Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 518-521
Received: 01-11-2020
Accepted: 03-12-2020

Kalepalli Reddy Prasanna
Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

P Aruna
Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

K Hemaprabha
Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

S Srinivasan
Department of Crop Physiology, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

Corresponding Author:
Kalepalli Reddy Prasanna
Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore. Tamil Nadu, India

Comparative studies on tissue cultured plantlets with the conventional method of tuberose (*Polianthes tuberosa* L.)

Kalepalli Reddy Prasanna, P Aruna, K Hemaprabha and S Srinivasan

Abstract
Conventional (C) (Bulb propagated) plantlets were superior to tissue culture (TC) tuberose plants in terms of yield and income with better growth and yield parameters. The highest plant height (C-41.60 cm, TC-28.40 cm), number of leaves (C-41.90 nos., TC-23.50 nos.), leaf length (C-35.23 cm, TC- 26.56 cm), leaf width (C-2 cm, TC-1.45 cm), leaf area (T-2874.80 cm^2, TC-903.56 cm^2), number of side shoots (C-9.56 nos., TC- 2.26 nos.) and yield attributes like spike length (C-96.20 cm, TC-78.02 cm), rachis length (C-31.06 cm, TC-23.50 cm), spike girth (C-3.64 cm, TC.- 3.14 cm), number of florets per spike (C-24 nos., TC-17.03 nos.), floret length (C-6.38 cm, TC-6.06 cm), floret diameter (C-3.63 cm, TC-3.20 cm), flowering duration (C-21.46 days, TC-20.33 days), single floret weight (C-1.10 g, TC-0.99 g), hundred florets weight (C-112.98 g, TC-87.06 g) were also significantly higher in conventional plants than tissue cultured plants. The highest number of bulbs (C-12.73 nos., TC-4.73 nos.), number of Bulblets (C-22.66 nos., TC-8.63 nos.), clump weight (C-595 g, TC-277 g), weight of bulbs (C-217.43 g, TC-127.73 g), weight of bulblets (C-164.86 g, TC-52.50 g), weight of individual bulb (C-54.13 g, TC-28.23 g), bulb length (C-52.20 mm, TC-22.53 mm), bulb width (C-42.06 mm, TC- 23.40 mm) was noted in plots raised with conventional bulbs and tissue culture plants. The number of days taken for flowering is also delayed in tissue culture plants (231days), which is almost twice the number of days taken for conventional plants flowering.

Keywords: Tuberose, tissue culture, conventional bulbs

Introduction
Tuberose is one of the most important tropical ornamental bulbous flowering plant cultivated to produce long-lasting flower spikes. It is popularly known as Rajinigandha or Nishigandha. It belongs to the family Amaryllidaceae, and it is a native of Mexico. Tuberose is an important commercial cut flower as well as loose flower crop due to pleasant fragrance, longer vase-life of spikes, higher returns per unit area, and wide adaptability to varied climate and soil. It has long been cherished for the aromatic oils extracted from its fragrant white flowers. Tuberose blooms throughout the year and spikes are rich in fragrance, and its essential oil is an important component of high-grade perfumes. Single varieties are more fragrant than double types and contain 0.082-0.14% concrete, which is used in high-grade perfumes. There is a high demand for tuberose concrete and absolute in the International market, which fetches an excellent price. Flowers of the single type are commonly used to extract the essential oil, as loose flowers, making garlands, *etc.* In contrast, double varieties are used as cut flowers, garden display, and interior decoration. The flower spikes of tuberose remain fresh for a long time, and it finds a distinct place in the flower market. Due to its immense export potential, the cultivation of tuberose is gaining importance day by day in our country.

Tuberose was grown in tropical and temperate countries. Tuberose was commercially cultivated in states *viz.*, Karnataka, Tamil Nadu, West Bengal, Andhra Pradesh, Assam, Gujarat, Maharashtra, Uttar Pradesh, Punjab, Haryana, and few parts of Rajasthan. About 7.95 lakh hectares of land in India was under tuberose cultivation. Cut flowers of 1560.70 lakh numbers, loose flowers of 27.71 MT were produced in India every year (National Horticultural Board, 2013). In India, the average flower yield of tuberose was 2-3 lakh cut flower spikes and loose flowers of 14-15 t/ha (TNAU agritech portal).

Average bulb and bulblet yield in tuberose was 20-23 t/ha (TNAU agritech portal) (harvested at the end of the third year). Bulbs were commercial and common planting material in tuberose; bulblets were used for multiplication purposes. Among the harvested bulbs, 30% of the bulbs were utilized for planting in the same field, and only the remaining bulbs were available to meet the increasing demand of growers. Since tuberose is an emerging crop among the farmers of Tamil Nadu, the production and supply of alternative quality planting

material is vital for tuberose production. Tissue culture is a recently emerging technology for producing quality planting material in large numbers within a short period. Tissue culture also aids in utilizing fewer explants to grow superior quality plants with resistance to biotic and abiotic stress. In tuberose, tissue culture can be used to meet the planting material demand among growers, to produce high-yielding plants while having resistance to diseases and nematodes.

The *in vitro* banana plants are superior to the conventional suckers due to their vigorous growth (Daniells, 1998), precocity (Drew and Smith, 1998), and higher yields (Pradeep *et al.*, 1992). Tissue culture is much discussed as a superior means of propagation with plants guaranteed free from pests and diseases. However, the potential hazards of the technique, such as variety mix-ups, susceptibility to pests and diseases, and different management requirements, are not often publicized (Daniells, 1997). Tissue cultured banana has a high field establishment rate, uniformity in growth, which ensures synchronized harvesting, early maturity, better quality fruits, and a high production rate (Rao *et al.*,1996, Robinson, 1996, and Njuguna *et al.*, 2007). Significant differences between tissue culture plants and conventional suckers of banana in the vegetative and phonological growth parameters were reported by Njuthi *et al.*, 2009 [10].

Materials and Methods

The present investigation was carried out at the Department of Floriculture and Landscape Archit, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, from October 2019 to December 2020. Geographically the field is situated at 11^0 0.2" N latitude and 76^0 57" E longitudes. The altitude of the area is 426.76 m above MSL. The topography of the land was medium with a good drainage facility. The soil of the research field is sandy loam in nature with good drainage and aeration capacity, and also nutrient and organic-rich.

Tissue cultured tuberose plants were produced at tissue culture lab Horticultural College and Research Institute, Tamil Nadu Agricultural University, by using bulbs of Prajwal variety as explants. After the third subculture, the micro shoots obtained were sub-cultured onto the shoot elongation medium. When the micro shoots had attained sufficient growth, they were transferred to rooting media, which was a half-strength MS medium supplemented with auxins. The rooted plantlets were carefully taken out of the rooting medium without damage and thoroughly washed under running tap water, and planted in pot mix. The plantlets were covered with polybags to maintain high humidity conditions and were kept under 30 ± 2^0 C for 25-30 days. Just one week before transplanting in experimental field, tissue cultured plants were kept under direct sunlight to acclimatize plants to open field conditions. Tissue culture plants had 8 to 15 leaves and were 15 cm in height at the time of transplanting. Bulbs of Prajwal variety were taken for conventional planting, and bulbs of 3 to 4 cm diameter, with 3 to 4 active buds and 30 g in weight, were taken for planting. Bulbs were of uniform size, healthy, and free from diseases. The bulbs were dipped in bavistin solution (1%) to prevent rot. The experimental field was ploughed to a fine tilth, then furrows and ridges are made. Basal application of Urea, SSP, MOP, and FYM was applied to the field. Irrigation was done at five days interval for the first three months, and later it was done at weekly intervals. The experimental field was kept free of weeds at all times. Manual weeding was done at fortnightly intervals.

Fig 1: Tissue cultured tuberose plants

Fig 2: Conventional tuberose bulbs

Results

120 days after planting, the observations regarding vegetative parameters were recorded and statistically analyzed. The summarized data, statistical parameters, and results were represented.

Table 1: Vegetative parameters of Conventional and tissue cultured tuberose plants at 120 DAP

Parameters	Growth characters		
	Conventional plants	Tissue cultured plants	P value
Plant height	41.60 cm	28.40 cm	< 0.05 (S)
No of leaves	41.90 nos.	23.50 nos.	< 0.05 (S)
No of side shoots	9.56 nos.	2.26 nos.	< 0.05 (S)
Leaf length	35.23 cm	26.56 cm	< 0.05 (S)
Leaf breadth	2.00 cm	1.45 cm	< 0.05 (S)
Leaf area	2874.80 cm^2	903.56 cm^2	< 0.05 (S)

The results of the present research entitled "Comparative studies on tissue cultured plantlets with the conventional method of tuberose (*Polianthes tuberosa* L.)" was presented in tables 1, 2 and 3.Among the conventional plants and tisuue cultured plants, conventional plants are performing better than tissue cultured plants in almost all the parameters. The highest plant height (C-41.60 cm, TC-28.40 cm), number of leaves (C-41.90 nos., TC-23.50 nos.), leaf length (C-35.23 cm, TC-26.56 cm), leaf width (C-2 cm, TC-1.45 cm), leaf area (T-2874.80 cm^2, TC-903.56 cm^2), number of side shoots (C-9.56 nos., TC- 2.26 nos.) was recorded in conventional plants.

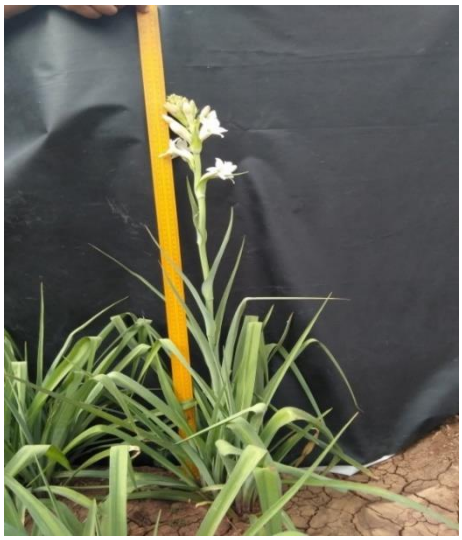

Fig 3: Tissue cultured tuberose plant at flowering satge

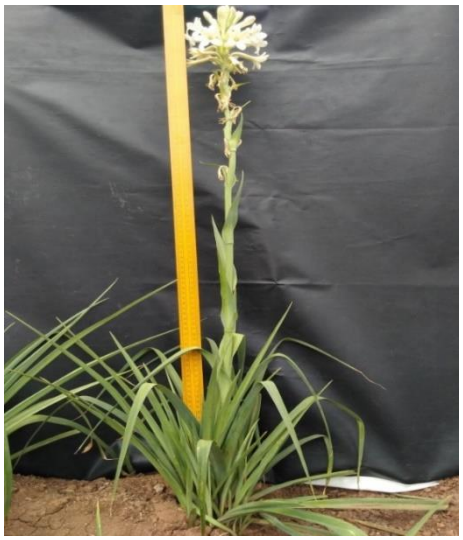

Fig 4: Conventional tuberose plant at flowering stage

Table 2: Floral parameters of Conventional and tissue cultured tuberose plants at 240 DAP

Parameters	Growth characters		
	Conventional plants	Tissue cultured plants	P value
No of days taken for flowering	108.60	231.40	< 0.05 (S)
Spike length	96.20 cm	78.02 cm	< 0.05 (S)
Rachis length	31.06 cm	23.50 cm	< 0.05 (S)
Spike girth	3.67 cm	3.14 cm	< 0.05 (S)
No of florets per spike	24 nos.	17.03 nos.	< 0.05 (S)
Floret length	6.38 cm	6.06 cm	< 0.05 (S)
Floret diameter	3.63 cm	3.20 cm	< 0.05 (S)
Single floret weight	1.10 g	0.99 g	< 0.05 (S)
Flowering duration	21.46 days	20.33 days	> 0.05 (NS)

240 days after planting, the observations regarding floral parameters were recorded and statistically analyzed. The summarized data, statistical parameters, and results were represented. 120 days after planting, flowering was observed in conventional plants, where as in tissue culture plants average days taken for first flowering is almost double the number of days of conventional plants. Yield attributes like spike length (C-96.20 cm, TC-78.02 cm), rachis length (C-31.06 cm, TC-23.50 cm), spike girth (C-3.64 cm, TC.- 3.14 cm), number of florets per spike (C-24 nos., TC-17.03 nos.), floret length (C-6.38 cm, TC-6.06 cm), floret diameter (C-3.63 cm, TC-3.20 cm), flowering duration (C-21.46 days, TC-20.33 days), single floret weight (C-1.10 g, TC-0.99 g), hundred florets weight (C-112.98 g, TC-87.06 g) were also significantly higher in conventional plants than tissue cultured plants.

Table 3: Bulb parameters of Conventional and tissue cultured tuberose plants at 360 DAP

Parameters	Growth characters		
	Conventional plants	Tissue cultured plants	P value
No of bulbs	12.73 nos.	4.73 nos.	< 0.05 (S)
No of bulblets	22.66 nos.	8.63 nos.	< 0.05 (S)
Weight of mother bulb	214.93	96.09	< 0.05 (S)
Weight of bulbs	217.43 g	127.73g	< 0.05 (S)
Weight of bulblets	164.86 g	56.50 g	< 0.05 (S)
Weight of individual bulb	37.13 g	23.23 g	< 0.05 (S)
Whole clump weight	595 g	277 g	< 0.05 (S)
Bulb length	52.20 mm	22.53 mm	< 0.05 (S)
Bulb width	42.06 mm	23.40 mm	< 0.05 (S)
Mother bulb length	62.50 mm	32.73mm	< 0.05 (S)
Mother bulb width	46.30 mm	22.03 mm	< 0.05 (S)

360 days after planting, the observations regarding bulb parameters were recorded and statistically analyzed. The summarized data, statistical parameters, and results were represented. The highest number of bulbs (C-12.73 nos., TC-4.73 nos.), number of Bulblets (C-22.66 nos., TC-8.63 nos.), clump weight (C-595 g, TC-277 g), weight of bulbs (C-217.43 g, TC-127.73 g), weight of bulblets (C-164.86 g, TC-52.50 g), weight of individual bulb (C-54.13 g, TC-28.23 g), bulb length (C-52.20 mm, TC-22.53 mm), bulb width (C-42.06 mm, TC- 23.40 mm), mother bulb length (C-62.50 mm, TC-32.73 mm), mother bulb width (C-46.30 mm, TC-22.03 mm) was noted in plots raised with conventional bulbs and tissue culture plants.

Discussion

The vegetative growth parameters, bulb parameters, and yield attributes were significantly higher in conventional plants than tissue culture plants (Table 1, 2 and 3). The reasons for

the observed results were, tuberose propagated using the traditional method of bulbs will have stored food material. After planting, the bulb will start producing healthy roots and leaves by using stored energy. As a result, the number of leaves will increase, finally leading to an increase in total leaf area. Conventional plants will have more leaf surface to perform more photosynthesis; the increase in photosynthesis leads to faster growth of the plant. Whereas in the case of tissue cultured plants, with the smaller bulb size and narrow leaves, they also need to acclimatize to open field conditions because they were cultured *in vitro* conditions. So it will take more time to establish and produce photosynthetically active leaves.

Conclusion

Thus it is clear that conventional plants are performing better than tissue cultured plants in all vegetative, floral and bulb parameters with higher yields. Further research may be carried out with the bulbs of first-generation tissue culture plants to raise second generation and evaluation.

References

1. Bhanusree, MR, Ravi Kumar K, Suresh C, Shukla G, Chakravarty S. "Comparative studies on tissue culture plantlet versus conventional sucker var. Grand Naine banana." Plant Archives 2015;15(2):785-788.
2. Buah, John Nelson, Yoshinobu Kawamitsu, Shigeyasu Yonemori, Seiichi Murayama. "Field performance of *in vitro*-propagated and sucker-derived plants of banana *(Musa* spp.)." Plant production science 2000;3(2):124-128.
3. Damankeshan B, Panahi B. "A comparative study on the growth characteristics of offshoot and tissue culture propagated palm trees in orchards." International Journal of Agriculture and Crop Sciences. 2013;5(19):2221.
4. Dave, Ashish, Geeta Bilochi, Sunil D Purohit. "Scaling-up production and field performance of micropropagated medicinal herb 'Safed Musli'(*Chlorophytum borivilianum*)." *In Vitro* Cellular & Developmental Biology-Plant 2003;39(4):419-424.
5. Debnath, Samir C. "Characteristics of strawberry plants propagated by *in vitro* bioreactor culture and ex vitro propagation method." Engineering in Life Sciences 2009;9(3):239-246.
6. Drew RA, Smith MK. "Field evaluation of tissue-cultured bananas in south-eastern Queensland." Australian Journal of Experimental Agriculture 1990;30(4):569-574.
7. Espinosa-Leal, Claudia A, César A Puente-Garza, Silverio García-Lara. "*In vitro* plant tissue culture: means for production of biological active compounds." *Planta* 2018;248(1):1-18.
8. Maximova, Siela N, Ann Young, Sharon Pishak, Mark J Guiltinan. "Field performance of *Theobroma cacao* L. plants propagated via somatic embryogenesis." *In vitro* Cellular & Developmental Biology-Plant 2008;44(6):487.
9. Munikrishnappa PM, Chandrashekar SY. "Effect of growth regulators on growth and flowering of China aster [*Callistephus chinensis* (L.) Nees.]-A review." Agricultural Reviews 2014;35(1):57-63.
10. Nguthi F, Karembu M, Njuguna J, Thuranira E, Muli S, Gitau D *et al*. "Comparison of conventional suckers with tissue-cultured planting material of Cavendish banana cultivars (*Musa spp*.) in central Kenya." Session: Crop management-Comparison of conventional suckers with tissue culture planting material of banana 2009.
11. Oggema JN, Kinyua MG, Ouma JP, Owuoche JO. "Agronomic performance of locally adapted sweet potato (*Ipomoea batatas* (L) Lam.) cultivars derived from tissue culture regenerated plants." African Journal of Biotechnology 2007;6(12).
12. Robinson JC, Anderson T. "Tissue culture banana plants versus conventional suckers-components of yield." Information Bulletin-Citrus and Subtropical Fruit Research Institute 1990, (210).
13. Roy, Olivia Saha, Pranay Bantawa, Swapan Kumar Ghosh, Jaime A Teixeira da Silva, P Deb Ghosh *et al*. "Micropropagation and field performance of 'Malbhog'(*Musa paradisiaca*, AAB group): a popular banana cultivar with high keeping quality of north east India." Tree and Forestry Science and Biotechnology 2010;4(1):52-58.
14. Saini RK, Shetty NP, Giridhar P, Ravishankar GA. "Rapid *in vitro* regeneration method for *Moringa oleifera* and performance evaluation of field grown nutritionally enriched tissue cultured plants." *3 Biotech* 2012;2(3):187-192.
15. Shahzad A, Faisal M, Anis M. "Micropropagation through excised root culture of *Clitoria ternatea* and comparison between *in vitro*–regenerated plants and seedlings." Annals of Applied Biology 2007;150(3):341-349.
16. Singh, Th Dikash, Ch Henary Singh, Kh Nongalleima, Sila Moirangthem, Sunitibala Devi H. "Analysis of growth, yield potential and horticultural performance of conventional vs. micropropagated plants of *Curcuma longa* var. Lakadong." African Journal of Biotechnology 2013;12(14).
17. Sood, Neeru, Piyush Kumar Gupta, Srivastava RK, Gosal SS. "Comparative studies on field performance of micropropagated and conventionally propagated sugarcane plants." Plant Tissue Culture and Biotechnology 2006;16(1):25-29.