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## Effect of different mulches on growth and yield of carrot (*Daucus carota* L.)

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### Abstract

The present research work was conducted at Research field, Department of Horticulture, School of Agriculture, ITM University, Gwalior (M.P.) during the winter season of 2016-17. The experiment comprises of eight treatment viz. T<sub>1</sub> -Control, T<sub>2</sub> -Sugarcane straw mulch, T<sub>3</sub> -Black polythene mulch, T<sub>4</sub> -Leaves mulch (*Dalbergia sissoo*) T<sub>5</sub> -Blue polythene mulch, T<sub>6</sub> -Paddy straw mulch, T<sub>7</sub> -Grass mulch (*Cynodon dactylon*) and T<sub>8</sub> -White polythene mulch. The experiment was laid out in Randomized Block Design with three replication. The results revealed that the treatment T<sub>3</sub> - Black polythene mulch was found to be the best among the various treatment and recorded maximum plant height (61.70 cm), Length of leaf (26.78 cm), number of leaves (9.84 plant<sup>-1</sup>), Fresh weight of leaves (39.38 plant<sup>-1</sup>), Dry weight of leaves plant<sup>-1</sup> (5.83 plant<sup>-1</sup>), Fresh weight of root plant<sup>-1</sup> (225.33 plant<sup>-1</sup>), Dry weight of roots plant<sup>-1</sup> (17.88 plant<sup>-1</sup>), Fresh weight of plant (264.72 g), Dry weight of plant (23.71 g), Total root length (23.45), Total root diameter (5.54cm). The treatment T<sub>3</sub> also recorded the maximum yield (1.43 kg/m<sup>2</sup> and 54.69 t/ha) which was followed by T<sub>5</sub>- Blue polythene mulch for these parameters.

**Keywords:** Carrot, cultivar, growth characters, mulching

### Introduction

Vegetable production is becoming an important industry in India due to high production per unit area as compare to cereals. Increasing awareness among the people for the nutritional importance of vegetable in daily diet is increasing a high demand of vegetable in country. Total cultivated area under vegetable crop in India is 9396.06 hectare and production 162896.91 metric tons (Anonymous, 2014) [2].

Carrot (*Daucus carota* L.) is one of the most ancient vegetable. It is grown in spring, summer and autumn in temperate countries and during winter in tropical and subtropical countries (Bose and Som, 1990) [5]. Carrot belongs to Apiaceae family and said to be originated in Mediterranean region and its cultivation as a crop also began in that region (Shinohara 1984). Carrot is well distributed throughout the tropical, subtropical and temperate regions of the world (Bose and som, 1990) [5] and extensively cultivated in North and South America, Europe, Asia, North Africa (Thompson and Kelly, 1957) [18]. It is grown during the autumn in temperate countries and during the winter in tropical and subtropical countries of the world (Sadhu, 1990) [16].

In India carrot is grown during winter season when the rainfall is scanty. So irrigation is essential for cultivation. But it increases the cost of cultivation. Under such condition mulching may be useful in reducing irrigation requirement. To serve this purpose rice straw, leaves mulch, grass mulch, blue polythene, white polythene and black polythene sheets may be used as mulching materials. Mulching is highly effective in checking evaporation loss of soil moisture. Mulching protects the loss of soil moisture by soil evaporation induced by wind and reduces the irrigation requirement (Roy *et al.* 1990) [15]. Different mulches regulate soil moisture and temperature, suppress weeds and improve germination and emergence. Higher yield and better quality, less infestation of insects diseases, earliness, prolong growing season, higher nutritive value of the produced, improved storability are the advantages of mulching (Ahmed, 1999) [1].

### Materials and Methods

The present research work entitled "Effect of Different Mulches on Growth and Yield of Carrot (*Daucus carota* L.)" was conducted at Research field, Department of Horticulture, School of Agriculture, ITM University Gwalior (M.P.) during the winter season of 2016-17.

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A detailed note on the materials used and the methodology adopted for the present study is detailed below. Geographically, the experiment site falls under humid sub-tropical climate and located in between 23° 10'N latitude and 79° 54' E longitudes at an elevation of 411.98 meters above mean sea level in Gwalior district of the Gird region of northern Madhya Pradesh. The soil type of experimental field was sandy loam in nature. The experiment was laid out in Randomized Block Design with three replication. Basal application of fertilizers, full dose of phosphorus, potassium and ½ dose of nitrogen were applied in marked plots respectively. These nutrients supplied by Urea, Di-ammonium phosphate (DAP) and Muriate of Potash (MOP). Some amount of nitrogen was supplied by Di-ammonium phosphate (DAP) and remaining nitrogen was applied through urea as top dressing in two equal doses at 30 and 45 days after sowing.

Organic manures were applied before sowing as per treatment. Before sowing of seeds mulching was done with rice straw, black polythene, white polythene, blue polythene, sugarcane straw, leaves mulches, grass mulches. Black polythene sheet with small holes at planting distance was

spread over the plots accordingly so that the seedling could emerge easily through holes.

## Results and Discussion

The analysis of variance for all vegetative and yield parameters in carrot have been tabulated, statistically computed and the same are presented here under the appropriate headings.

**Table 1:** Effect of different of mulch on vegetative growth characters

Treatment	Plant height (cm)	Leaf length (cm)	Number of leaves/plant
T1 Control (no use of mulch)	44.92	17.37	7.25
T2 Sugarcane straw mulch	55.39	25.28	8.64
T3 Black polythene mulch	61.70	26.78	9.84
T4 Leaves mulch ( <i>Dalbergia sissoo</i> )	55.08	24.79	8.53
T5 Blue polythene mulch	60.22	25.66	9.40
T6 Paddy straw mulch	54.57	22.88	8.29
T7 Grass mulch ( <i>Cynodon dactylon</i> )	53.78	21.10	7.98
T8 White polythene mulch	59.13	25.48	9.07

**Table 2:** Effect of different mulches on yield attribution

Treatment	Fresh weight of leaves <sup>-1</sup> (g)	Dry weight of leaves <sup>-1</sup> (g)	Fresh weight of root <sup>-1</sup> (g)	Dry weight of root <sup>-1</sup> (g)	Fresh weight of plant (g)	Dry weight of plant (g)	Root Length (cm)	Root Diameter (cm)	Yield (kg/m <sup>2</sup> )	Yield (t/ha)
T1 Control (no use of mulch)	27.55	3.57	125.00	9.63	152.55	13.20	15.20	3.02	0.85	32.48
T2 Sugarcane straw mulch	35.11	4.93	172.00	13.76	207.11	18.69	19.52	4.12	1.20	45.87
T3 Black polythene mulch	39.50	5.83	225.33	17.88	264.72	23.71	23.45	5.54	1.43	54.69
T4 Leaves mulch ( <i>Dalbergia sissoo</i> )	33.45	4.37	165.67	13.25	199.12	17.62	18.75	4.07	1.16	44.18
T5 Blue polythene mulch	39.38	5.34	215.33	16.68	254.83	22.02	21.04	5.08	1.35	51.40
T6 Paddy straw mulch	32.28	4.25	164.33	13.15	196.62	17.40	18.15	3.97	1.15	43.82
T7 Grass mulch ( <i>Cynodon dactylon</i> )	31.60	4.19	162.00	12.96	193.60	17.15	17.88	3.83	1.13	43.20
T8 White polythene mulch	36.03	5.27	205.33	16.43	241.36	21.70	20.21	5.04	1.34	51.29

### Plant Height (cm)

It is evident from the table 1 that the height of plant was significantly influenced by the different mulching treatments. The highest plant height at harvest (61.70) is produced with the treatment T<sub>3</sub> - Black polythene mulch followed by the treatment T<sub>5</sub> - Blue polythene mulch which was found to be *at par* with the treatment T<sub>3</sub> - White polythene for plant height. The minimum plant height was recorded with the treatment T<sub>1</sub>- control (44.92 cm at harvest).

### Leaf length (cm)

The longest leaf length was recorded with the treatment T<sub>3</sub>-Black polythene mulch (26.78 cm at harvest) followed by the treatment T<sub>5</sub> - Blue polythene mulch (25.66 cm at harvest), T<sub>8</sub> -White polythene mulch (25.48 cm at harvest), T<sub>2</sub>- Sugarcane straw mulch (25.28 cm at harvest), T<sub>4</sub> -Leaves mulch (24.79 cm at harvest) which were *at par* with the treatment T<sub>3</sub>. The treatment T<sub>3</sub> was observed to be significantly superior to all other treatments. The minimum leaf length was recorded with the treatment T<sub>1</sub>- control (17.37 cm at harvest).

### Number of leaves per plant

The data revealed that the maximum number of leaves per plant was recorded under the treatment T<sub>3</sub> - Black polythene mulch (9.84 at harvest) followed by the treatment T<sub>5</sub> - Blue polythene (9.40 at harvest), T<sub>8</sub> - White polythene (9.07 at harvest) T<sub>2</sub> - Sugarcane straw (8.64 at harvest) which were *at par* with the treatment T<sub>3</sub>. The treatment T<sub>3</sub> was significantly superior to the all others treatments. The minimum number of leaves was observed with T<sub>1</sub>- Control (7.25 at harvest).

### Fresh weight of leaves (g/plant)

It was observed that the effect of mulching treatments on fresh weight of leaves were significant at all the stages of crop growth.

The maximum fresh weight of leaves was recorded under the treatment T<sub>3</sub> - Black polythene mulch 39.50 at harvest (105 DAS) followed by T<sub>5</sub> - Blue polythene 39.38 (105 DAS) at harvest, T<sub>8</sub> - White polythene 36.03 (105DAS) at harvest, which were *at par* with the treatment T<sub>3</sub>.The treatment T<sub>3</sub> was significantly superior than the other treatments. The minimum

Fresh weight of leaves per plant was observed with T<sub>1</sub> - Control (105DAS) 27.55 at harvest.

#### Dry weight of leaves (g/plant)

It is observed that the effect of mulching treatments on dry weight of leaves were significant at all the stages of crop growth. The mean data for various treatment with respect to dry weight of leaf at successive stages of crop growth.

The maximum dry weight of leaves per plant was recorded under the treatment T<sub>3</sub> -Black polythene mulch (5.83 g/plant at harvest) followed by T<sub>5</sub> - Blue polythene mulch (5.34 at harvest), T<sub>8</sub> - White polythene mulch (5.27 at harvest), T<sub>2</sub> - Sugarcane Straw mulch (4.93 at harvest) which were *at par* with the treatment T<sub>3</sub>. The treatment T<sub>3</sub> was recorded to be significantly superior to all other treatments. The minimum Dry weight of leaves was recorded with the treatment T<sub>1</sub>-control (3.57 at harvest).

#### Fresh weight of root (g)

The maximum fresh weight of root per plant was recorded under the treatment T<sub>3</sub> - black polythene (225.33g) per plant followed by blue polythene mulch (215.33 gm), white polythene mulch (205.33 gm), T<sub>2</sub> - Sugarcane Straw mulch (172.00 gm), T<sub>4</sub> - Leaves mulch (165.67 gm), T<sub>6</sub> - Paddy Straw mulch (164.33 gm), T<sub>7</sub> - Grass mulch (162.00 gm) which were significantly different from treatment T<sub>3</sub> (Black Polythene). The treatment T<sub>3</sub> was recorded to be significantly superior to all other treatments. The minimum Fresh weight of root recorded with the treatment T<sub>1</sub> - control (125.00gm).

#### Dry weight of roots (g)

the maximum dry weight of roots was recorded under the treatments T<sub>3</sub> -Black polythene (17.88 g), followed by blue polythene mulch (16.68 gm), white polythene mulch (16.43 gm), T<sub>2</sub> - Sugarcane leaves mulch (13.76 gm), T<sub>4</sub> - Leaves mulch (13.25 gm), T<sub>6</sub> - Paddy Straw mulch (13.15 gm), T<sub>7</sub> - Grass mulch (12.96 gm) which were *at par* with treatment T<sub>3</sub> (Black Polythene). The treatment T<sub>3</sub> was recorded to be significantly superior to all other treatments. The minimum dry weight of roots was recorded in T<sub>1</sub> - control (9.63 g). However, all the treatments except control were produced comparable root dry weight.

#### Fresh weight and Dry weight of carrot plant (g)

The maximum fresh weight of plant was obtained in application of T<sub>3</sub> -black polythene mulch (264.72 g), it was comparable to all other mulching treatment except grass mulch (193.60g). However, the minimum fresh weight of plant was recorded in control (152.55 g).

That the maximum dry weight is recorded in T<sub>3</sub> - Black Polythene mulch (23.71 g) followed by T<sub>5</sub> - Blue polythene much (22.02 gm), T<sub>8</sub> - White polythene mulch (21.70 g) and T<sub>2</sub> - sugarcane straw mulch (18.69 g). The minimum dry weight of plant was recorded in T<sub>1</sub> - control (13.20 g).

#### Root length (cm)

The maximum root length was recorded under the treatment T<sub>3</sub> .Black polythene mulch and the minimum was recorded in T<sub>1</sub> - control (15.20 cm). The root length was comparable to T<sub>5</sub> - blue polythene mulch (21.04 cm) and T<sub>8</sub> - white polythene mulch (20.21 cm). However the organic mulching materials produced the comparable root length to each other but they are significantly inferior to black polythene mulch.

#### Root diameter (cm)

The maximum root diameter was obtained in the T<sub>3</sub>- Black polythene mulch (5.54 cm). However, the minimum root diameter was recorded in T<sub>1</sub>- Control (3.02 cm). The root diameter was comparable in different synthetic mulching material which was T<sub>5</sub> - Blue polythene mulch (5.08 cm) and T<sub>8</sub> - white polythene mulch (5.04 cm). However, T<sub>3</sub> was significantly superior over all other organic mulching material and control treatment.

#### Discussion on Growth Characters

The results obtained in this study clearly indicate that carrot responded well to synthetic and organic mulching materials. In general, the black polythene mulch produced significantly higher growth character of crop during whole growing season. The increasing plant height due to mulching might be accounted for providing favorable soil moisture and a favorable temperature condition for proper plant growth (Yu *et al.* 1981) [20] Chawla (2006) [6] obtained maximum plant height (70.91 cm), plant spread (53.05 cm) and highest number of branches (18.54) at harvest in marigold cv. Double mix with application of black plastic mulch compared to other mulching treatment. The higher number of leaves per plant was produced might be due to the higher plant height caused by advantageous condition utilized by the plants. A slight increase in number of leaves per plant due to the application of mulch in carrot was also observed by Mia (1996) [14].

The increased fresh weight of leaves with different mulches might be attributed to the supply of moisture that possibly accelerated the cell division and elongation activities producing more leaves and their development leading to increased fresh weight of leaves (Dey, 2000) [8]. The maximum dry weight of plant was obtained under black polythene mulch while minimum was recorded in control or no mulch. This result was in agreement with that of Roy *et al.* (1990) [15].

Coper and Law (1978) [7] stated that the soil temperature raised by polythene mulching led to a greater rate of development and leaf area production and ultimately greater dry matter production in plant during growth stages.

#### Yield of root (kg/m<sup>2</sup> and t/ha)

Yield was significantly influenced by all the concentrations of organic manure. The maximum yield kg/m<sup>2</sup> and t/ha was recorded through the application of the T<sub>3</sub> - black polythene mulch i.e. 1.43 kg/plot and 54.69 t/ha respectively. It was comparable with T<sub>5</sub> - blue polythene mulch, T<sub>8</sub> - white polythene mulch and T<sub>2</sub> - sugarcane straw mulch. However, the minimum were recorded under T<sub>1</sub>-control 0.85 kg/m<sup>2</sup> and 32.48 t/ha respectively.

The organic mulches produced comparable yield to each other and maximum yield was obtained under T<sub>2</sub> -sugarcane straw mulch (kg/m<sup>2</sup> and 45.87 t/ha) which was followed by T<sub>4</sub> - leaves mulch, T<sub>6</sub> - paddy straw, and T<sub>7</sub> - grass mulch and statistically superior over the T<sub>1</sub>-control.

Mulching provides a favorable environment for growth which results more vigorous, healthier plants and resistant to pest injury. Increase in soil temperature and moisture content stimulate root growth which leads to greater plant growth. Therefore, mulched plants usually grow and mature more uniformly than UN mulched plants (Bhardwaj *et al.* 2011; Sarolia and Bhardwaj 2012) [4, 17]. Hassan *et al.* (1994) [10] and Yamaguchi *et al.* (1996) [19] revealed that combination of reflective film mulching and shading treatments increased plant height, length of primary and secondary branches of

carnation seedlings. Lourduraj *et al.* (1996) obtained highest plant height (81.5 cm) and number of laterals (8.6 per plant) in tomato with the application of Black LDPE mulch as compared to organic mulch and no use of mulch. Similar results were also reported by Kim *et al.* (2000) <sup>[12]</sup> in *Crococmia crocosmiiflora*, Hong *et al.* (2001) <sup>[11]</sup> in lilies. Gao *et al.* (2001) <sup>[9]</sup> found that the nutrient paper mulch advanced plant growth as compared to plastic mulch and no use of mulch in tomato. Barman *et al.* (2005) <sup>[3]</sup> recorded significant improvement in number of days taken for first floret opening, spike length and rachis length with the application of paddy straw mulch in gladiolus. As root length and diameter were maximum in case of black polythene treatment and the root weight was obviously the highest from the same. The results agree with findings of Shyu (1979) and Berle *et al.* (1988).

### Conclusion

From the present study it could be concluded that the performance of various mulches was better than control (no use of mulch). Further, treatment T<sub>3</sub> - Black polythene mulch was observed to be the best treatments among in all the growth and yield parameters and T<sub>5</sub> and T<sub>8</sub> treatments were *at par* with T<sub>3</sub> treatments

However, this result is based on one year experiment; hence further trials may be conducted for the confirmation of the aforesaid findings.

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