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DK Vasoya
Department of Floriculture and Landscape Architecture, S.D.A.U., Jagudan, Gujarat, India

MK Sharma
Assistant Professor, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India

PN Patel
Department of Floriculture and Landscape Architecture, S.D.A.U., Jagudan, Gujarat, India

VM Gohil
Department of Fruit Science, S.D.A.U., Jagudan, Gujarat, India

Corresponding Author:
DK Vasoya
Department of Floriculture and Landscape Architecture, S.D.A.U., Jagudan, Gujarat, India

Effect of different mulches on bulb yield and soil properties in tuberose (*Polianthes tuberosa* L.) var. Suvasini

DK Vasoya, MK Sharma, PN Patel and VM Gohil

Abstract
An experiment was conducted at College of Horticulture, SDAU, Jagudan (Gujarat) during the period of April, 2022 to February 2023 and employing a randomized block design with three replications and eight mulch treatments. These treatments included no mulch, black polythene film (50 µ), silver-black polythene film (50 µ), red-black polythene film (50 µ), mustard straw (2" thick layer), castor shell (2" thick layer), fennel straw (2" thick layer), and bishop's seed straw (2" thick layer). Seed bulbs are planted as per the recommended package of practice for the region. The impact of mulch materials on soil properties and bulb yield was significant compared to the control. Mulching with bishop's seed straw (2" thick layer) demonstrated the maximum organic carbon, available nitrogen and phosphorus, followed by fennel straw (2" thick layer). The same treatment also exhibited the maximum bulb yield of tuberose followed by fennel straw (2" thick layer) and black polythene film (50 µ).

Keywords: Mulches, bulb yield, soil, *Polianthes tuberosa* L.

Introduction
Tuberose is introduced in India during 16th century and cultivated commercially for its varied uses. Tuberose belongs to family Amaryllidaceae and botanically known as *polyanthus tuberosa*. Tuberose is a half-hardy, bulbous perennial plant. The leaves are long, narrow, linear, grass like and roots are adventitious. The flowers have a funnel shaped perianth, waxy white and are fragrant. There are three types of tuberose cultivars *viz.* single, semi-double and double. Double type hybrids are gaining importance for the purpose of cut flowers cultivation because of long flower spikes and florets are arranged in more than three rows which are bold, big, and white in colour and tinged with pinkish red. Tuberose is an important commercial crop in floriculture, it occupied a prime position because of its elegance and fragrance, popularity as cut flower, loose flower, as well as for its potential in perfume industry. The flowers are numerous, 4-6 cm long having funnel shaped perianth fragrant, waxy white and born in pair on erect leafy flower stalk called scape (Prakash *et al*., 2011) [6]. Technically, mulch means 'covering of soil'. While organic mulches such as straw, dead leaves and compost have been used for centuries but during the past 60 years, the beginning of artificial materials has modified the methods and advantages of mulching (Ahmad *et al*., 2011) [3]. The type of materials used as mulch and the time (cropping season) they are applied may determine its impact on soil physical and chemical properties and crop yield. This is due to the biochemical qualities of the plant materials. Soil fertility enhancement due to mulching can be attributed to the promotion of microbial activity and consequent enhancement of decomposition of organic material. Mulches can bring a lot of N and P to the soil and therefore reduce the need for other nutrient inputs. (Adekiya *et al*., 2017) [1].

Materials and Methods
The present experiment was conducted during the period from April, 2022 to February, 2023 to find out the influence of mulch on soil properties and bulb yield of tuberose at College Farm, College of Horticulture, SDAU, Jagudan, Gujarat. The experiment laid out in Randomized Block Design with three replications and consisting eight treatments *viz.* control (no mulching), black polythene mulch, Silver-black polythene mulch, Red-black polythene mulch, Mustard straw, Castor shell, Fennel straw and Bishop's seed straw. The thickness of all polythene mulch was 50 µ while organic mulch was applied at 5 cm thick layer. The bulbs were planted at 30 cm × 30 cm distance and after planting, mulching was done according to

treatments. Five plants were randomly selected from each plot for collection of bulb yield data. The soil of experimental field was having an even topography with a gentle slope and good drainage. The data presented in Table 1, indicated that the soil of experimental site is loamy sand in texture with slightly alkaline in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and potassium. The pH of the soil is neutral and normal in salt content.

Table 1: Physico-chemical properties of soil before planting

Characteristics		Value obtained
Mechanical analysis		
(a)	Sand (%)	79.57
(b)	Silt (%)	13.32
(c)	Clay (%)	06.50
(d)	Textural class	Loamy sand
Chemical analysis		
(a)	Soil pH (1:2 soil: water ratio)	7.82
(b)	Electrical conductivity (dSm^{-1}) (1:2 soil: water ratio)	0.22
(c)	Organic carbon (%)	0.25
(d)	Available N (kg ha^{-1})	170.00
(e)	Available P_2O_5 (kg ha^{-1})	30.25
(f)	Available K_2O (kg ha^{-1})	260.55

Results and Discussion

Effect of mulching on bulb yield

The results revealed that different types of mulching materials significantly influenced the bulb yield of tuberose. Analysis of data on number of bulblets per clump showed significant difference among the various mulches. The maximum number of bulblets per clump was counted with treatment T_8 (25.93) followed by T_7 (25.13) and T_2 (23.47) treatments. Similar results were earlier reported by Prakash *et al*. (2011) [6] and Sultana *et al*. (2018) [7] in tuberose. Result revealed that maximum number of bulblets per hectare was observed with treatment T_8, which being at par with T_7 and T_2. Similar in regard to bulblets yield due to different mulches was previously reported by Prakash *et al*. (2011) [6] and Mridul and Choudhury (2017) [5] in tuberose. The same treatment also exhibited the maximum weight and diameter of mother bulb followed by fennel straw (2" thick layer) and black polythene film (50 µ).

Table 2: Effect of different mulches on bulb yield

Treatments	Number of bulblets per clump	Bulblets yield per hectare '000 (Number)	Weight of mother bulb	Diameter of mother bulb
T_1	19.13	1977.78	71.50	4.49
T_2	23.47	2459.26	87.53	4.74
T_3	21.60	2251.85	72.67	4.45
T_4	21.07	2192.59	81.79	4.45
T_5	21.53	2244.44	78.30	4.28
T_6	21.60	2251.85	78.00	4.55
T_7	25.13	2644.44	89.20	4.75
T_8	25.93	2733.33	88.90	4.61
S.Em±	1.16	129.19	2.17	0.11
CD at 5 %	3.53	391.79	6.58	0.33
C.V.%	8.98	9.54	4.54	4.02

Soil fertility status at after bulb harvest

The different chemical constituents were determined in the composite soil sample and the initial fertility status of experimental field soil is given in Table 1, indicated that the soil of experiment site is loamy sand in texture with slightly alkaline in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and potassium. Different mulching treatments had significant effect on organic carbon, available nitrogen and phosphorus content of soil. The mean maximum soil organic carbon at harvest (0.29%) was observed in bishop's seed straw mulch (T_8), which was at par with T_7, T_5 and T_6 (0.28%, 0.27% and 0.26%, respectively). The minimum soil organic carbon at harvest (0.22%) was observed with control (T_1), which being at par with T_3 (0.23%), T_2 (0.24%) and T_4 (0.24%). The maximum available nitrogen (182.33 kg ha^{-1}) was observed in bishop's seed straw mulch, which was being at par with T_7, T_5 and T_6 (179.23 kg ha^{-1}, 178.67 kg ha^{-1} and 177.93 kg ha^{-1}, respectively). The data pertaining to available phosphorus as influenced by various mulching treatments was found significant. The maximum available phosphorus (38.79 kg ha^{-1}) was observed with treatment T_8, which was at par with T_7, T_5 and T_6 (38.19 kg ha^{-1}, 37.79 kg ha^{-1} and 36.67 kg ha^{-1}, respectively), while it was minimum with treatment T_1 (29.46 kg ha^{-1}). The application of organic mulches on experimental field might be improves soil fertility by adding organic carbon and releasing nitrogen and phosphorus after decomposition. Similar results were observed by Agele *et al.* (2010) [2] in sunflower. The influence of different mulches treatments on available potassium at after bulb harvest was found to be non-significant

Table 3: Effect of different mulches on soil fertility at after bulb harvest

Treatments	OC (%)	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})
T_1	0.22	162.07	29.46	259.40
T_2	0.24	168.30	34.00	261.13
T_3	0.23	165.68	34.34	262.73
T_4	0.24	168.83	32.99	263.47
T_5	0.26	178.67	37.79	268.10
T_6	0.27	177.93	36.67	268.63
T_7	0.28	179.23	38.19	270.47
T_8	0.29	182.33	38.79	271.40
S.Em±	0.01	3.62	0.98	6.32
CD at 5 %	0.02	10.99	2.97	NS
C.V.%	4.22	3.63	4.80	4.12

Conclusion

This study provides farmers with a cost-effective selection of mulching practices, aiding in the management of spice crop residues and promoting the commercial cultivation of tuberose in the future.

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