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Effect of different mulches on growth, yield and quality of tuberose (*Polianthes tuberosa* L.) var. Suvasini

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Abstract

An experiment was conducted at College of Horticulture, SDAU, Jagudan (Gujarat) during the period of April, 2022 to February 2023. The experiment included eight treatments viz. no mulch, black polythene, silver-black polythene, red-black polythene, mustard straw, castor shell, fennel straw and bishop's seed straw. The experiment was laid out in a Randomized Block Design and each treatment was replicated three times. The treatments were evaluated based on growth, yield and quality of tuberose. All the types of mulches, whether inorganic or organic, performed better than bare soil. The plots treated with bishop's seed straw mulch recorded maximum growth parameters and highest yield with better quality followed by fennel straw and black polythene mulch. No mulch recorded lowest value in all parameters during the investigation.

Keywords: Tuberose, mulch, organic mulches, inorganic mulch

Introduction

Tuberose (*Polianthes tuberosa* L.) is an important flower crop grown in India mainly for its beautiful and fragrant cut flowers as well as loose flowers. Tuberose belongs to the family Asparagaceae and is commonly known as *Rajanigandha* and *Nishigandha* [Vaid *et al.*, 2019] [14]. Tuberose is a native of Mexico and was introduced into India during the 16th century and its commercial cultivation is confirmed mainly in West Bengal, Karnataka, Tamil Nadu and Maharashtra [Barman *et al.*, 2015] [5]. It is one of the most popular bulbous ornamental plants of tropical and sub-tropical areas, producing attractive, elegant and fragrant white flowers. The long flower spikes are excellent for table decoration when arranged in bowls and vases. They emit a delightful fragrance and are the source of tuberose oil [Sultana *et al.*, 2018] [13]. Mulching is the process or practice of covering the soil/ground to make more favorable conditions for plant growth, development and efficient crop production. Mulch is a technical term meaning 'covering of soil' [Sikarwar *et al.*, 2021] [11]. Tuberose is known to be thermos-photo sensitive crop, so that temperature plays a vital role in crop production. [Amin *et al.*, 2015] [1]. Due to its long growing period, tuberose requires several irrigations; mulching helps in retaining moisture in the soil and sometimes even substitutes soil. Its vegetative growth, flower and bulb development are greatly influenced by the growing environment [Barman *et al.*, 2015] [5]. Mulching increases soil temperature and moisture, controls weeds besides improving the chemical and physical properties of soil, thereby improving the productivity of the crop. In the era of declining resources, there is a need to standardize precision farming technologies for farmers with the aim to enhance productivity and to reduce the water footprint per unit crop produced. Generally, crop residues or polythene mulch can be used as mulches in ornamental crops [Shinde *et al.*, 2021] [10].

Materials and Methods

The present investigation was carried out during the year 2022-23 at College Farm, College of Horticulture, SDAU, Jagudan, Gujarat. According to the agro-climatic situation, Jagudan is located in North Gujarat Agro Climatic Zone – IV. The soil of the experimental plot was loamy sand in texture with slightly alkaline reaction, low organic carbon and available nitrogen, medium available phosphorus and potassium. The pH of the soil is neutral and normal in salt content. Eight mulching treatments viz. no mulch, black polythene mulch, silver-black polythene mulch, red-black polythene mulch, mustard straw, castor shell, fennel straw and bishop's seed straw were evaluated with three replications in Randomized Block Design. The thickness of all polythene mulch was 50 μ while organic mulch was applied at 5 cm thick layer.

The experimental field was thoroughly prepared by two ploughing followed by harrowing before planting of tuberose bulb. The required quantity of FYM (25 t/ha), 50% of Nitrogen, full dose of Phosphorus and Potassium (200:200:2000 kg/ha) were incorporated in experimental plot during the land preparation and rest of 50% of nitrogen was applied in two splits at 30 and 60 days after planting. The raised bed plot size 1.5 m × 1.5 m was prepared and levelled properly. Then, healthy, disease free bulb of uniform size (3.0-3.5 cm diameter) was planted at 30 cm × 30 cm distance. Black, silver-black and red-black polythene film were prepared according to the size of the plot with small circular holes as per the spacing and spread over the plant and different organic mulches were applied around plant basin. Five plants were randomly selected from each experimental plot for recording observations on growth, flowering and quality parameters.

Results and Discussion

Effect of mulching on growth parameters

The vegetative growth parameters were significantly influenced by various type of polythene and organic mulches. Application of fennel straw mulch recorded maximum plant height and number of leaves at 45 days after planting (23.17 cm and 18.40 clump⁻¹, respectively) which was at par with T₈ and T₂. Whereas maximum plant height and number of leaves at 90 days after planting (52.67 cm and 62.70 clump⁻¹, respectively) were observed in bishop's seed straw mulch and at par with T₇ and T₂. The minimum was observed in no mulch during the all stage of growth. This may be due to decomposition of organic mulch that might add organic matter to the soil which helps to prevent soil from compactness and helps to retain oxygen and aeration, which is beneficial for stimulation of root growth, thereby improving the supply of sufficient quantity of water and nutrient to the plants. Moreover, mulching provides a favourable micro-climate for vegetative growth which resulted in vigorous and healthier plant (Soujanya *et al.*, 2022) [12]. Similar kind of observation reported by Amin *et al.* (2015) [11] and Mridul and

Choudhury (2017) [7] in tuberose; Sarmah *et al.* (2014) [9] in gerbera; Baladha *et al.* (2020) [4] in gladiolus; Sikarwar *et al.* (2021) [11] and Wagan *et al.* (2022) [16] in marigold.

Table 1: Effect of different mulches on growth parameters

Treatments	Plant height (cm)		Number of leaves per clump	
	45 Days	90 Days	45 Days	90 Days
T ₁	20.57	42.53	13.80	42.47
T ₂	21.52	48.33	17.07	56.47
T ₃	20.63	44.33	15.20	46.13
T ₄	20.23	44.07	14.07	45.40
T ₅	18.47	41.80	12.40	40.87
T ₆	20.50	43.07	16.40	52.93
T ₇	23.17	50.70	18.40	55.80
T ₈	22.13	52.67	17.33	62.70
S.Em±	0.73	1.57	0.57	2.01
CD at 5%	2.22	4.77	1.74	6.11
C.V.%	6.06	5.93	6.37	6.93

Effect of mulching on flowering characters

The data on different flowering characters showed significant difference in all the parameters (Table 2). The earliest emergence of spike (106.53 DAP) and opening of floret (125.40 DAP), maximum longevity of intact spike (20.60 days) and duration of flowering (181.13 days) observed in bishop's seed straw mulch, which being at par with T₇ and T₂ treatments. The spreading of mulches might be contributed to improve the physical, chemical and biological properties of the soil by optimizing soil temperature and soil moisture and hastened the decomposition of organic matter in soil, resulting in greater availability and uptake of nutrients as reflected through increased photosynthesis towards reproductive structure, which enhances flowering characters (Vamaja *et al.*, 2021) [15]. These finding are in consequence with the result of Mridul and Choudhury (2017) [7] in tuberose; Bohra *et al.* (2016) [6] in rose; Bajad *et al.* (2017) [3] in China aster; Annasamy *et al.* (2020) [2] in nerium and Shinde *et al.* (2021) [10] in marigold.

Table 2: Effect of different mulches on flowering characters

Treatments	Days taken for emergence of first spike	Days taken for opening of first florets	Longevity of spike
T ₁	123.73	22.13	16.80
T ₂	118.40	21.20	19.27
T ₃	122.40	22.07	18.07
T ₄	126.07	22.60	18.47
T ₅	131.33	22.93	15.80
T ₆	127.60	21.53	18.67
T ₇	111.53	20.07	19.87
T ₈	106.53	18.87	20.60
S.Em±	4.95	0.72	0.51
CD at 5%	15.01	2.18	1.55
C.V.%	7.09	5.81	4.80

Effect of mulching on yield attributes

The data presented in Table 3 revealed that all the yield attributes *i.e.*, number of florets per spike (52.80), weight of spike (155.50 g), number of spikes (57.33 plot⁻¹ and 707.82 thousand ha⁻¹), florets yield (3.37 kg plot⁻¹ and 41.60 t ha⁻¹) and number of harvestings of spike (6.13) and were significantly favoured by bishop's seed straw mulch over the bare soil plots, which being at par with T₇ and T₂. The data (Table 3) clearly indicated the application of various mulches was found statistically non-significant effect on weight of 100 florets.

This might be due to improved micro-climate both beneath and above the soil surface, which led to increased microbial activity in soil that improves the availability and uptake of nutrient by the plants, consequently, it promotes the plant growth and development in terms of both vegetative and reproductive, ultimately it enhanced the yield (Soujanya *et al.*, 2022) [12]. Results are in close agreement with the earlier finding of Prakash *et al.* (2011) [8], Mridul and Choudhury (2017) [7] and Vaid *et al.* (2019) [14] in tuberose; Younis *et al.* (2012) [17] in *Freesia* and Vamaja *et al.* (2021) [15] in chrysanthemum.

Table 3: Effect of mulching on yield attributes

Treatments	Number of florets per spike	Weight of spike (g)	Spike yield (number)		Florets yield		Weight of 100 florets (g)	Number of harvestings
			Plot ⁻¹	in '000 ha ⁻¹	kg plot ⁻¹	tonne ha ⁻¹		
T ₁	40.40	141.33	44.00	543.21	2.77	34.16	232.22	4.20
T ₂	52.67	161.87	56.00	691.36	3.35	41.30	236.11	4.87
T ₃	43.13	152.67	53.33	658.44	2.83	34.92	232.26	4.27
T ₄	42.40	143.00	49.33	609.05	2.77	34.16	232.96	4.33
T ₅	36.80	141.00	46.00	567.90	2.73	33.70	233.40	3.93
T ₆	42.13	152.00	52.00	641.98	3.13	38.64	233.08	4.60
T ₇	51.07	161.00	55.00	679.01	3.32	41.01	237.27	4.80
T ₈	52.80	163.67	56.33	695.47	3.37	41.60	237.42	5.13
S.Em±	1.01	1.44	1.58	19.54	0.04	0.53	2.68	0.14
CD at 5%	3.07	4.37	4.8	59.27	0.13	1.59	NS	0.43
C.V.%	3.88	1.64	5.23	5.32	2.43	2.43	1.98	5.46

Table 4 indicate that statistically significant differences were recorded for bulblets yield of tuberose with application of different mulches, the highest number of bulblets (25.93 clump⁻¹, 221.40 plot⁻¹ and 2733.33 thousand ha⁻¹) was recorded in treatment bishop's seed straw mulch, which was being at par with T₇ and T₂ treatments. Whereas, minimum yield was recorded in no mulch treatment.

Increased number of bulblets by mulches, may be due to optimum presence of available moisture and better absorption of nutrients which resulted in better vegetative growth, thus produced more photosynthate which is transferred to the developing bulblets. Similar in regard to bulblets yield due to different mulches was previously reported by Prakash *et al.* (2011)^[8] and Mridul and Choudhury (2017)^[7] and Sultana *et al.* (2018)^[13] in tuberose.

Table 4: Effect of different mulches on bulblets yield

Treatments	Number of bulblets		
	clump ⁻¹	plot ⁻¹	in '000 ha ⁻¹
T ₁	19.13	160.20	1977.78
T ₂	23.47	199.20	2459.26
T ₃	21.60	182.40	2251.85
T ₄	21.07	177.60	2192.59
T ₅	21.53	181.80	2244.44
T ₆	21.60	182.40	2251.85
T ₇	25.13	214.20	2644.44
T ₈	25.93	221.40	2733.33
S.Em±	1.16	10.46	129.19
CD at 5%	3.53	31.73	391.79
C.V.%	8.98	9.54	9.54

Effect of mulching on quality parameters

The different types of mulching materials significantly influenced the quality parameters of tuberose *viz.* spike length and rachis length. Among different mulching treatments, treatment T₈ (bishop's seed straw) resulted maximum spike length (80.60 cm) and rachis length (57.97 cm). Whereas various mulches were found non-significant effect on vase life. Application of mulches eliminates the weed competition with the prime crop, so it may lead to better quality flowering (Sarmah *et al.*, 2014)^[9]. Similar results were also observed by Prakash *et al.* (2011)^[8], Mridul and Choudhury (2017)^[7], Sultana *et al.* (2018)^[13] and Vaid *et al.* (2019)^[14] in tuberose; Vamaja *et al.* (2021)^[15] in chrysanthemum and Sikarwar *et al.* (2021)^[11] in marigold.

Table 5: Effect of mulching on quality parameters

Treatments	Spike length (cm)	Rachis length (cm)	Vase life (Days)
T ₁	66.83	45.93	8.67
T ₂	79.03	56.30	9.33
T ₃	67.93	46.77	8.67
T ₄	68.00	46.60	8.67
T ₅	61.73	43.27	9.00
T ₆	71.83	51.10	9.00
T ₇	76.27	53.47	9.33
T ₈	80.60	57.97	9.33
S.Em±	1.24	1.64	0.30
CD at 5%	3.76	4.97	NS
C.V.%	3.01	5.65	5.75

Summary and Conclusion

From the results of the present experiment, it can be concluded that both the inorganic and organic mulches have an impressive effect on crop production because of their properties like regulating soil temperature, improve soil properties and conserve soil moisture. Among them bishop's seed straw mulch enhances the vegetative growth, flowering and yield with better quality of tuberose var. Suvasini.

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