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Research Article

IMPROVEMENT OF QUALITY OF STRAWBERRY CV. CHANDLER THROUGH MULCHING IN SUBTROPICAL CONDITIONS OF PUNJAB

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A B S T R A C T

An experiment was conducted in the Department of Horticulture, Khalsa College, Amritsar during 2016-2017 to study the effect of various mulches on quality of strawberry cv. Chandler. The runners of strawberry cv. Chandler were planted in the second fortnight of October with a spacing of 45 × 30 cm. The investigation was laid out in RBD with seven treatment combinations viz.T1 (Black polyethylene), T2(Silver polyethylene),T3 (Sugarcane trash),T4(Paddy straw), T5(Grass),T6 (Saw dust) and T7 (Control). The treatments were replicated thrice. Results of the study showed that black polyethylene mulch was the remarkable treatment for physico-chemical properties of the fruits with maximum fruit weight (12.63g), fruit length (4.93cm), fruit breadth (3.83cm), TSS (9.60 %), TSS:acid ratio (14.61), reducing sugars (4.76 %), total sugars (7.27 %), ascorbic acid (61.23 mg/100g) and minimum acidity (0.65 %) respectively. Hence application of black polyethylene mulch improved the quality of strawberry fruits.

INTRODUCTION

The modern cultivated strawberry is a hybrid of two largely dioecious octaploid species, *Fragaria chiloensis* Duch and *Fragaria virginiana* Duch. With chromosome number (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). It packs a lot of nutritional value with in itself, being a rich source of Vitamin A, B, C, niacin and minerals like phosphorus, potassium, calcium and iron. (Karkara and Dwivedi 2002). It contains relatively high quantities of ellagic acid, which has a wide range of biological activity (Meyer *et al* 2003). Medicinally strawberries have been known to kill certain viruses like polio and herpes which may block the formation of Chitosamines which may cause cancer. It also contains high level of antioxidants that slows the ageing and the ability to reduce blood sugar. It is one of the delicious fruit of the world which has attained a premium position in the world fruit market as well as in the processing industries (Sharma and Sharma 2003). Among the various methods to enhance the yield and quality, mulching is one of most important aspect. Mulch is any material used to cover the surface of garden soil. 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). Various types of mulches like plastic mulch, paddy straw, sugarcane trash, grasses etc are used. Plastics technology was introduced to improve crops input use efficiency in terms of nutrients, irrigation water and agrochemicals with the ultimate goal of maximizing the yield, fruit quality and harvest precocity (Fan *et al* 2005, Posada *et al* 2011).Keeping in view, the present studies were carried out to study the impact of different mulching material so as to ascertain the treatments which can increase its quality.

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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 Radomized 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 observations were recorded of the fruit physical and bio chemical analysis according to A O A C (1990).

RESULTS AND DISCUSSION

The data in Table 1 pertaining to the fruit length influenced by mulching treatments showed that the maximum fruit length 4.93 cm was found in the plants under treatment T_1 which was significantly differ from other treatments.The minimum fruit length was observed in control with 3.40 cm fruit length. Results of these findings showed that the application of mulches increased the fruit length in strawberry. These results are in accordance with the findings of Sonkar *et al* (2012) who also reported that the plastic mulches are the best than other mulches.

Maximum fruit breadth 3.83 cm was found in the plants receiving T_1 treatment which was significant all over the treatments. Lowest fruit breadth 1.90 cm was observed in the control. The increase in fruit size by black polyethylene mulch was attributed to more plant growth and development under micro-climate conditions resulting in better nutrient uptake (Bakshi *et al* 2014). Also, the better plant growth owing to the favourable hydrothermal regime of the soil and completely weed free environment led to the increased fruit size (Singh *et al* 2005). Never the less, plants under clear polyethylene mulch and paddy straw showed less fruit size which might be due to the fact that the emergence of weeds was quite common with clear plastic films and straw which hindered the plant growth and effected the fruit size of strawberry. The research findings of Sharma *et al* (2013), Hassan *et al* (2005), Sharma and Khokhar (2006) and Kumar *et al* (2012) in strawberry plants are in line with the present results.

The data regarding the fruit weight of strawberry fruits showed that all the mulching treatments gave significantly higher fruit weight than control. Maximum fruit weight 12.63 g was observed in the treatment T_1 which was found to be significant over all the treatments. It was followed T_2 treatment with fruit weight 11.53 g which was significantly different from other treatments. Treatment T_3 and T_4 were at par with each other with fruit weight of 10.16 g and 10.60 g respectively. Treatment T_5 and T_6 registered 9.63 g and 9.20 g fruit weight respectively. Minimum fruit weight 8.13 g was recorded from the treatment T_7. Results of these findings were confirmed by Singh *et al* (2005) who also gave the opinion that plants under black polyethylene produced larger fruit because of better plant growth owing to favourable hydrothermal regime of the soil and a complete suppression of weeds. So there was better availability of moisture to plants under black mulch which proved to be very essential for the development of fruits. Under silver polyethylene mulch there was not complete suppression of weeds and in organic mulches fast evaporation took place. Moisture availability was less in these treatments which favoured the less growth of fruit. The vigorous growth of plants under black polyethylene resulted in fruits with more fruit weight. The research findings of Mathad and Jholgiker (2005), Kumar *et al* (2012), Nagalakshmi *et al* (2002) in strawberry are in conformation with the present research.

Table 1 Effect of various mulches on the physical characters of fruits of strawberry cv. Chandler

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)
T_1 Black polyethylene 100 gauze	4.93	3.83	12.63
T_2 Silver polyethylene 100 gauze	4.43	3.46	11.53
T_3 Sugarcane trash 5 cm	4.16	2.90	10.16
T_4 Paddy straw 5 cm	4.26	3.00	10.60
T_5 Grass 5 cm	3.90	2.40	09.63
T_6 Saw dust 5 cm	3.83	2.20	09.20
T_7 Control	3.40	1.90	08.13
CD (5%)	0.37	0.17	0.47

It was clear from the data that TSS increased significantly with mulching treatments. Maximum TSS of 9.60 per cent was found in the fruits treated with T_1 treatment and it was followed by treatment T_2 and T_4 with TSS 9.26 and 9.06 per cent respectively. Results of these findings are confirmed by Singh *et al* (2005). They observed the positive response of black mulch on the TSS of strawberry fruit. This might be due to the creation of a better microclimate and a weed free environment by black polyethylene mulch in fields which led to high TSS. The gradual supply of moisture and nutrients by roots, higher photosynthesis and higher enzyme activity increased the metabolities by breakdown of carbohydrates (Hassan *et al* 2005). These results are in agreement with the findings of Mathad and Jholgiker (2005), Singh *et al* (2005) in strawberry plants. The resemblance of the findings of Pandey *et al* (2016) in strawberry plants also justified the present results.

The data of acidity level of fruits as influenced by various mulching treatments showed that the acidity decreased significantly with best mulching material. Minimum acidity 0.65 per cent was found in fruits produced by plants under treatment T_1 which was significantly followed by treatment T_2 with acidity 0.71 per cent. Both of these treatments were found to differ significantly. Plants under T_3 and T_4 treatment registered acidity of 0.73 per cent and 0.72 per cent respectively which were found to be at par with each other. Treatment T_4 and T_2 also showed no significant difference. Maximum acidity was found in control with 0.84 per cent. Hence results of the study reported that black mulching decreases the acidity of strawberry fruits. Results of these findings are in confirmation with Sharma and Sharma (2003) who evaluated black mulch, white mulch, paddy straw and control and revealed the significant influence of black mulch over other mulch materials which may be attributed to better microclimate modifications and partly due to less depletion of nutrients, owing to better weed control which favoured the less synthesis of organic acids (Hassan *et al*, 2000 and Sharma *et al*, 2004). These results are also in conformity with the findings of Mathad and Jholgiker (2005) and Pandey *et al*

Table 2 Effect of various mulches on the bio-chemical characters of fruits of Strawberry cv. Chandler

Treatments	TSS (°Brix)	Titratable acidity (%)	TSS: acid ratio (%)	Total sugar (%)	Reducing sugars (%)	Ascorbic acid (mg/100g pulp)
T_1 Black polyethylene 100 gauze	9.60	0.65	14.61	7.27	4.76	61.23
T_2 Silver polyethylene 100 gauze	9.26	0.71	12.92	7.04	4.43	59.89
T_3 Sugarcane trash 5 cm	8.76	0.73	11.95	6.81	3.96	54.46
T_4 Paddy straw 5 cm	9.06	0.72	12.54	6.97	4.13	55.84
T_5 Grass 5 cm	7.43	0.74	10.01	6.62	3.70	54.00
T_6 Saw dust 5 cm	7.10	0.76	9.34	6.10	3.63	52.33
T_7 Control	6.73	0.84	7.99	5.37	3.16	50.66
CD (5%)	0.46	0.01	0.64	0.24	0.19	4.80

(2016). TSS : acid ratio (14.61) was observed in the plants of treatment T_1 which was found to be significantly higher than all other treatments. Minimum TSS : acid ratio 7.99 was observed under the control treatment T_7. Results of these findings are confirmed by Sharma and Sharma (2003) who observed the maximum TSS: acid ratio from the plants applied with black polyethylene mulch. The improvement of fruit quality by black polyethylene mulch might be responsible for the improvement of TSS: acid ratio. Pandey *et al* (2016) also reported the same.

It was noted that plants of treatment T_1 yielded fruits with maximum total sugars of 7.27 per cent which was at par with the treatment T_2 with total sugars of 7.04 per cent. Lowest per cent of total sugars were obtained from the treatment T_7 (control). Ali and Radwan (2008) also found increase in total sugars content with the application of black mulch, transparent polyethylene mulch and paddy straw over un mulched. Pandey *et al* (2016) also favoured that application of black mulch enhanced the sugars content of strawberry fruits. This might be due to the fact that absorption of solar radiation, conduction of heat to the soil and vice versa, heat loss through mulch itself as radiation and conduction resulted in differential soil regimes. Thus it might be assumed that the response of black polyethylene mulch in terms of improvement of fruit sugars as found in the present experiments might be due to changes in substrate temperature more than reflected light higher. Higher reflectance light and modified soil thermal regime might be linked to the increase in sugars (Kesperbauer *et al* 2001). The research findings of Bakshi *et al* (2014), Singh *et al* (2005) reported the same in strawberry.

Results of the study showed that reducing sugars increased rapidly with the application of mulch. It was noted that plants under treatment T_1 yielded fruits with maximum reducing sugars 4.76 per cent which was significantly higher than all other treatments. Minimum reducing sugars 3.16 per cent were observed under control. Results of these findings are in confirmation with the results of Pandey *et al* (2016). They also recorded the maximum reducing sugars under black polyethylene mulch. This might be due to the fact that black polyethylene reflected less than five percent of incident radiation irrespective to growing environments. Thus it might be due to changes in substrate temperature more than to the reflected light (Kesperbauer *et al* 2001). These findings are in line with the research study of Pandey *et al* (2016) and Bakshi *et al* (2014) in strawberry.

The data regarding ascorbic acid as affected by different mulching materials showed that ascorbic acid percentage tended to increase with the application of mulches.

Maximum ascorbic acid content 61.23 mg/100 g pulp was found in fruits produced by plants of T_1 treatment followed by 59.89 mg/100 g pulp of ascorbic acid of fruits under treatment T_2. Both of these treatments did not differ significantly. Treatment T_2 was found to be at par with the treatment T_4 with ascorbic acid content of 55.84mg/100 g pulp. It was followed by treatment T_3, T_5, T_6 and T_7 with the ascorbic acid of 54.46, 54.00, 52.33, 50.66 mg/100 g pulp. All of these treatments were found to be at par with each other. Treatment T_3, T_5, T_6 were also at par with the treatment T_4. Hence the results revealed the application of mulches had the beneficial effect specially inorganic mulches (Black and silver mulch) over the control treatment. Results of these findings are confirmed by Singh *et al* (2006) and Pandey *et al* (2016). They also reported that all mulches were superior over no mulch. Highest vitamin C content was observed under black polyethylene mulch indicates higher role of elevated soil temperature as catalyst for root activities including uptake of water and nutrients which ultimately produce fruits with better quality. This might be attributed to the fact that creation of a better microclimate and a weed free environment by black mulch in fields led to higher ascorbic acid (Singh *et al* 2005). Bakshi *et al* (2014) also reported the same.

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