Rai University AHMEDABAD
RISING - A Journal of Researchers
Bi-Annuals Peer Review Journal
Vol.9 Issue 1 (Jan 2025)
Impact Factor : 5.999
RISING A journal of researchers
ISSN No : 2456-7752

IMPROVING SOIL PROPERTIES AND GROWTH OF TUBEROSE (POLIANTHES TUBEROSA L.) THROUGH THE APPLICATION OF ORGANIC MULCHES

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ABSTRACT:

Mulch is an extraneous material which covers the soil. Mulching is a horticultural practice that involves covering the soil surface with organic or synthetic materials to provide more favourable environment for plant growth and production. Mulches enhance plant growth by conserving moisture, regulating soil temperature and reducing weed competition. Additionally, they improve soil properties by enriching organic matter, promoting nutrient availability and enhancing soil structure. An experiment employing a randomized block design with three replications and eight mulch treatments was conducted. 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

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 belong to family Asparagaceae and commonly known as Rajanigandha and Nishigandha [Vaid et al., 2019]. Tuberose is a native to Mexico and introduced in India during the 16th century and the commercial cultivation is confirm mainly to West Bengal, Karnataka, Tamil Nadu and Maharashtra [Barman et al.,2015]. It is one of the most popular bulbous ornamental plants of tropical and sub-tropical areas, produced attractive, elegant and fragrant white flower. The long flower spikes are excellent for table decoration when arranged in bowls and vases. Emit a delightful fragrance and are the source of tuberose oil [Sultana et al., 2018]. 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 technical term means 'covering of soil' [Sikarwar et al., 2021]. Tuberose is known to be thermos-photo sensitive crop, so that the temperature plays a vital role in crop production. [Amin et al., 2015]. Due to long growing period tuberose required several irrigations, mulching helps to retaining moisture on the soil and sometimes even substitutes soil. Its vegetative growth, flower and bulb development are greatly influenced by growing environment [Barman et al., 2015]. Mulching increases the soil temperature and moisture, control 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 need to standardize precision farming technologies for farmers with aim to enhance the productivity and to reduce water foot print per unit crop produce. Generally, crop residues or polythene mulch can used as mulches in ornamental crops [Shinde et al., 2021].

MATERIAL AND METHODS:

The present investigation was carried out during the year 2022-23 at College Farm, College of Horticulture, SDAU, Jagudan, Gujarat. According to agro-climatic situation, Jagudan is placed in North Gujarat Agro Climatic Zone – IV. The soil of the experimental plot was 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. Eight mulching treatment 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, parameters. 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 P2O5 (kg ha-1)	30.25
f)	Available K2O (kg ha-1)	30.25

Results and Discussion

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 (T8), which was at par with T7, T5 and T6 (0.28%, 0.27% and 0.26%, respectively). The minimum soil organic carbon at harvest (0.22%) was observed with control (T1), which being at par with T3 (0.23%), T2 (0.24%) and T4 (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 T7, T5 and T6 (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 ha1) was observed with treatment T8, which was at par with T7, T5 and T6 (38.19 kg ha-1 , 37.79 kg ha-1 and 36.67 kg ha-1 , respectively), while it was minimum with treatment T1 (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 2: Effect of different mulches on soil fertility at after bulb harvest

Treatments	OC (%)	Available N (kg ha-1)	Available P2O5 (kg ha-1)	Available K2O (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

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). Similar kind of observation reported by Amin et al. (2015) and Mridul and Choudhury (2017) in tuberose, Sarmah et al. (2014) in gerbera, Baladha et al. (2020) in gladiolus, Sikarwar et al. (2021) and Wagan et al. (2022) in marigold.

Table 3: 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

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 of tuberose var. Suvasini. It also help to 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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