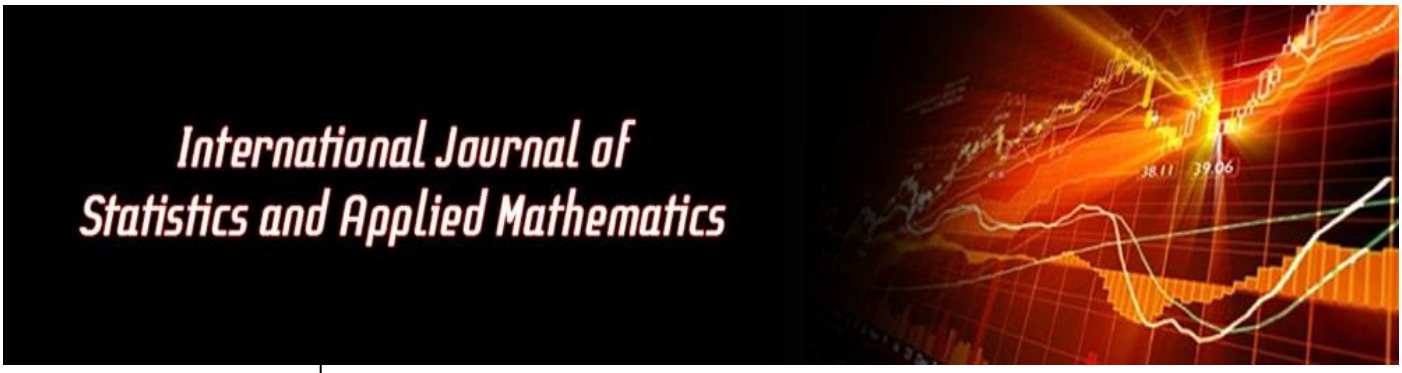

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Economic analysis on different varieties of tuberose as affected by different spacing on growth, yield and quality

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Abstract
The present investigation was carried out to ascertain performance of tuberose (*Polianthes tuberosa* L.) with different spacing during March, 2021 to January, 2022 at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Dist. Mehsana, Gujarat. Experiment was comprised of two factors *viz.* three spacings i.e. 30 cm x 30 cm (s_1), 45 cm x 20 cm (s_2) and 45 cm x 30 cm (s_3) and five varieties Arka Prajwal (v_1), Phule Rajani (v_2), Shringar (v_3), Mexican Single (v_4) and Arka Nirantara (v_5). Total 15 treatments were evaluated in present investigation *viz.*, T_1: 30 cm x 30 cm + Arka Prajwal, T_2: 30 cm x 30 cm + Phule Rajani, T_3: 30 cm x 30 cm + Shringar, T_4: 30 cm x 30 cm + Mexican Single, T_5: 30 cm x 30 cm + Arka Nirantara, T_6: 45 cm x 20 cm + Arka Prajwal, T_7: 45 cm x 20 cm + Phule Rajani, T_8: 45 cm x 20 cm + Shringar, T_9: 45 cm x 20 cm + Mexican Single, T_{10}: 45 cm x 20 cm + Arka Nirantara, T_{11}: 45 cm x 30 cm + Arka Prajwal, T_{12}: 45 cm x 30 cm + Phule Rajani, T_{13}: 45 cm x 30 cm + Shringar, T_{14}: 45 cm x 30 cm + Mexican Single and T_{15}: 45 cm x 30 cm + Arka Nirantara. Treatments were evaluated with respect to growth, yield and quality parameters of tuberose. Among various treatments, the highest benefit cost ration and net realization obtained with treatment T_6: 45 cm x 20 cm + Arka Prajwal.

Keywords: Tuberose, single type, variety and spacing, economics, benefit cost ratio

Introduction
In India, tuberose (*Polianthes tuberosa* L.) is a popular crop for cut and loose flowers. It is an ornamental bulbous plant belongs to family Asparagaceae and is native of Mexico (Trueblood, 1973) [3]. In South India, it is commonly planted for its fragrant white flowers, which are used for garlands and decorations. It is also used for worshipping, offerings in religious functions and on auspicious days (Krishnamoorthy, 2014) [1]. The flowers are used for the extraction of valuable essential oil, which is having greater export demand (Martolia and Srivastava, 2012) [2]. For this crop, there are numerous local varieties and cultivars available these days. Certain types may not perform as well in other places with different climates than they do in one. Thus, the varietal evaluation for a certain site enables the producer to choose the variety that will yield the most and be most fit for that specific area. Any crop's ability to be successfully grown is determined by a number of agronomic practices, such as optimal spacing, in addition to the high yielding variety. Thus, in order to cultivate tuberose and produce the best possible quality and number of tuberose flowers, plant spacing is very crucial. Considering the present situation and above facts, the present investigation was undertaken with the objective to determine the optimum spacing for better growth, spike yield and quality of tuberose.

Materials and Methods
The current study was conducted from March 2021 to January 2022 at the College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat. Split plot design was used to set up the experiment, which included fifteen treatment combinations of three spacings and five varieties: 30 cm x 30 cm (s_1), 45 cm x 20 cm (s_2) and 45 cm x 30 cm (s_3) and five varieties Arka Prajwal (v_1), Phule Rajani (v_2), Shringar (v_3), Mexican Single (v_4) and Arka Nirantara (v_5). He treatments that were combined

were as follows: T_1: 30 cm x 30 cm + Arka Prajwal, T_2: 30 cm x 30 cm + Phule Rajani, T_3: 30 cm x 30 cm + Shringar, T_4: 30 cm x 30 cm + Mexican Single, T_5: 30 cm x 30 cm + Arka Nirantara, T_6: 45 cm x 20 cm + Arka Prajwal, T_7: 45 cm x 20 cm + Phule Rajani, T_8: 45 cm x 20 cm + Shringar, T_9: 45 cm x 20 cm + Mexican Single, T_{10}: 45 cm x 20 cm + Arka Nirantara, T_{11}: 45 cm x 30 cm + Arka Prajwal, T_{12}: 45 cm x 30 cm + Phule Rajani, T_{13}: 45 cm x 30 cm + Shringar, T_{14}: 45 cm x 30 cm + Mexican Single and T_{15}: 45 cm x 30 cm + Arka Nirantara. In March, bulbs with a diameter of 2.5 - 3.0 cm were planted, and irrigation and fertilization were done in accordance with standard recommended package standards. From each treatment, five plants were chosen for observation.

Results and Discussion

Table 1: Cost of cultivation and gross realization of tuberose

a) Details of fixed cost

Sr. No.		Particular	Labour/quantity	Frequency	Fixed Cost (3 yr)		Fixed Cost (For 1 yr)
					Cost of Material	Labour Cost	
[A]	**Pre-Planting Operation**						
	1.	Ploughing (3 hr x 600 ₹)	-	2	3,600	-	1,200
	2.	Planking (3 hr x 600 ₹)	-	1	1,800	-	600
	3.	FYM @ 20 t/h	-	1	60000	-	20000
	4.	FYM application	10	1		10200	3400
[B]	**Bulb**						
	1.	Transport	-		1,000	-	334
	2.	COC treatment (5 kg)	4	1	3,500	1,360	11,273
	3.	GA_3 treatment (20 g)			28,960		
[C]	**Fertilizer Cost**						
	1.	Urea (N: 200 kg/ha)	1304 kg urea	-	7,735	-	2,578
	2.	SSP (P: 200 kg/ha)	3750kg SSP	-	31,125	-	10,375
	3.	MOP (K: 200 kg/ha)	1034 kg MOP	-	18,713	-	6,238
	4.	Fertilizer application	12	6	-	24,480	8,160
[D]	**Planting**						
	1.	Bed preparation	10	1	-	3,400	1,134
	2.	Bulb Planting	15	1	-	1,700	567
[E]	**Intercultural Operations**						
	1.	Weeding	6	45	-	91,800	30,600
	2.	Plant protection	4	15	-	22,550	7,517
[F]	Irrigation		-	-	60,000		20,000
	Total Cost (₹/ha)				2,16,433	1,55,490	1,23,976

(**Note:** Tuberose is generally grown for 3 years but here experiment was carried out for 1 year)
Rate of labour = 340 ₹/dayUrea = 5.93 ₹/kg
SSP= 8.3 ₹/kg MOP= 18.09 ₹/kg
Bulb = 5 ₹/bulb FYM= 1000 ₹/t

Among various treatments, the least total variable cost (1,26,857 ₹/ha) was found in T_{13} (45 cm x 30 cm + Shringar) while highest total variable cost (1,92,665 ₹/ha) was found in treatment T_6 (45 cm x 20 cm + Arka Prajwal). Total cost of cultivation for tuberose crop in 1 hectare area was minimum with (2,50,832 ₹/ha) T_{13} (45 cm x 30 cm + Shringar) treatment. While highest total cost of cultivation (3,16,641₹/ha) for 1 hectare was found with treatment T_6 (45 cm x 20 cm + Arka Prajwal).

Table 1b: Details of variable cost

Treatment	Number of plants / ha	Bulb cost (₹/ha)	Harvesting cost (₹/ha)	Variable cost (₹/ha)
T_1	1,11,111	1,85,185	5,440	1,90,625
T_2	1,11,111	1,85,185	3,740	1,88,925
T_3	1,11,111	1,85,185	3,400	1,88,585
T_4	1,11,111	1,85,185	3,400	1,88,585
T_5	1,11,111	1,85,185	3,400	1,88,585
T_6	1,11,111	1,85,185	7,480	1,92,665
T_7	1,11,111	1,85,185	4,080	1,89,265
T_8	1,11,111	1,85,185	3,400	1,88,585
T_9	1,11,111	1,85,185	3,740	1,88,925
T_{10}	1,11,111	1,85,185	3,400	1,88,585
T_{11}	7,40,74	1,23,457	5,100	1,28,557
T_{12}	7,40,74	1,23,457	4,080	1,27,537
T_{13}	7,40,74	1,23,457	3,400	1,26,857
T_{14}	7,40,74	1,23,457	3,740	1,27,197
T_{15}	7,40,74	1,23,457	3,400	1,26,857

Price of bulb = 5 ₹/bulb
(**Note:** Bulb cost is divided by 3 as experiment was carried out for 1 year)

Table 1c: Details of total cost

Treatment	Fixed cost (₹/ha)	Variable cost (₹/ha)	Total cost (₹/ha)
T_1	1,23,976	1,90,625	3,14,601
T_2	1,23,976	1,88,925	3,12,901
T_3	1,23,976	1,88,585	3,12,561
T_4	1,23,976	1,88,585	3,12,561
T_5	1,23,976	1,88,585	3,12,561
T_6	1,23,976	1,92,665	3,16,641
T_7	1,23,976	1,89,265	3,13,241
T_8	1,23,976	1,88,585	3,12,561
T_9	1,23,976	1,88,925	3,12,901
T_{10}	1,23,976	1,88,585	3,12,561
T_{11}	1,23,976	1,28,557	2,52,532
T_{12}	1,23,976	1,27,537	2,51,512
T_{13}	1,23,976	1,26,857	2,50,832
T_{14}	1,23,976	1,27,197	2,51,172
T_{15}	1,23,976	1,26,857	2,50,832

Table 2: Effect of treatments on economics and benefit cost ratio (B:C ratio)

Treatment	Yield (kg/ha)	Gross income (₹/ha)	Total cost of cultivation (₹/ha)	Net income (₹/ha)	B: C ratio
T_1	26564.81	1062592.59	321433.30	741159.29	3.31
T_2	19321.30	772851.85	319733.30	453118.55	2.42
T_3	18145.14	725805.56	319393.30	406412.25	2.27
T_4	17714.24	708569.44	319393.30	389176.14	2.22
T_5	23565.05	942601.85	319393.30	623208.55	2.95
T_6	30377.51	1215100.53	323473.30	891627.23	3.76
T_7	19609.52	784380.95	320073.30	464307.65	2.45
T_8	19635.45	785417.99	319393.30	466024.69	2.46
T_9	21512.17	860486.77	319733.30	540753.47	2.69
T_{10}	25265.61	1010624.34	319393.30	691231.04	3.16
T_{11}	17325.93	693037.04	259364.91	433672.13	2.67
T_{12}	12165.12	486604.94	258344.91	228260.03	1.88
T_{13}	12514.81	500592.59	257664.91	242927.69	1.94
T_{14}	11855.25	474209.88	258004.91	216204.97	1.84
T_{15}	18721.30	748851.85	257664.91	491186.95	2.91

Data (Table 2) pertaining to the economics of treatments shows that maximum gross income (323473.30 ₹) was observed with treatment T_6 (45 cm x 20 cm + Arka Prajwal) followed by T_1 (30 cm x 30 cm + Arka Prajwal) and minimum (474209.88 ₹) in the treatment T_{14} (45 cm x 30 cm + Mexican Single). Similarly, maximum net income (891627.23 ₹) was observed with treatment T_6 (45 cm x 20 cm + Arka Prajwal) followed by T_1 (30 cm x 30 cm + Arka Prajwal) and minimum (216204.97 ₹) in the treatment T_{14} (45 cm x 30 cm + Mexican Single). On the other hand highest benefit cost ratio (3.76) also observed with treatment T_6 (45 cm x 20 cm + Arka Prajwal) followed by T_1 (30 cm x 30 cm + Arka Prajwal) and minimum (1.84) in the treatment T_{14} (45 cm x 30 cm + Mexican Single).

Conclusion

From the present study, it could be concluded that planting of variety Arka Prajwal under spacing 45 cm x 20 cm spacing was found most beneficial in terms economics and benefit cost ratio as compared to other varieties and spacings under study.

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