Original Research Article

# Effect of various mulches on the growth and yield of strawberry cv. chandler under sub tropical conditions of Punjab

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**Abstract**

A field study was conducted in the Department of Horticulture, Khalsa College, Amritsar during 2016-2017 to study the effect of various mulches on performance of strawberry cv. Chandler. The runners of strawberry cv. Chandler were planted in the second fortnight of October with spacing of 45 × 30 cm. The investigation was laid out in RBD replicated thrice. There were treatments were seven treatments including $T_1$(Black polyethylene), $T_2$(Silver polyethylene), $T_3$ (Sugarcane trash), $T_4$(Paddy straw), $T_5$(Grass), $T_6$ (Saw dust) and $T_7$ (Control). Results of the study showed that black polyethylene mulch increased the vegetative growth parameters of strawberry. The maximum plant height (21.43 cm), number of leaves per plant (37.66), leaf area (89.36cm$^2$), number of flowers (27.52), number of fruits (22.46), fruit set per cent (82.99) were recorded in the treatment $T_1$ (black polyethylene mulch).It also increased the yield(145.43g/plant). Hence application of black polyethylene mulch enhanced the vegetative and yield characters of strawberry fruits than other mulches respectively.

**Key Words:** Strawberry, Chandler, Black polyethylene Mulch, RBD, Trash, Straw, Sawdust, Grass.

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## INTRODUCTION

Strawberry (*Fragaria × ananassa* Duch.) is one of the most important temperate fruit which can also be grown in tropical and sub-tropical climate with some efforts. It is very much liked for its attractive shape, distinct pleasant aroma and refreshing nature (Ali and Gaur 2007). It belongs to family Rosaceae and sub family Rosoideae. The modern cultivated strawberry is a hybrid of two largely dioecious octaploid species, *Fragaria chiloensis* Duch and *Fragaria virginiana* Duch. All the cultivated varieties are octaploid (2×=56). It is a small herbaceous plant which can be grown as an annual or perennial crop. Strawberry plant has crowns from which all leaves, roots, flowers and runners grow (Bowling 2000). The name strawberry may have derived from the practice of using straw mulch for cultivation and it may have come from the Anglo-Saxon word strew meaning to spread (Kaur and Kaur 2014). It is a short day plant growing predominantly in the temperate climate but it can also be grown in the tropical and sub-tropical climatic conditions (Bakshi *et al* 2014). Strawberry is generally grown in hilly as well as cool climatic zones of India. It is grown in Maharashtra, Haryana, Punjab, Uttar Pradesh, lower hilly areas of Himachal Pradesh and also in the hills upto an elevation of 3000m in humid and dry regions. Initially strawberry was grown in temperate zone of country but now it has become possible in the sub-tropical zones (Asrey and Singh 2004) During the recent years it has gained popularity due to its pleasant taste and refreshing nature but the main problem in strawberry is its fruit yield and quality. Among the various methods to enhance the yield and quality, mulching is one of most important

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aspect. Mulch is any material used to cover the surface of garden soil. Mulching is not only beneficial in minimizing the winter freezing injury but also have some other advantages of suppression the weeds, reducing berry disease, keeping the berry clean and conserving soil moisture and temperature (Kour and Singh 2009). Many researchers pointed that mulching had clear effects on microclimate around the plants by modifying the radiation budget of the surface and give significant increase on vegetative growth (Soliman *et al* 2015). Mulching has a strong influence on yield, quality and duration of harvesting which is due to improved nutrient availability, suppression in number and growth of weeds, protection from frost injury and reduction in number of dirty and diseased berries (Sharma 2002). Due to these bottlenecks, the poor people cannot afford it and also the farmers seldom go for its cultivation, Keeping in view, the present studies were carried out to study the impact of different mulching material on performance of strawberry

## MATERIALS AND METHODS

The present investigation was conducted in the Department of Horticulture, Khalsa College, Amritsar during 2016-2017. The experimental site was situated at 31°38 latitude and 75°52′ longitude with an elevation of 774 feet above sea level. The climate of the site can be characterized as sub-tropical with hot dry summer, cold winter months. The atmospheric temperature occasionally reaches up to 48°C.Soil of the experimental field was sandy loam in texture having Ph 8.4, low in organic carbon. Soil was thoroughly ploughed and raised beds of 2m in length and 1m in width were prepared at 45 cm distance. Healthy and disease free runners of strawberry cv. Chandler were planted in second fortnight of October, 2016 at a distance of 30 × 45 cm. Five plants were selected and marked with metal tag for recording observations. Experiment was laid out in Randomized block design with seven treatments viz.: $T_1$ (Black polyethylene), $T_2$ (Silver polyethylene), $T_3$ (Sugarcane trash), $T_4$ (Paddy straw), $T_5$ (Grass), $T_6$ (Saw dust), $T_7$ (Control). All the treatments were replicated thrice. The average height of plant was measured with a measuring scale from the crown level to the apex of primary leaves and results were expressed in centimeter. Data on number of leaves were recorded from five plants of each bed and results were expressed as leaf number per plant. The observations on leaf area were recorded at the end of the growing season where five leaves per plant were collected randomly from five plants per treatment and out of the pooled 25 leaves, five leaves were further selected at random for measuring leaf area. The leaf area was studied on a graph paper and average leaf area was expressed by counting squares in square centimetres($cm^2$). The total leaf was worked out by multiplying number of leaves with an average leaf area. To determine the number of flowers per plant, total number of flowers at five days interval was recorded and average numbers of flowers per plant were calculated. To determine the number of fruits set per plant, total number of fruits at five days interval was recorded and average number of fruits per plant was calculated. The total number of flowers per plant was counted and the number of fruit set in these plants was recorded after every five days. Per cent fruit set per plant was worked out with a formula given by Westwood (1979).

## RESULT S AND DISCUSSION

**Table 1:** Effect of various mulches on the plant growth characters of strawberry cv. Chandler

| Treatments | Plant height (cm) | Number of leaves | Leaf area ($cm^2$) |
|---|---|---|---|
| $T_1$ Black polyethylene 100 gauze | 21.43 | 37.66 | 89.66 |
| $T_2$ Silver polyethylene 100 gauze | 20.40 | 34.00 | 86.26 |
| $T_3$ Sugarcane trash 5 cm | 18.53 | 28.00 | 80.56 |
| $T_4$ Paddy straw 5 cm | 18.93 | 29.67 | 82.03 |
| $T_5$ Grass 5 cm | 18.10 | 27.36 | 78.93 |
| $T_6$ Saw dust 5 cm | 18.00 | 25.96 | 74.76 |
| $T_7$ Control | 13.63 | 23.56 | 69.93 |
| CD (5%) | 1.39 | 3.50 | 2.81 |

The data regarding plant height as influenced by various mulching treatments presented in Table 1 showed that the application of black mulch, silver mulch, paddy straw, sugarcane trash, saw dust, grasses significantly improved height of strawberry plants than control. Maximum plant height 21.43cm was recorded under treatment $T_1$ followed by $T_2$ with 20.40cm plant height. Both of these treatments are at par with each other. Plant height under treatment $T_4$ was 18.93cm followed by the treatments $T_3$, $T_5$, $T_6$, with plant height of 18.53cm, 18.10cm and 18cm respectively. All of these treatments were found to be at par with each other. The plant height 13.63cm under control was recorded to be the minimum. Increase in plant height by black polyethylene mulch might be due to the favourable environment, reduced soil moisture, weed emergence, water loss, increased nitrogen, recycling of

nutrients and addition of organic matter to the soil under black polyethylene (Qureshi *et al* 2012, Soliman *et al* 2015). Favourable modification of hydrothermal regime and physico-chemical properties might also be attributed for better vegetative growth as similar observations were reported in several studies of Mohamed (2002), Arin and Ankara ( 2001). The present findings are also in line with the findings of Ali and Gaur (2007) and Bakshi *et al (2014).* Maximum number of leaves per plant 37.66 were observed in plants treated with $T_1$ which was found to be statistically significant than all other treatments. It was followed by the plants treated with $T_2$ which produced 34.00 leaves. Number of leaves under treatment $T_4$ was 29.67 followed by $T_3$ and $T_5$ with 28.0 and 27.36 leaves respectively which were found to be at par with each other. Lowest number of leaves (23.56) were observed in control $T_7$.The present findings are in conformity with earlier reports of mulching in strawberry (Sharma and Sharma (2003) and Kher *et al* 2010). The black polyethylene mulch might had conserved higher soil moisture and temperature as well as reduced the nutrients losses by suppressing the weed population. These results are also in agreement with the findings of Ali and Radwan (2008), Kumar and Dey (2011). Singh *et al* (2010) and Bakshi *et al* (2014) also reported the same in strawberry plants cv. Chandler.

**Table 2:** Effect of various mulches on the flowering and fruiting of strawberry cv. Chandler

| Treatments | Number of flowers | Number of fruits | Fruit set per cent |
|---|---|---|---|
| $T_1$ Black polyethylene 100 gauze | 27.52 | 22.46 | 82.99 |
| $T_2$ Silver polyethylene 100 gauze | 25.89 | 20.40 | 80.16 |
| $T_3$ Sugarcane trash 5 cm | 22.19 | 16.60 | 72.63 |
| $T_4$ Paddy straw 5 cm | 24.82 | 18.76 | 75.30 |
| $T_5$ Grass 5 cm | 20.27 | 14.30 | 71.47 |
| $T_6$ Saw dust 5 cm | 18.70 | 12.16 | 68.26 |
| $T_7$ Control | 14.29 | 08.43 | 61.26 |
| CD (5%) | 0.78 | 1.69 | 1.11 |

The perusal of the data regarding average leaf area of strawberry plants as affected by various mulching treatments showed a rapid increase under treatment $T_1$ as compared to other treatments with average leaf area 89.36 $cm^2$ which was found to statistically significant over all other treatments. It was followed by treatment $T_2$ with 86.26 $cm^2$. Plants treated with $T_3$ and $T_4$ treatments reported with an average leaf area of 80.56 $cm^2$ and 82.03 $cm^2$ which were found to be at par with each other. Treatment $T_3$ was followed by $T_5$ with an average leaf area of 78.93 $cm^2$ and both were at par with each other. Minimum leaf area 69.93 $cm^2$ was recorded in plants under control. The results of present study showed that the application of mulch increased the average leaf area of strawberry plants. These results confirmed the findings of Singh *et al* (2005) in strawberry in which they also reported the positive role of black mulch in enhancing leaf area than other mulches of paddy straw, clear polyethylene mulch. This may be attributed to better soil hydrothermal regimes and suppression of weeds which decreased the competition among the plants and weeds and helped the plant to produce more leaves with more leaf area. The enhancement of soil properties like cation exchange capacity and soil microbial activity also led to the growth of the leaf acquiring more leaf area. These results are in line with the findings of Sharma and Sharma (2003), Ali and Gaur (2013) and Dwivedi *et al* (2000). Maximum number of flowers per plant 27.52 was observed in plants treated with black polyethylene mulch ($T_1$) which was followed by plants under $T_2$, $T_4$, $T_3$ with 25.89, 24.82 and 22.19 flowers per plant respectively. All of these treatments were found to be significantly differ with each other. Plants of the treatment $T_5$ and $T_6$ registered 20.27 and 18.7 number of flowers per plant respectively. Lowest number of flowers 14.29 were observed in control. The observed enhancement effect on flowering parameters due to black mulch might be attributed to the benefit which led to decreased water loss and soil temperature, reduced soil erosion and suppressed weeds which in turn promoted vegetative growth which positively reflected on flowering traits. These results seemed to be in general agreements with those reported by Arin and Ankara (2001), Ali and Radwan (2008) and Kour and Singh (2009) in strawberry. The findings of Soliman *et al* (2015) in various strawberry cultivars, Bakshi *et al* (2014) in strawberry cv. Chandler are also in conformity with the present results. The data on the number of fruits per plant in strawberry as affected by different mulching treatments. Results of present study showed that the maximum number of fruits per plant 22.46 was observed in plants treated with $T_1$ treatment which was significantly different over all other treatments. It was followed by the treatment $T_2$ and $T_4$ with 20.40 and 18.76 fruits per plant respectively. Both of the treatments were at par with each other. Number of fruits of plants under treatment $T_3$, $T_5$, $T_6$ were 16.60, 14.30, 12.16 per plant respectively which were significantly differ from each other. Lowest number of fruits 8.43 was observed in control. Hence results of the study demonstrated that black polyethylene mulch

increased the number of fruits per plant as compared to other mulches of sugarcane trash, paddy straw, grasses, sawdust and clear polyethylene. These findings are in line with the results of Shokouhian and Asghari (2015) who favored that application of black mulch increased the number of fruits per plant in strawberry as compared to paddy straw and clear polyethylene mulch. This might be attributed to the fact that the black polyethylene enhanced the number of flowers due to the decreased water loss and soil temperature which in turn increased the number of fruits respectively. These results are in support to the findings of Pandey *et al* (2016), Singh *et al* (2005) and Bakshi *et al* (2014) in strawberry plants. The data pertaining to fruit set as influenced by mulching treatments depicted that the mulching treatments significantly enhanced the fruit set per cent than control (no mulch). Maximum fruit set per cent 82.99 was recorded in plants under treatment $T_1$ which was found to be statistically significant than all other treatments. It was followed by plants under treatment $T_2$, $T_4$, $T_3$, $T_5$, $T_6$ with fruit set per cent of 80.16, 75.30, 72.93, 71.47 and 68.26 respectively. Minimum fruit set per cent 61.26 was observed under control. Similar findings have been reported by Pandey *et al* (2016). Use of black mulch improved nutrients and moisture level of the soils and improved the fruit set in strawberry as it reduces the drop of flowers by reducing the moisture stress and hence increased the fruit set per cent. Higher number of fruits per plant under mulched conditions has also been reported by Nagalakshmi *et al* (2002). The research findings of Bakshi *et al* (2014) are also in line with the present findings. Maximum number of runners per plant 10.43 was observed in plants treated with paddy straw mulch ($T_4$) which was followed by plants under $T_5$ and $T_6$ with 8.51 and 7.55 runners per plant respectively. All of these treatments were found to be significantly differ from each other. Plants under $T_1$ and $T_2$ registered 6.69 and 5.12 runners per plant respectively which were also differ significantly from each other. Lowest number of runners 3.33 were observed under control. These results are also in conformity with the findings of Ali and Gaur (2013). Maximum fruit yield per plant was noted in the plants under treatment $T_1$ with 145.43 g/plant and proved to be significantly superior over other treatments. It was followed by the plants with treatment $T_2$ and $T_4$ with 120.70 g/plant and 98.53 g/plant respectively which were also significantly higher than treatment $T_3$, $T_4$, $T_5$, $T_6$ and control. Yield recorded from the plants under treatment $T_3$, $T_5$,$T_6$ was 94.4, 85.36, 81.16 g/plant respectively which differ significantly among each other but significantly superior over control. So all the mulching treatments proved to be significantly superior over the control. Minimum fruit yield 62.50 g/plant was observed under control.

**Table 3:** Effect of various mulches on the yield and runner characters of strawberry cv. Chandler

| Treatments | Fruit yield/plant (g) | Number of runners/plant |
|---|---|---|
| $T_1$ Black polyethylene 100 gauze | 145.43 | 6.69 |
| $T_2$ Silver polyethylene 100 gauze | 120.70 | 5.12 |
| $T_3$ Sugarcane trash 5 cm | 94.40 | 4.22 |
| $T_4$ Paddy straw 5 cm | 98.53 | 10.43 |
| $T_5$ Grass 5 cm | 85.36 | 8.51 |
| $T_6$ Saw dust 5 cm | 81.16 | 7.55 |
| $T_7$ Control | 62.50 | 3.33 |
| CD (5%) | 1.58 | 0.84 |

Hence results of the study showed that mulching had positive effect on increasing the fruit yield of strawberry. The yield under black polyethylene was more than double as compared to no mulch. Favourably modified hydrothermal condition improved nutrients availability supported better plant growth under black polyethylene mulch was well translated in form of highest fruit yield per plant. Increase in availability of nutrients and highly suppressed weeds as a reason for improved yield has been reported by Sharma and Khokhar (2006) and Nagalakshmi *et al* (2002) in strawberry. Pandey *et al* (2016), Soliman *et al* (2015) and Bakshi *et al* (2014) also reported the same result**s.**

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