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Assessment of Improved Variety of Tuberose (*Polianthes tuberosa* L.) Arka Prajwal for Yield and Economics in Nellore District of Andhra Pradesh

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A B S T R A C T

The present study was conducted during 2017-18 to 2019-20 for three (3) years to assess the performance of high yielding tuberose variety Arka Prajwal in Nellore district of Andhra Pradesh. The improved variety Arka Prajwal was planted along with local variety (Suvasini) as check in 0.2ha each in the fields of five farmers at Veguru and Leguntapadu villages of Kovurumandal of Nellore district during the year 2017 and continued for three years. The results revealed that among the two varieties Arka Prajwal recorded significantly higher number of spikes per plant (1.86 no./plant), number of florets per spike (31.88 no./spike), 100 Nos florets weight (173 g), flower yield per plant (102.46 g) and flower yield per hectare (8.75 t/ha). The economic parameters *viz.*, benefit cost ratio (2.84), marginal benefit cost ratio (22.28) and relative economic efficiency (2.80) were recorded more in Arak Prajwal than Local variety. The Arka Prajwal variety showed superiority over Local variety and found suitable for Nellore district of Andhra Pradesh. Extension gap (yield gap) refers to the difference between demonstration plot yield and actual yield (farmers practice) and it was 4.64 t ha^{-1}. There was 25.78 per cent reduction in yield as compared to demonstration plots yield. A sizable total yield gap of 13.36t ha^{-1} was observed and it accounted for 74.22 per cent.

Introduction

Tuberose (*Polianthes tuberosa*) belongs to family Agavaceae is a bulbous fragrant ornamental plant grown in the tropical and subtropical areas for cut flower and fragrance (Manas *et al.*, 2018). Tuberose is a widely cultivated crop grown in India for use as a cut flower, loose flower and in perfumery industry. The haploid chromosome number of tuberose is 30, among these 5 are large and 25 are small. The somatic chromosome number is 2n=2x=50. Single cultivars are fertile used in perfumery and seed setting erratic with 2n=2x=60. Double cultivars are fertile and used as cut flower. Seed setting is not observed in double cultivars. The genetic variability available in tuberose is very limited and available

named varieties are very few in India. Major growing state in India, West Bengal, Tamil Nadu, Maharashtra, Andhra Pradesh, Karnataka, Assam, Gujarat and parts of Punjab and Uttar Pradesh.

Major cultivated districts in Andhra Pradesh *viz.*, East Godavari, Guntur, Chittoor, Krishna are the leading districts taking up tuberose cultivation (Jadav and Gurav, 2018). Among ornamental bulbous plants valued for their beauty and fragrance of the flowers, the tuberose occupies a very special and selective place (Sood and Nagar, 2005). In India, Tuberose is a very popular flower and millions of spikes are sold every year.

Tuberose flowers are cultivated to produce flower spikes and loose flowers on a commercial scale for the domestic market and loose flowers on a commercial scale for the domestic market. Tuberose flowers are cultivated throughout the year and can be grown out door or under green house conditions. Single type is predominantly cultivated and used in garland making, social functions and in perfumery industry for extraction of essential oil.

Mostly local varieties are cultivated by the farmers of Nellore district. Productivity was lesser due to low yielding local varieties. Many hybrids have been introduced in Tuberose by Indian Institute of Horticultural Research (IIHR), Bengaluru, National Botanical Research Institute (NBRI), Lucknow and various other Agricultural Institutes.

Tuberose is one of the important flower crops (after Jasmin) cultivated in Nellore district of Andhra Pradesh as loose flower for purpose of making garland and veni. It is being used for worshipping, offerings in religious functions and auspicious days (Pocha *et al.*, 2019).

The performance of tuberose cultivars varies with climate. In Nellore district maximum temperature occur during the summer at 36 to 46 °C, while the minimum temperature occurs during the winter at 23 to 25 °C. The average annual rainfall of the district is 1,080 mm (43 in) and reaches its peak during the South West (June-September) and North-East monsoon (October-December). Nellore is subjected to both droughts and floods, depending on the seasons. The existing local cultivars are low yielding and give low margin to the farmers. Hence, experiment was conducted to assess suitable high yielding variety 'Arka Prajwal' for commercial cultivation in this district.

Materials and Methods

The experiment has been conducted at farmer's fieldforthreeyearsduring2017-19atfivefarmer's field in Veguru and Leguntapadu villages of Nellore district. Two varieties were used and Arka Prajwal tuberose bulbs were supplied to the farmers under treatment T_1 was Arka Prajwal whereas T_2 was local variety.

Yield gap analysis

Technological gap (yield gap 1) = Potential yield - Demonstration plot yield

Extension gap (yield gap- II) = Demonstration plot yield - Actual yield (Farmers practice)

Total yield gap = Potential yield - Actual yield (Desai *et al.*, 2018)

Economic analysis

Net returns = Gross returns - Total cost of cultivation.

Benefit cost Ratio (BCR) = Gross returns ÷ Total cost of cultivation.

Gross return of new variety – Gross return of farmer's variety

Marginal Benefit Cost Ratio (MBCR)

Total variable cost of new variety – Total variable cost of farmer's variety (Sarma 2018 and Pocha *et al.*, 2019).

Relative Economic Efficiency (REE)

$$= \frac{\text{Net return of new variety} - \text{Net return of farmer's variety}}{\text{Net return of farmer's variety}}$$

(Sarma 2018 and Pocha *et al.,* 2019)

Eachexperimentalplotsizewas0.2 ha and the planting was taken up during June 2017 at five farmer's fields. The observations *viz.*, number of spikes per plant, number of florets per spike, 100florets weight (g), flower yield per plant (g) and flower yield per hectare (t/ha) and economic character like cost of cultivation, gross income, net income, marginal benefit cost ratio (MBCR), relative economic efficiency (REE), benefit to cost ratio (BCR), Total yield gap, Extension gap and Technological gap were recorded.

Results and Discussion

Results revealed that the improved variety Arka Prajwal showed the highest number of spikes per plant (1.86 no./plant), number of florets per spike (31.88 no./spike), 100 florets weight (173 g) compared to Local variety, i.e., number of spikes per plant (1.61 no./plant), number of florets per spike (27.95 no./spike), 100 florets weight (97g).

In Arka Prajwal flower yield per plant (102. 46 g) and flower yield per hectare (8.75 t/ha) were more compared to Local variety i.e., flower yield per plant (43.49g) and flower yield per hectare (4.64t/ha). Maximum recorded in Arka Prajwal the reason might be due to more number of flower per spike and more flower weight per plant which also reflected in higher 100 florets weight (173 g). Similar results were revealed by Krishnamoorthy (2014); Ranchana *et al.*, (2013); Gurav *et al.,* (2005) and Pocha *et al.,* (2019) in tuberose.

It is evident from Table 3, There was 61.84 per cent increase in yield per hectare than local variety. It might be due to 135. 60 per cent increase in yield per plant, 78.35 per cent increase in 100 Nos florets weight. Even though Arka Prajwal flowers fetch higher price per kilogram compared to the local varieties because of its quality *i.e.* fragrance and appearance. Arka Prajwal also used for concrete extraction and it fetched more price per kilogram as compared to local varieties which resulted in higher net returns to the farmers. Hence improved tuberose variety Arka Prajwal was most suitable for cultivation. Similar results were reported by Singh *et al.*, (2018).

Yield gap and Economic analysis

From the Table 4. Arka Prajwal tuberose variety farmers got more benefit cost ratio (2.84) over Local variety (1.49). This may be due to higher yield obtained with Arka Prajwal tuberose variety compared to farmer's practice. Similar results were obtained by Mahawer *et al.,* (2013). Suitability of new variety was assessed with marginal benefit cost ratio (22.28) and economic efficiency was assessed with Relative Economic Efficiency (2.80). The cultivation of Prajwal tuberose variety gave higher net return Rs. 403104.67/-over three years as compared to Local variety (Rs. 106216.00).

The yield gaps are presented in Table 4. The potential yield of Tuberose was found to be 18.00 t ha^{-1} and the Arka Prajwal mean plot yield was 8.75t ha^{-1}. The actual yield obtained by the farmers on their farm with their own resources and management practices was 4.64t ha^{-1}. The magnitude of technological gap (yield gap-I) was 9.27t ha^{-1}, which was 51.38 per cent lesser than the maximum attributable yield. Extension gap (yield gap-II) refers to the difference between demonstration plot yield and actual yield and it was 4.64t ha^{-1}. There was 25.78 per cent reduction in yield as compared to demonstration plots yield. A sizable total yield gap of 13,36t ha^{-1} was observed and it accounted for 25.76 per cent.

Table.1 Details of the Experiment

Sl. No.	Particulars	T_1-Arka Prajwal	T_2-Local Variety
1	Characters	Arka Prajwal is a Hybrid of Shringar x Mexican single. Released by Indian Institute of Horticulture Research (IIHR), Bengaluru, during the year 2014. This hybrid bears single type white flowers on long stiff spikes (95 cm, 50 florets per spike). The individual flowers are larger in size compared to local single. Arka Prajwal yields 15.5 – 18 t/ha/year which is 20 per cent more loose flowers than "Shringar". The loose flowers yield is high compared to other varieties of Tuberose.	Single type white flowers on long thin stiff spikes and small florets with thin stiff. Susceptible to Red rust and rot.
2	Soil Types	p^H-6.8. Electrical Conductivity (EC)- 0.7-0.8, Sandy Loamy soils, Available Nitrogen, Phosphorous and Potash – 140, 14 and 212 receptively.	p^H-6.8. Electrical Conductivity (EC)- 0.7-0.8, Sandy Loamy soils, Available Nitrogen, Phosphorous and Potash – 140, 14 and 212 receptively.
3	Spacing	Double row system with spacing of 120 x 20 × 10cm (Ridge and Furrow)	Double row system with spacing of 120 x 20 × 10cm (Ridge and Furrow)
4	Seed treatment	Copper oxy chloride (3g/l).	Not treated
5	Fertilizers (Organic and In organic)	Farm yard manure (10 t/ha), recommended dose of fertilizersNPK– 200:200:200kg/ha,neemcake250 kg/ha has been applied as a basal dose	Farm yard manure (5 t/ha), recommended dose of fertilizersNPK–120:150:120kg/ha has been applied as a basal dose
6	Irrigation	Ridge and Furrow	Ridge and Furrow

Table.2 Performance of Tuberose varieties at farmer's field during 2017-18 to 2019-20.

S. No.	Parameters	Arka Prajwal				Local variety			
		2017-18	2018-19	2019-20	Mean	2017-18	2018-19	2019-20	Mean
1	No. of spikes plant^{-1}	1.90	1.79	1.88	**1.86**	1.59	1.63	1.60	**1.61**
2	No. of florets spike^{-1}	31.70	31.55	32.40	**31.88**	27.95	28.10	27.80	**27.95**
3	100 Florets weight (g)	173	176	171	**173**	97	100	94	**97**
4	Yield plant^{-1} (g)	103.86	99.37	104.16	**102.46**	42.88	45.79	41.81	**43.49**
5	Yield t ha^{-1}	9.78	8.61	7.86	**8.75**	4.20	4.24	5.49	**4.64**

Table.3 Comparison of means of yield and yield attributes of Tuberose varieties 2017-2019

Sl. No.	Parameters	Arka Prajwal	Local variety	Per cent increase
1	No. of spikes plant^{-1}	1.86	1.61	15.52
2	No. of florets spike^{-1}	31.88	27.95	14.06
3	100 Nos Florets weight (g)	173	97	78.35
4	Yield plant^{-1} (g)	102.46	43.49	135.60
5	Yield t ha^{-1}	8.75	4.64	61.84

Table.4 Economics mean analysis of Tuberose variety Arka Prajwal

Tuberose Variety	Gross income/ha	Cost of cultivation/ha	Net returns/ha	B:C ratio	MBCR	REE
T1-Arka Prajwal	626450.00	223345.33	403104.67	2.84	22.28	2.80
T2-Local Variety	312320.00	209240.67	106216.00	1.49		

Table.5 Yield gap analysis of Tuberose production

Particulars	Yield t ha^{-1}	Per cent Increase
Potential yield	22	--
Demonstration plot yield	8.75	--
Actual yield (Farmers practice)	4.64	--
Technological gap (Yield gap I)	9.27	51.38
Extension gap (Yield gap II)	4.64	25.78
Total yield gap	13.36	74.22

Tuberose growers getting high remunerative price with Tuberose improved variety Arka Prajwal. Because Tuberose improved variety gives a higher number of spikes per plant, more flowers per spike and more flower weight per plant gave higher yield, higher net returns and B:C ratio. Hence, the farmers

were satisfied with the tuberose variety Prajwal cultivation. Hence, it was concluded that tuberose variety Arka Prajwal was most suitable variety for Nellore district of Andhra Pradesh. At present, the area under Arka Prajwal in Nellore district is nearly 76 per cent of the total area under tuberose.

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