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# Effect of plastic mulches and irrigation levels on yield parameters of tomato (*Solanum lycopersicum*) in Madurai District of Tamil Nadu

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**ABBSTRACT**

A field experiment was conducted to study the effect of different plastic mulches (black on silver, silver on black, white on black, and control) and $ET_c$(100, 80 and 60%) on tomato yield in Madurai District of Tamil Nadu. The design of experiment used was factorial randomized block design (FRBD) with three replications. The yield parameters were measured. The results revealed that the highest total yield (119.1 t $ha^{-1}$), fruit diameter (7.91cm), fruit weight (88.31 kg), number of fruits/plants(93.1, no.) and fruit yield/plant (8.12kg) were registered with the treatments combination of white on black mulch with 80% $ET_c$.

***Key words :*** *Coloured plastic mulch, Irrigation levels, Tomato, Yield parameters*

## Introduction

Water conservation methods and technologies are need of hour for increasing crop production against the adverse weather condition due to rapid climate change. Mulching with drip irrigation is one of the water conservation methods for crop production and is most suitable for irrigation where water is in scarce and rainfall is insufficient. This method enables to grow high value crops with low water consumption (Bastug *et al.,* 2006). Surface mulches have been used to improve soil water retention, conserving soil moisture by reducing evaporation from soil surface, controlling weed growth, reduced soil temperature and soil erosion (Lamont, 2005; Zhang *et al.*, 2007). In addition, surface mulches, can also improve water penetration by encumbering runoff and protecting the soil from raindrop splash and reducing soil crusting. Water saving from drip irrigation system varied from 12 to 84% for different crops besides increasing the production of crops (Narayanamoorthy, 2004). Brown and Channell-Butcher (2001) reported that bell peppers grown on black plastic mulch alone or in combination with drip irrigation increased pepper yields by 18 and 16 metric t/ha, respectively, when compared with bare soil.

Plastic mulches affect plant microclimate by modifying the soil energy balance and restricting soil water evaporation, thereby affecting plant growth and its yield. The color of the mulch is a big determinant in the microclimate around the plant.

Black, silver and white are the color of plastic mulches mostly used in vegetable production. Ham *et al*. (1993) reported that White-on black and silver mulches reflect 48 and 39% of shortwave radiation, respectively. In recent years, it has been shown that selecting the plastic mulch of right color is very important of vegetables production. Tomato (*Lycopersicon esculentum* L.) is one of the important and high value vegetable crops extensively grown during the spring and summer seasons in most of the regions of India. In India, tomato is grown in an area of 4.6 lakh hectares with an average productivity of 17.7 t/ha. Scarcity of water has always been affecting the tomato cultivation in arid and semi-arid regions. However, to ensure the food security increasing crop cultivation is very important (Badr *et al.*, 2016). So, mulching and drip irrigation can improve the water management practice connected with tomato production. Hence, the objective of this study is to determine the effect of different colored plastic mulches in combination of irrigation regimes on the yield of tomatoin Madurai District of TamilNadu.

## Materials and Methods

### Experimental field location

The study was carried out at Agricultural College and Research Institute, Madurai (Form December 2017 to March 2018). The field is located at $9^0$ 54′ N latitude and $78^0$ 54′ E longitudes, with mean altitude of 147 m above sea level.

### Experimental field preparation

Topography of the experimental plot was levelled. Farmyard manure was applied, and thoroughly ploughed with disc plough and repeatedly tilled with cultivator to bring optimum soil tilth. The field experiment was laid out in a factorial randomized block design (FRBD) with towel treatments and three replications (Table 1). The laterals were laid in each bed. Inline drippers were used at a spacing of 40 cm. Over the drip line mulching sheets were spread according to the treatment in each plot and holes were punched to transplant the seedlings. Both ends of plastic sheets were buried into the soil up to a depth of 10 cm.

### Transplanting and irrigation

Hybrid tomato (*Iswarya*) seeds were used for seedling. The seedlings were planted in paired row system, adopting a spacing of 45 cm between plants and 1.2 m between rows. Irrigation was given before transplanting for maintaining soil moisture in field. Lifesaving irrigation was given immediately after transplanting and again the field was irrigated on $4^{th}$ day and $8^{th}$ day.

### Data collection and Statistical analysis

Randomly five plants were selected from each treatment and yield parameters such as number of fruits per plant, individual fruit weight, fruit diameter and total yield were recorded. Number of fruits per plant was counted after harvesting. Individual fruit weight and total yield of the fruits were measured. Fruit diameter was measured by thread method. The data were collected in triplicates. The mean value of individual parameter was calculated. The SED (Standard error of difference) and CD (Critical difference) were estimated using AGRIS for testing significance of data.

## Results and Discussion

**Fruit yield per plant:** Drip irrigation as well as

**Table 1.** Details of different treatments in the experiments

| | | |
|---|---|---|
| T1 (M1I1) | : | Black on silver plastic mulch of 25 µ thickness with 60 % $ET_c$ |
| T2 (M2I1) | : | White on black plastic mulch of 25 µ thickness with 60 % $ET_c$ |
| T3 (M3I1) | : | Silver on black plastic mulch of 25 µ thickness with 60 % $ET_c$ |
| T4 (M4I1) | : | No mulch with 60% $ET_c$ |
| T5 (M1I2) | : | Black on silver plastic mulch of 25 µ thickness with 80 % $ET_c$ |
| T6 (M2I2) | : | White on black plastic mulch of 25 µ thickness with 80 % $ET_c$ |
| T7 (M3I2) | : | Silver on black plastic mulch of 25 µ thickness with 80 % $ET_c$ |
| T8 (M4I2) | : | No mulch with 80% $ET_c$ |
| T9 (M1I3) | : | Black on silver plastic mulch of 25 µ thickness with 100 % $ET_c$ |
| T10 (M2I3) | : | White on black plastic mulch of 25 µ thickness with 100 % $ET_c$ |
| T11 (M3I3) | : | Silver on black plastic mulch of 25 µ thickness with 100 % $ET_c$ |
| T12 (M4I3) | : | No mulch with 100% $ET_c$ |

coloured plastic mulching significantly improved the fruit yield per plant. The maximum fruit yield was observed in white on black mulch ($M_2$) 6.96 kg followed by silver on black mulch ($M_3$) 6.53 kg (Fig. 1). Lowest fruit yield of 4.86 kg was observed in ($M_4$) control. Around 31 to 43% more yield was found in mulched treatments compared to control. The fruit yield per plant at different irrigation levels was recorded maximum in treatment drip irrigation with 80 % $ET_c$ (6.9 kg) followed by treatment drip irrigation with 100 per cent ET (6.1 kg) and drip irrigation with 60 per cent ET (5.6 kg) respectively. The results were in consensus with the findings of Kishore *et al.* (2018) and Sreedevi *et al.* (2017). Drip irrigation at 80% $ET_c$ with white on black mulch (8.1kg) produced significantly maximum fruit yield as compared other irrigation levels and yield was minimum in 60 per cent ET with control treatment (4.1kg).

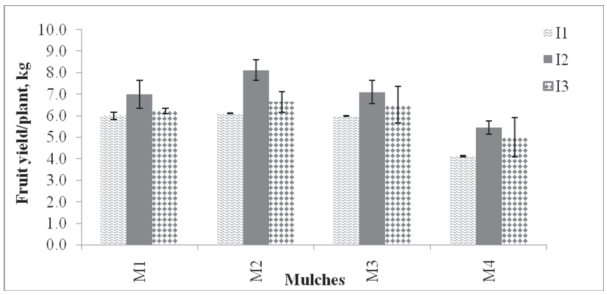


**Fig. 1.** Effect of different levels of irrigation and plastic mulches on fruit yield/plant

**Number of fruits per plant:** Number of fruits per plant yield was significantly influenced byboth plastic mulches and irrigation levels and its mean value ranged from 79 to 59 fruits (Fig. 2). The maximum number of fruits 79 was registered in the treatment receiving white on black color mulch ($M_2$) followed by silver on black color mulch ($M_3$) 59 fruits.

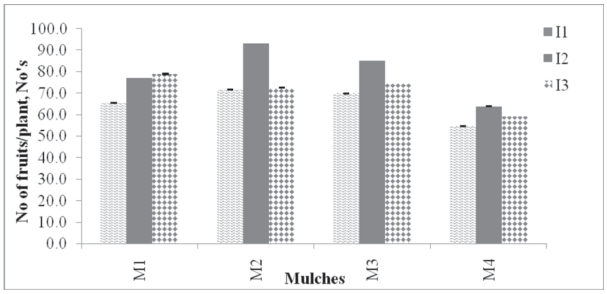


**Fig. 2.** Effect of different levels of irrigation and plastic mulches on number of fruits/plants

The highest yield recorded in white on black mulch might be due to the conservation of moisture, reduced number of weeds and enhanced microclimate both underneath and above soil surface. These mulching results were similar with Awodoyin *et al.*(2010) and Parmar *et al.* (2013).

A maximum number of fruits 80 were recorded in treatments receiving 80% $ET_c$ ($I_2$) followed by 71 fruits 100% $ET_c$ ($I_3$) and lower number of 65 fruitsper plant recorder in 60% $ET_c$ ($I_3$).Similar to the individual effect, the effect of mulches and irrigation levels had also influenced the number of fruits per plant significantly and the number of fruits ranged from 93 to 55 fruits. The maximum of 93 number of fruits were confabulated that treatment receiving white on black mulch with irrigation level 80% ETc($M_2I_2$).

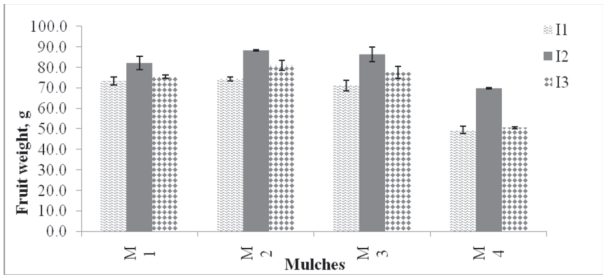


**Fig. 3.** Effect of different levels of irrigation and plastic mulches on fruit weight

**Fruit weight:** Effect of colored plastic mulches, irrigation levels and their interaction on fruit weight are shown in Fig. 3. The maximum fruit weight 81.2 gwas registered in the treatment receiving white on black color mulch ($M_2$) followed by silver on black color mulch 78.3 g. The maximum fruit weight recorded in white on black mulch might be due to congenial soil moisture results higher uptake of nutrition for better growth of fruit. The minimum fruit weight was recorded in control (56.7g).

In the case of irrigation levels fruit weight ranged from 81.7 to 67.1 g. The maximum fruit weight of 81.6 g was recorded in a treatment receiving 80% $ET_c$ ($I_2$) followed by 100% $ET_c$ ($I_3$). Similarly Agrawal *et al.* (2010) found the maximum weight of fruits was achieved by mulching the soil with plastic mulch and minimum with cultivation on the soil (control). Similar to the individual effect, the effect of mulches and irrigation levels had also influenced the fruit weight significantly. It was ranged from 88.3 to 49.54 g. The maximum fruit weight of 88.3 g

was confabulated that treatment receiving white on black mulch with 80% Etc level ($M_2I_2$). The results of present study were in line with the findings of (Angrej and Gaur (2007), Ibarra-Jimenez *et al.*(2002) and Parmar *et al.* (2013).

**Fruit diameter:** The data pertaining to fruit diameter is depicted in Fig. 4 and mean value of fruit diameter ranged from 7 to 4 cm. The maximum fruit diameter 7 cmwas registered in the treatment receiving white on black color mulch ($M_2$) followed by silver on black color mulch ($M_3$) 6 cm and minimum fruit diameter was recorded in control (4 cm).

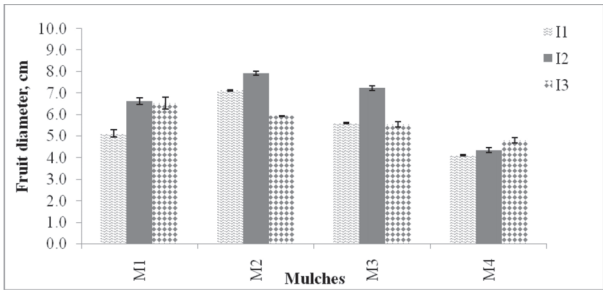


**Fig. 4.** Effect of different levels of irrigation and plastic mulches on fruit diameter

In the case of irrigation levels tomato yield ranged from 6.5 to 5.5 cm. The maximum fruit diameter of 6.5 cm was recorded in a treatment receiving 80% $ET_c$ ($I_2$) followed by 100% $ET_c$ ($I_3$). The results are in conformity with the results of Decoteau *et al.* (1989). Similar to the individual effect, the effect of mulches and irrigation levels had also influenced the fruit diameter. It was ranged from 7 to 4 cm. The maximum fruit diameter of seven cm was confabulated that treatment receiving white on black mulch with irrigation level 80% ETc($M_2I_2$).

**Total yield:** The results revealed that both plastic mulches and irrigation levels significantly influenced the tomato yield (Fig. 5). The mean value of yield ranged from 75.7- 109.2 t/ha. The highest tomato yield 109.2 t/ha was registered in the treatment receiving white on blackcolor mulch ($M_2$) followed by silver on black color mulch ($M_3$) 105.4 t/ha. The highest yield recorded in white on black mulch might be due to prevention of moisture evaporation and maintaining the soil temperature underneath white on black mulch because of little amount of incident radiation entered through the white on black mulch reflected to the environment. The lowest yield was recorded in control (75.5 t/ha).

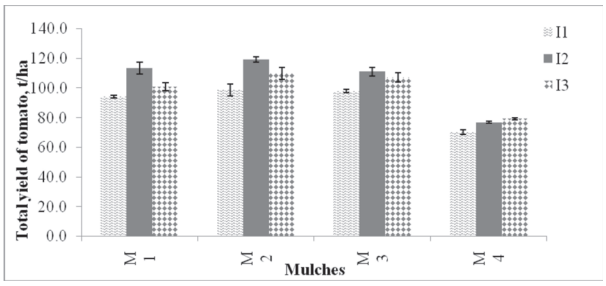


**Fig. 5.** Effect of different levels of irrigation and plastic mulches on total yield

In the case of irrigation levels tomato yield ranged from 90.3-105.2 t/ha. The highest tomato yield of 105.2 t. $ha^{-1}$ was recorded in a treatment with 80% $ET_c$ ($I_2$) followed by 100% $ET_c$ ($I_3$). Similar trend was also reported by Santosh *et al.* (2010). The highest total yield was observed in 80% Etc level followed by 100 and 60% Etc level respectively. The white on black mulch reflected more reflected more PAR (photo synthetically active radiation) than black on silver mulch. This increase in PAR could increase the rate of photosynthesis (Decoteau *et al.*, 1989). The plants on the white on black mulch may have set fruit earlier as compare to other color mulches. Like the individualeffect, the effect of mulches and irrigation levels had also influenced the tomato yield significantly. It was ranged from 70.3-119.1 t/ha. The highest tomato yield of 119.1 t/ha was confabulated that treatment receiving white on black mulch with irrigation level 80% ETc($M_2I_2$).

## Conclusion

In this study, tomato was grown on plants grown on black on silver, silver on black, white on black, and control) mulches and $ET_c$ (100, 80 and 60%). From the results, it was observed that white on black mulch with 80% $ET_c$ recorded highestyield than other mulches and control.

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