PLANT SCIENCE TODAY
Vol 13(sp9): 01-14
https://doi.org/10.14719/pst.15358

eISSN 2348-1900
OPEN ACCESS

Research Article | Agriculture
2026, Volume 13, Issue sp9, pp. 01-14

Comparative study on growth and floral attributes of some double tuberose varieties as influenced by black polythene mulch-induced microclimate modification under coastal Odisha agroclimatic conditions

Subhendu Jena[1*], Chitta Ranjan Mohanty[1], Sukirti Mohanty[1], Debi Archana Nayak[2], Gopa Mishra[3], Suchismita Mishra[1] & Subhalaxmi Mishra[2]

[1]Department of Floriculture & Landscaping, Faculty of Agricultural Sciences, Siksha'o' Anusandhan (Deemed to be University), Bhubaneswar 751 003, Odisha, India

[2]Department of Vegetable Sciences, Faculty of Agricultural Sciences, Siksha'o' Anusandhan (Deemed to be University), Bhubaneswar 751 003, Odisha, India

[3]Department of Fruit Sciences, Faculty of Agricultural Sciences, Siksha'o' Anusandhan (Deemed to be University), Bhubaneswar 751 003, Odisha, India

***Correspondence:** sjena.agri@gmail.com

Abstract

Tuberose (*Agave amica* L.) occupies a unique position in the cut flower industry and is widely cultivated as a commercial cut flower in coastal Odisha, where double-flowered cultivars are preferred for daily use. However, information on high-yielding cultivars suitable for this region is scarce. In addition, the tropical humid climate favours severe weed infestation, resulting in intense competition for nutrients, moisture, light and space, thereby reducing crop growth and productivity. Black polythene mulching offers an effective means of suppressing weeds while improving the soil microenvironment. Therefore, a field experiment was conducted to evaluate the performance of seven double tuberose varieties, Calcutta Double (V_1), Pearl Double (V_2), Suvasini (V_3), BR-24 (V_4), Vaivab (V_5), BR-19 (V_6) and Hyderabad Double (V_7), under the influence of black polythene mulch. The results revealed that V_5 recorded the highest flower yield, with 4.09 spikes clump^{-1}, 187.60 spikes plot^{-1} and 312666.67 spikes ha^{-1}, whereas V_3 excelled in flower quality by producing the longest spikes (96.06 cm) and the largest floret (4.62 cm diameter). Black polythene mulch significantly enhanced flower yield, increasing the number of spikes by 20.26 % clump^{-1}, 17.77 % plot^{-1} and 17.76 % ha^{-1} over the non-mulched treatment. It also improved crop performance and profitability by reducing weed management costs. Therefore, V_5 is recommended for commercial flower production owing to its superior yield and early flowering, while V_3 is recommended for premium flower quality. Thus, the adoption of black polythene mulch with these varieties is recommended for profitable and sustainable tuberose cultivation under the coastal agroclimatic conditions of Odisha.

Keywords: black polythene mulch; floral diameter; leaf width; mulching; number of florets spike^{-1}; number of leaves clump^{-1}; number of plants clump^{-1}; plant height; spike length; tuberose varieties

Received: 02 May 2026. **Accepted:** 19 August 2026. **Available online:** 26 November 2026.

Cite this article: Subhendu J, Chitta RM, Sukirti M, Debi AN, Gopa M, Suchismita M, Subhalaxmi M.Comparative study on growth and floral attributes of some double tuberose varieties as influenced by black polythene mulch-induced microclimate modification under coastal Odisha agroclimatic conditions. Plant Science Today. 2026;13(sp9):01-14. https://doi.org/10.14719/pst.15358

Introduction

Tuberose (*Polianthes tuberosa* L.), popularly known as Rajanigandha, is an important tropical bulbous ornamental plant grown for its highly fragrant white flowers. It is a commercially grown tropical ornamental bulbous flowering plant currently known as *Agave amica* L. belonging to the family Asparagaceae (formerly *Polianthes tuberosa* belongs to the family Amaryllidaceae). The species was first described by Carl Linnaeus in 1753 as *P. tuberosa*. Both morphological and molecular phylogenetic studies have shown that *Polianthes* is embedded within the larger genus *Agave* and the genus is now included in a broadly circumscribed *Agave* (1). Among its types, the double tuberose is characterised by multiple layers of petals, giving it a fuller and more attractive appearance. Although slightly less fragrant than single varieties, it is highly preferred for table arrangement, bouquets and decorative purposes. Popular double varieties in India include Suvasini, Vaivab, Hyderabad Double, Calcutta Double, Pearl Double, etc. Many cultivars of tuberose are introduced and some of them have evolved. Tuberose exhibits a wide range of genetic variability in growth habit, flowering behaviour and other

morphological characteristics. However, only a limited number of genotypes possess the desirable combination of high yield and superior flower quality. Therefore, systematic evaluation, selection and conservation of promising germplasm are essential for ensuring sustainable production (2). The performance of a variety is largely influenced by its genetic characteristics and the environmental conditions prevailing in the region where it is cultivated. Therefore, a cultivar that performs well in one region may not show similar performance under different agroclimatic conditions. Hence, systematic evaluation of available genotypes is essential to identify suitable and high-yielding cultivars adapted to a specific region (3). Most previous investigations have evaluated only a limited number of cultivars in different agroclimatic regions of India, including Goa, Tamil Nadu and North Coastal Andhra Pradesh. However, published information on the comparative performance of double tuberose cultivars and detailed recommendations for suitable varieties adapted to the agroclimatic conditions of coastal Odisha are lacking, presenting a significant challenge for farmers and commercial flower growers in this particular region. This region of Odisha is well known for its rich fertile soil and adaptive environment for the commercial cultivation of double tuberoses and other cut flowers. Adaptation of high-yielding and superior cultivars in this region needs to be confirmed for better commercial production of tuberose. However, the lack of information regarding high-yielding genotypes and the assessment of their performance remains a hurdle for growers in choosing the best variety of their choice. Hence, this knowledge gap highlights the need for region-specific screening and evaluation of double tuberose cultivars to identify superior-performing varieties and develop reliable recommendations for commercial cultivation, thereby benefiting growers in coastal Odisha. Also, weeds are a major constraint in the cultivation of tuberose particularly during the early growth stages when the crop establishes slowly and is less competitive. In tuberose fields, weeds compete aggressively with the crop for nutrients, moisture, light and space, leading to reduced plant growth, delayed flowering and lower yield of spikes and bulbs. The problem is more severe in this region, which comes under tropical and humid conditions, where favourable conditions promote rapid weed growth throughout the season. Previous studies have demonstrated that, black polythene mulch can significantly improve crop performance by conserving soil moisture, moderating soil temperature, suppressing weed growth and enhancing nutrient-use efficiency, thereby improving the chemical and physical properties of the soil at the microclimate level. These improvements have been associated with enhanced vegetative growth, earlier flowering, increased flower yield and improved flower quality (4). In tuberose, several researchers have reported that black polythene mulch increased plant height, leaf production, spike length, number of florets spike^{-1} and flower yield compared with un-mulched conditions, primarily due to improved soil moisture conservation and effective weed suppression (4). However, the magnitude of these responses has varied with cultivar (5), agroclimatic conditions (6) and crop management practices (4). Since the maximisation of flower yield with quality is of prime importance in the cultivation of tuberose it becomes quite important to screen suitable varieties with appropriate cultural practices to gather maximum benefit from the crop. Unfortunately, limited research has been conducted on mulching, particularly in tuberose, in this region as well as in other agroclimatic locations of India to determine the precise efficacy of mulching. Hence, in view of this information, the present investigation was conducted by modifying the soil climate at the microenvironmental level using black polythene with some double tuberose varieties, which may open up a path for integrated cultivation practices to increase both quality and quantity parameters in open field cultivation of flower crops like tuberose under local agroclimatic conditions of coastal Odisha.

Materials and Methods

Experimental site and agroclimatic conditions

The present investigation was undertaken in the form of a field experiment at the Agricultural Research Station, Binjhagiri, Chhatabara, Institute of Agricultural Sciences (Faculty of Agricultural Sciences), Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, from Pre-Rabi 2022 to Pre-Rabi 2024 (the 1st crop was from 04/09/2022 to 6/09/2023 and the 2nd crop was from 10/09/2023 to 10/10/2024) for two consecutive years. The experimental site i.e., Agricultural Research Station, Binjhagiri, Chhatabara, is situated 63 km away from the Bay of Bengal, at an elevation of 25.5 m above mean sea level. Geographically it is located at 20°25′ N latitude and 85°67′ E longitude, which is the midpoint of the coastal Odisha. During the study period (September 2022–September 2024), the experimental site recorded an annual rainfall of 1621.5 mm in 2022, 1589.8 mm in 2023 and 1704.6 mm in 2024, with an average annual rainfall of approximately 1639 mm. The region experienced high relative humidity (approximately 75–80 %) due to its coastal tropical climate. The mean annual atmospheric temperature remained around 27 °C, with maximum temperatures reaching 38–42 °C during summer and minimum temperatures declining to 12–16 °C during winter. During the rainy season, the average temperature remained around 28–30 °C.

Soil characteristics of the site

The soil of the experimental site was found to be clay loam, with an organic carbon content of 0.24 %. The total nitrogen (N) content was 125.44 kg ha^{-1}, available phosphorus (P) was 19.7 kg ha^{-1}, while available potassium (K) was 66.17 kg ha^{-1}. The soil had a pH of 4.36 and an electrical conductivity of 1.46.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

Design of experiment and treatment details

The experiment was laid out in a factorial randomised block design (FRBD) with two factors i.e., mulching and variety and was replicated thrice. The mulching factor was adopted in two levels i.e., mulching with black polythene mulch (M_1) and no mulching or without mulch (M_0). Similarly, the other factor, variety, comprised seven varieties of double tuberose viz Calcutta Double (V_1), Pearl Double (V_2), Suvasini (V_3), BR-24 (V_4), Vaivab (V_5), BR-19 (V_6) and Hyderabad Double (V_7).

Implementation of the experiment

Tuberose bulbs (approx 2.5 cm diameter) of different varieties were procured from the Department of Floriculture and Landscaping, OUAT, Bhubaneswar and used as planting materials in the experimental block. Prior to commencement of the experiment, the experimental site was ploughed thoroughly by means of a power tiller and brought to a fine tilth. Then, the land was properly cleaned and levelled and the plots were prepared as per the plan. The treatments were allotted as per the random table. The plots of desired dimensions were prepared in the form of raised beds of 20 cm height from the ground level which were sloped on all sides. The plots under each treatment scheduled for planting with different tuberose varieties were prepared as per the plan. After final digging and prior to levelling of plots, farmyard manure at the rate of 20 t ha^{-1} (2.0 kg/m^2) was thoroughly incorporated into the soil. Black polythene mulch (40 µm) was applied to the designated treatment plots before planting, with circular holes of 15 cm diameter made to accommodate the tuberose bulbs. The edges of the mulch were firmly secured with soil to prevent displacement and ensure close contact with the bed surface. The mulch was replaced at the end of each planting year due to physical and mechanical damage sustained during intercultural operations such as weeding and routine field maintenance.

Application of nutrients and other chemicals

Chemical fertilisers at the rate of 20 g N, 20 g P_2O_5 and 20 g K_2O m^{-2} were applied, out of which one-third of the nitrogen, the full dose of phosphorus and potash were applied as basal dressing to each plot. The rest of the nitrogen was applied in two equal splits after 30 and 60 days of planting the bulbs. The nutrients N, P and K were applied in the form of urea (46.2 % N), single superphosphate (16.50 % P_2O_5) and muriate of potash (60 % K_2O) respectively.

Planting of bulbs

Prior to planting, the bulbs were treated with 0.2 % Bavistin solution for about half an hour and thereafter, they were spread on the ground over a newspaper sheet under shade for 2–3 hr and were allowed to dry before being planted in the experimental plots. Bulbs were planted with a spacing of 30 × 30 cm at a depth of 5.0 cm in individual plots of 1.2 × 5.0 m. All recommended standard cultural practices were followed for raising the crop.

Data collection

Five plants were randomly selected from each plot in every replication for recording observations on vegetative parameters at 45 and 90 days after planting (DAP) and flowering parameters were recorded during winter, summer and rainy seasons after the appearance of flowers in each year. Observations on various growth and flowering parameters such as plant height, number of leaves $clump^{-1}$, number of plants $clump^{-1}$, leaf width, spike length, floral diameter, number of florets $spike^{-1}$, weight of 10 florets, days taken for the emergence of the flower spike and number of spikes $clump^{-1}$, $plot^{-1}$ and ha^{-1} were recorded.

Statistical analysis

The data were collected over two consecutive years and the pooled data of both years were subjected to statistical analysis using the standard method of factorial analysis of variance (ANOVA) appropriate for FRBD (7), using Microsoft Excel 2007. The results were interpreted at the 5 % level of significance and Duncan's multiple range test (DMRT) was employed for mean separation to determine the significance of differences among treatment means.

Results

Vegetative parameters

The significant variations in various vegetative parameters due to mulching treatments are presented in Table 1. The treatment M_1 with mulching played an important role in improving most of the vegetative traits (Fig. 1). The genotypes exhibited considerable variation in parameters like plant height, number of leaves $clump^{-1}$, leaf width and other growth characteristics, suggesting strong genetic control over these traits. Such variability offers ample scope for the selection of superior genotypes with desirable vegetative performance under the existing agroclimatic conditions.

Plant height

Irrespective of varieties, plants grown under non mulching treatments (M_0) had significantly higher plant height than the mulched treated plants (M_1) after 45 days of planting (Table 1, Fig. 2). An average height of 32.06 cm was observed in plants under non-mulching treatments (M_0), whereas plants under black polythene mulch (M_1) recorded 29.50 cm, which was comparatively lower than that under the non-mulching treatments (M_0). Observations recorded at 90 DAP revealed that mulching with black polythene influenced plant height significantly and registered a height of 39.79 cm, which was significantly higher as compared to M_0, which recorded a height of 34.43 cm. Regarding the varieties, significant variation was found among the genotypes with respect to plant height when observed after 45 days of planting. It was maximum (37.45 cm) in V_7 followed by and at par with V_1 which recorded a height of 36.85 cm. On the other hand, the V_6 recorded

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

a plant height of 19.85 cm which was the lowest among all varieties under study, whereas after 90 days of planting, V_1 recorded the maximum height of 47.16 cm followed by V_7 which recorded a height of 41.45 cm. Again, the V_6 recorded the lowest height of 25.56 cm.

Number of leaves clump^{-1}

The number of leaves clump^{-1} was recorded as maximum with mulching treatment M_1 during both observations, which recorded 20.33 and 52.03 leaves after 45 and 90 DAP respectively (Table 1, Fig. 3). Plants grown without mulching (M_0) recorded 16.16 and 33.66 leaves respectively during both the observations, which were significantly lower than those under the mulched treatments (Fig. 4). The number of leaves per plant was observed to be maximum (28.35) in V_5 after 45 days of planting, while the minimum (10.33) was observed in V_4 among all other varieties. Again, after 90 days of planting, it was found that the V_5 also exhibited the maximum number of leaves (60.46) while V_4 recorded the minimum (23.41).

Table 1. Effect of mulching and tuberose varieties on vegetative parameters

Treatments	Plant height (in cm)		Number of leaves clump^{-1}		Number of plants clump^{-1}		Leaf width (in cm)	
Mulching	45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP
M_1 (mulching)	29.50^{b}	39.79^{a}	20.33^{a}	52.03^{a}	5.21^{a}	14.64^{a}	1.83^{a}	1.97^{a}
M_0 (no mulch)	32.06^{a}	34.43^{b}	16.16^{b}	33.66^{b}	2.81^{b}	9.74^{b}	1.54^{b}	1.70^{b}
SEM (±)	0.24	0.55	0.29	0.62	0.13	0.44	0.01	0.01
CD ($p \leq 0.05$)	0.68	1.56	0.83	1.75	0.36	1.25	0.04	0.04
Varieties								
V_1 (Calcutta Double)	36.85^{a}	47.16^{a}	23.55^{b}	52.03^{b}	3.88^{bc}	12.75^{bc}	1.72^{bc}	1.84^{b}
V_2 (Pearl Double)	31.22^{c}	36.98^{cd}	16.18^{c}	39.90^{d}	3.61^{bc}	11.63^{cd}	1.68^{bcd}	1.79^{bc}
V_3 (Suvasini)	28.68^{d}	35.82^{cd}	17.45^{c}	44.93^{c}	4.58^{b}	15.51^{ab}	1.77^{b}	1.98^{a}
V_4 (BR-24)	27.47^{d}	32.60^{d}	10.33^{e}	23.41^{f}	2.33^{d}	7.45^{e}	1.59^{de}	1.73^{cd}
V_5 (Vaivab)	33.94^{b}	40.22^{bc}	28.35^{a}	60.46^{a}	7.20^{a}	18.48^{a}	1.88^{a}	2.06^{a}
V_6 (BR-19)	19.85^{e}	25.56^{e}	13.41^{d}	30.52^{e}	3.04^{cd}	8.59^{de}	1.54^{e}	1.66^{d}
V_7 (Hyderabad Double)	37.45^{a}	41.45^{b}	18.47^{c}	48.66^{bc}	3.46^{c}	10.92^{cde}	1.65^{cde}	1.78^{bc}
SEM (±)	0.45	1.04	0.55	1.16	0.24	0.83	0.03	0.02
CD ($p \leq 0.05$)	1.26	2.93	1.55	3.27	0.68	2.34	0.07	0.07

Identical superscript letters indicate no statistically significant difference among the corresponding values, whereas different superscript letters denote a statistically significant difference. DAP: days after planting; SEM: standard error of the mean; CD: critical difference.



Fig. 1. A comparative view of growth performances between mulching and without mulching treatment.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

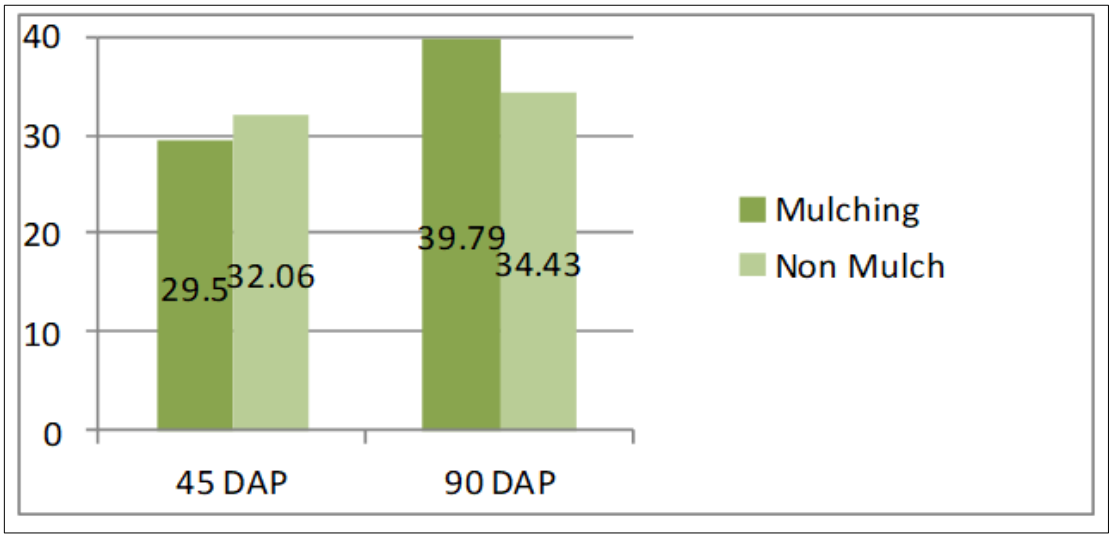


Fig. 2. Graph interpretation of effect of mulching and non-mulching on plant height at various stages of growth.

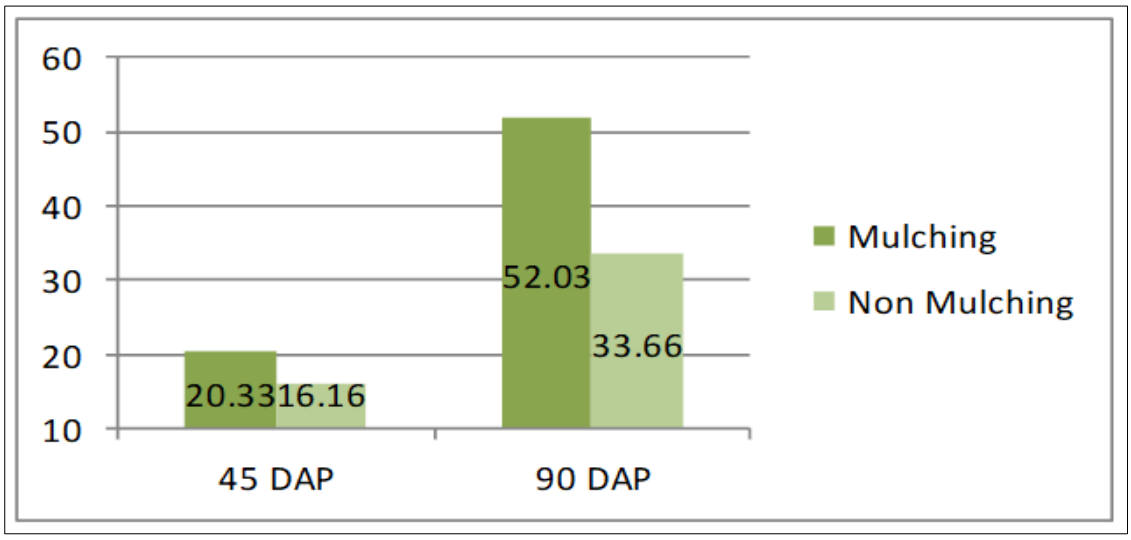


Fig. 3. Graph interpretation of effect of mulching and non-mulching on number of leaves clump^{-1} at various stages of growth.

Number of plants clump^{-1}

It was observed that the number of plants clump^{-1} was maximum (5.21 and 14.64) in plants receiving the mulched treatment (M_1) and minimum (2.81 and 9.74) under non mulched treatments (M_0), as recorded during both observations of 45 and 90 DAP, respectively (Table 1, Fig. 4). So far as varieties were concerned, the maximum number of plants clump^{-1} was found in V_5 i.e. 7.20, while the minimum number was recorded in V_4 which was 2.33 during the observation recorded at 45 DAP. Assessing the data at 90 DAP, it was found that the highest number of plants clump^{-1} was also registered with the V_5 (18.48) and V_4 consistently recorded the lowest number among all other varieties, which was only 7.45 plants clump^{-1}.

Leaf width

Significant variation was found between the treatments of black polythene mulch (M_1) and non-mulching (M_0) with respect to the width of leaves at 45 and 90 DAP. Significantly greater leaf width (1.83 and 1.97 cm) was recorded under the mulching treatment as compared to the non-mulching treatment, which recorded 1.54 and 1.70 cm during both assessments. Significant variation among different varieties was also noticed with respect to leaf width. Maximum width (1.88 and 2.06 cm) was found in the V_5 during both observations of 45 and 90 DAP respectively while the lowest (1.54 and 1.66 cm) was recorded in the V_6 during the same period of observations.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358



Fig. 4. Comparison of vegetative parameters with respect to number of leaves clump^{-1}, number of plants clump^{-1} in mulching and non-mulching treatment.

Flowering parameters

The significant variations were found in various flowering parameters due to mulching treatments (Table 2). The treatment M_1, which received black polythene mulch, played a crucial role in improving almost all the flowering parameters. The genotypes exhibited considerable variation in traits such as days to spike emergence, spike length, floret length, number of florets spike^{-1} and other floral characteristics, indicating the influence of genetic factors. This variability highlights the potential for identifying superior genotypes with desirable flowering attributes under the prevailing agroclimatic conditions.

Days taken for emergence of flower spike

There was a substantial difference between the treatments with respect to the number of days taken for the emergence of the flower spike, which could indicate the earliness and delay in flowering. The minimum number of days (75.18 days) was taken for the emergence of the flower spike under mulching treatment (M_1) (Fig. 5), whereas it was delayed under non-mulch treatment (M_0), which took 93.39 days for the same. Earliness in flower spike emergence was observed in V_5 i.e. 56.28 days, whereas it was most delayed in V_6, which took 123.72 days among all the varieties under study (Fig. 6).

Spike length

Spike length, independent of varietal differences, was observed to be maximum (74.95 cm) under the mulched (M_1) treatment, while the minimum (65.37 cm) was recorded under non-mulched (M_0) plots during the winter season. A similar trend was also observed in both the summer and rainy seasons. In these seasons, treatments with black polythene mulch (M_1) exhibited maximum spike lengths (79.91 and 87.35 cm respectively) and plants under non-mulched plots (M_0) showed the minimum values (65.86 cm and 75.64 cm). Maximum spike length was recorded in V_3 i.e. V_3 (91.29 cm) followed by V_5 (83.63 cm) whereas the lowest value was registered by genotype V_6 (46.98 cm) during the observations recorded in the winter season. A similar trend was also observed during both summer and rainy seasons where the V_3 exhibited maximum spike lengths of 93.01 and 96.06 cm followed by V_5 with 83.03 and 92.12 cm during summer and rainy seasons respectively. On the other hand, the lowest spike lengths (49.64 and 58.48 cm) were again observed in V_6, during summer and rainy seasons (Table 2, Fig. 7).

Floret diameter

Across all three seasons greater floret diameter was recorded in M_1 treatment i.e. 3.47, 3.60 and 3.97 cm during winter, summer and rainy seasons as compared to the M_0 treatment, which recorded 3.24, 3.32 and 3.54 cm respectively during the same period of observations. Significant variations were noticed among the varieties with respect to floret size. Observations recorded during the winter season indicated that maximum diameter (4.34 cm) was observed in V_3, followed by V_5 (3.98 cm) while V_4, registered the lowest diameter of 2.58 cm. A similar trend was also found during the summer season, where V_3 resulted in the highest value of 4.22 cm, followed by V_5, i.e. 3.90 cm and V_4 recorded the lowest diameter of 2.72 cm. Following the trend, again, V_3 resulted in the maximum diameter (4.62 cm) followed by V_5 (4.33 cm), whereas V_4 consistently exhibited the minimum diameter (3.04 cm) during the observation recorded in the rainy season (Fig. 8).

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

Table 2. Effect of mulching and tuberose varieties on flowering and yield parameters

Treatments	Spike length (in cm)			Floret diameter (in cm)			No. of florets spike^{-1}			Weight of 10 florets (in g)			Days taken to emergence of flower spike	No. of spikes clump^{-1}	No. of spikes plot^{-1}	No. of spikes ha^{-1}
Treatments	W	S	R	W	S	R	W	S	R	W	S	R				
Mulching																
M_1 (mulching)	74.95^{a}	79.91^{a}	87.35^{a}	3.47^{a}	3.60^{a}	3.97^{a}	33.12^{a}	41.92^{a}	45.56^{a}	17.65^{a}	17.94^{a}	22.56^{a}	75.18^{a}	2.79^{a}	131.09^{a}	218476.19^{a}
M_0 (no mulch)	65.37^{b}	65.86^{b}	75.64^{b}	3.24^{b}	3.32^{b}	3.54^{b}	29.48^{b}	36.64^{b}	41.60^{b}	15.24^{b}	14.77^{b}	18.80^{b}	93.39^{b}	2.32^{b}	111.31^{b}	185523.81^{b}
SEM (±)	0.72	0.82	0.87	0.02	0.02	0.02	0.25	0.34	0.29	0.23	0.36	0.41	1.00	0.02	0.99	1657.25
CD ($p \leq 0.05$)	2.05	2.30	2.46	0.06	0.05	0.07	0.70	0.95	0.83	0.66	1.01	1.17	2.81	0.07	2.81	4680.71
Varieties																
V_1 (Calcutta Double)	73.30^{c}	76.03^{c}	85.44^{bc}	3.47^{c}	3.69^{c}	4.01^{c}	31.98^{c}	39.67^{c}	44.53^{c}	15.88^{c}	16.28^{bc}	19.46^{c}	74.39^{d}	2.92^{c}	140.00^{c}	233333.33^{c}
V_2 (Pearl Double)	67.58^{d}	70.45^{c}	79.85^{c}	3.14^{d}	3.45^{d}	3.69^{d}	28.68^{de}	34.94^{e}	39.74^{e}	12.16^{d}	12.52^{de}	16.21^{cd}	77.72^{d}	2.62^{d}	125.60^{d}	209333.33^{d}
V_3 (Suvasini)	91.29^{a}	93.01^{a}	96.06^{a}	4.34^{a}	4.22^{a}	4.62^{a}	38.61^{b}	48.69^{b}	51.41^{b}	28.51^{a}	25.48^{a}	33.71^{a}	65.70^{e}	3.36^{b}	160.40^{b}	267333.33^{b}
V_4 (BR-24)	54.63^{e}	61.20^{d}	69.93^{d}	2.58^{f}	2.72^{g}	3.04^{f}	18.12^{f}	24.64^{f}	28.28^{f}	9.90^{e}	11.09^{e}	14.24^{d}	103.02^{b}	0.88^{f}	42.40^{f}	70666.67^{f}
V_5 (Vaivab)	83.63^{b}	83.03^{b}	92.12^{ab}	3.98^{b}	3.90^{b}	4.33^{b}	43.57^{a}	52.08^{a}	56.34^{a}	22.08^{b}	18.70^{b}	25.53^{b}	56.28^{f}	4.09^{a}	187.60^{a}	312666.67^{a}
V_6 (BR-19)	46.98^{f}	49.64^{e}	58.48^{e}	2.93^{e}	2.93^{f}	3.20^{f}	27.97^{e}	36.71^{de}	41.69^{de}	12.67^{d}	15.65^{c}	17.22^{cd}	123.72^{a}	1.46^{e}	70.00^{e}	116666.67^{e}
V_7 (Hyderabad Double)	73.72^{c}	76.83^{bc}	88.58^{ab}	3.04^{de}	3.30^{e}	3.39^{e}	30.20^{cd}	38.26^{cd}	43.08^{cd}	13.93^{d}	14.75^{cd}	18.41^{c}	89.17^{c}	2.55^{d}	122.40^{d}	204000.00^{d}
SEM (±)	1.36	1.52	1.63	0.04	0.03	0.04	0.47	0.63	0.55	0.43	0.67	0.77	1.86	0.05	1.86	3100.44
CD ($p \leq 0.05$)	3.83	4.31	4.59	0.10	0.09	0.13	1.32	1.78	1.56	1.23	1.90	2.18	5.26	0.13	5.25	8756.81

Identical superscript letters indicate no statistically significant difference among the corresponding values, whereas different superscript letters denote a statistically significant difference. W: winter season; S: summer season; R: rainy season; SEM: standard error of the mean; CD: critical difference.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358



Fig. 5. An early spike initiation in black polythene mulching.

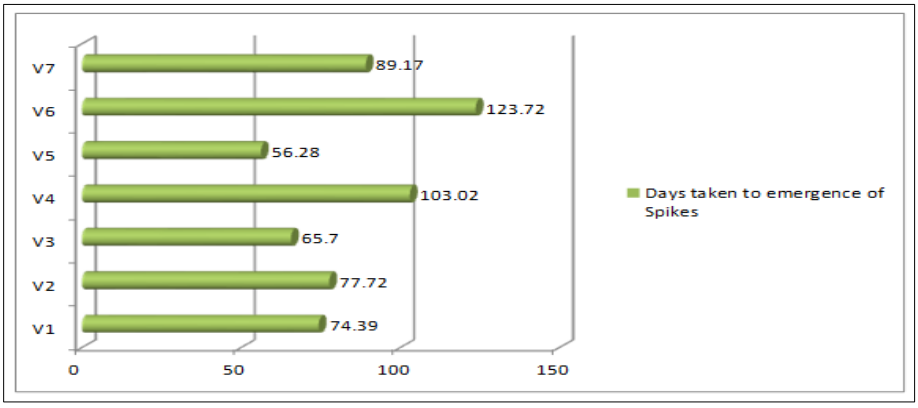


Fig. 6. Graph interpretation of effect of varieties on days taken for emergence of spikes.

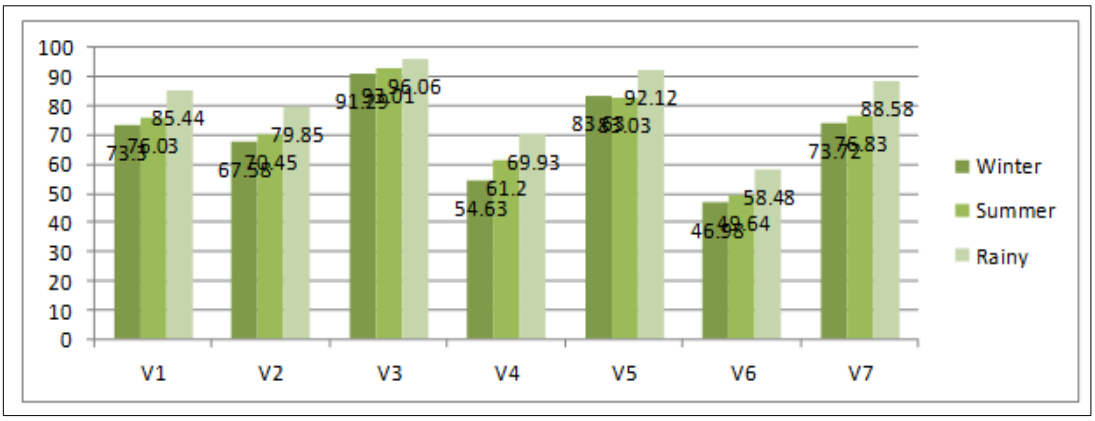


Fig. 7. Graph interpretation of effect of varieties on spike length at various seasons.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

Number of florets spike^{-1}

A significant difference was observed in the number of florets spike^{-1} with respect to mulching treatments. The maximum number of florets spike^{-1} was recorded in plots receiving mulching treatment (M_1) i.e. 33.12, 41.92 and 45.56 during winter, summer and rainy season respectively. On the other hand, the minimum number i.e. 29.48, 36.64 and 41.60 was produced in plots under M_0 during the same period of observation. Among the varieties under study, significant variations were found among them. The maximum number of florets spike^{-1} was produced in V_5 during the winter (43.57), summer (52.08) and rainy seasons (56.34) respectively. In contrast, the lowest number of florets spike^{-1} was recorded in V_4 (18.12, 24.64 and 28.28) across observations taken in all three seasons.

Weight of 10 florets

The average weight of 10 florets, irrespective of varieties was significantly influenced by the mulching treatment. It was higher in plots treated with black polythene mulch (M_1) which recorded 17.65, 17.94 and 22.56 g during winter, summer and rain seasons respectively whereas plots with non-mulching treatment (M_0) recorded 15.24, 14.77 and 18.80 g during the same period of observations. Significant variation was also noticed among the varieties with respect to the weight of 10 florets. The maximum weight (28.51 g) was recorded in V_3, while the minimum was observed in V_4 (9.90 g), across the observations taken in the winter season. A similar trend was noticed during the other two seasons; the maximum weight of 10 florets was observed in V_3 (25.48 g and 33.71 g) and the minimum was observed in V_4 (11.09 and 14.24 g) respectively.

Yield data

The data on yield parameters described in Table 2 exhibited significant variation among the genotypes. Yield attributes were also notably influenced by mulching treatments, which were much superior under black polythene mulch (M_1) as compared to the non-mulch (M_0) treatments.

Number of spikes clump^{-1}

The number of spikes clump^{-1} varied significantly among the treatments (Fig. 9). So far as the mulching treatment was concerned, a significantly higher number was observed in M_1 (2.79) as compared to M_0 (2.32). The number of spikes clump^{-1} varied significantly among the genotypes tried across the experiment. It was found to be highest in V_5 (4.09), followed by V_3 (3.36), while V_4 registered the lowest number of spike clump^{-1} (0.88).

Number of spikes plot^{-1}

The number of spike plot^{-1} was also significantly higher in M_1 (131.09) as compared to M_0 (111.31). Among the varieties under study, V_5 again recorded the highest number of spikes plot^{-1} (187.60), followed by V_3 (160.40), whereas V_4 consistently recorded the lowest number (42.40).

Number of spike ha^{-1}

The computed data on the number of spikes ha^{-1} was also found to be higher in M_1 (218476.19) than in M_0 (185523.81), which was significantly lower than the mulched treatments. Finally, the number of spikes ha^{-1} confirmed that V_5 exhibited the highest yield (312666.67) followed by V_3 (267333.33) and V_4 recorded the lowest (70666.67) number of spikes ha^{-1}.

Discussion

Vegetative parameters

Plant height

At 45 DAP, plants under non-mulching (M_0) exhibited greater plant height than mulched plants (M_1). This initial advantage in non-mulched conditions is attributed to relatively higher soil temperature fluctuations and reduced physical barriers, which can sometimes promote early vegetative elongation. However, this effect was not sustained over time. By 90 DAP, mulching with black polythene (M_1) significantly enhanced plant height, surpassing the non-mulched treatment. Earlier studies reported that the improvement can be explained by the beneficial effects of mulching on soil microclimate, including improved moisture retention, moderated soil temperature and reduced weed competition. Similar findings were reported regarding these factors, which collectively create a more favourable environment for sustained plant growth and development, particularly during later growth stages (8, 9).

The superior performance of V_7 and V_1, which are statistically at par with each other at various observation periods in terms of plant height, was attributed to their genetic potential, which enables better utilisation of available resources such as nutrients, moisture and light. The variation in growth among different genotypes is primarily governed by their inherent genetic makeup, which influences physiological processes like cell division, elongation and photosynthetic efficiency, as reported in previous findings (10). The comparatively lower plant height observed in V_6 indicates its relatively poor adaptability or lower vigour under the given agroclimatic conditions. These observations are attributed to the hereditary traits, which are further controlled by prevailing environmental conditions. The present findings are in agreement with previous studies conducted in the sub-humid southern plains and Aravalli hills of Rajasthan (11).

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

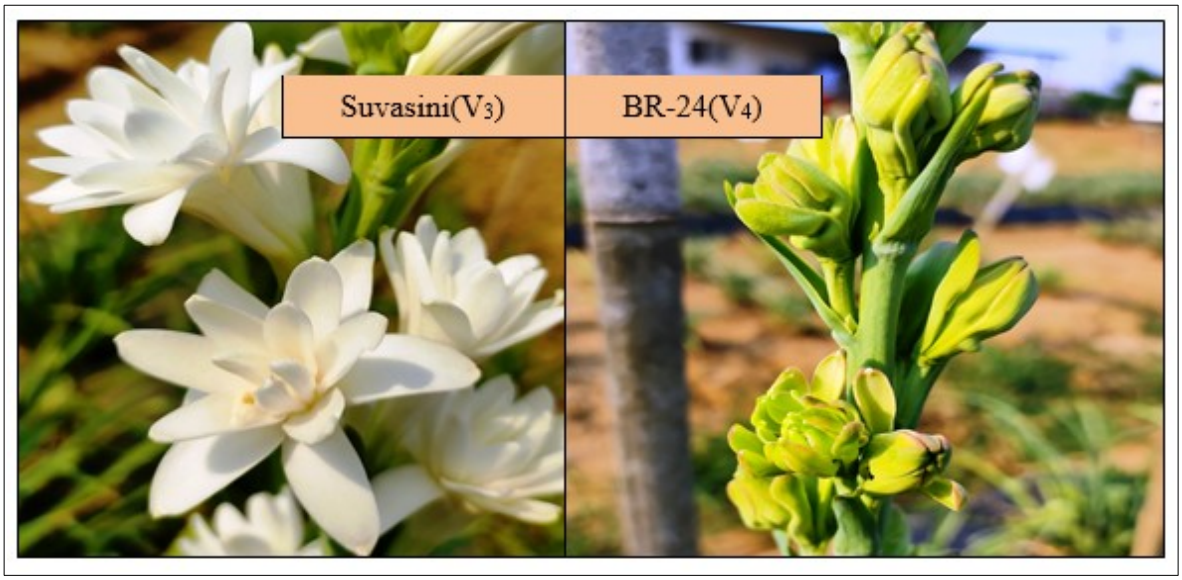


Fig. 8. Comparison of floret morphology in tuberose varieties showing “Suvasini” with prominent, large florets and “BR-24” with comparatively smaller florets.

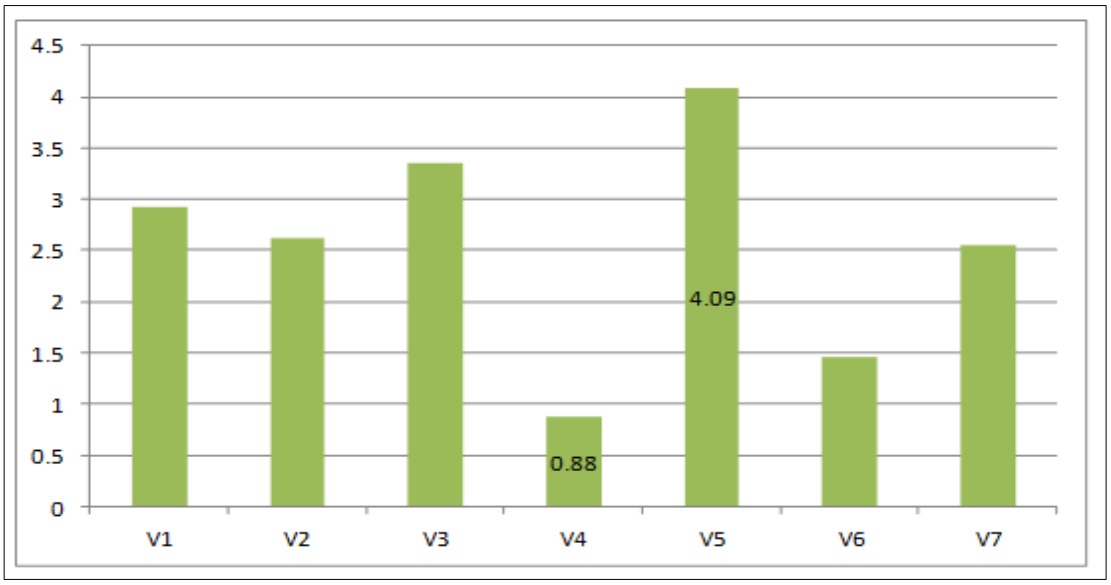


Fig. 9. Graph interpretation of effect of varieties on yield of spikes clump^{-1}.

Number of leaves clump^{-1}

The number of leaves clump^{-1} was consistently higher under the mulched treatment at both observation intervals and lowest in non-mulching plots. This indicates that mulching promotes better vegetative growth due to enhanced nutrient availability and reduced moisture stress. Increased leaf production under mulching also contributes to higher photosynthetic efficiency, thereby supporting overall plant vigour. It improved the soil environment for better uptake of nutrients by plants for their efficient physiological processes, which resulted in the production of a greater number of leaves. These findings are consistent with earlier reports highlighting the beneficial effects of plastic mulching on crop growth and productivity (4, 12).

The higher leaf production in V_5 may be attributed to its inherent varietal characteristics and better adaptation to the prevailing growing conditions, which could have contributed to more efficient resource utilisation and improved vegetative development. The superior leaf production may also be associated with better establishment, canopy development and assimilate production capacity. In contrast, the comparatively lower performance of V_4 may be related to differences in its growth behaviour, adaptability and phenotypic response under the experimental conditions. The increase in leaf number from 45 to 90 DAP across all varieties reflects normal plant growth trends and

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

developmental progression. However, the magnitude of increase varied significantly among the varieties, further confirming differential growth responses (13, 14).

Number of plants clump^{-1}

Similarly, the number of plants clump^{-1} was significantly greater in the mulched treatment compared to the non-mulched treatment during both observations. This suggested that mulching not only improved individual plant growth but also supported better tillering or clump development due to improved soil structure and reduced competition from weeds, which resulted in less competition for space, moisture and nutrients leading to better plant growth (4, 15).

The observed differences among the varieties were statistically significant in terms of the number of plants clump^{-1}, indicating the strong influence of genetic factors on vegetative growth during both observations at 45 and 90 DAP. The present observation is substantiated by earlier findings indicating that some vegetative parameters are largely determined by the genetic constitution of the varieties with respect to prevailing climatic conditions (14, 16).

Leaf width

Leaf width was also positively influenced by mulching, with significantly higher values recorded in M_1 at both 45 and 90 DAP. Wider leaves are often associated with improved photosynthetic capacity and better plant health. The improved leaf expansion under mulching could be linked to consistent soil moisture availability and reduced environmental stress. Previous studies have suggested that black polythene mulch is largely impermeable to carbon dioxide (CO_2), allowing CO_2 released from the soil to accumulate beneath the mulch. The gas escapes primarily through planting holes, creating a localised “chimney effect” that may increase CO_2 concentration around actively growing leaves and potentially enhance photosynthesis, thereby promoting greater leaf expansion and increased leaf width (4, 17). Although previous reports have suggested that CO_2 accumulation beneath plastic mulch may enhance photosynthetic activity, this mechanism was not directly measured in the present study and is therefore considered a possible contributing factor rather than a confirmed cause of increased leaf width.

Leaf width was also significantly influenced among the different genotypes and maximum leaf width was observed in V_5 and minimum in V_6, which might be due to the inherent characters of individual genotype and their adaptability to varied agroclimatic conditions. Similar results were also obtained in earlier reports, with maximum leaf width in V_5 due to varied agroclimatic conditions supporting the present findings (18).

Flowering parameters

Days taken for emergence of flower spike

Earliness in flowering was recorded under mulching (Fig. 5), while non-mulching recorded a delay in flowering. This is due to lesser weed competition, favourable soil microclimate and improved hydrothermal conditions established by the mulch, particularly higher soil temperature and improved moisture conservation which enhanced plant growth and physiological activity, thereby promoting early spike initiation and flowering. Previous reports of early flowering under mulch have also observed in tuberose and marigold (15, 19). Among the varieties, the earliest flowering was obtained from V_5 and V_4 was regarded as the latest variety with respect to delayed flowering. Earlier findings also suggested that this is due to their genetic potentiality and makeup (14).

Spike length

The flowering parameter of spike length, irrespective of seasons was recorded as significantly higher under mulching as compared to that recorded under non mulching conditions. The increased spike length under black polythene mulching was attributed to improved soil moisture conservation, higher soil temperature and enhanced nutrient availability, which promoted vigorous vegetative growth and increased photosynthetic activity. Consequently, greater assimilate production and translocation to the developing spikes favoured spike elongation as reported in earlier studies (4, 6, 20). In addition to this, the increased spike length was closely associated with greater plant height, which was also obtained under black polythene mulch, suggesting that taller plants possessed a higher capacity to support and develop longer flower spikes (21). The present findings are in close agreement with the above-mentioned previous studies, which also reported that black polythene mulching improved plant vigour and resulted in increased spike length due to favourable soil hydrothermal conditions and enhanced vegetative growth.

The maximum spike length recorded in V_3 followed by V_5 and minimum in V_6 might be due to their inherent varietal characteristics, capacity and response to various agroclimatic conditions. The present findings are supported by earlier reports in which flowering traits are governed by varietal makeup with respect to varied agroclimatic conditions (18, 22).

Floret diameter

Observations recorded during all three seasons in both years revealed that significantly greater floret diameter was found under mulching than under non-mulching conditions due to better vegetative growth as a result of conservation of soil moisture, greater uptake of nutrients and higher photosynthetic activity, leading to greater assimilate production and translocation to the developing florets. Consequently, improved availability of carbohydrates and nutrients during flower development resulted in increased floret diameter under black polythene mulching, which was supported by evidence from earlier reports (4, 8).

Variation in floret diameter was found among the varieties under study. It was maximum in V_3 and minimum in V_4 which was due to differences in genetic

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

constitution and hereditary behaviour of the varieties, as reported in similar studies conducted previously (2, 23, 24).

Number of florets spike^{-1}

Production of a greater number of florets spike^{-1} under black polythene mulch is due to enhanced soil moisture conservation, increased soil temperature and minimised weed competition (6, 20). These conditions improved nutrient uptake, photosynthetic efficiency and vegetative growth, resulting in greater assimilate production and its efficient translocation to the developing floral axis. Consequently, during spike development, greater assimilate partitioning to reproductive structures resulted in more floret primordia developing into fully formed florets, which contributed to a greater number of florets spike^{-1} (25, 26).

The number of florets spike^{-1} is a hereditary character for which variation in floret number was observed among the varieties. In the present study, the maximum number of florets spike^{-1} was found in V_5, while the minimum was recorded in V_4. The present findings corroborate previous studies, which reported comparable trends and variation among the varieties in other agroclimatic regions (13, 14).

Weight of 10 florets

Higher weight of 10 florets recorded under black polythene mulch is due to the improved growth conditions that favours better floret development, size and biomass accumulation. Black polythene mulch improves soil moisture retention, increases soil temperature, reduces weed competition and enhances nutrient availability as reported in previous experiments (21, 26). These conditions promote higher photosynthetic activity and greater carbohydrate production, resulting in increased assimilates translocation towards developing florets. The better supply of carbohydrates and nutrients enhances cell division, cell expansion and accumulation of dry matter in florets, leading to increased floret weight. The present findings support this view, as the increased weight of 10 florets under black polythene mulch may be attributed to enhanced assimilate production and translocation, which promoted better floret development and greater dry matter accumulation (25, 27).

Among different varieties, the maximum weight of 10 florets was recorded in V_3 followed by V_5. This variation is attributed to the production of bold and larger-sized florets in these varieties (Fig. 8), which is governed by their genetic makeup influencing floral morphology and assimilate partitioning towards developing florets. The higher floret weight in these varieties may be due to greater floret size and enhanced accumulation of fresh and dry matter in floral tissues. These inherent varietal characteristics contributed to superior floret weight compared with the other varieties (13, 18, 25).

Yield data

The number of spikes clump^{-1}, plot^{-1} and ha^{-1}, was higher under the mulching treatment as compared to the non-mulching treatment, which might be due to the favourable microclimate prevailing under black polythene mulch which resulted in better vegetative growth due to adequate moisture conservation and a good supply of nutrients ultimately improving the spike yield clump^{-1}, plot^{-1} and ha^{-1}. Likewise, previous studies also reported similar findings to those observed in the present experiment (8, 28, 29).

The number of spikes clump^{-1}, plot^{-1} and ha^{-1}, was the highest in V_5 followed by V_3 and the lowest in V_4 which was due to the fact that the number of spikes produced by a plant is a genetically controlled factor and depends on the yield potentially of the variety. Therefore, variation observed among the varieties with respect to this parameter would be obviously expected under the prevailing environment conditions. A similar trend in tuberose, in which varieties V_5 and V_3 were statistically at par with each other in terms of yield, was also recorded in various other evaluations at other agroclimatic conditions (5, 16, 18).

Conclusion

Among the evaluated varieties, V_3 proved superior from the flower quality point of view by producing the longest spikes with the largest floret diameter, whereas V_5 was the best-performing variety from the flower yield point of view, recording the maximum number of florets spike^{-1}, the earliest spike emergence (56.28 days) and the highest yield with 4.09 spikes clump^{-1}, 187.60 spikes plot^{-1} and 312666.67 spikes ha^{-1}, followed by V_3 (267333.33). Black polythene mulch significantly enhanced vegetative growth, flowering and yield across the winter, summer and rainy seasons, increasing the number of spikes clump^{-1} (2.79), plot^{-1} (131.09) and ha^{-1} (218476.19) by 20.26 %, 17.77 % and 17.76 %, respectively, compared with the non-mulched treatment. Despite the additional cost of mulching, the increased flower yield, improved crop performance and reduced weed management costs resulted in higher economic returns, making black polythene mulch a cost-effective practice. Proper disposal of the used mulch through the municipal waste management system also minimised environmental concerns. Future studies should focus on evaluating a wider range of tuberose genotypes under different mulch types, colours, thicknesses and application durations, together with detailed physiological and microclimatic investigations, to develop location-specific production technologies. Since maximising flower yield and quality is the primary objective of tuberose cultivation, it can be concluded that V_5 is the most suitable variety for commercial flower production owing to its superior yield performance and early flowering, whereas V_3 is recommended for premium flower quality. Thus, the adoption of black polythene mulch along with these varieties is

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

recommended for profitable tuberose cultivation under the coastal agroclimatic conditions of Odisha, ensuring enhanced productivity, improved flower quality and higher economic returns.

Authors' contributions

SJ conducted the experiment and prepared the manuscript. CRM guided the experiment overall and corrected the manuscript. SM[1] helped in compiling all the observations. DAN carried out the statistical analysis. GM conceived of the study and participated in its design and coordination. SM[2] helped in writing the discussion part of the manuscript. SM[3] helped in preparing the draft. All authors have read and approved the final manuscript [SM[1] stands for Sukirti Mohanty, SM[2] stands for Suchismita Mishra and SM[3] stands for Subhalaxmi Mishra].

Compliance with ethical standards

Conflict of interest

Authors do not have any conflict of interests to declare.

Ethical issues

None

References

1. Bogler DJ, Pires JC, Francisco-Ortega J. Phylogeny of Agavaceae based on ndhF, rbcL and ITS sequences: implications of molecular data for classification. Aliso. 2006;22:313–28. https://doi.org/10.5642/aliso.20062201.26
2. Ranchana P, Kannan M, Jawaharlal M. Evaluation of tuberose (*Polianthes tuberosa*) genotypes (double) for yield and genetic variability. J Ornam Hort. 2013;16(1–2):10–4.
3. Naik BC, Kamble BS, Tirakannanavar S, Parit S. Evaluation of different genotypes of tuberose (*Polianthes tuberosa* L.) for growth, flowering and yield characters. Int J Curr Microbiol App Sci. 2018;7(7):4135–41. https://doi.org/10.20546/ijcmas.2018.707.482
4. Deka M, Talukdar. Effect of mulching on growth and flowering of tuberose (*Polianthes tuberosa* Linn.) cv. Double. Res Crops. 2017;18(1):129–32. https://doi.org/10.5958/2348-7542.2017.00022.5
5. Safeena SA, Thangam M, Singh NP. Evaluation of different cultivars of tuberose (*Polianthes tuberosa* L.) under humid agro-climatic conditions of Goa. J Hortic Sci. 2019;14(2):109–14. https://doi.org/10.24154/jhs.v14i2.793
6. Vaid N, Chaudhary SVS, Sharma BP, Gupta YC, Chauhan G. Effect of planting dates and mulching on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. Sikkim selection. Int J Curr Microbiol App Sci. 2019;8(5):199–206. https://doi.org/10.20546/ijcmas.2019.805.024
7. Panse VG, Shukhatme PV. Statistical methods for agricultural workers. 2nd ed. New Delhi: ICAR; 1967.
8. Das JN, Mishra HN. Studies on graded doses of fertilisers and polythene mulches on growth, flowering and yield of African marigold (*Tagetes erecta* L.) cv. Siracole. Orissa J Hort. 2005;33(2):42–5.
9. Vasoya DK, Sharma MK, Patel PN, Pand R, Gohil VM. Effect of different mulches on growth, yield and quality of tuberose (*Polianthes tuberosa* L.) var. Suvasini. Pharma Innov J. 2023;12(12):2698–701.
10. Rao KD, Sushma K. Evaluation of certain tuberose (*Polianthes tuberosa* L.) double genotypes for assessing yield and quality traits under agro-climatic conditions of Telangana. J Res PJTSAU. 2025;43(1–2):51–6.
11. Mahawer LN, Bairwa HL, Shukla AK. Field performance of tuberose cultivars for growth, floral and economic characters under sub-humid southern plains and Aravalli hills of Rajasthan. Indian J Hort. 2013;70(3):411–6.
12. Soujanya MB, Bhat ST, Tandel BM, Patel HM, Patel GD, Bhatt DS. Effect of organic mulch on growth and flowering of country rose. Pharma Innov J. 2022;11(5):1950–7.
13. Hasna PM, Manjusha AM. Varietal evaluation of tuberose (*Polianthes tuberosa* L.) for growth and yield characters. J Trop Agric. 2021;59(2):302–5.
14. Pal V, Singh KP, Tyagi A, Kumar A, Singh O. Performance of tuberose (*Polianthes tuberosa* L.) cultivars grown for spikes under Western Uttar Pradesh conditions. HortFlora Res Spectr. 2017;6(2):119–21.
15. Koppad BV, Biradar MS, Hiremath SM, Yenagi BS. Growth, yield and quality of tuberose (*Polianthes tuberosa* L.) as influenced by raised bed system, mulching and planting geometry. J Farm Sci. 2022;35(1):132–5.
16. Ramachandrudu K, Thangam M. Performance of tuberose (*Polianthes tuberosa* L.) cultivars in Goa. J Hortic Sci. 2009;4(1):76–7. https://doi.org/10.24154/jhs.v4i1.562
17. Sanders DC. Using plastic mulches and drip irrigation for vegetable gardens. Raleigh (NC): College of Agriculture and Life Sciences, North Carolina State University, Department of Horticultural Science; 2001. p. 1.
18. Singh KP. Field evaluation of double petalled tuberose (*Polianthes tuberosa*) genotypes for vegetative growth, floral and bulb production parameters. Indian J Agric Sci. 2017;87(11):1549–53. https://doi.org/10.56093/ijas.v87i11.75790
19. Shinde MV, Malshe KV, Salvi BR, Sagvekar VV, Khandekar RG. Effect of different mulches on flowering and flower characters in marigold under Konkan agroclimatic conditions. Pharma Innov J. 2021;10(11):479–81.
20. Gavhane PB, Kore VN, Dixit AJ, Gondhali BV. Effect of graded doses of fertilisers and polythene mulches on growth, flower quality and yield of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda. Orissa J Hort. 2004;32:35–7.
21. Dhatt KK, Ravikumar B. Evaluation of mulch types on weed management, soil moisture conservation and crop performance in *Gladiolus hybridus* cv. Punjab Glance. J Appl Hortic.2024;26(2):212–5. https://doi.org/10.37855/jah.2024.v26i02.40
22. Shete MB, Gaikwad SD, Lohate SR, Gondali BV. Testing of genotypes in tuberose (double type) for cut flower varieties under Pune conditions. Pharma Innov J. 2023;12(10S):1884–7.
23. Sateesha GR, Kumar A, Biradar MS. Growth and floral parameters of different tuberose (*Polianthes tuberosa* L.) varieties under field conditions. Plant Arch. 2011;11(1):467–8.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.
https://doi.org/10.14719/pst.15358

24. Patil VS, Munikrishnappa PM, Shantappa T. Performance of growth and yield of different genotypes of tuberose under transitional tract of North Karnataka. J Ecobiol. 2009;24(4):327–33.

25. Marcelis LF. Sink strength as a determinant of dry matter partitioning in the whole plant. J Exp Bot. 1996;47(Special Issue):1281–91. https://doi.org/10.1093/jxb/47.Special_Issue.1281

26. Kasirajan S, Ngouajio M. Polyethylene and biodegradable mulches for agricultural applications: a review. Agron Sustain Dev. 2012;32(2):501–29.

27. Taiz L, Zeiger E, Møller IM, Murphy A. Plant physiology and development. 6th ed. Sunderland (MA): Sinauer Associates; 2015. https://doi.org/10.1007/s13593-011-0068-3

28. Sihombing D, Handayati W. Effect of mulch on the growth and yield of *Polianthes tuberosa*. In: 2nd International Conference on Sustainable Agriculture and Food Security: A Comprehensive Approach. KnE Life Sciences; 2017. p. 579–86. https://doi.org/10.18502/kls.v2i6.1080

29. Barman A, Abdullah AHMd, Hossen A, Asrafuzzaman M, Rahman KbdMdH. Effect of different mulch on growth and yield of tuberose. Int J Res Rev. 2015;2(6):301–6.

Additional information

Peer review: Publisher thanks the Sectional Editor and anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information: Available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy.

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting.

Copyright: © The Author(s). This is an open-access article distributed under the Creative Commons Attribution License CC BY 4.0.

Publisher information: Plant Science Today is published by Horizon e-Publishing Group with support from Empirion Publishers Private Limited, Thiruvananthapuram, India.

© The Author(s) 2026. Creative Commons CC BY 4.0. Published by Horizon e-Publishing Group.

https://doi.org/10.14719/pst.15358