Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8951

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2022) *10*(6), 53-60

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Effect of Spacing, Nitrogen and Phosphorus on Growth and Flowering Characters of Tuberose under Eastern Part of Uttar Pradesh Conditions

Shailendra Vikram Singh[1] and Abhimanyu Chaturvedi[2*]

[1]Associate Professor & Head, Dept of Horticulture, S.D.J.P.G. College, Chandeshwer, Azamgarh, U.P.

[2]Ph.D. scholar, S.D.J.P.G. College, Chandeshwer, Azamgarh, U.P.

*Corresponding Author E-mail: mannuhorti@gmail.com

Received: 12.07.2022 | Revised: 26.10.2022 | Accepted: 26.11.2022

ABSTRACT

A field experiment was conducted to study the effect of different Nitrogen, phosphorus and spacing doses on the growth and flowering characters of tuberose cv. Hyderabad double at Krishi Vigyan Kendra- 1, Azamgarh, during 2019-20 and 2020-21. The treatments consisted 4 levels of Nitrogen (100, 200, 300 and 400 kg/ha-1), 3 levels of phosphorus (100,150, and 200 kg/ha-1), respectively and 3 spacing's: 30 x 20 cm, 30 x 30 cm, and 30 x 40 cm were evaluated in factorial randomized block design replicated thrice. The results revealed that the growth and quality characteristics of tuberose were increased significantly. The best result reg. maximum plant height (43.77 cm), number of leaves/plant (27.25), length of leaves (60.97 cm), width of leaves (2.60 cm), days for spike emergence (109.77 days) days to flowering (118.68 days), spike length (88.80 cm), rachis length (35.71 cm), Florets/spike (34.99), spike /clump (3.17), flowering duration (31.64 days) and flower's yield (4.18 lakh/ha) were reported with S2N2P2 (30 x 30 cm, 200 kg/ha, 150 kg/ha).

Keywords: *Tuberose, nitrogen, phosphorus, spacing.*

INTRODUCTION

Tuberose (*Polianthus tuberose* L.) belongs to the family Amaryllidaceae and genus has about 14 species. Its origin place is Mexico. It is an important commercial cut flower crop among bulbous flowers. It is very popular among the farmers due to higher return, sweet fragrance, longer vase life of spikes and wide adaptability to climate and soil. Its flowers are used for making garlands, bouquets, gajras and essential oil extraction. The Iran country is famous for the best quality of tuberose flowers worldwide because of aroma and the best quality of flowers with quantity too; which is highly in demand in all worlds. Although nutritional issues are important in improving qualitative and quantitative properties, marketability and exports of this flower, but they have not been getting much attention in eastern Uttar Pradesh region.

Cite this article: Singh, S. V., & Chaturvedi, A. (2022). Effect of Spacing, Nitrogen and Phosphorus on Growth and Flowering Characters of Tuberose under Eastern Part of Uttar Pradesh Conditions, *Ind. J. Pure App. Biosci. 10*(6), 53-60. doi: http://dx.doi.org/10.18782/2582-2845.8951

Nitrogen fertilizer has a key role in canopy formation as its deficiency leads to slowing down the photosynthesis process (Thoma et al., 1975). Also, nitrogen and phosphorous are essential elements for growth (Banker et al., 1980). However, potassium does not affect it (Kishore et al., 2006). Gopal Krishnan et al. (1995) reported 120:60:30 kg/ha of N: P: K led to maximum growth and yield of the flower.

Al-Badawy et al. (1995) reported the application of nitrogen led to an increase of photosynthetic pigments (chlorophyll a, b) in leaves, carotenoid content in flowers and nitrogen percentage in shoot. Observations taken by Khalaj *and* Edrisi (2007) on tuberose showed that the application of nitrogen had no significant effect on vase-life of tuberose cv. Double (*Polianthes tuberosa* L.).

The study on this aspect under eastern Uttar Pradesh is scanty; hence the present investigation on "Effect of nitrogen, phosphorus and spacing on growth, flowering, yield and post-harvest parameters in tuberose (*Polianthes tuberosa* L.)" had conducted at the Farm of Krishi Vigyan Kendra-1, Azamgarh-Uttar Pradesh under the supervision of the department of horticulture, S.D.J.P.G. college-Chandeshwer- Azamgarh district.

MATERIALS AND METHODS

The experiment was conducted during 2019-20 and 2020-21 respectively (Kharif season, May to September month) at the Farm of Krishi Vigyan Kendra-1, Azamgarh. The KVK situated 05 km away from Azamgarh city in southern Uttar Pradesh. The soil of the field had pH of was 7.8 (measured by Beckman's glass electrode method), EC = 0.52 mmhos/cm, Organic carbon = 0.40% (low), available Nitrogen= 365 kg/ha (medium), available Phosphorus= 12 kg/ha (low) and available potassium=194 kg/ha (medium).

The trial was carried out by using Simple Randomized Block design with 3 treatment (**Nitrogen:** 4 levels: N_1=100 kg/ha, N_2=200 kg/ha, N_3=300 kg/ha N_4=400 kg/ha, **Phosphorus**: 3 levels: P_1 = 100 kg/ha, P_2 = 150 kg/ha, P_3 = 200 kg/ha and **Spacing:** 3 levels: S_1= 30 x 20 cm, S_2= 30 x 30 cm and S_3= 30 x 40 cm) & 3 replications. The well rotten Farm Yard Manure was applied during last ploughing @ 5 kg/m^2. The fertilizers were applied before planting in form of Urea and Di-ammonium Phosphate as per treatment. The Variety- Hyderabad Double was used in research.

Table1. Treatment detail used to test in experiment

Treatment No.	Treatment Notation	Treatment detail		
		Spacing (S)- cm×cm	Nitrogen (N)- kg ha^{-1}	Phosphorus (P)- kg ha^{-1}
T1	S1N1P1	30×20	100	100
T2	S1N2P1	30×20	200	100
T3	S1N3P1	30×20	300	100
T4	S1N4P1	30×20	400	100
T5	S1N1P2	30×20	100	150
T6	S1N2P2	30×20	200	150
T7	S1N3P2	30×20	300	150
T8	S1N4P2	30×20	400	150
T9	S1N1P3	30×20	100	200
T10	S1N2P3	30×20	200	200
T11	S1N3P3	30×20	300	200
T12	S1N4P3	30×20	400	200
T13	S2N1P1	30×30	100	100
T14	S2N2P1	30×30	200	100
T15	S2N3P1	30×30	300	100
T16	S2N4P1	30×30	400	100
T17	S2N1P2	30×30	100	150

T18	S2N2P2	30×30	200	150
T19	S2N3P2	30×30	300	150
T20	S2N4P2	30×30	400	150
T21	S2N1P3	30×30	100	200
T22	S2N2P3	30×30	200	200
T23	S2N3P3	30×30	300	200
T24	S2N4P3	30×30	400	200
T25	S3N1P1	30×40	100	100
T26	S3N2P1	30×40	200	100
T27	S3N3P1	30×40	300	100
T28	S3N4P1	30×40	400	100
T29	S3N1P2	30×40	100	150
T30	S3N2P2	30×40	200	150
T31	S3N3P2	30×40	300	150
T32	S3N4P2	30×40	400	150
T33	S3N1P3	30×40	100	200
T34	S3N2P3	30×40	200	200
T35	S3N3P3	30×40	300	200
T36	S3N4P3	30×40	400	200

RESULT AND DISCUSSION

The results depicted in table no-2 & 3, showed that all the growth and flowering characters were significantly influenced by effect of nitrogen, phosphorus and spacing. In vegetative parameters (Table-2) among all treatments, T-18 (wider spacing- 30 x 30 cm, 200 kg/ha, 150 kg/ha) resulted best result (mean of two years) in every parameters. The maximum plant height (43.77 cm) followed by T-31 (42.73 cm) while minimum (35.20 cm) in T-1, maximum number of leaves/plant (27.25) recorded with treatment T-18 followed by T-30 (24.51) while minimum (21.18) in T-1, maximum length of leaves (60.97 cm) recorded with T-31 followed by T-18 (60.47 cm) and minimum (50.55 cm) in T-1, maximum width of length (2.60 cm) reported with T-30 followed by T-13 (2.47 cm) while minimum (1.08 cm) in T-36 (30 x 40 cm, 400 kg/ha, 200 kg/ha), Desai and mamatha (2016) reported that the 30 x 30 cm spacing resulted the best plant height of tuberose (variety: Prajwal) while the lowest plant height recorded with 30 x 15 cm spacing at Tumkur district of Karnataksa state, India. The Nitrogen levels play promontory effect on plant height of Tuberose (variety: Pune single). Higher doses of nitrogen induce the plant height which converted in maximum plant growth. The similar finding reported by Bharathi et al. (2016) who find out that increasing dose of NPK up to 250:310:200 NPK/ha has resulted positive effect on plant growth. These findings are in accordance with Desai & Mamatha (2016) who revealed that spacing of 30 x 30 cm best for maximum number of leaves/plant. The wider spacing with optimum nitrogen & phosphorus can provide the optimum space and solar radiation which ultimately resulted in big size of leaves. Thus the combination of wider spacing & optimum level of N and P resulted into more leaf/plant. This finding also supported by Ambad et al. (2017) in tuberose.

The results from table no -3 shows that flowering traits were significantly influenced by combination of spacing, different doses of nitrogen, phosphorus positively. The minimum days for spike emergence (109.77 days) reported in T-18 followed by T-25 (110.22 days) while in T-5 took maximum days (116.09 days), minimum days to flowering (119.14 days) reported in T-18 followed by T-20 (120.02 days) while maximum (127.58 days) in S1N4P2, maximum length of spike (88.80 cm) reported with T-18 followed by T-31 (85.00 cm) while minimum (74.54 cm) reported in S_1 N_1 P_2 , maximum rachis length (35.71 cm)

reported S2N2P2 followed by S2N2P3 (35.28 cm) while minimum (22.95 cm) with S1N1P3, maximum florets/spike (34.99) produced in S2N2P2 followed by S_2 N_1 P_2 (34.52) while the minimum (26.54) was produced by S_1 N_1 P_1, maximum spike /clump (3.17) with S2N2P2 followed by S3N3P2 (2.79) while poorest (0.80) recorded with S1N1P2, maximum flowering duration (31.64 days) with S2N2P2 followed by S2N3P2 (30.33 days) while poorest value (16.91 days) recorded with T-5 and flower's yield (4.18 lakh/ha) were reported with T-18 followed by T-22 (4.04) while minimum (2.16) reported with T-18.

Dense planting took maximum days for spike emergence while little wider spacing recorded minimum days. The similar finding also reported by Aklande (2016) who reported that significantly minimum days for spike emergence obtained in wider spacing in tuberose. The Nitrogen accelerates the cell division which ultimately resulting into fast vegetative growth of the plant; consequently early reproductive phase/ induction of early flowering happened. This results supported by Rajwal and Singh (2006) who studied the effect of various N rates (100, 125 and 150 kg/ha) on the performance of Tuberose (double variety) in Muzzaffarnagar- Uttar Pradesh- India during 2002-03. Kumar et al. (2016) reported that maximum spike length (81.56 cm) in medium spacing (30 x 40 cm). The optimum level of Nitrogen enhanced the growth of spike which resulted maximum length of spike and the result are close associated with Dhakal et al. (2017) who reported that Nitrogen 150 kg & Phosphorus 100 kg/ha produced the maximum spike length (76.54 cm) while minimum spike length (62.43 cm) reported in control. Mane et al. (2007) reported that maximum number of florets/spike (26.31) in wider spacing. This result also proven by Gowthami et al. (2017) who find out that maximum number of florets per spike (57.29) were produced with 100 Kg N + 60 Kg K /ha. The maximum duration of flowering observed in wider spacing with medium dose of N and higher dose of Phosphorus which is associated with Rana et al. (2005) in gladiolus at Horticulture Research Farm of the C.C.S. University, Meerut during 2000-01 and 2001- 02 who reported the medium spacing (30 x 20 cm) produced the maximum duration of flowering. Priyanka et al. (2017) revealed that maximum florets weight in closer spacing observed in crossandra. The Khalaj et al. (2012) had also supported this finding by reporting that increasing N dose from 0 to 250 kg/ha; florets weight also increased positively.

Table No: 2: Growth characters

Treatments	Plant height (cm)			Number of leaves per plant			Length of leaves (cm)			Width of leaves (cm)		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
S1N1P1	34.39	35.20	34.80	20.29	21.01	20.65	50.04	50.55	50.29	1.03	1.08	1.06
S1N2P1	35.85	36.17	36.01	21.67	22.09	21.88	51.00	51.65	51.32	1.11	1.17	1.14
S1N3P1	35.98	36.17	36.08	21.51	21.66	21.58	50.40	51.25	50.83	1.12	1.15	1.14
S1N4P1	36.50	36.57	36.53	21.23	21.65	21.44	50.55	51.20	50.87	1.10	1.20	1.15
S1N1P2	35.28	35.67	35.47	20.85	21.18	21.01	50.00	50.75	50.38	1.41	1.57	1.49
S1N2P2	35.47	35.74	35.61	21.72	22.41	22.07	51.33	52.00	51.66	1.58	1.79	1.69
S1N3P2	36.50	36.97	36.74	22.56	22.96	22.76	51.83	52.55	52.19	2.14	2.35	2.24
S1N4P2	36.91	37.52	37.22	22.52	22.83	22.67	51.49	52.45	51.97	2.05	2.17	2.11
S1N1P3	37.30	37.39	37.35	22.90	23.35	23.12	52.39	52.95	52.67	1.56	1.67	1.61
S1N2P3	38.12	37.91	38.02	22.61	22.86	22.74	51.25	52.47	51.86	1.54	1.74	1.64
S1N3P3	37.20	37.42	37.31	22.99	23.27	23.13	52.01	52.85	52.43	2.08	2.25	2.17
S1N4P3	37.68	37.83	37.76	23.80	24.01	23.91	52.90	53.60	53.25	2.20	2.37	2.28
S2N1P1	38.39	38.57	38.48	23.57	24.10	23.83	52.87	53.65	53.26	1.54	1.63	1.59

S2N2P1	38.05	38.57	38.31	24.03	24.39	24.21	52.98	53.95	53.47	1.69	1.83	1.76
S2N3P1	38.45	38.95	38.70	25.55	25.76	25.66	54.24	55.30	54.77	2.04	2.12	2.08
S2N4P1	39.96	40.29	40.13	25.08	25.34	25.21	53.79	54.91	54.35	2.11	2.19	2.15
S2N1P2	39.87	40.36	40.12	25.06	25.77	25.42	54.45	55.35	54.90	1.60	1.71	1.66
S2N2P2	43.63	43.77	43.70	27.27	27.75	27.51	61.66	62.42	62.04	2.43	2.60	2.52
S2N3P2	40.16	42.27	41.21	26.63	26.99	26.81	58.88	60.17	59.53	1.71	1.78	1.74
S2N4P2	40.76	41.27	41.02	26.09	26.31	26.20	59.61	56.98	58.30	1.32	1.43	1.38
S2N1P3	37.61	38.29	37.95	25.14	25.32	25.23	56.22	60.47	58.35	1.34	1.37	1.36
S2N2P3	38.13	38.93	38.53	26.14	27.03	26.59	59.53	60.22	59.88	1.58	1.75	1.67
S2N3P3	39.63	40.56	40.10	26.53	26.83	26.68	59.34	60.02	59.68	1.53	1.68	1.61
S2N4P3	38.75	39.30	39.03	25.32	25.50	25.41	58.01	58.72	58.37	1.32	1.34	1.33
S3N1P1	39.09	39.17	39.13	24.95	25.76	25.36	58.02	58.97	58.50	1.30	1.41	1.36
S3N2P1	40.27	40.78	40.52	25.10	25.50	25.30	58.17	58.72	58.45	1.49	1.35	1.42
S3N3P1	39.80	40.53	40.17	25.59	25.90	25.75	57.81	59.17	58.49	1.61	1.69	1.65
S3N4P1	40.49	40.95	40.72	25.77	26.32	26.05	58.97	59.52	59.25	1.32	1.39	1.35
S3N1P2	40.74	41.36	41.05	24.18	27.05	25.62	57.91	58.47	58.19	1.81	1.90	1.86
S3N2P2	41.21	42.06	41.64	26.39	24.51	25.45	60.05	60.97	60.51	2.06	2.10	2.08
S3N3P2	42.26	42.73	42.50	27.06	27.25	27.16	60.90	61.45	61.18	2.34	2.47	2.40
S3N4P2	40.66	41.30	40.98	23.01	23.46	23.23	55.29	55.90	55.60	1.53	1.55	1.54
S3N1P3	39.75	40.27	40.01	23.56	24.01	23.79	55.60	56.48	56.04	1.34	1.43	1.39
S3N2P3	40.13	40.83	40.48	23.89	24.25	24.07	56.02	56.72	56.37	1.43	1.53	1.48
S3N3P3	39.93	41.04	40.48	23.48	23.79	23.63	55.42	56.23	55.83	1.37	1.40	1.39
S3N4P3	39.69	40.59	40.14	21.66	22.36	22.01	54.23	54.88	54.56	1.29	1.38	1.33
S .Ed.	1.01	1.02	0.37	0.97	0.97	0.56	1.01	1.01	0.79	0.78	0.77	0.06
CD	2.01	2.02	0.73	1.92	1.93	1.11	2.02	2.02	1.57	1.56	1.54	0.12
t Tab	1.99	1.99	1.98	1.99	1.99	1.98	1.99	1.99	1.98	1.99	1.99	1.98

Table No: 3 (A): Flowering characters

Treatments	Days to spike emergence			Days to flowering			Spike length (cm)			Rachis length (cm)		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
S1N1P1	113.11	112.09	112.60	124.38	124.18	124.28	75.08	75.87	75.48	23.69	24.76	24.22
S1N2P1	114.14	113.59	113.87	124.94	125.22	125.08	75.67	76.41	76.04	24.63	25.31	24.97
S1N3P1	115.25	114.79	115.02	125.37	125.68	125.53	74.95	75.48	75.22	23.73	24.37	24.05
S1N4P1	115.79	115.09	115.44	126.19	126.10	126.15	74.48	75.16	74.82	23.52	24.24	23.88
S1N1P2	116.46	116.09	116.28	127.58	127.18	127.38	73.96	75.12	74.54	23.14	24.01	23.58
S1N2P2	115.14	114.59	114.87	126.52	126.28	126.40	74.81	75.79	75.30	23.70	24.68	24.19
S1N3P2	114.43	114.09	114.26	127.21	126.78	127.00	74.82	75.94	75.38	23.73	24.37	24.05
S1N4P2	114.81	113.59	114.20	127.82	127.34	127.58	74.68	75.48	75.08	22.64	23.36	23.00
S1N1P3	112.14	111.59	111.87	123.66	123.18	123.42	73.60	74.54	74.07	22.46	23.43	22.95
S1N2P3	113.70	113.09	113.40	124.71	124.03	124.37	74.79	75.21	75.00	23.42	24.30	23.86

S1N3P3	115.12	114.09	114.61	125.12	124.68	124.90	74.23	75.36	74.80	23.59	24.25	23.92
S1N4P3	115.52	114.94	115.23	126.20	125.59	125.90	73.95	74.90	74.43	22.56	23.79	23.17
S2N1P1	111.67	110.55	111.11	124.45	123.68	124.07	75.09	76.60	75.85	24.55	25.49	25.02
S2N2P1	112.67	111.55	112.11	123.45	122.53	122.99	77.46	78.10	77.78	25.69	26.96	26.33
S2N3P1	113.57	112.55	113.06	124.17	123.48	123.82	76.47	77.23	76.85	25.59	26.31	25.95
S2N4P1	114.48	114.05	114.27	124.86	124.45	124.66	76.27	77.15	76.71	25.53	26.04	25.79
S2N1P2	111.41	110.43	110.92	120.53	119.68	120.11	86.74	87.80	87.27	32.88	33.02	32.95
S2N2P2	111.11	109.77	110.44	119.59	118.68	119.14	88.30	89.30	88.80	35.35	36.06	35.71
S2N3P2	111.77	110.65	111.21	120.42	119.69	120.06	84.18	85.43	84.81	34.21	35.19	34.70
S2N4P2	113.10	111.77	112.43	120.38	119.67	120.02	82.79	83.35	83.07	34.08	35.11	34.60
S2N1P3	111.75	110.57	111.16	120.89	120.83	120.86	81.53	82.24	81.89	33.40	34.00	33.70
S2N2P3	111.90	110.69	111.29	122.44	121.77	122.11	82.92	83.92	83.42	34.88	35.68	35.28
S2N3P3	113.57	112.27	112.92	123.59	122.62	123.11	81.76	82.98	82.37	33.67	34.61	34.14
S2N4P3	113.22	112.77	112.99	124.60	124.26	124.43	81.88	82.85	82.37	33.60	34.52	34.06
S3N1P1	112.08	110.22	111.15	121.20	120.68	120.94	76.57	77.77	77.17	29.02	29.53	29.28
S3N2P1	112.20	110.40	111.30	122.04	121.73	121.89	77.94	78.77	78.35	29.58	30.53	30.06
S3N3P1	112.56	111.40	111.98	123.75	123.23	123.49	77.08	77.77	77.43	28.73	29.53	29.13
S3N4P1	113.27	112.70	112.99	125.46	125.01	125.24	76.72	77.27	77.00	28.05	29.03	28.54
S3N1P2	113.81	113.42	113.61	122.21	121.27	121.74	80.24	80.71	80.48	30.15	30.80	30.48
S3N2P2	114.43	113.76	114.09	122.83	122.17	122.50	82.52	82.53	82.53	30.70	31.29	31.00
S3N3P2	113.22	112.22	112.72	124.39	123.27	123.83	84.72	85.27	85.00	30.00	30.65	30.33
S3N4P2	114.05	113.72	113.88	124.72	124.45	124.59	82.63	83.91	83.27	28.56	29.29	28.93
S3N1P3	111.34	110.22	110.78	120.89	120.27	120.58	81.86	82.91	82.38	27.53	28.29	27.91
S3N2P3	111.48	110.42	110.95	121.66	121.33	121.50	82.65	83.66	83.16	28.02	29.04	28.53
S3N3P3	112.29	111.20	111.75	122.08	121.57	121.83	83.63	84.32	83.98	28.78	29.70	29.24
S3N4P3	113.31	112.22	112.76	123.54	122.45	123.00	82.42	83.24	82.83	27.92	28.62	28.27
S. Ed.	0.96	1.00	0.37	0.95	1.02	0.13	SED	0.99	0.99	0.98	0.98	0.20
CD	1.92	2.00	0.74	1.89	2.03	0.25	CD	1.97	1.98	1.96	1.95	0.40
t Tab	1.99	1.99	1.98	1.99	1.99	1.98	t Tab	1.99	1.99	1.99	1.99	1.98

Table No: 3 (B): Flowering characters

Treatments	Florets/spike			Spike/clump			Flowering duration (days)			Flower's yield (lakhs/ha)		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
S1N1P1	25.87	27.22	26.54	1.32	1.59	1.46	20.03	21.00	20.52	2.11	2.21	2.16
S1N2P1	27.02	27.68	27.35	1.47	1.76	1.62	18.49	19.08	18.79	2.1	2.22	2.16
S1N3P1	26.45	27.61	27.03	1.10	1.20	1.15	18.56	19.50	19.03	2.21	2.33	2.27
S1N4P1	26.42	27.67	27.04	1.08	1.14	1.11	18.67	19.96	19.31	2.09	2.16	2.13
S1N1P2	27.69	28.97	28.33	0.75	0.84	0.80	18.00	18.00	18.00	2.06	2.12	2.09
S1N2P2	29.13	30.64	29.88	1.39	1.51	1.45	16.71	17.10	16.91	2.19	2.27	2.23
S1N3P2	28.90	30.33	29.62	1.56	1.69	1.63	17.48	18.40	17.94	2.66	2.78	2.72
S1N4P2	29.94	30.82	30.38	1.13	1.19	1.16	17.67	18.16	17.91	2.59	2.68	2.64
S1N1P3	29.23	30.55	29.89	1.23	1.42	1.33	18.22	19.59	18.91	2.69	2.78	2.73
S1N2P3	29.04	29.87	29.46	1.80	1.93	1.87	19.33	20.50	19.92	2.73	2.83	2.78
S1N3P3	29.02	30.21	29.62	2.01	2.08	2.05	20.43	21.15	20.79	2.57	2.65	2.61
S1N4P3	28.13	29.19	28.66	2.00	2.06	2.03	20.33	21.25	20.79	2.52	2.6	2.56
S2N1P1	33.04	34.18	33.61	2.15	2.32	2.24	22.55	23.29	22.92	3.14	3.26	3.2
S2N2P1	33.58	34.68	34.13	2.56	2.74	2.65	22.29	23.23	22.76	3.15	3.27	3.21
S2N3P1	33.71	34.63	34.17	2.67	2.80	2.74	24.00	25.00	24.50	3.25	3.37	3.31
S2N4P1	33.02	34.36	33.69	2.42	2.55	2.49	24.74	25.90	25.32	3.2	3.29	3.25
S2N1P2	34.05	34.98	34.52	2.23	2.36	2.30	26.20	30.99	28.60	3.96	4.07	4.01
S2N2P2	34.32	35.66	34.99	3.12	3.22	3.17	31.28	32.00	31.64	4.14	4.23	4.18
S2N3P2	33.66	34.79	34.23	2.22	2.35	2.29	29.67	30.99	30.33	3.94	4.07	4.01
S2N4P2	33.85	34.71	34.28	2.16	2.27	2.22	31.03	31.35	31.19	3.88	3.99	3.94
S2N1P3	32.30	33.60	32.95	1.13	1.35	1.24	27.48	28.84	28.16	3.85	3.97	3.91
S2N2P3	34.08	35.28	34.68	2.57	2.78	2.67	27.52	28.91	28.22	3.98	4.09	4.04
S2N3P3	33.17	34.21	33.69	1.57	1.77	1.67	28.34	29.05	28.70	3.85	3.93	3.89
S2N4P3	33.18	34.21	33.70	1.61	1.77	1.69	29.34	30.41	29.88	3.84	3.9	3.87
S3N1P1	33.27	34.13	33.70	1.46	1.69	1.58	27.14	28.08	27.61	3.47	3.59	3.53
S3N2P1	33.19	34.31	33.75	1.71	1.87	1.79	28.32	29.23	28.78	3.59	3.7	3.65
S3N3P1	33.31	34.12	33.72	1.45	1.57	1.51	29.52	30.72	30.12	3.77	3.9	3.84

S3N4P1	32.56	33.63	33.10	1.11	1.19	1.15	31.00	31.20	31.10	3.62	3.73	3.68
S3N1P2	29.76	31.10	30.43	2.00	2.07	2.04	25.08	26.08	25.58	3.34	3.49	3.42
S3N2P2	30.43	31.59	31.01	2.33	2.52	2.43	25.78	26.18	25.98	3.45	3.53	3.49
S3N3P2	31.03	32.36	31.70	2.70	2.87	2.79	26.86	27.67	27.26	3.59	3.7	3.65
S3N4P2	30.01	31.00	30.50	2.42	2.42	2.42	28.10	28.85	28.47	3.5	3.6	3.55
S3N1P3	29.09	30.00	29.54	2.46	2.46	2.46	23.96	24.90	24.43	3.22	3.33	3.28
S3N2P3	29.64	30.75	30.20	2.62	2.62	2.62	22.97	24.18	23.58	3.29	3.37	3.33
S3N3P3	30.14	31.41	30.77	1.95	1.95	1.95	25.12	25.97	25.55	3.42	3.52	3.47
S3N4P3	29.30	30.33	29.81	1.75	1.75	1.75	25.96	26.69	26.33	3.33	3.42	3.38
SED	0.93	0.93	0.19	0.82	0.82	0.07	1.01	0.96	0.68	0.77	0.76	0.02
CD	1.86	1.85	0.37	1.63	1.64	0.14	2.01	1.91	1.35	1.54	1.53	0.04
t Tab	1.99	1.99	1.98	1.99	1.99	1.98	1.99	1.99	1.98	1.99	1.99	1.98

CONCLUSION

From the results, it may be concluded that the combined impact of spacing @ 30 x 30 cm, N & P_2O_5 200 kg & 150 kg per ha^{-1}, respectively, had a significant impact on the growth and floral characteristics of tuberose. Thus, it seems quite logical to apply nitrogen and phosphorus with sufficient does under the Azamgarh district of Uttar Pradesh to obtain the economic yield.

Acknowledgement:

The authors are thankful to Principal of S.D.J.P.G. College chandeshwer and Senior Scientist & Head- KVK -1, Azamgarh for his motivation and guidance.

Conflict of interest:

There is no conflict of interest among authors. The first author is guided the research programme as Ph.D. supervisor and second author is the Ph.D. student.

Author Contribution:

First author designed the research programme, calculated the statistical data while second author planted and supervised the trials during both years, collected data and wrote the entire manuscript.

REFERENCES

Al-Badawy, A. A., Abdalla, N. M., & El-Sayad, A. A. (1995). Response of *Calendula Officinalis* L. plants to different nitrogenous fertilizers. *Hort Science*, *30*, 195-914.

Ambad, S. N., Pandey, N. C., Singh, R. P., Tripathi, R. S., & Nigam, H. K. (1997). Influence of planting density and depth on biometric characters and bulb production in tuberose. *South India Horticulture, 45*(3), 207-208.

Banker, G. J., & Mukhopadhyay, A. (1980). Varital trial on tuberose (*Polianthes tuberosa* L.). *J. Indian Hort*., *28*(4), 150-151.

Bharti, S., Pushpendra, V., & Devi, S. (2016). Effect of different concentration levels of NPK on growth, flowering and yield of tuberose (*Polianthes tuberosa* L.) cv. Shringar. *International Journal of Agriculture Sciences*, *8*(57), 3137-3140.

Desai, N., & Mamatha, B. (2016). Effect of spacing on yield of tuberose at farmers field at Karnataka., Krishi Vigyan Kendra, Konehally- Tumkur (Karnataka). *J. Krishi Vigyan. 5*(1), 54-56.

Dhakal, K., Khanal, B., Ayer, D. K., Khanal, A. P., Pandey, L., & Pant, S. S. (2017). Effect of nitrogen and phosphorus on growth, development and vase life of gladiolus. *J of Agril. Sci. and tech. 6*(3), 2278-2206.

Gopal Krishnan, M., Sadawarte, K. T., Mahorkar, V. K., Jadhao, B. J., & Golliwar, V. J. (1995). Effect of N, P and K on the quality of (*Polianthes tuberosa* L.) cv. Single. *Soil and Crops Journal*, *2*, 148-150.

Gowthami, L., Nageshwerrao, M. B., Umajyothi, K., & Umakrishna, K. (2017). Studies on the effect of nitrogen and potassium on flowering

in Crossandra (*Crossandra infundibuluformis* L.). *Int. J Curr. Microbiol. App. Sci., 6*(7), 2537-2541.

Khalaj, M. A., & Edrisi, B. (2007). Effect nitrogen levels and plant spacing on growth and flower yield in tuberose (*Polianthes tuberosa* L). *Scientific Agricultural Information and Documents Center, Serial Number 86*, 1224.

Khalaj, M. A., Edrisi, B., & Amiri, M. (2012). Effect of nitrogen and plant spacing on nutrients uptake, yield and growth of tuberose (*Polianthes tuberosa* L.). *J. Ornam. Horti. Pl., 2*(1), 45-54.

Kishore, G. R., & Singh, P. V. (2006). Effect of N, P, K fertilization on vegetative growth of tuberose (*Polianthes tuberosa* L.) cv. Single. *Plant Archives*. *6*(1), 377-378.

Kumar, K., Singh, C. N., Beniwal, B. S., & Pinder R. (2016). Effect of spacing on growth, flowering and corm production of Gladiolus (*Gladiolus sp.*) cv. American Beauty., *Intl. J of Env., Agri., and Biotech. (IJEAB). 1*(3), 550-554.

Mane, P. K., Banker, G. J., & Makne, S. S. (2007). Influence of spacing, bulb size and depth of planting on flower yield and qualiy of tuberose (*Polianthus tuberosa* L.) cv. 'Single'. *Ind J of Agri. Res. 47*(1), 71-74.

Priyanka, T. K., Kamble, B. S., Subiya, R. K., Anuradha, R. W., & Kulkarni, B. S. (2017). Evaluation of different crossandra genotypes for vegetative shelf life and flower quality parameters. *Int. J.Pure. App.Bio. Sci. 5*(6), 443-447.

Rajwal, N., & Singh, R. K. (2006). Effect of difference levels of nitrogen on performance of tuberose (*Polianthus tuberose* L.). *Int. J. plant sci., 1*(1), 111-112.

Rana, P., Kumar, J., & Kumar, M. (2005). Response of GA_3, plant spacing and plant depth on growth , Flowering and corm production in Gladiolus. *J. of Ornamental Hort. 8*(1), 41-44.

Thomas, S. M., & Thorne, J. N. (1975). Effect of nitrogen fertilizer on photosynthesis and ribulose 1, 5-diphosphate 488. *J. Appl. Environ. Biol. Sci., 2*(9), 485-49.