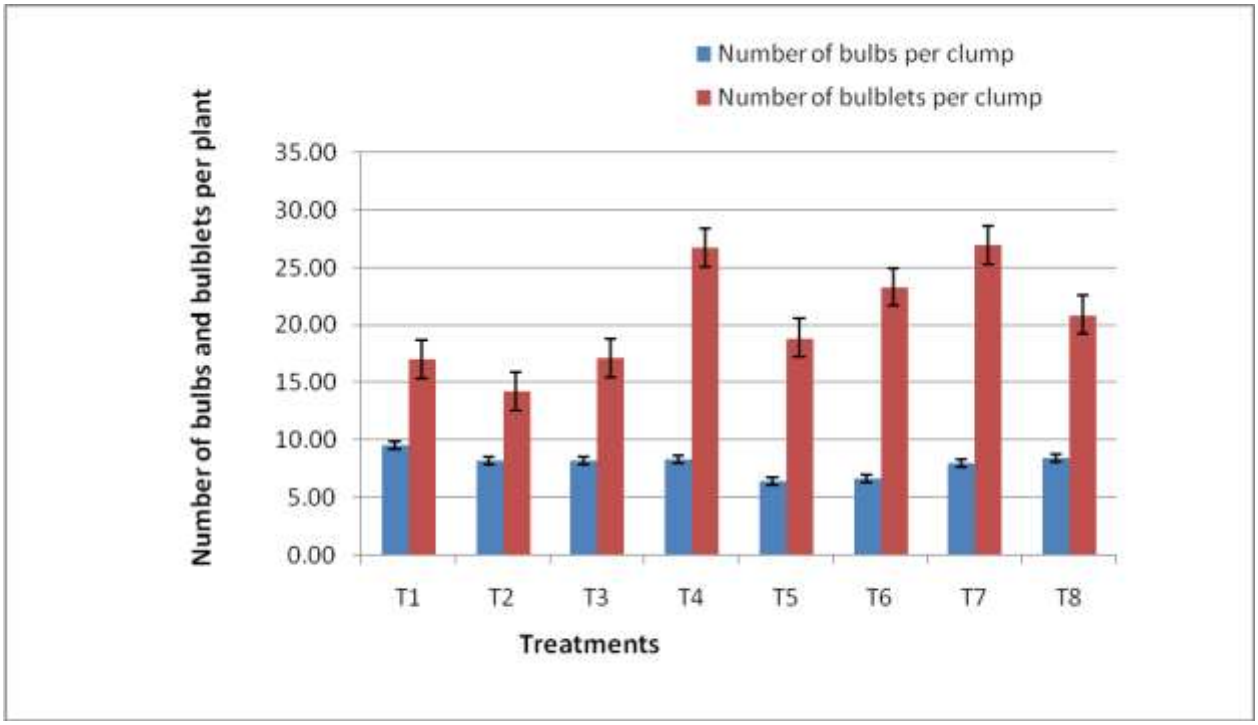
AFC – Arka fermented cocopeat, VC-Vermicmpost, FYM- Farm Yard Manure

Table.3 Influence of substrate combination on bulb parameters of tuberose variety Arka Sugandhi

Treatment	Weight of bulbs per plant	Weight of bulblets per plant	Girth of bulbs (cm)
T_1- AFC alone	219.44	91.67	9.66
T_2- AFC + Soil + Sand + FYM (1:1:1:1 v/v)	186.11	63.89	8.78
T_3- AFC + Soil + Sand + VC(1:1:1:1 v/v)	133.33	61.11	9.10
T_4- AFC + Sand + FYM (1:1:1: v/v)	147.22	83.33	9.40
T_5- AFC + Soil + FYM (1:1:1: v/v)	127.78	80.56	8.99
T_6- AFC + Sand + VC (1:1:1: v/v)	147.22	111.11	8.37
T_7- AFC + Soil + VC (1:1:1: v/v)	144.45	88.89	8.72
T_8- Soil + Sand + FYM (1:1:1: v/v)	141.67	75.00	8.86
CV%	20.09	19.91	4.38
CD (*P=0.05*)	**NS**	**26.83**	**0.68**

AFC – Arka fermented cocopeat, VC-Vermicmpost, FYM- Farm Yard Manure

Fig.1 Effect of different media combination on number of bulbs and bulblets production



Cocopeat in combination with soil, sand and FYM has resulted in production of higher number of spikes than cocopeat alone as the soil is rich in nutrients and minerals as compared to soilless media and FYM releases nutrients to the plants besides sand which prevents compaction of the media and thereby helps in root growth. Application of FYM releases the nutrients slowly and steadily throughout the crop growth period (Akparobi, 2009), sand improves the aeration in the growing media. Anjana *et al.*, (2017) also observed improved growth and development of pot plants of croton with the media composition of cocopeat, vermicompost and farmyard manure in the proportion of 1:1:2 (v/v).

The floral parameters *viz*., rachis length, number of flowers per spike, numbers of flowers open at a time and floret length were found to be non-significant. The results revealed that these floral parameters were not influenced by the substrate combination and are governed by the genetic character of the tuberose variety Arka Sugandhi. Similar results were observed in freesia by Ali *et al.*, (2011) in which the different media composition could not alter the cultivar response.

The longevity of spike on the plant was the highest (35.42 days) in the substrate combination of Arka fermented cocopeat (AFC) + soil + sand + FYM (1:1:1:1 v/v) which was on par with the combination of Arka fermented cocopeat (AFC) + Soil + VC (1:1:1 v/v). Sustained release of nutrients and hormones from the nutrient sources might have resulted in increase in spike longevity. According to Shadanpour *et al.*, (2011) addition of vermicompost which is rich in humus and plant growth promoting hormones like auxins and gibberellins to the potting media improves the growth, development, flowering and appearance of pot plants. The

results are in confirmation with the findings of Naggar and Nasharty (2009) in *Hippeastrum vittatum* where different growing media had significant influence on the growth and flowering parameters.

Plants grown on Arka fermented cocopeat alone produced the maximum number of bulbs (9.56 per clump). Maximum number of bulblets per clump (27.00) was recorded in the media combination of Arka Fermented cocopeat + soil + vermicompost (1:1:1: v/v) followed by Arka Fermented cocopeat + soil + FYM (1:1:1: v/v) (Fig. 1). The findings are similar to that of Moghadam *et al.,* (2012) and Rajera and Sharma (2017) who reported that growing media amended with vermicompost increased the number of propogules per plant in Asiatic hybrid lily 'Novana' and LA hybrid lily.

On the perusal of data on Table 3 revealed that the weight of bulblets per plant (111.11 g) was the maximum in the treatment consisting of Arka Fermented cocopeat + soil + vermicompost (1:1:1: v/v) followed by Arka fermented cocopeat alone as substrate. Similar results were observed by Rajera and Sharma (2017) in LA hybrid lily wherein addition of vermicompost resulted in increased bulb weight. The substrate combination of Arka fermented cocopeat alone had produced bulbs with the maximum girth (9.66 cm) followed by Arka Fermented cocopeat + soil + vermicompost (1:1:1: v/v). The bulbs grown in the substrate Arka fermented cocopeat alone might have prevented compaction of media, accumulated more fresh weight which in turn increased the girth of the bulbs and hence bulb production. Similar results were reported by Treder (2008) in Oriental Lily 'Star Gazer'.

In conclusion, tuberose var. Arka Sugandhi performed well in the Arka Fermented Cocopeat (AFC) with amendments such as soil, sand and FYM as substrate in containerized production in 6" plastic pots. The substrate Arka fermented cocopeat (AFC) + soil + sand + FYM (1:1:1:1 v/v) improved the growth, flowering, bulb parameters and was amenable for pot plant production of tuberose var. Arka Sugandhi.

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