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Short communication

Effect of time and depth of planting on growth, flowering and yield of tuberose cv. Single

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ABSTRACT

Field experiment was carried out to study the suitable planting dates and depths for tuberose under Manipur conditions. Early (20th April) and shallow planting (4 cm) recorded significantly the maximum values for vegetative growth, floral and bulb parameters.Among the treatment combinations, April 20th at 4 cm (P_1D_1) significantly improved the spike length (91.2 cm), rachis length (17.73 cm) and spikes yield per hectare (3,14,000 No.), while, P_1D_3 resulted in maximum spike longetivity (18.13 days), maximum number of bulbs per clump (16.07), maximum bulb weight per clump (16.08 g) and maximum diameter of the largest bulb (3.68 cm). However, maximum number of florets per spike (28.07) was obtained in P_1D_2.

Key words: Time, depth, tuberose, spike, bulb.

Tuberose (*Polianthes tuberosa*) cv. Single, belongs to the family Amaryllidaceae is one of the most popular bulbous ornamental crops in India and abroad because of its multipurpose use. It is grown widely for aesthetic, aromatic and commercial purposes. The growth and flowering is mainly influenced by various factors such as time of planting and the depth at which the bulbs are planted. The time of planting influences the growth and flower production of tuberose (Gaurav *et al*., 3). Depth of planting also influences the growth and flowering of tuberose (Kumar *et al*., 4). However, there is no systemic report available on these aspects of tuberose production under Manipur conditions. Therefore, an effort was made to find out the suitable time and depth of planting for commercial production of tuberose cv. Single.

The present investigation was carried out at Horticultural Experimental Field, College of Agriculture, Central Agricultural University, Imphal during April 2011-March 2012. Tuberose cv. Single was grown following the recommended package of practices. The experiment was laid out in a factorial randomized block design with 15 treatment combinations which included five dates of planting, *viz*., April 20th (P_1), April 30th (P_2), May 10th (P_3), May 20th (P_4) and May 30th (P_5) and three planting depths, *viz*., 4 cm (D_1), 6 cm (D_2) and 8 cm (D_3), respectively, which were replicated thrice. Each replication comprised of a raised bed of size 1.5 x 1.8 m^2. Uniform cultural operations were followed during the course of investigation. Bulbs were lifted at the end of each season. The data on vegetative growth parameters, *viz*., plant height, leaves per plant and number of tillers per clump; flowering parameters like days to flowering, length of spike, length of rachis, length of rachis, number of spikes per plant, number of florets per spike, spike longevity on the plant, vase-life of the spikes and yield of spikes and bulb parameters, *viz*., number of bulbs per clump, weight of bulbs per clump, diameter of largest bulb, weight of largest bulb and yield of largest bulb were recorded. Data collected were statistically analyzed.

The data presented in Table 1 reveals that time of planting had significant influence on the growth, flowering and yield of tuberose. April 20th planting recorded higher and maximum plant height (49.02 cm) followed by April 30th (48.71 cm). The least plant height (47.22 cm) was observed in May 30th planting. This might be due to congenial climatic conditions for growth during April (Gaurav *et al*., 3). Maximum plant height was recorded when the bulbs were planted at shallow depth (4 cm). This might be due to early sprouting of bulbs at shallow depth. Results are in agreement with the findings of Rana *et al.* (8) in gladiolus.

The date of planting significantly altered the number of leaves per plant in tuberose. Bulbs from April 20th planting attained maximum number of leaves (45.61), while the least was observed under late planting, *i.e*., May 30th planting (44.69). This might be due to the fact that bulbs experienced optimum temperature and high humidity during the growth period (Sharma *et al*., 13). The number of leaves per plant was maximum (45.67) in shallow depth of planting (4 cm) as compared to the medium (6 cm) and deep planting (8 cm). The results are in agreement with Tyagi *et al*. (12). Among all the different depths of planting, crop planted in April 20th had the maximum

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number of tillers (2.78) per clump compared to the rest of the planting dates. Minimum number of tillers (2.24) was observed in May 30th planting. It is also clear from Table 1 that shallow planted bulbs resulted in maximum number of tillers (2.73) per clump. The interaction owing to different dates and depths of planting had non-significant influence.

The depth of planting significantly influenced the number of days taken for flowering (Table 2). The minimum days (101.73) for flowering were recorded in the bulbs, which were planted during April 20th (101.73), while it was most delayed (105.64) due to late planting (May 30th). The planting on April 20th accelerated flower emergence which was probably due to the occurrence of good vegetative growth, which might have made it possible to prepare enough photosynthates, which made the flowering plants to turn into reproductive phase (Padaganur *et al.*, 6). It is also clear from Table 2 that there was a considerable delay in the flowering with bulbs planted at deeper depths. This might be due to the delayed sprouting of bulbs and less emergence of shoots, which is in agreement with the findings of Kumar *et al.* (3).

Table 1. Effect of different planting dates and depth on growth characteristics of tuberose cv. Single.

Planting date	Plant height (cm)	No. of leaves/plant	No. of tillers/plant
April 20th (P_1)	49.02	45.61	2.78
April 30th (P_2)	48.71	45.42	2.71
May 10th (P_3)	48.58	45.32	2.64
May 20th (P_4)	47.29	44.87	2.60
May 30th (P_5)	47.22	44.69	2.24
CD (P = 0.05)	0.23	0.36	0.20
Planting depth (cm)			
4 (D_1)	48.33	45.67	2.73
6 (D_2)	48.19	45.24	2.59
8 (D_3)	47.97	44.64	2.47
CD (P = 0.05)	0.30	0.46	0.26
Interaction	Plant height	No. of leaves/plant	No. of tillers/plant
P_1D_1	49.07	46.03	2.93
P_1D_2	49.13	45.65	2.80
P_1D_3	48.87	45.14	2.60
P_2D_1	48.93	45.89	2.87
P_2D_2	48.73	45.64	2.73
P_2D_3	48.47	44.72	2.53
P_3D_1	48.87	45.74	2.80
P_3D_2	48.53	45.67	2.60
P_3D_3	48.33	44.56	2.53
P_4D_1	47.47	45.27	2.67
P_4D_2	47.27	44.85	2.60
P_4D_3	47.13	44.49	2.53
P_5D_1	47.33	45.40	2.40
P_5D_2	47.27	44.38	2.20
P_5D_3	47.07	44.29	2.13
CD (P = 0.05)	NS	NS	NS

The maximum number of spikes (1.47) per plant was harvested from April 20th planting and minimum number of spike (1.16) per plant was obtained from May 30th planting. The increase in number of spikes per plant could be attributed to early sprouting and better vegetative growth. There was a tendency for spike numbers to decline with increase in planting depth (Table 2). The length of spike and length of rachis were significantly influenced by the date of planting. The longest spike (87.69 cm) and longest rachis length (16.76 cm) were harvested from April 20th planting and the shortest spike length (81.56 cm) and rachis length (13.84 cm) were recorded under May 30th planting. The increase in spike length and rachis length may be due to more favourable climatic conditions and early sprouting (Nair *et al.*, 5). Shallow planting (4 cm) resulted in increase in both length of spike (88.63 cm) as well as length of rachis (16.24 cm) as compared to those arising from bulbs planted at medium (6 cm) and deep planting (8 cm). The results are in agreement with the works of Tyagi *et al.* (12) in tuberose.

Maximum number of florets per spike (26.53) was recorded in April 20th planting which was significantly higher than the rest of the treatments (Table 2). Late planted bulbs recorded minimum number of florets per spike (22.09). This could be due to the enhanced growth components and translocation of more photosynthates to reproductive parts under congenial conditions. The results are in accordance with the findings reported by Asif *et al.* (1), and Prakash and Shukla (6) in tuberose. Among the different depths of planting, medium planting depth at 6 cm recorded highest (25.83) number of florets per spike, while the minimum number of florets per spike (23.55) recorded at deep planted bulbs at 8 cm. Similar results were obtained by Mane *et al.* (4) and Tyagi *et al.*(12) on tuberose.

Maximum duration of flowering (17.69 days) was recorded in early planting date (April 20th) and minimum was recorded in late planting by May 30th (15.89 days). This might be due to the fact that

Table 2. Effect of different planting dates and depth on floral parameters of tuberose cv. Single.

Planting date	Days taken for flowering	Spike length (cm)	Rachis length (cm)	No. of florets per spike	No. of spikes per plant	Duration of flowering	Yield of spikes ('000/ha)
April 20th (P_1)	101.73	87.69	16.76	26.53	1.47	17.69	298.67
April 30th (P_2)	101.89	87.05	16.67	25.96	1.42	17.51	292.89
May 10th (P_3)	103.24	83.51	15.18	24.29	1.27	16.58	273.11
May 20th (P_4)	103.73	82.87	14.95	24.25	1.22	16.38	245.33
May 30th (P_5)	105.64	81.56	13.84	22.09	1.16	15.89	229.78
CD (P = 0.05)	0.69	0.38	0.18	0.33	0.09	0.29	4.38
Planting depth (cm)							
4 (D_1)	100.17	88.63	16.24	24.49	1.41	16.09	284.80
6 (D_2)	103.75	84.11	15.40	25.83	1.29	16.73	272.53
8 (D_3)	105.83	80.87	14.80	23.55	1.21	17.60	246.53
CD (P = 0.05)	0.89	0.50	0.23	0.43	0.11	0.38	5.66
Interaction							
P_1D_1	98.60	91.20	17.73	26.13	1.60	17.00	314.00
P_1D_2	102.07	87.07	16.73	28.07	1.47	17.93	308.67
P_1D_3	104.53	84.80	15.80	25.40	1.33	18.13	273.33
P_2D_1	98.80	91.07	17.53	25.87	1.53	16.80	309.33
P_2D_2	102.27	86.80	16.40	26.87	1.40	17.73	301.33
P_2D_3	104.60	83.27	16.07	25.13	1.33	18.00	268.00
P_3D_1	100.40	87.80	15.67	23.80	1.33	15.87	288.67
P_3D_2	103.93	83.40	15.20	25.93	1.27	16.20	280.67
P_3D_3	105.40	79.33	14.67	23.13	1.20	17.67	250.00
P_4D_1	100.87	87.33	15.80	24.67	1.33	15.67	261.33
P_4D_2	104.13	82.20	14.93	25.20	1.20	16.07	246.00
P_4D_3	106.20	79.07	14.13	22.87	1.13	17.40	228.67
P_5D_1	102.20	85.73	14.47	22.00	1.27	15.13	250.67
P_5D_2	106.33	81.07	13.73	23.07	1.13	15.73	226.00
P_5D_3	108.40	77.87	13.33	21.20	1.07	16.80	212.67
CD (P = 0.05)	NS	0.86	0.40	0.74	NS	NS	9.80

temperature during flowering days was comparatively more favourable in early planting. Longest duration (17.60) of flowering was recorded in deep planted bulbs at 8 cm as compared to shallow and medium depths of planting. This might be attributed to healthy spike and quality flowers obtained from deep planted bulbs. Interaction effect due to time and depth of planting had significant influence on the length of spike, rachis length and number of florets per spike, while the interaction could not significantly alter the rest of the floral parameters observed. P_1D_1 recorded the maximum length of spike, length of rachis and yield of spikes per hectare and P_5D_3 recorded minimum value for these parameters.

Table 3 reveals that early date of planting at April 20th resulted in maximum number of bulbs per clump (14.42), weight of bulbs per clump (99.24 g), weight of the largest bulb (17.30 g) diameter of the largest bulb (3.53 cm) and yield of the bulbs (10.15 t ha^{-1}). This was possibly due to April 20th plantings received comparatively favourable environment for higher vegetative growth and higher photosynthesis rate which might resulted in higher accumulation of dry matter. Among the planting depth treatments, deep planted tuberose bulbs at 8 cm (D_3) produced the maximum number of bulbs per clump (14.23), weight of bulbs per clump (101.98 g), weight of the largest bulb (19.51 g), diameter of the largest bulb (3.15 cm)

Table 3. Effect of different planting dates and depth on growth characteristics of tuberose cv. Single.

Planting date	No. of bulbs per clump	Wt. of bulbs per clump (g)	Wt. of largest bulb (g)	Dia. of largest bulb (cm)	Yield of bulbs (t/ ha)
April 20th (P_1)	14.42	99.24	17.30	3.53	10.15
April 30th (P_2)	14.02	98.40	16.62	3.22	10.09
May 10th (P_3)	12.67	96.82	16.19	2.69	10.01
May 20th (P_4)	12.31	94.44	15.81	2.51	9.81
May 30th (P_5)	11.25	90.26	14.81	2.39	9.50
CD (P = 0.05)	0.36	1.05	1.25	0.09	0.31
Planting depth (cm)					
4 (D_1)	11.38	89.74	13.79	2.62	9.34
6 (D_2)	13.20	95.87	15.14	2.82	9.94
8 (D_3)	14.23	101.89	19.51	3.15	10.46
CD (P = 0.05)	0.47	1.36	1.62	0.12	0.40
Interaction					
P_1D_1	12.47	92.55	14.35	3.33	9.60
P_1D_2	14.73	99.09	16.12	3.57	10.09
P_1D_3	16.07	106.08	21.42	3.68	10.76
P_2D_1	12.40	91.69	14.18	3.04	9.49
P_2D_2	14.00	97.61	15.50	3.24	10.11
P_2D_3	15.67	105.89	20.18	3.37	10.68
P_3D_1	10.87	89.89	13.92	2.36	9.41
P_3D_2	13.07	96.94	15.02	2.64	10.02
P_3D_3	14.07	103.62	19.65	3.06	10.59
P_4D_1	10.67	89.09	13.55	2.22	9.26
P_4D_2	12.73	94.74	14.72	2.31	9.84
P_4D_3	13.53	99.50	19.16	2.99	10.31
P_5D_1	10.47	85.48	12.93	2.15	8.93
P_5D_2	11.47	90.95	14.36	2.35	9.60
P_5D_3	11.80	94.34	17.15	2.67	9.98
CD (P = 0.05)	0.81	2.35	NS	0.21	NS

as well as yield of bulbs per hectare (10.46 t ha^{-1}). This might be due to deeper planted bulbs established their roots more easily which enabled them to easy uptake of nutrients from the soil and produced more healthy and productive daughter bulbs and hence increased in the yield of bulb per hectare. The findings are in close agreement with the observations made by Sharma and Talukdar (9) on gladiolus.

The interaction effect of time and depth of planting had no significant effect on the number of bulbs per clump, weight of bulbs per clump and diameter of the largest bulb. Combination P_1D_3 recorded the maximum value for number of bulbs per clump, weight of bulbs per clump and diameter of largest bulb, while P_5D_1 recorded minimum values. The interaction effects were non-significant.

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