

Original Research Article

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Effect of Different Mulches on Conservation of Soil Moisture, Growth, Yield and Quality of Tomato (*Solanum lycopersicum L.*) cv. Kashi Amrit

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ABSTRACT

Keywords

Black polythene,
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The present investigation was carried out during winter season of 2018-19 at Experimental Farm, Department of Horticulture, Udai Pratap Autonomous College, Varanasi (U.P.) in Randomized Block Design with three replications. Different mulching material such as Black polythene, White polythene, Sugarcane leaves, Mango leaves, Paddy straw and Wheat straw with control were used as treatment. Observations were recorded on soil moisture, soil temperature, vegetative, reproductive, yield and quality related parameters. On the basis of recorded observations, it is found that the performance of the T₄ (Black polythene of 200 gauge) was better in soil moisture parameter 14.04%, soil temperature 22.85°C and also all growth parameters such as plant height (35.04, 68.35 and 79.97 cm), number of branches per plant (7.50), diameter of main stem (0.88, 1.85 and 1.88 cm) at 45, 60 and 75 DAT, reproductive parameter such as number of flower per cluster (9.80, 9.70, 9.40), number of fruit per plant (6.60, 7.20 and 6.80), yield parameter viz. diameter of tomato (3.0 cm), weight of tomato (114.30g), yield of tomato kg / plot (17.20 kg) yield of tomato q / ha (353.90 q) and quality parameter such as total soluble solids (4.57 brix), ascorbic acid mg/100g fresh weight (33.40 mg) showed highly significant performance. The treatment T₄ (Black polythene of 200 gauge) performed as the best mulching material for growth, reproductive, yield and quality characters for commercial production of Tomato followed by T₂ (Clear polythene mulch 50µ) is considered as the another best mulching material.

Introduction

Tomato (*Solanum lycopersicum*, L) belongs to the solanaceae family and chromosome no. is 2n= 2x=24. It is introduced in India by Portuguese and It is originated in Peru and Mexico, from where it spread to other parts of the world. It is considered as “poors man orange” in India while “Love of apple” in England. Tomato world’s largest vegetable crop cultivated after potato and sweet potato

and universally treated as a protective food 33% of total growing area is covered by F1 hybrid which is highest among the vegetable grown in India.

Tomato crop is very important in terms of diet and economy both during the rainy season (rainfed) and dry season using irrigation facilities. It is grown as an off season vegetable in hills of India and farmers fetch good income after sending there produce in

the plains from June to September. Large quantities of tomato are used to prepare soup, juice, ketchup, puree, pickle paste and powder. Tomato has outstanding vitamin contents like Ascorbic acid (vitamin c), vitamin A, thiamine and riboflavin.

Different types of mulch used in the experimental field for different benefits. Such as Dried sugarcane leaf mulch used for temperature and extensive weed growth during summer, mulch for moisture conservation and suppression of weed is highly useful in tomato cultivation with application of dried sugarcane leaf mulch. It collected and spread 7.5cm to 10cm layer over the all plot of each replication and about 10 tonnes of sugarcane trash per hectare is required. Clear polythene mulch of 50 μ reduced whitefly populations, aphids caught in yellow traps and virus diseases incidence, in comparison to bare soil.

The reflective plastic mulches can reduce the incidence of aphid-borne viruses and exclude some species of pest (Saroa and Lal, 2003). Owing to its greater permeability to long wave radiation it can increase temperature around the plants during night in winter.

Paddy straw mulch use in bare soil exposed to heat, wind and compaction loses water through evaporation and is less able to absorb irrigation or rainfall. Under this treatment, the respective sub plots of all the application were thoroughly covered with 8cm layer of paddy straw. Black polythene mulch of 200 gauge is usually restricted to perennial crops. Various colours of woven and solid film plastics have been tested for weed control in the field (Hundal, *et al.*, 2000).

Dried mango leaf used as mulch reduces runoff, evaporation soil in coastal area. Dried leaves were collected and the respective sub-plot of all the replication was thoroughly covered with 8cm thick layer of dried mango leaf.

Wheat straw is one of the best mulch material can be use around the vegetable plants. It's clean, light and break down relatively high, giving plants what they need to grow easily. It is collected after dried and applied on plot at 3 to 6 inches (7.5 to 15cm) layer. Keep the straw away from the leaves and stems of the plants, as it may spread fungus and bacteria to the plant.

Materials and Methods

The experimental material for the present investigation was comprised of a standard variety 'kashi amrit' and treated with different mulching material viz. Black polythene, Clear polythene, Mango leaves, Sugarcane leaves, Paddy straw and Wheat straw at different interval land replicated thrice in Randomized Block Design.

The experiment was carried out at Experimental Farm, Department of Horticulture, Udai Pratap College, Varanasi (U.P.), during *Rabi* season of 2018-19.

During study, observations for growth parameters such as Plant height (cm), Number of branches per plant, Diameter of main (cm), reproductive parameters like Number of flowers per plant, Number of fruits per plant, yield parameters and quality parameter were recorded on five randomly selected plants from each treatment.

The different treatments used are T₁ (Dried sugarcane leaves 8cm thickness), T₂ (Clear polythene mulch 50 μ), T₃ (Paddy straw 8cm thickness), T₄ (Black polythene of 200 gauge), T₅ (Wheat straw 8cm thickness), T₆ (Mango leaves 8cm thickness), T₇ (Control). The data recorded from experiment for fifteen characters in Tomato cv. 'kashi amrit' with different treatments was subjected to the statistical analysis as per procedure described by Gomez and Gomez (1984).

The significance of the treatments was tested through F-test at 5% and 2% level of significance. Whereas, the mean analysis was done after testing the significance of the variance ratio of error mean squares.

Results and Discussion

Average soil moisture at 15 cm, 30 cm and 45 cm depths were 9.14 %, 11.33 % and 11.92 %, While, the minimum soil moisture content 7.76cm, 10.29cm and 10.59cm were recorded under the treatment T₇ (control) at 15, 60 and 75 DAT, respectively.

Black polythene mulch play an important role in conservation of soil moisture, it reduce light penetration in the soil, weed cannot survive under such mulch. Klar and Jadoski (2004) reported that water use efficiency was found to be higher (169 L/Kg fruit) in mulched treatments as compared to treatments without mulched (140 L/kg fruit) in humid climate zone under a protected environment.

Palada *et al.*, (2003) concluded that the high yield and the water use efficiency of fruit vegetables like cucumber, bell paper and tomato grown in plastic bags and gross straw mulch resulted in 33-52% more efficient than of irrigation water in this crops compared to bare soil.

The significantly maximum soil temperature 22.85°C were found in treatment T₄ (Black polythene of 200 gauge) at 15, 30, and 45 DAT followed by 21.55°C were observed in treatment T₂ (Clear polythene mulch 50µ) at 15 45, and 75 DAT as compare to other treatments.

Beside the inorganic mulches dry sugarcane leaf mulch gives higher result 21.33°C among the organic mulch. Bhardwaj *et al.*, (2011) studied that Mulching provide a favorable environment for growth which result in more

vigorous, healthier plant for growth which may be more resistant to plant injury.

Dickerson (2012) reported that earlier plant growth and earlier crop production are two of the primary benefits of using silver reflective and black plastic mulches.

Earlier crop production generally results in higher market prices and have yield black plastic mulch can accelerate crop production as much as one to two weeks.

The application of Treatment T₄ (Black polythene of 200 gauge) was showed the maximum plant height, number of branches, Diameter of main stem, Number of flower, Number of fruit, Yield per plot and Yield per hectare significantly.

The use of Black polythene in comparison to other mulching material significantly improves the growth and yield of Tomato crop with recommended dose of nutrients.

The quality of tomato crop also increased with the application of mulching practices. Black polythene conserves maximum soil moisture for proper plant growth and development as well as soil temperature for seed germination with Treatment T₄.

Similar types of results are recorded in various crops likes brinjal, chilli, chick pea, moringa okra carrot water melon, musk melon etc. by various researchers likes Erenstein (2002), Klar and Jadoski (2004), Awasthi *et al.*(2006), Onder *et al.*, (2006), Moreno *et al.*, (2006), Dickerson (2012), Gupta *et al.*, (2013), Sahariar *et al.*, (2015).

The mulch material Black polythene was showed very well effect on tomato diameter, tomato weight and yield of tomato respectively (Fig. 1–15 and Table 1–3).

Table.1 Effect of different mulches on growth characters of tomato crop

Treatments	Plant height (cm)			Number of branches/plant	Main stem diameter (cm)			Number of flower/plant			Number of fruit/plant		
	45 DAT	60 DAT	75 DAT	Mean	45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT	45 DAT	60 DAT	75 DAT
T ₁	34.81	64.92	77.67	6.60	0.84	1.77	1.79	8.60	9.10	8.20	5.30	6.20	5.00
T ₂	34.94	65.95	78.45	7.10	0.86	1.79	1.87	9.40	9.50	8.80	5.90	6.70	6.50
T ₃	32.10	63.97	76.60	6.20	0.83	1.63	1.75	7.60	8.80	7.60	4.70	6.30	4.90
T ₄	35.04	68.35	79.95	7.50	0.88	1.85	1.88	9.80	9.70	9.40	6.60	7.20	6.80
T ₅	34.20	60.55	75.20	5.70	0.82	1.58	1.74	7.70	8.40	6.40	4.50	5.30	4.80
T ₆	33.76	59.30	69.80	5.20	0.73	1.56	1.68	7.50	7.60	6.20	4.10	5.10	4.50
T ₇	32.53	57.90	66.94	4.53	0.71	1.43	1.52	5.40	5.60	4.93	1.70	4.90	3.80
SEm ±	0.264	0.645	0.735	0.036	0.002	0.008	0.001	0.113	0.178	0.069	0.045	0.070	0.038
CD (P=0.05)	0.813	1.986	2.264	0.110	0.007	0.024	0.004	0.410	0.548	0.213	0.140	0.216	0.117

Table.2 Effect of different mulches on yield and quality characters of tomato crop

Treatments	Tomato diameter (cm)	Tomato weight (g)	Yield/plot (kg)	Yield/ha (q)	TSS(°Brix)	Ascorbic acid (mg/100g fresh wt.)
T ₁	2.60	104.70	15.66	322.22	4.00	32.30
T ₂	2.90	109.60	16.53	340.12	4.40	32.60
T ₃	2.40	97.36	14.90	306.58	3.70	30.70
T ₄	3.00	114.30	17.20	353.90	4.57	33.40
T ₅	2.10	92.40	14.46	297.53	3.60	29.30
T ₆	1.90	88.80	12.60	259.25	3.32	28.83
T ₇	1.50	73.53	7.60	156.37	3.10	23.30
SEm ±	0.022	0.676	0.210	4.324	0.046	0.206
CD (P=0.05)	0.067	2.084	0.648	13.472	0.142	0.636

Table.3 Effect of different mulches on quality of tomato crop, soil moisture and soil temperature

Treatments	Lycopene content (mg/100g)	Dry matter (%)	Soil moisture (%)	Soil temperature (°C)
T ₁	7.10	7.10	12.237	21.33
T ₂	7.30	7.30	12.600	21.55
T ₃	6.80	6.56	10.717	20.37
T ₄	7.60	7.60	14.040	22.85
T ₅	6.56	6.86	11.250	20.52
T ₆	6.30	6.30	10.920	20.39
T ₇	6.10	6.10	09.540	19.58
SEm ±	0.222	0.155	0.2712	0.2253
CD (P=0.05)	0.683	0.477	0.8358	0.6941

Fig Graphical representation of effect of different mulches on soil moisture, soil temperature, growth, reproductive, yield and quality characters of tomato cv. Kashiamrit

Fig.- 1

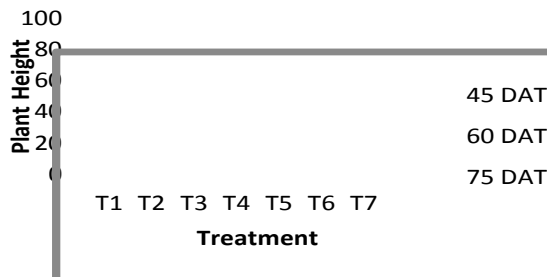


Fig.- 2

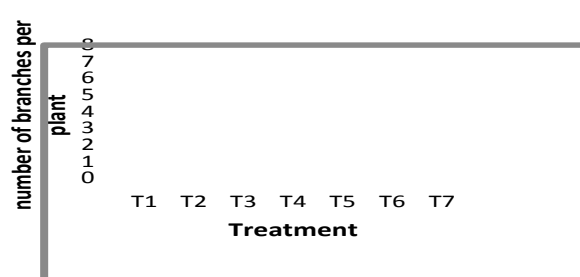


Fig.- 3

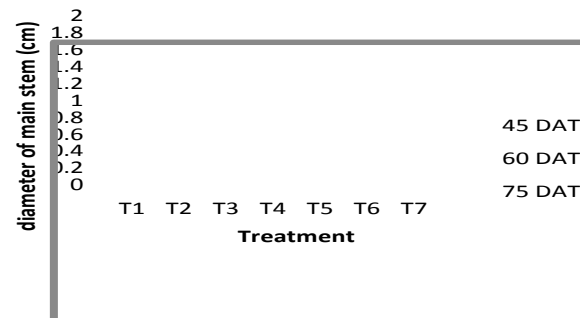


Fig.- 4

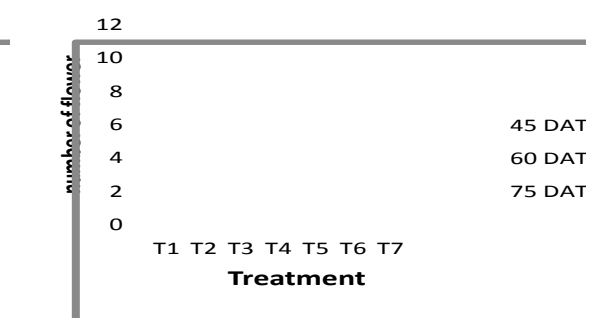


Fig.- 5



Fig.- 6

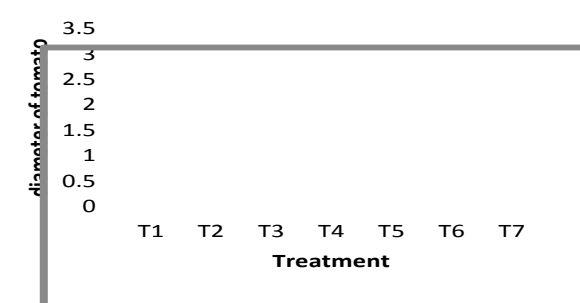


Fig.- 7

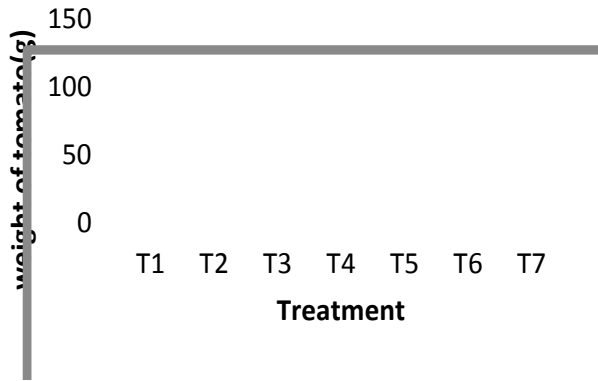


Fig.- 8

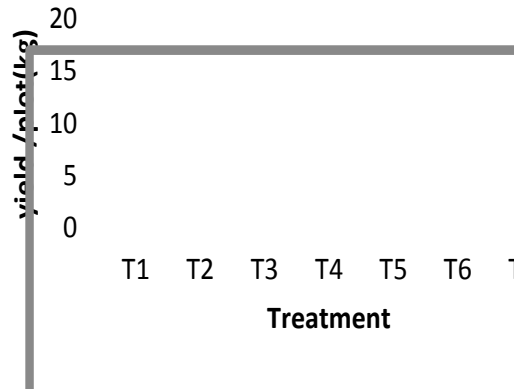


Fig.- 9

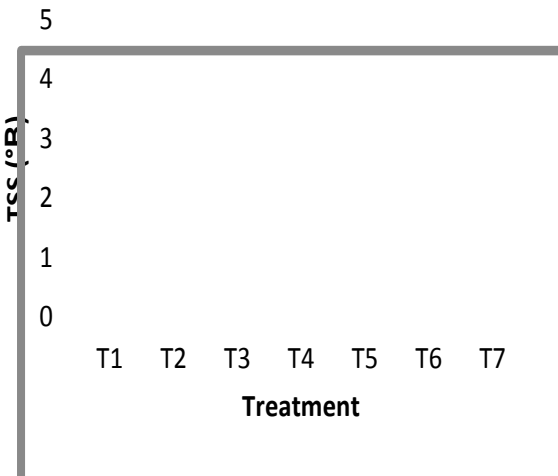


Fig.10

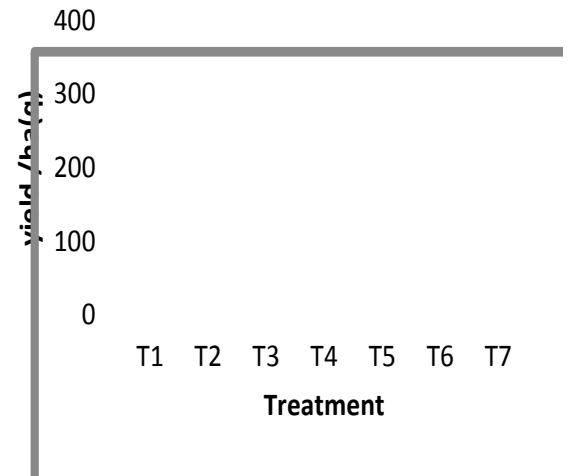


Fig.-11

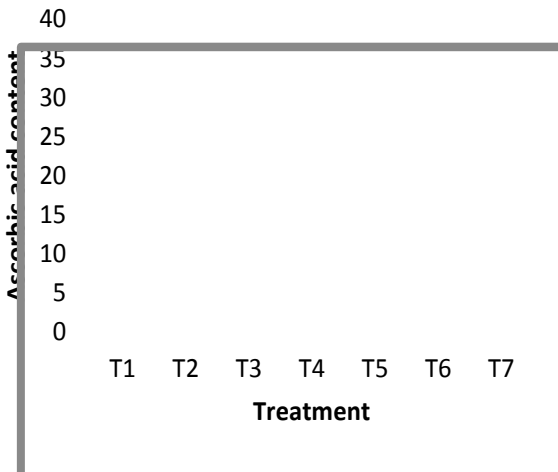


Fig.-12

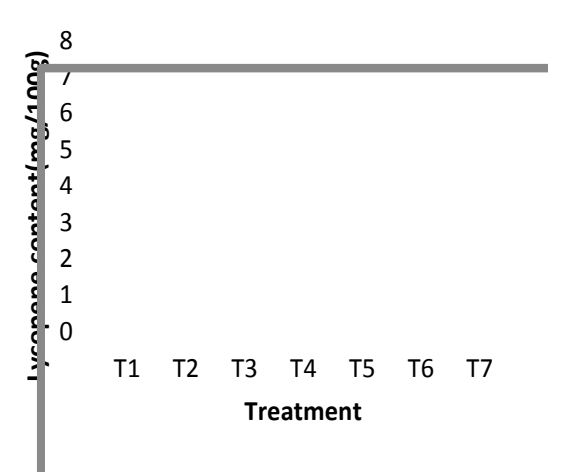


Fig.-13

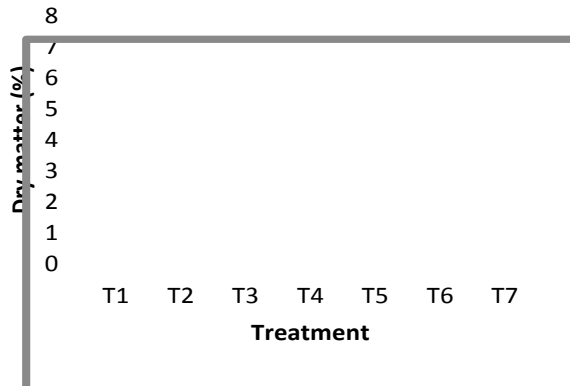


Fig.14

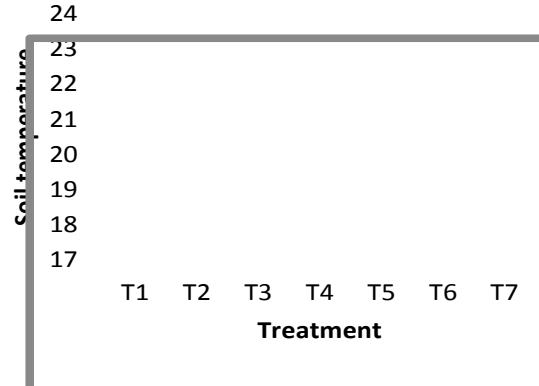
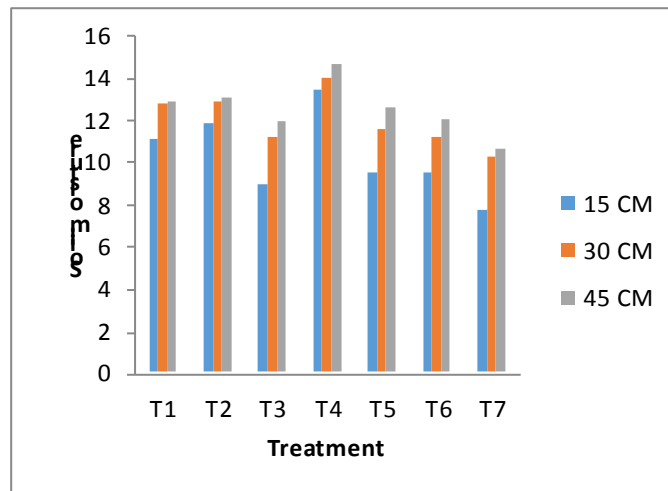


Fig.15



The maximum tomato diameter, tomato weight and tomato yield were reported with the application of treatment T₄ (Black polythene of 200 gauge). Simultaneous types of results are also found in different crops by various researchers likes Kalaghatagi *et al.*, (1990), Sahariar *et al.*, (2015), thus it can be concluded that there are ample variation exist among the different treatments under study which reflects the great opportunity for improving yield, quality as well as quantity with different mulches in Tomato.

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