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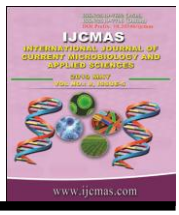

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Effect of Planting Dates and Mulching on Growth and Flowering of Tuberose (*Polianthes tuberosa* L.) cv. Sikkim Selection

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A B S T R A C T

"Effect of planting dates and mulching on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. Sikkim Selection" was studied at the Research farm of Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2016-2017. The experiment was laid out in Randomized Block Design (Factorial) having 12 treatment combinations with three planting dates i.e. 20th May, 15th June and 10th July along with 3 mulching material i.e. dry grass mulch, black plastic mulch and transparent plastic mulch with control treatment and each treatment was replicated thrice. The results showed that 20th May planting gave the best results in terms of all the growth and flowering parameters and tuberose plants mulched with black plastic established significantly with superior plant and yield parameters. Amongst various interactions crop planted on 20th May with black plastic mulch showed best results in various growth and flowering parameters like early sprouting of bulb, earliest spike emergence, maximum spike length, maximum rachis length, maximum number of florets per spike, maximum fresh weight of spike, maximum duration of flowering, largest sized bulb. Based on the findings 20th May planting and black plastic mulch were found to be best treatments.

Introduction

Tuberose is an important flower crop grown in India mainly for its beautiful and fragrant cut flowers as well as loose flowers, belongs to family Amaryllidaceae and is commonly known as Rajnigandha or Nishigandha. It is native to Mexico. Tuberose is most important commercial flower among bulbous ornamental. They are valued much by the aesthetic world for their beauty and fragrance. It has long been cherished for the aromatic oils extracted from its fragrant flowers. There is high demand for tuberose concrete and absolute in the international markets which fetch a very good price. Tuberose can successfully be grown in pots, borders, beds and commercially cultivated for its various uses, as for making artistic garlands, floral ornaments and bouquets. Its importance among the commercially grown flowers is due to its potential for cut flower trade, long

vase life and essential oil industry (Singh, 1995). Total area under tuberose cultivation is 7.77 thousand ha and production of loose flower is 40.22 thousand metric tons and that of cut flower is 13.90 thousand metric tons in India (Anonymous, 2015). The cultivation of tuberose on commercial basis is being taken around big cities in India. With the improvement in standard of living of the people, the demand for flowers is increasing by leaps and bounds. To meet this demand, it is being cultivated on large scale in different states of the country. For getting higher yield with quality flowers, time of planting is one of the most important factors. Vegetative growth and quality of tuberose is improved by proper planting time which also satisfies the consumer's demands (Muhammad *et al.*, 2013). According to Sadhu and Bose (1973), the tuberose in India is generally planted in February-March in plains and April-May in hills and February planting in plains increased the vegetative growth of tuberose. Planting time varies from place to place because of differences in photoperiods, temperatures and light intensity.

Mulching is a very useful technique for protecting the roots of plant from heat, cold injuries and mulching cover the surface around the plants with aim to create congenial conditions for the growth of plants and has an influence on various aspects of soil environment and crop requirements. Physically, mulches prevent rapid evaporation from the soil surface and reduce rapid drying which result moisture conservation. Mulching and its skilful application can lead to improved soil organic matter contents, mulching practices give positive effect on the soil biota, it increases under mulched soil environment thereby improving nutrient cycling and organic matter build-up over a period of several years and thereby improving other soil characteristics. It helps in enhancing microbial activity in the soil (Parmar *et al.*, 2013). It is an important technology that helps in conserving soil moisture thus reducing the irrigation requirements, act as insulation layer, increasing root development, promoting faster crop development, reducing weed population and inducing earlier harvest of crop (Mahajan *et al.*, 2007). Beneficial effect of mulching materials on growth, flowering and yield has been reported in most of the vegetables and fruit crops. However, literature on its valuable effects on flower crops is scanty. Keeping this in view, this investigation was undertaken with the objective to find out appropriate planting date for tuberose under mid hill conditions of Himachal Pradesh and to identify suitable mulch for tuberose crop.

Materials and Methods

The present investigation entitled, "Effect of planting dates and mulching on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv.Sikkim Selection" was carried out at the Research farm of department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the year 2016 and 2017. The experimental farm of the department is located in the hilly regions of Western Himalayas at an altitude of 1276 m amsl having latitude of 30 52 02 N and longitude 70 11 30 E. The climate is sub-temperate to sub-tropical type and characterized by mild summers and cool winters. The unsprouted, healthy and disease free bulb of uniform size were planted. Proper plant to plant and row to row distance was maintained and tuberose bulbs were planted at desired depth and spacing of 25 cm × 25 cm to accommodate 16 bulbs/m^2. The experiment was laid out in randomized block design with 3 replications. The treatments included three dates of planting i.e. 20th May, 15th June and 10th July along with 3 mulching material i.e. black plastic mulch, dry grass mulch,

transparent plastic mulch and control i.e. no mulch. Uniform cultural operations like; weeding, hoeing, fertilization, spraying against insect-pest and diseases and staking etc were followed for all the treatments. Data was recorded on growth, flowering and bulb attributes and subjected to statistical analysis.

Results and Discussion

Data presented in table 1 exhibited significant influence of planting dates, mulching material and their interaction on days taken for sprouting of bulbs. Among the different planting dates, minimum days taken for sprouting of bulbs (8.38 days) was recorded in 20th May planting (D_1), whereas, maximum days taken for sprouting of bulbs (12.42 days) was recorded in 10th July planting (D_3). As regards the effect of mulching, lesser time for sprouting of bulbs (9.06 days) was recorded in black plastic mulch (M_2), whereas, bulbs took more time for sprouting (10.92 days) without mulch (M_0).

Padaganur *et al.,* (2005) and Khobragade *et al.,* (1997) stated that early planting induced early sprouting while working in various cultivars of tuberose, they stated that this might be attributed to the fact that plants experienced optimum temperature and humidity during their grand growth period. Messar (2011) also reported that the soil moisture conservation under black polythene mulch is comparatively more than the other mulches, thus ensuring early sprouting of bulbs.

Data in table 2 show that spike length was positively influenced with planting dates, mulching material and their interaction. Spike length was recorded to be better in plants being planted earlier i.e. 20th May and decreased with delay in planting. The critical examination of data presented in table 2 revealed that maximum spike length (102.36 cm) was recorded in 20th May planting (D_1), whereas, minimum spike length (91.73cm) was recorded in 10th July planting (D_3). As regards the effect of mulching, maximum spike length (100.42 cm) was recorded in black plastic mulch (M_2), whereas minimum spike length (93.35 cm) was recorded without mulch (M_0). The interaction of planting dates × mulching materials was also found to be significant. Maximum spike length (107.51 cm) was recorded in 20th May planting with black plastic mulch ($D_1 \times M_2$), whereas, minimum spike length (89.40 cm) was recorded in 10th July planting without mulch ($D_3 \times M_0$) which proved statistically at par (91.24 cm) in10th July planting with transparent plastic mulch ($D_3 \times M_{3)}$. These results are in close proximity with the work of Padaganur *et al.,* (2005), Dubey and Shukla (2002), Thokchom and Singh (2015) who observed that early planting resulted in better spike length than later plantings. Messar (2011) observed maximum spike length under black plastic mulch in gladiolus.

Table 3 shows among the different planting dates and mulching materials used maximum number of spikes per plot (20.83) and (17.37) were recorded in 20th May planting and black plastic mulch respectively and minimum number of spikes (11.83) and (14.87) was observed in 10th July planting and without mulch respectively. The interaction of planting dates × mulching material influenced number of spikes per plot. Maximum number of spikes per plot (22.27) was recorded in 20th May planting with black plastic mulch ($D_1 \times M_2$). However minimum number of spikes per plot (10.67) was recorded in 10th July planting without mulch. Findings of Rana (2014) showed that last week of April planting improved number of spikes as compared to later plantings. Kumar *et al.,* (2010 b) and Thokchom and Singh (2015) while working on tuberose also observed more number of spikes in early planting, the increase in

number of spikes per plant could be attributed to early sprouting and better vegetative growth. On the other hand work of Deka and Talukdar (2017) who observed maximum number of shoots in tuberose under black plastic mulch.

Data in table 4 shows that among the different planting dates, maximum fresh weight of spike (183.93 grams) was recorded in 20th May planting (D_1), whereas minimum fresh weight of spike (157.24 grams) was recorded in 10th July planting (D_3). As regards the effect of mulching, maximum fresh weight of spike (175.69 grams) was recorded in black plastic mulch (M_2), whereas minimum fresh weight (165.74 grams) was recorded without mulch (M_0). The interaction of planting dates × mulching material influenced fresh weight of spike. Maximum fresh weight of spike (190.37 grams) was recorded in 20th May planting with black plastic mulch ($D_1 \times M_2$), however minimum fresh weight of spike (152.52 grams) was recorded in 10th July planting without mulch at different level of significance. Fresh weight of spike was recorded maximum in early planting and decreased with delayed planting. The results are in close agreement with the findings of Gurav *et al.,* (2005) who observed that weight of flower stalk was significantly maximum in April planted crop. Maximum fresh weight of spike was found in black plastic mulch. The results got support from the findings of Messar (2011) while working on gladiolus.

The data related to number of florets per spike in table 5 shows that planting dates, mulching material and their interaction significantly affected the number of florets per spike. Among the different planting dates tested, maximum number of florets per spike (31.25) was recorded in 20th May planting (D_1), whereas, minimum number of florets per spike (18.00) was recorded in 10th July planting (D_3) which proved to be significantly different. As regards the effect of mulching, maximum number of florets per spike (26.94) was recorded in black plastic mulch (M_2), whereas minimum number of florets (21.64) was recorded without mulch (M_0) which varied significantly. The interaction of planting dates × mulching material influenced number of florets per spike. Maximum number of florets per spike (34.33) was recorded in 20th May planting with black plastic mulch ($D_1 \times M_2$), however, minimum number of florets per spike (15.67) was recorded in 10th July planting without mulch which proved statistically at par (16.67) in 10th July planting in transparent plastic mulch ($D_3 \times M_3$).

Table.1 Effect of planting dates and mulching material on days taken for sprouting of bulb of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / **Planting Dates**	**Days taken for sprouting of bulb**				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	8.96	8.43	7.53	8.60	8.38
15th June (D_2)	9.96	9.43	8.77	10.46	9.66
10th July (D_3)	13.83	12.17	10.87	12.80	12.42
Mean	10.92	10.01	9.06	10.62	

Table.2 Effect of planting dates and mulching material on spike length of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / Planting Dates	Spike length (cm)				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	97.73	104.28	107.51	99.92	102.36
15th June (D_2)	92.90	97.73	99.92	95.23	96.45
10th July (D_3)	89.40	92.45	93.82	91.24	91.73
Mean	93.35	98.16	100.42	95.46	

Table.3 Effect of planting dates and mulching material on number of spikes per plot of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / Planting Dates	Number of spikes per plot				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	19.43	21.17	22.27	20.43	20.83
15th June (D_2)	14.50	16.33	16.50	15.33	15.67
10th July (D_3)	10.67	11.67	13.33	11.67	11.83
Mean	14.87	16.39	17.37	15.81	

Table.4 Effect of planting dates and mulching material on fresh weight of spike of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / Planting Dates	Fresh weight of spike (gram)				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	177.51	186.51	190.37	181.33	183.93
15th June (D_2)	167.17	171.86	175.16	168.56	170.69
10th July (D_3)	152.52	158.93	161.54	155.99	157.24
Mean	165.74	172.43	175.69	168.63	

Table.5 Effect of planting dates and mulching material on number of florets per spike of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / Planting Dates	Number of florets per spike				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	28.23	32.30	34.33	30.13	31.25
15th June (D_2)	21.03	23.47	26.16	21.36	23.00
10th July (D_3)	15.67	19.33	20.33	16.67	18.00
Mean	21.64	25.03	26.94	22.72	

CD 0.05 for	
Planting dates	: 0.20
Mulching material	: 0.24
Planting dates × Mulching material	: 0.40

Table.6 Effect of planting dates and mulching material on size of bulb produced of tuberose (*Polianthes tuberosa* L.) cv. 'Sikkim Selection'

Mulching material / Planting Dates	Size of bulb (cm)				
	No mulch (M_0)	Dry grass mulch (M_1)	Black plastic mulch (M_2)	Transparent plastic mulch (M_3)	Mean
20th May (D_1)	2.30	2.40	2.70	2.35	2.44
15th June (D_2)	2.29	2.40	2.47	2.33	2.37
10th July (D_3)	2.29	2.35	2.39	2.33	2.34
Mean	2.30	2.38	2.52	2.34	

CD 0.05 for	
Planting dates	: 0.05
Mulching material	: 0.06
Planting dates × Mulching material	: 0.10

These results are in agreement with the findings of Padaganur *et al.,* (2005), Gurav *et al.,* (2005), Thokchom and Singh (2015) while working on tuberose and Kumar (2005) who observed maximum yield in April planting under Nauni, Solan conditions while working on China aster. . Maximum number of florets was observed in black plastic mulching. The results are in close agreement with the findings of Messar (2011) who observed maximum number of florets under black plastic mulch in gladiolus and Bohra *et al.,* (2016). Table 6 shows that size of bulb produced was significantly influenced by

planting dates, mulching material and their interaction. Among the different planting dates, maximum size of bulb (2.44 cm) was recorded in 20th May planting (D_1), whereas minimum size of bulb (2.34 cm) was recorded in 10th July planting (D_3) which proved statistically at par (2.38 cm) in 15th June planting (D_2). The results are in accordance with the result of Thokchom and Singh (2015) who recorded diameter of largest bulb in the early date of planting at 20th April planting. Contrary results were obtained by Zubair and Wazir (2006) who suggested that delay in planting resulted in decreased bulb diameter. Mulching influenced the bulb size significantly. Maximum size of bulb (2.52 cm) was recorded in black plastic mulch (M_2), whereas minimum size of bulb (2.30 cm) was recorded without mulch (M_0) followed by M_3 (2.34 cm). The interaction of planting dates × mulching material influenced size of bulb produced significantly. Maximum size of bulb produced (2.70 cm) was recorded in 20th May planting with black plastic mulch ($D_1 \times M_2$), However minimum size of bulb produced (2.29 cm) was recorded in 10th July planting without mulch ($D_3 \times M_0$), followed by (2.30 cm) in ($D_1 \times M_0$), (2.30 cm) in ($D_2 \times M_0$), , (2.33 cm) in ($D_2 \times M_3$), (2.33 cm) in ($D_3 \times M_3$), (2.35 cm) in ($D_3 \times M_1$) (2.35 cm) in ($D_1 \times M_3$) and (2.39 cm) in ($D_3 \times M_2$). The results are in close proximity with the findings of Messar (2011) while working on gladiolus and Deka and Talukdar (2017) who observed maximum number of large sized bulbs in black polythene mulch.

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