C Rajamanickam
Department of Horticulture,
Agricultural College and
Research Institute, TNAU,
Madurai, Tamil Nadu, India

C Ravindran
Horticultural College and
Research Institute, TNAU,
Periyakulam, Tamil Nadu, India

Assessment of tuberose (*Polianthes tuberose* L.) varieties for higher productivity

C Rajamanickam and C Ravindran

Abstract
On Farm Trail on "Assessment of tuberose varieties for higher productivity" was carried out at farmers' field of Thanda Goundan Patti village of Alanganallur Block of Madurai District to assess the tuberose hybrids suitable for Madurai district of Tamil Nadu to replacing the local variety was aimed at. Prajwal, Phule Rajani and Local check (Farmers practice) were used for the study. Prajwal and Phule Rajani tubers were purchased and distributed to five identified farmers. The treatments were comprised of tuberose bulbs were treated with *Pseudomonas fluorescens* (10g per litre of water) and planted in the farmers field and followed recommended package of practices recommendations of TNAU, Coimbatore. Observations on plant height (cm), days taken for sprouting (days), days taken for flowering, spike length (cm), number of florets per spike, 100 florets weight (g), yield per ha (t/ha) and B:C ratio were recorded. The results revealed that Prajwal recorded the highest values in days taken for sprouting (13.0 days), plant height (115.25 cm), number of leaves per plant (258.0) and days taken for flowering (135.0 days) followed by Phule Rajani. Farmer practices (local check) recorded the lowest values of all the traits *viz.,* days taken for sprouting (20.0 days), plant height (98.5 cm), number of leaves per plant (220.0) and days taken for flowering (162.30 days). In the case of flower characters, Prajwal recorded the longer spike length (98.2 cm), number of florets per spike (42.0), number of flower stalk per plant (5.8) and 100 florets weight (95.6 g). Whereas farmers practices observed the lowest values of the traits like spike length (52.5 cm), number of florets per spike (31.0), number of flower stalk per plant (3.5) and 100 florets weight (85.1 g). Prajwal recorded the highest flower yield of 15.2 t/ha whereas farmers practices observed the lowest yield of 10.1 t/ha. In the case of B:C ratio, Prajwal recorded the highest ratio of 3.76 followed by Phule Rajani (2.92) while farmers practices recorded the lowest B:C ratio of 2.57. Conclusion of the present study, Prajwal was found suitable for Madurai district of Tamil Nadu in terms of yield and market values and conducted Front Line Demonstrations of the ensuing season.

Keywords: Tuberose, OFT, performance, hybrids, flowers, bulbs, yield

Introduction

Tuberose (*Polianthes tuberose* L.) belongs to the family Amarylladiaceaea and originated from Mexico. Tuberose popularly called as 'Rajanigandha' and 'Nilasampangi'. It is one of the important bulbous ornamentals and commercial flower crops of Indian, tropical and subtropical world. The flowers remain fresh for days together and impart sweets and lingering pleasant fragrance to the atmosphere (Sadhu and Bose, 1973) [6]. Tuberose is commercially propagated through bulbs, seeds and division of bulbs. It is grown for garden decoration in pots, beds and borders. The long flower spikes are excellent cut flower when arranged in vases, bouquets and bowls and flowers remain fresh for a long time. Loose flowers are used for making garlands and ornaments for bridal make up. Valuable natural aromatic oil is extracted from the flowers for the high cost perfume industry. Infect, India is the 2nd largest producer and exporter of tuberose concrete to the world market like France, Germany, Italy and other European countries with attractive price as long as there is no synthetic flavour to replace it is fragrance. It is cultivated on a large scale in Tamil Nadu, Karnataka, West Bengal, and Maharashtra. To a lesser extent, it is also grown in Andhra Pradesh, Haryana, Delhi, Uttar Pradesh and Punjab (Rachana *et al.*, 2013) [4]. It is grown mild climate without extremes of high or low temperature even though it can be grown under wide range of climatic conditions. It requires warm humid areas with average temperature ranges of 20 – 35 °C. The temperature above 40 °C reduces the spike length and flower quality. Very low temperature and frost also damage to the plants as well as flowers. It is grown well in sunny situation. In Madurai district, tuberose is cultivated at Vadipatti, Alanganallur, Kottampatti, Madurai East and Madurai West blocks in larger areas. Tuberose is being cultivated in about 420 ha in Madurai district.

Correspondence
C Ravindran
Horticultural College and
Research Institute, TNAU,
Periyakulam, Tamil Nadu, India

In Madurai district, farmers are cultivating local varieties during long period and fetches getting poor yield, lower prices and poor quality of flowers as well as lesser shelf life. Farmers' were not knowing improved varieties, recent technologies and also repeatedly cultivating pest affected tubers as a planting material. With this backround, the present study was undertaken to assessing the performance of tuberose varieties at farmer's field for higher productivity and suitable for Madurai district.

Materials and Methods
On Farm Trial (OFT) on "Assessment of tuberose varieties for higher productivity" was carried out by Krishi Vigyan Kendra, Madurai at five identified farmer's field of Thathagoundanpatti village of Alanganallur Block of Madurai district with the aim to assessing the best tuberose variety suitable for Madurai district. Prajwal, Phule Rajani and local check (Farmers practice) were used for the assessment. Prajwal tubers were purchased from Indian Institute of Horticultural Research, Bengaluru and Phule Rajani bulbs were purchased from Marathwada Agricultural University, Parabhani, Maharashtra and distributed to five identified farmers. The local variety is available at farmer's field were used for this study.

Main field preparation
Demonstrated package of practices and farmers practice of tuberose varieties are presented in Table 1. Field was thoroughly ploughed with 15 days prior to planting of bulbs and during the last ploughing 25 tonnes of well decomposed Farmyard Manures were applied and incorporated to per ha area. 100 kg of neem cake were also applied and incorporated during last ploughing for minimizing the activity of nematodes. Bulbs were soaked with neemseed kernel extract @ 2ml per litre of water for overnight to control the scale insects and also treated with *Pseudomonas fluorescens* @ 10g

per litre of water to control the basal rot and stem rot. Bulbs also treated with 5000 ppm CCC (5g/lit) before planting to increase the yield. Each bulb weighing about 25- 30 g with 2.5 -3.0 cm diameter were selected and planted in the main field. Prior to the planting of bulbs 200:200:200 kg/ha of NPK were applied as basal dose of manuring per ha area. Full P and K can be applied during the final preparation of plots, while N can be applied in 3 equal split doses *i.e.*, at final preparation of plots, 60 and 90 days after planting of bulbs. The sprouting was taken as 12 -15 days from each and every node of the bulbs.

Planting of bulbs
Irrigation was applied one day prior to planting of bulbs. 500 kg of bulbs of Prajwal and Phule Rajani hybrids were planted at a distance of 45 x 25 cm spacing during 1st week of August. In the case of local variety (farmers practice) were planted at a distance of 30 x 15 cm. After planting of bulbs life irrigation was given at 3rd day after planting. Irrigation was given at the regular intervals. Foliar spraying of micronutrients like 0.5% $ZnSO_4$ + 0.2% $FeSO_4$ + 0.1 % Boric acid were applied at 30 days after planting. Foliar application of GA_3 also applied at the rate of 50 to 100 ppm thrice at 40, 55 and 60 days after planting. Three to four hand weeding was carried out at initial period of establishment and weeding can be made when ever is required.

Regular field visits were made by the team of KVK scientists. The biometrical observations on number of days taken for sprouting, plant height (cm), number of leaves per plant, days taken for flowering (days), spike length (cm), number of florets per spike, 100 florets weight (g), yield per ha (t/ha) and B:C ratio were recorded. Economics was also worked out and compared with farmers practice from the information obtained from each farmer. This study was laid out in a Randomized Block Design (RBD) with five replications (demonstrations) and datas were analysed statistically.

Table 1: Demonstrated package of practices and farmers practice of tuberose varieties

Sl. No.	Cultural Operations	Particulars	Total amount (Rs.)		
			Farmer practice	Prajwal	Phule Rajani
1.	Ploughing	Tractor ploughing – 2 times @ Rs. 2000 per hour and one rotovator ploughing @Rs. 2500/ha/3 hr.	6500	6500	6500
2.	Land preparation, beds and channel formation	On contract basis Rs. 7500/day/ha	7500	7500	7500
3.	Bulb cost		-	8500	7000
4.	Bulb treatment	Pseudomonas treatment, neem seed kernel extract treatment and 5000 ppm CCC (5g/lit)	-	2500	2500
5.	Planting bulbs	On contract basis (5A type + 10 B type)	4500	4500	4500
6.	Spraying of micronutrients and application cost	ZnSO4 0.5% + FeSO4 0.2% + Boric acid 0.1% and foliar application of GA₃ @ 50 to 100 ppm thrice and application cost.	-	2000	2000
7.	Irrigation	Once in 4 days interval	12000	12000	12000
8.	Manuring	25 tonnes of FYM, 200:200:200 kg/ha NPK, neemcake and application cost	38500	38500	38500
9.	Plant protection (4 technical sprays) for the control of pests and diseases	1. Dimethioate @ 1.0 g/l or Imidachlopride @ 1.5 ml/lit (200 litres/ha)	1000	1000	1000
		2. Bluepentamite @1.0ml/l or Indosocarp 0.5ml/l (200 litres/ha)	1500	1500	1500
		3.propinoconasol @ 1.5 ml/l or mancozeb @ 2.5g/l (200 litres/ha)	1000	1500	1500
		4. CCC 2g/lit and application cost		1000	1000
10.	Harvest (daily plucking of flowers)	30A + 25B type @ 250 per day/labour	13750	15000	15000

Results and Discussion
Vegetative parameters
Vegetative parameters of tuberose varieties and local check are presented in Table 2. Datas of the vegetative parameters showed significant difference. The results revealed that Prajwal recorded the lowest days taken for sprouting (13.0 days) followed by Phule Rajani (18.0) while local check (farmers practices) observed the longer days taken for sprouting (20.0 days). In the case of plant height, Prajwal recorded the highest height (115.25 cm) followed by Phule Rajani (110.20 cm). Farmers practice (local check) found the lowest plant height of 98.50 cm. This finding was in congruity with Ranchana et al. (2013) [4] stated that Prajwal recorded the highest plant height among the varieties were studied. In the present study, Prajwal produced the highest number of leaves per plant (258.00) followed by Phule Rajani (249.00) while the lowest leaves per plant was noticed in farmers practices (220.00). The variation of leaves among the tuberose varieties was attributed to their genetic makeup of variety. This is in accordance with findings of Gudi (2006) [1], Ramachandrudu et al. (2009) [5], Vijayalaxmi et al (2010) [7] and Ranchana et al. (2013) [4]. Regarding days taken for flowering, Prajwal registered early flowering (135.0 days) followed by Phule Rajani (138.50 days) whereas farmer practices (local check) recorded late flowering of 162.3 days. This is accordance with conformity of Krishnamoorthy (2014) [2] he stated that Prajwal recorded the early flowering of 153.0 days under Pudukottai conditions.

Table 2: Mean performance of different hybrids and local check of tuberose for vegetative parameters

Sl. No.	Characters	Prajwal	Phule Rajani	Local check (Farmers practice)
1.	No. of days taken for sprouting (days)	13.0	18.0	20.0
2.	Plant height (cm)	115.25	110.20	98.50
3.	Number of leaves per plant	258.00	249.00	220.00
4.	Days taken for flowering (days)	135.0	138.5	162.3

Floral parameters
Floral characters of different tuberose varieties are presented in Table 3. Datas of the floral parameters showed significant difference. The results revealed that Prajwal recorded longer spike length of 98.2 cm followed by Phule Rajani (76.2 cm) while local check (farmers practices) observed the shortest spike length (52.5 cm). This might be due to varietal character as well as properly followed the cultural practices. This is accordance with the finding of Krishnamoorthy (2014) [2] reported that Prajwal recorded the highest spike length among the different varieties were studied. The similar finding was also reported by Ranchana et al. 2013 [4] she stated that Prajwal recorded the highest spike length of 98.05 cm. In the case of number of florets per spike the same trend was occurred. Prajwal showed the highest number of florets per spike (42.0) followed by Phule Rajani (38.0). The lowest values were found in local check (Farmers practices) of 31.0. This was in accordance with results observed by Krishinamoorthy (2014) [2] and Ranchana et.al. (2013) [4] they stated that Prajwal registered the more number of florets per spike. Phule Rajani recorded the highest number of flower stalk per plant (6.0), followed by Prajwal (5.8) while the lowest number was noticed in local check (3.50). This is in conformity of Krishnamoorthy (2014) [2] he stated that Prajwal registered the higher number of flower stalk per plant under Pudukottail district.

Yield parameters
Yield characters of different tuberose varieties are presented in Table 3. Datas of the yield parameters showed significant difference. The assessment results revealed that Prajwal recorded the highest 100 flowers weight (95.6 g) followed by Phule Rajani (90.9 g) while the lowest weight was observed in local check (farmers practices) of 85.1 g. Prajwal recorded the highest flower yield of 15.2 t/ha followed by Phule Rajani (12.8 t/ha) whereas the lowest yield was noticed in local check (farmers practices) of 10.1 t/ha. This might be due to genetic characters of the variety and its capacity to produce more number of florets per spike and florets weight. This is in accordance with the findings of Ranchana (2013) [4], Krishnamoorthy (2014) [2] and Madhumathi (2018). Krishnamoorthy (2014) [2] reported that Prajwal recorded the highest yield of 15.4 t/ha under Pudukottai district of Tamil Nadu. Madhumathi stated that Prajwal registered the yield under Andhra Pradesh conditions. Regarding market preference of tuberose varieties, prajwal found to be very good than other varieties.

Table 3: Floral and yield characters of different hybrids and local check of tuberose

Sl. No.	Characters	Prajwal	Phule Rajani	Local variety (Farmers practice
1.	Spike length (cm)	98.2	76.2	52.5
2.	No. of florets per spike	42.0	38.0	31.0
3.	No. of flower stalks per plant	5.8	6.0	3.5
4.	100 flowers weight (g)	95.6	90.9	85.1
5.	Flower yield per ha (t/ha)	15.2	12.8	10.1
6.	Market preference	Very Good	Good	Good

Economics
B:C ratio (economic analysis) are presented in Table 4. The gross cost of cultivation almost similar for two improved varieties but farmers practice was the lowest gross cost. Prajwal recorded the highest net profit of Rs. 3,84,000 per ha with the Benefit Cost Ratio of 3.76 followed by Phule Rajani (Rs.2,91,500, 2.92) whereas the local check (farmers practices) registered the lowest net profit of Rs. 2,21,750 with B:C ratio of 2.57.

Table 4: Cost economics of different tuberose varieties

Sl. No.	Characters	Local check (Farmers practice	Prajwal	Phule Rajani
1.	Gross cost (Rs.)	Rs. 86,250	Rs. 1,02,000	Rs. 1,00,500
2.	Gross returns (Rs.)	Rs. 3,08,000	Rs.4,86,000	Rs. 3,92,000
3.	Net returns (Rs.)	Rs. 2,21,750	Rs. 3,84,000	Rs. 2,91,500
4.	B:C ratio	2.57	3.76	2.92

Conclusion
The study has shown that OFT programme was found useful in enhancing the knowledge and various adoption level of farmers in various aspects of production technologies. The present study it was concluded that Prajwal is highly suitable hybrid under Madurai condition and recorded the highest values of yield contributing traits *viz.,* 100g flower weight, spike length, number of floret per spike and retain the freshness when compared to local check. Farmers realized that Prajwal was better choice variety in terms of yield, BC ratio, net profit and market preference. Therefore Prajwal is found to be highly suitable for Madurai district of Tamil Nadu and recommended for large scale demonstration through Front Line Demonstrations (FLD) during ensuing season under Madurai district.

References
1. Gudi G. Evaluation of tuberose varieties. Thesis submitted to university of agricultural sciences, Dharwad, Karnataka, 2006.
2. Krishnamoorthy V. Assessment of tuberose (*Polianthes tuberose* L.) varieties for growth and yield characters. The Asian journal of horticulture. 2014; 9(2):515-517.
3. Madhumathi CV, Bhargav D, Srinivasareddy D, Sreedhar, T Nagalakshmi. Evaluation of tuberose genotypes for vegetative, flowering and yield traits. International journal of chemical studies. 2018; 6(6):88-90.
4. Ranchan P, Kannan M, Jawaharlal M. The assessment of genetic parameters: yield, quality traits and performance of single genotypes of tuberose (*Polianthes tuberose* L.). Adv. Crop Sci. Tech. 2013; 1(3):111-114.
5. Ramachandrudu K, Thangam M. Performance of tuberose (*Polianthes tuberosa* L.) cultivars in Goa. J Horti. Sci. 2009; 4(1):76-77.
6. Sadhu MR, Bose. Tuberose for most artistic garlands. Indian Hort. 1973; 18:17-20.
7. Vijayalaxmi M, Manoharrao A, Padmavatamma AS, Sivashanker A. Evaluation of variability studies in tuberose (*Polianthes tuberose* L.) single cultivars. Journal of Ornamental Horticulture. 2010; 13:251-256.