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Advancing early flowering in tuberose (*Polianthes tuberosa* L.) under low plastic tunnel

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Abstract **:** The studies were conducted on advancing early flowering in two single petalled tuberose cultivars namely; Shringar and Mexican Single due to the bulbs planted under three different growing conditions *viz.,* under low plastic tunnel (planted on 2nd December, 2005), under open field conditions (planted on 2nd December, 2005) and under open field conditions on recommended planting time (planted on 2nd March, 2006).The results obtained showed that the tuberose bulbs planted under low plastic tunnel started flowering during last week of May (26th), which was 44 day earlier to the bulbs planted without tunnel and 38 day earlier to the normal recommended planting time (March) under Delhi conditions in cv. Shringar. The flower quality in terms of spike length (66.88 to 68.67 cm) and number of florets per spike (43.13 to 44.63) was not affected significantly under low plastic tunnel grown crop. The early plantings with plastic tunnels had a non significant effect on plant height and spike length in cv. SHRINGAR and a significant effect in cv. Mexican Single except for other growth and flowering parameters studied. However, the advanced off-season flowering in tuberose will offer higher returns to the farmers owing to an overall increase in total flowering period of the crop.

Key words **:** Early flowering, Plastic low tunnel, Spike, Tuberose

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Tuberose (*Polianthes tuberosa* L.), commonly known as *Rajnigandha* in Hindi, a member of family Agavaceae, is cultivated as summer crop in North Indian plains. Tuberose is largely cultivated for the commercial production of cut flower, loose flower and extraction of concrete/ absolute. The farmer's ease to grow tuberose as summer crops has made it viable for commercial cultivation.The tuberose is native to Mexico and largely cultivated in Italy, France, Morocco, South Africa, Taiwan, Egypt and India, including many other tropical and sub-tropical areas of the world. In India, it is being grown commercially on over 30,000 ha area (Singh *et al.*, 2010). Flowers of tuberose produce one of the rarest and most valuable aroma compounds. Tuberose is an important bulbous ornamental plant and produce waxy white flowering spikes with sweet and pleasant fragrance and are in great demand for indoor decoration, garland, bouquet, cut flower trade and extraction of essential oil.

The availability of cut flowers is available especially during the summer months coincided with a season of less demands during the period of June to October. Plastic coverings have also shown to reduce number of days to fruit set and first harvest compared to uncovered treatment. However, the effect of cultivars and perforations on number of days taken to fruit set and fruit harvest was not significant (Kumar and Srivastava, 2000). However, an early crop if advanced by a fortnight not only fetch a higher price but duration of crops in increased with a significant increase in total flower yield due to the faster sprouting of the bulbs and plants development under the tunnels than in open as it has been reported in the raising seedlings of rice, brinjal, tomato cosmos and zinnia (Mittra *et al.,* 1990) under plastic low tunnels. The augmenting of plastic low tunnel treatment in tomato increased total and early yields from a 1.4 and 22.6 times, compared with conventional cultural methods (Apaydn *et al.,* 1998). Therefore, the present experiment was undertaken to explore the early advancing of flowering in two single petalled tuberose cvs namely, Shringar and Mexican Single planted under plastic low tunnels.

RESEARCH METHODS

The studies conducted by the authors at the Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi revealed that the optimum planting time for tuberose bulbs under Delhi conditions has been during March. The bulbs planted in March starts flowering July onwards (rainy season) and continue till November. It has been noted that between March to June there are not much arrival of locally grown flowers in Delhi and surrounding flower markets. Therefore, efforts are made at IARI, New Delhi to advance the off-season flowering in tuberose under Delhi conditions. For those purpose two commercial cultivars of Single petalled tuberose, namely, Shringar and Mexican Single were selected for this study. Three types of growing conditions *viz.,* under low plastic tunnel (planted on 2nd December, 2005), under open field conditions (planted on 2nd December, 2005) and under open field conditions on recommended planting time (planted on 2nd March, 2006) were compared. Rested bigger sized bulbs having a diameter of 2-2.5 cm were selected and planted at 30 x 30 cm spacing with 3-4 cm depth. The beds were made with the help of tractor-operated rotavator in the field and drip lines of 16:2:30 (16 mm in diameter, 2 litre discharge/dripper/h and 30 cm spacing between two drippers) were laid out on the beds before planting of tuberose bulbs. Two lines on each bed were laid out and closing their ends with the help of end plugs. After planting of bulbs on 25 cm raised beds on 2nd December, 2005, galvanized iron arches were fixed manually at distance of 2.0 m, to support the plastic (single layer of polythene film) laid tunnels keeping a width between two hoops to 80 cm with a height of 75 cm above the ground level of the bed. To make the plastic tunnels over the beds, a transparent non-perforated polyethylene film of 30-micron thickness was used to impart partly reflected infrared radiation and to keep the temperature of the low tunnels higher than outside. After covering the polyethylene film on beds small vents were made on the eastern side of the plastic tunnel at a spacing of 2.0 m each for proper aeration and to avoid steep increase of temperature inside the polyethylene tunnel. Normal package of practices were followed to grow good crop. Different observations on different vegetative growth and flowering parameters were recorded time to time. Collected data were analysed statistically and presented in Tables 1 and 2.

RESEARCH FINDINGS AND DISCUSSION

The results of the present study revealed that the crop raised bulbs of tuberose cultivar, Shringar planted under different growing conditions did not show a significant difference in respect to the days taken to flowering (Table 1). However, the plants raise under plastic low tunnel on 2nd December could produce flower 44 days earlier than those planted under open beds on recommended time *i.e.* 2nd March and delayed by 6 days in the plants raised from the open bed planting on 2nd December without plastic low tunnel. Flower duration in the cultivar,Shringar varied from 7.86 days to 9.25 days and shown a significant difference due to plastic low tunnel growing . Whereas, an early planting under plastic low tunnel on 2nd December and planting at recommended time (2nd March) did not differ significantly and remain at par (9.25 days and 8.81days days, respectively) with each other. Flower diameter, spike length and number of florets per spike recorded due to different growing conditions did not show any significant difference among them. Whereas, rachis length varied from 33.70 cm recorded from the plants raised under plastic low tunnel from the bulbs planted on 2nd December to 37.93 cm in the plants grown in open beds planted on 2nd December and remain at par with those (36.05 cm) raised from the planting on 2nd March *i.e.* recommended planting time.

The results obtained on induction of flowering in tuberose cultivar, Mexican Single raised under different growing conditions (Table 2) revealed that the plant height, number of leaves per clump, leaf width and number of tillers per clump recorded were found non-significant in respect to the plantings done with or without plastic low tunnel on 2nd December and on recommended time on 2nd March. The plantings under different growing conditions differed significantly with respect to the days to first flowering. The earliest (133.51 days) flowering was recorded in the plants

Table 1 : Induction of earlier flowering in tuberose cv. SHRINGAR under plastic low tunnel

Treatments	Plant height (cm)	No of leaves/ clump	Width of leaf (cm)	No of tillers / clump	Days to first flowering	Flowering duration (days)	Floret diameter (cm)	Spike length (cm)	Rachis length (cm)	No. of florets / spike
T_1	39.15	24.97[b]	1.80[b]	4.05[b]	155.50	7.86[b]	3.77	68.10	33.70[b]	44.63
					26 May,06					
T_2	40.25	28.67[a]	2.20[a]	8.84[a]	199.86	9.25[a]	3.82	67.99	37.93[b]	43.13
					09 July,06					
T_3	39.53	26.59[ab]	2.07[a]	7.86[a]	125.25	8.81[a]	3.71	66.88	36.05[b]	44.14
					03 July,06					
CD (P=0.05)	NS	3.67	0.19	1.68	NS	0.83	NS	NS	3.63	NS

T_1= Low plastic tunnel beds (2nd December planting); $T_{2=}$ Open beds (2ndDec. 2005 planting);
$T_{3=}$ Open beds (2nd March, 2006 planting, as recornmended planting time) NS=Non-significant

Table 2 : Induction of earlier flowering in tuberose cultivar, Mexican single under plastic low tunnel

Treatments	Plant height (cm)	No. of leaves/ clump	Width of leaf (cm)	No. of tillers /clump	Days to first flowering	Flowering duration (days)	Floret diameter (cm)	Spike length (cm)	Rachis length (cm)	No. of florets /spike
T_1	48.12	35.02	1.71	6.39	215.08[b]	8.72	4.00	104.14[a]	51.71	44.85
					4July,06					
T_2	47.32	1.73	2.20[a]	8.14	228.18[b]	9.60	3.97	105.42[a]	50.17	43.16
					17 July,06					
T_3	48.23	1.74	2.07[a]	7.86	133.51	9.40	3.84	98.18[b]	46.54	43.10
					01 July,06					
CD(P=0.05)	NS	NS	NS	NS	8.73	NS	NS	5.95	NS	NS

T_1= Low plastic tunnel beds (2nd December planting); $T_{2=}$ Open beds (2ndDec. 2005 planting);
$T_{3=}$ Open beds (2nd March, 2006 planting, as recornmended planting time) NS=Non-significant

raised from the open bed planting on 2nd March *i.e.* recommended time. However, the flowering delayed significantly (228.18 days) in open beds plated on 2nd December by 16 days followed by plants raised from the planting under plastic low tunnel (delayed by 3 days). Flowering duration, floret diameter, rachis length and number of florets per spike did not have any significant difference due to the different growing conditions. However, the flower diameter (4.00 cm), rachis length (51.71cm) and number of florets per spike (44.85) were recorded higher in the plants raised from bulbs planted under plastic low tunnel on 2nd December (Table 2). Spike length recorded due to different growing conditions varied significantly from the longest spikes (105.42 cm) from open beds planted on 2nd December followed by plants raised with (104.14 cm) or without (98.18 cm) plastic low tunnels planted on 2nd December.

Flowering potential in different varieties is normally conditioned by two successive physiological processes namely, flower induction and dormancy due to the sensitivity to photoperiodic requirements and temperature sensitivity and interaction among them (Bose and Demene, 2009) which is more or less physiological related to the lifting of dormancy during low temperature and strong vegetative growth, resulting in delaying the flower induction process. The similar results of the non-significant differences in flower induction in the cultivar 'Mexican Single' may have been achieved due to an adaptation to the chilling requirement in bulbs to overcome dormancy and resulted in delayed sprouting and vegetative growth and development. The similar effects of faster seedling emergence and developmental growth are reported in a study conducting for augmenting various field crops under low plastic tunnel as compared to those planted in open beds (Mittra *et al*., 1990). Plastic covering was also similarly reported the reducing the number of days to first fruit set and harvest when compared to uncovered treatment during the winter season (Kumar and Srivastava, 2000). In contrary to this effect observed in cultivar, Mexican Single, the positive response on early flowering may have been more pronounced effects on early flowering response is the result of increase in the mean micro area temperature under the low plastic tunnel resulting in the increased rate of reproductive development in the tuberose plants (Khan *et al.*, 2007).

A significant response for early induction of flowering in tuberose cultivar Shringar under plastic low tunnel plant growth characters namely, number of leaves per clump, leaf width and number of tillers per clumps recorded except plant height were recorded. However, the similar effects were non significant in cultivar Mexican single. The aim of getting early (off-season) flowering in tuberose by 44 days than those from normal planting had been shown to open up a way to offer higher returns to the farmers owing to the increased in total flowering period and final spike yield in the tuberose crop using early planting (2nd December) of the bulbs using plastic low tunnel under Delhi conditions.

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