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EFFECTS OF MULCHES ON FLOWERING, FRUITING, YIELD AND PEST - DISEASE INCIDENCE OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

P. D. BHUJBAL[1], T. B. TAMBE[2] AND P. H. ULEMALE[*3]
[1]SVGI College of Horticulture, Jalgaon (Jamod) Buldhana - 443 402 (Maharashtra), INDIA
[2]Fruit Research Centre Himayat Baug, Delhi Gate, Aurangabad - 431 001 (Maharashtra), INDIA
[3]Department of Horticulture, PGI, Dr. PDKV, Akola - 444 104 (Maharashtra), INDIA
e-mail: pulemale@yahoo.in

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***Corresponding author**

ABSTRACT
The experiment was carried out at College of Agriculture, Latur. These sought to study the effects of different types of mulches on flowering, fruiting, yield and incidence of pest and diseases of tomato. (*Lycopersicon esculentum* Mill.) Var. Dhanashree. The flowering and fruiting attributes like lowest number of days for initiation of flowering of tomato (30.40 days), maximum number of flowers per plant (39.86), minimum number of days to first picking of tomato (83.40 days), maximum per cent of fruit set (70.36 %) and minimum per cent of fruit drop (12.51 %) was observed in treatment black colour on silver polythene mulch treatment. The yield attributes like maximum number of fruits per plant (26.66), maximum weight of fruit (72.40 g), maximum volume of fruit (77.33 ml), maximum yield of tomato (1.63 kg/plant) and (60.61 Mt/ha) and the pest-disease attributes like minimum leaf curl incidence (6.43 %), minimum spotted wilt incidence (2.26 %), minimum incidence of late blight (6.61 %) and minimum fruit borer incidence (5.06 %) was observed in black colour on silver polythene mulch treatment.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the world's most popular vegetable crops and is available round the year. The total area under tomato cultivation in India is 880 (000'ha) with annual production of 18227(000'Mt) and productivity of 20.7 Mt/ha (Annony, 2013). Inspite of its wide cultivation, the average yield is rather low because little attention is paid towards scientific methods of production. In Marathwada region of Maharashtra state, cold winter is the main hindrance for planting tomato in winter to get early spring crop. Therefore, there was an urgent need to develop proper technology for getting early yield and consequently higher profits. Under such circumstances, use of mulches has been found beneficial (Hooda *et al.*, 1999). Surface-applied mulches provide several benefits to crop production through improving soil moisture content, regulating soil temperature, improving nutrient status in soil, preventing soil and water loss, and weed control (Bu *et al.*, 2002). Mulches may be composed of plant materials or they may be synthetic mulches consisting of plastic sheets (Anonymous, 2000). They also observed that mechanical furrow mulching decreased runoff, increased infiltration, increased irrigation efficiency, and decreased sediment load. Mulching was reported to have effect on growth characteristics such as height and girth. Significant increase in plant height and plant girth was observed when mechanical loosening of soil was used as mulching treatment (Chaudhry *et al.*, 2004).

However, little information is available regarding different types of mulches used to increase flowering, fruiting, yield and incidence of pest and diseases of tomato. Such knowledge is needed for developing new strategies for early production of tomato. Therefore, the present experiment was conducted to study the effects of different types of mulches on flowering, fruiting, yield and incidence of pest and diseases of tomato.

MATERIALS AND METHODS

A field experiment was conducted during winter season of 2010-11 at Instructional cum Research Farm, Department of Horticulture, College of Agriculture, Latur (M.S.). Treatments consisted of eight mulch materials, *viz.* T1 i.e. black colour on silver polythene mulch (BSPM) (25 microns); T2 i.e. silver colour on black polythene mulch (SBPM) (25 microns); T3 i.e. transparent polythene mulch (TPM) (30 microns); T4 i.e. blue polythene mulch (BPM) (30 microns); T5 i.e. sugarcane trash mulch (STM) (10 cm thickness); T6 i.e. soybean straw mulch (STM) (10 cm thickness); T7 i.e. dry grass mulch (DGM) (10 cm thickness) and T8 i.e. no mulch (control). The experiment was laid out in randomized block design and replicated thrice. Transplanting of tomato var. Dhanashree was done as per treatment at spacing of 60x45 cm. Fertilizers were applied by method of fertigation. The mulches were spread manually and holes of 5 cm diameter were made on the polythene films for planting. Data was recorded for days required for initiation of flowering was recorded by counting the days from trans-

planting to occurrence of flowering. Number of flowers per plant was recorded by counting the number of flowers of plant. Days to first picking was recorded by counting the days from fruit setting to fruit maturity. Number of fruits per plant was counting by the fruits at each harvest. Weight of fruit measured on a pan balance Volume of fruit was determined by using measuring cylinder and it was calculated by following formula given by Mazumdar and Majumder (2003). For recording the fruit set on observational plants, the number of flowers born on each tagged shoots and number of fruit set on same shoot counted and calculated, fruit drop calculated in percentage by using flower per shoot, fruit set and final retention of fruit on plant. Naturally, dropped fruits were collected, counted. Yield per plant was calculated by the fruits at each harvest and weighed for each tree on a pan balance and yield per hectare was calculated by following formula. Yield per ha (MT) = yield per tree (kg) x no. of trees per ha /1000. Incidence of pest-disease were calculated by number of affected plants divided by total number of plants per treatment into hundred. The data was analyzed by the method advocated by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Among different mulching treatments, polythene mulches *viz*. black colour on silver polythene mulch, silver colour on black polythene mulch and transparent polythene mulch were able to increase flowering, fruiting, yield and decrease incidence of pest-disease parameter significantly as compared to organic mulches *viz*.dry grass mulch, soybean straw mulch and control.

Effect on flowering and fruiting

The statistically analyzed data on flowering and fruiting attributes of tomato is presented in Table 1. The significantly lowest number of days for initiation of flowering of tomato (30.40 days) and maximum number of flowers per plant (39.86) was observed in treatment T_1 *i.e.* black colour on silver polythene mulch. This was followed by treatments T_2 *i.e.* silver colour on black polythene mulch and T_3 *i.e.* transparent polythene mulch with respect to number of days for initiation of flowering (33.26 days and 34.73 days, respectively) and number of flowers per plant (37.66 and 36.13, respectively). Minimum number of days to first picking of tomato (83.40 days), maximum per cent of fruit set (70.36 %) and minimum per cent of fruit drop (12.51 %) was observed in treatment T_1 i.e. black colour on silver polythene mulch. This was followed by treatments T_2 *i.e.* silver colour on black polythene mulch and T_3 i.e. transparent polythene mulch with respect to number of days to first picking (83.66 days and 84.53 days, respectively), fruit set percentage (66.93 % and 62.49 %, respectively) and fruit drop percentage (15.98 % and 16.26 %, respectively).

The beneficial effect of black polythene mulches as compared to other mulch material might be due to higher soil temperature and more availability of moisture. The increased soil temperature under plastic beds had enhanced the plant growth and development which has led to early flowering. As black colour absorbs more solar radiation; maximum temperature was recorded under black polythene mulch. Hence plants took minimum days to flowering. These findings are in agreement with those of Igbal *et al*. (2009), Parmar *et al*. (2013) and Hooda *et al*. (1999). Black polythene mulch had least competition from weeds as higher temperature under black polythene mulch affected weed growth adversely and uniform moisture conservation throughout the growing season might be responsible for better performance leading to higher flowering and fruiting. These findings are in agreement with those of Gudugi *et al*. (2012). Sannigrahi and Borah (2002). The earliest fruit maturity under black polythene mulch was due to better growth of plants, as a result of high soil temperature and moisture which helped in early flowering, fruiting and fruit ripening. These findings are in agreement with those of Pierce and Crispi (1989) and Decoteau *et.al*. (1989).The highest soil temperature under black polythene mulch which improved the plant micro-climate, thus helping in maximum plant growth and fruit setting in tomato. These findings are in agreement with those of Singh *et al*. (2005) and Chakraborty and Sadhu (1994).

Effect on yield and yield contribution characters

The statistically analyzed data on yield attributes is presented in Table 2. The significantly maximum number of fruits per plant (26.66), maximum weight (72.40 g), volume (77.33 ml) of fruit, maximum yield per plant of tomato (1.63 kg) and maximum yield per hectare (60.61 Mt/ha) was observed in treatment T_1 *i.e.* black colour on silver polythene mulch. This was followed by treatments T_2 *i.e.* silver colour on black polythene mulch and T_3 *i.e.* transparent polythene mulch with respect to number of fruits per plant (22.93 and 20.53, respectively), weight (69.59 g and 67.94 g, respectively) and volume (74.19 mL and 72.50 ml, respectively) of fruit, yield per plant (1.50 kg and 1.40 kg, respectively) and yield per

Table 1: Effect of different types of mulches on flowering and fruiting of tomato.

Treatment	Type of mulch	Days to flowering	Number of flowers per plant	Days to first picking	Fruit set (%)	Fruit drop (%)
T_1	BSPM	30.40	39.86	83.40	70.36	12.51
T_2	SBPM	33.26	37.66	83.66	66.93	15.98
T_3	TPM	34.73	36.13	84.53	62.49	16.26
T_4	BPM	37.33	34.66	85.46	59.24	17.47
T_5	STM	36.13	35.00	84.93	59.74	16.39
T_6	SSM	37.93	33.53	86.20	58.05	18.12
T_7	DGM	39.33	31.33	86.60	54.61	20.05
T_8	Control	41.46	28.73	88.06	52.53	22.99
SE		0.24	0.32	0.11	0.96	1.90
CD at 5%		0.74	0.97	0.36	2.90	NS

T_1: BSPM- Black colour on silver polythene mulch; T_2: SBPM- Silver colour on black polythene mulch; T_3: TPM- Transparent polythene mulch ; T_4: BPM- Blue polythene mulch ; T_5: STM- Sugarcane trash mulch; T_6: SSM- Soybean straw mulch; T_7: DGM- Dry grass mulch T_8: Control- No mulch

Table 2: Effect of different types of mulches on yield and yield contribution characters of tomato.

Treatment	Type of mulch	Number of fruits per plant	Weight of fruit (g)	Volume of fruit (ml)	Yieldper plant (kg)	Yield per hectare(Mt/ha)
T_1	BSPM	26.66	72.40	77.33	1.63	60.61
T_2	SBPM	22.93	69.59	74.19	1.50	55.79
T_3	TPM	20.53	67.94	72.50	1.40	55.09
T_4	BPM	19.20	65.91	70.23	1.17	45.33
T_5	STM	20.33	67.85	72.41	1.32	48.80
T_6	SSM	18.33	63.25	67.45	1.02	43.35
T_7	DGM	16.46	61.78	66.49	0.95	41.97
T_8	Control	14.53	58.05	62.39	0.88	40.59
SE		0.35	0.40	0.48	0.08	0.37
CD at 5%		1.08	1.23	1.46	0.02	1.14

T_1:BSPM- Black colour on silver polythene mulch; T_2:SBPM- Silver colour on black polythene mulch; T_3:TPM- Transparent polythene mulch ; T_4:BPM- Blue polythene mulch; T_5:STM- Sugarcane trash mulch; T_6:SSM- Soybean straw mulch; T_7:DGM- Dry grass mulch T_8: Control- No mulch

Table 3: Effect of different types of mulches on pest-diseases incidence of tomato.

Treatment	Type of mulch	Fruit borer incidence (%)	Leaf curl incidence (%)	Spotted wilt incidence (%)	Late blight incidence (%)
T_1	BSPM	5.06	6.43	2.26	6.61
T_2	SBPM	5.54	6.90	2.50	9.19
T_3	TPM	9.86	7.14	2.98	10.17
T_4	BPM	12.39	7.41	3.35	11.20
T_5	STM	10.47	7.33	3.17	10.41
T_6	SSM	13.32	7.51	3.53	11.54
T_7	DGM	13.54	7.53	3.60	11.90
T_8	Control	15.52	7.80	4.66	12.92
SE		0.05	0.46	0.20	1.20
CD at 5%		0.16	NS	0.61	NS

T_1:BSPM- Black colour on silver polythene mulch; T_2:SBPM- Silver colour on black polythene mulch; T_3:TPM- Transparent polythene mulch;T_4:BPM- Blue polythene mulch; T_5:STM- Sugarcane trash mulch ; T_6:SSM- Soybean straw mulch; T_7:DGM- Dry grass mulch T_8: Control- No mulch

hectare (55.79 Mt/ha and 55.09Mt/ha, respectively).

Increased weight of fruit and yield under drip irrigation and polythene mulch resulted due to better water utilization, higher uptake of nutrients and excellent soil-water-air relationship with higher oxygen concentration in root zone. These findings are in agreement with those of Singh and Kamal (2012) and Gornat *et al.* (1973). As mulch films are nearly impervious to carbon dioxide which is necessary for photosynthesis, 'Chimney effect' might have been created, resulting in abundant CO_2 for the plants which might have added higher plant growth and fruit yield grown under different plastic mulches. Increased yield under black polythene mulch might be due to higher magnitude of yield attributing characters as influenced by higher soil temperature and moisture. These findings are in agreement with those of Gudugi *et.al.* (2012) and Almasoum (1998). Ashworth and Harrison (1983) who reported higher yield under black polyethylene mulch ascribed to reduced nutrients losses due to weed control and improved hydrothermal regimes of soil. These results are also in line with the findings of Bhella (1988) and Chakraborty and Sadhu (1984).

Effect on pest-disease incidence

The statistically analyzed data on incidence of pest and diseases is presented in Table 1. The minimum leaf curl incidence (6.43 %) and minimum incidence of late blight (6.61 %) was observed in treatment T_1 *i.e.* black colour on silver polythene mulch. This was followed by treatments T_2 *i.e.* silver colour on black polythene mulch and T_3 *i.e.* transparent polythene mulch with respect to leaf curl incidence (6.90% and 7.14 %, respectively) and incidence of late blight (9.19 % and 10.17 %, respectively). The minimum spotted wilt incidence (2.26 %) was observed in treatment T_1 *i.e.* black colour on silver polythene mulch. However, it was at par treatments T_2 *i.e.* silver colour on black polythene mulch (2.50 %) and T_3 *i.e.* transparent polythene mulch (2.98 %). The minimum fruit borer incidence (5.06 %) was observed in treatment T_1 *i.e.* black colour on silver polythene mulch; however, it was at par with treatment T_2 *i.e.* silver colour on black polythene mulch (5.54 %).

Less incidence of leaf curl might be due to high soil temperature and intensity of light which might have affected white fly population. These findings are in agreement with those of Shehnaz and Kumar (2004). The light effects on the vector, coloured mulches modify root zone temperature (RZT) under the mulch. RZT directly affects plant growth, which influence plant response to spotted wilt incidence. These findings are in agreement with those of Diaz-Perez and Batal (2002) and John *et al.* (2005). Plastic mulching keeps away the foliage and fruits from soil contact and also cuts down from soil splash on lower canopy as soil often consist disease causing conidial spores. These findings are in agreement with those of Jambhulkar *et al.* (2012).

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