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RESEARCH ARTICLE

QUALITY IMPROVEMENT OF WINTER GUAVA CV.L-49 THROUGH VARIOUS MULCHES

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ABSTRACT

A field study was conducted in the guava orchard of Department of Horticulture, Khalsa College, Amritsar during 2017-2018 to study the effect of various mulches on yield and quality of guava cv. L-49. The plants of guava were mulched with paddy straw (10 cm, 15 cm and 20 cm), sugarcane trash (10 cm, 15 cm and 20 cm),black, green, silver, white polythene mulch, grass and control. The investigation was laid out in RBD with twelve treatment combinations replicated thrice. Results of the study showed that paddy straw (15 cm) increased the physical parameters of fruits with the maximum fruit weight (160.20 g), fruit length (10.10 cm), fruit breadth (6.53 cm) and fruit volume (195.00g/cc) while the black polythene mulch improved the biochemical characters reporting maximum TSS (8.87oBrix), total sugars (5.76%), reducing sugars(3.92%), ascorbic acid content(190.88 mg/100g) and minimum acidity (0.21%) respectively. Hence, application of black polyethylene mulch improved the quality of guava fruits.

INTRODUCTION

Guava (*Psidium guajava* L.) which is also known as "the poor man's fruit" or "apple of the tropics" is a popular tree of the tropical and subtropical climate and is native of tropical America, stretching from Mexico to Peru (Agnihotri *et al.,* 2013). It belongs to family Myrtaceae. It is one of the most popular fruit in India and excels the most other fruit trees in productivity, nutritive value, high yielding capacity, hardiness, good processing quality, vitamin C content and wide adaptability (Das *et al.,* 2010). The comparative low cost of the fruit combined with high nutritive value makes it an ideal economical dessert fruit (Rodriguez *et al.,* 2010). In India, it is successfully grown in Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, and West Bengal. Uttar Pradesh is considered as the most important guava producing state of India and Allahabad-Varanasi region has the reputation of growing the best quality guava in the country as well as in the world (Yadav *et al.,* 2014). Guava possess a high nutritive value as it is a good source of carbohydrates, minerals, iron, calcium and phosphorous. It is rich in dietary vitamin C with moderate levels of folic acid. Having a generally low calorie profile of essential nutrients a single common guava fruit contains four times the amount of vitamin C (Udemezue *et al.,* 2014). Mulching is an important soil management practice of covering the soil surface around the base of plants to make conditions more favorable for growth, conservation of soil moisture, regulation of soil temperature, improvement of soil aeration, control of weed population, increase in organic matter content and also increase the activity of soil microorganisms (Kher*et al* 2010; Das *et al.,* 2010). The commonly used mulch materials in fruit orchards include fallen leaves, paddy straw, saw dust, hay etc. But now a days the use of plastic mulch is becoming very popular (Fan *et al.,* 2005; Posada *et al.,* 2011). The present investigation was, therefore undertaken to study the influence of various soil covers on yield and quality parameters of guava cv. L-49.

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MATERIALS AND METHODS

The experiment was carried out in orchard of department of Horticulture, Khalsa College, Amritsar, during the year 2017-2018. The soil of the experimental orchard was sandy loam in nature with soil pH 7.5. Soil depth was sufficient, moderately fertile having good drainage system. The climatic condition of this research station was sub-tropical humid zone of Punjab state. The selected plants (8 years old) were uniform in growth and vigour and received uniform cultural practices. Different treatments(mulching with paddy straw 10 cm,15 cm and 20 cm, sugarcane trash 10cm,15 cm and20 cm, black, white, silver, green polythene, grass and unmulched) were applied in the month of July. Polythene mulches each of 100 gauge thickness were applied around the tree basin upto 90 cm from tree trunk while other mulches were applied uniformly to a thickness of 10, 15 and 20 cm. Before mulching, the entire plant basin was cleaned thoroughly. The experimental design was Randomized Block Design. The observations regarding fruit yield and quality were taken and analyzed.

Table 1. Role of various mulches on physical parameters of guava cv. L-49

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Fruit Volume (cc)	Specific gravity (g/cc)	Number of fruits per tree	Yield (kg/plant)
T_1	7.32	6.05	157.24	142.67	1.10	243.56	25.51
T_2	7.49	6.16	165.45	151.91	1.09	250.63	26.40
T_3	7.22	5.91	140.32	138.33	1.01	237.35	25.36
T_4	8.12	6.47	185.45	162.27	1.14	285.61	30.45
T_5	8.79	6.53	190.18	167.67	1.13	291.60	33.34
T_6	7.66	6.43	170.30	158.31	1.07	265.42	28.27
T_7	6.72	5.79	127.66	127.00	1.00	320.71	42.45
T_8	6.43	5.70	112.17	117.55	0.95	305.50	37.37
T_9	6.33	5.65	110.00	103.33	1.07	299.61	34.30
T_{10}	6.55	5.73	117.79	122.33	0.96	311.49	40.46
T_{11}	6.82	5.89	130.37	136.33	0.96	230.53	23.46
T_{12}	5.76	5.60	103.16	99.67	1.03	225.60	23.26
Mean	7.10	5.99	142.51	135.61	1.04	272.30	30.89
CD at 5% level	0.62	0.31	9.43	7.37	0.10	0.52	0.12

Table 2. Role of various mulches on biochemical parameters of guava cv. L-49

Treatments	TSS (°Brix)	Titatable acidity(%)	TSS: acid ratio	Total sugars (%)	Reducing sugars (%)	Ascorbic acid content (mg/100g)
T_1	8.58	0.34	25.27	8.36	4.59	180.14
T_2	8.60	0.34	25.70	8.40	4.62	180.51
T_3	8.54	0.34	25.16	8.31	4.52	177.98
T_4	8.73	0.28	30.86	9.00	4.66	182.27
T_5	8.77	0.28	31.36	9.21	4.71	183.38
T_6	8.70	0.33	26.48	8.88	4.63	181.07
T_7	10.10	0.21	47.45	10.03	4.92	190.88
T_8	9.08	0.26	35.16	9.58	4.82	184.78
T_9	8.82	0.28	31.52	9.42	4.78	183.74
T_{10}	9.23	0.24	38.24	9.83	4.88	189.09
T_{11}	8.47	0.37	22.72	8.22	4.51	175.49
T_{12}	8.36	0.38	21.99	8.15	4.46	175.34
Mean	8.83	0.31	30.16	8.95	4.68	182.05
CD at 5% level	0.32	0.04	3.49	0.04	0.02	0.95

Table 3. Role of various mulches on quality parameters of guava cv. L-49

Treatments	Number of fruits per tree	Yield (kg/plant)
T_1	243.56	25.51
T_2	250.63	26.40
T_3	237.35	25.36
T_4	285.61	30.45
T_5	291.60	33.34
T_6	265.42	28.27
T_7	320.71	42.45
T_8	305.50	37.37
T_9	299.61	34.30
T_{10}	311.49	40.46
T_{11}	230.53	23.46
T_{12}	225.60	23.26
Mean	272.30	30.89
CD at 5% level	0.52	0.12

RESULTS AND DISCUSSION

Fruit length (cm)

The maximum fruit length (8.79 cm) was recorded in the fruits harvested from the plants applied with paddy straw mulch (15 cm) followed by 8.12 cm, 7.66 cm, 7.49 cm, 7.32 and 7.22 cm with paddy straw mulch 10 cm, 20 cm, sugarcane trash mulch 15 cm, 10 cm, 20 cm and grass mulch (10 cm) with fruit length (6.82 cm) respectively. From the perusal of data, it was also clear that black polythene mulch (100 gauge) produced fruit length (6.72 cm) followed by green polythene mulch (100 gauge) with (6.55 cm), white polythene mulch (100 gauge) with fruit length (6.43 cm) and silver polythene mulch (100 gauge) with fruit length (6.33 cm). Minimum fruit length (5.76 cm) was registered under control.

Fruit breadth (cm)

Maximum fruit breadth (6.53 cm) was recorded in the fruits harvested from the plants covered with paddy straw mulch (15 cm).The treatment of sugarcane trash mulch (15 cm) recorded the fruit breadth (6.16 cm) while grass mulch produced breadth of (10 cm) respectively. Out of polyethylenes, black polythene mulch (100 gauge) produced the maximum fruit breadth (5.79 cm) which was more than control with fruit breadth of 5.60 cm respectively. The maximum fruit size in plants mulched with paddy straw could be due to the better partitioning of photo assimilates and nutrients through well-developed vascular connections than plants mulched with plastic polyethylene films. Similar results were reported by Das *et al.,* (2010) in guava and Kumar *et al.,* (2012) in strawberry. Bakshi *et al.,* (2015) also reported the same in aonla cv. NA-7.

Fruit weight (g)

The maximum fruit weight (190.18 g) was recorded in the fruits harvested from the plants applied with paddy straw mulch (15 cm) which was followed by (185.45 g) with paddy straw mulch (10 cm).The treatment of sugarcane trash mulch (15 cm) recorded more fruit weight than 10and 20 cm. Grass mulch (10 cm) recorded (130.37 g) of fruit weight followed by black polythene mulch (100 gauge) with (127.66 g) which was more than other polyethylenes. The minimum fruit weight (103.16 g) was recorded under control. The maximum fruit weight registered in fruits mulched with paddy straw might be due to the fact that it continuously supplied the photo assimilates and nutrients during the fruit development which thereby increased the fruit weight. These results were in conformity with the findings of Moor *et al.,* (2008) in strawberry and Gaikwad *et al.,* (2004) in Nagpur mandarin. Das *et al.,* (2010) also reported the same in guava cv. L-49. Present results are also in line with the results of Bakshi *et al.,* (2015) in aonla cv. NA-7.

Fruit volume (cc)

It is evident from the data that the maximum fruit volume (167.67 cc) was recorded in the fruits harvested from plants covered with paddy straw mulch (15 cm) followed by (162.27 cc) with paddy straw mulch (10 cm) and (158.31 cc) with paddy straw mulch (20 cm) respectively. The application of sugarcane trash mulch (15 cm) recorded the fruit volume of (151.91 cc) followed by sugarcane trash mulch (10 cm, 20 cm) with 142.67 cc and 138.33 cc which was at par with 136.33 cc with grass mulch (10 cm) respectively. Black polythene mulch (100 gauge) recorded the volume of (127.00 cc) followed by green polythene mulch (100 gauge) with (122.33 cc), white polythene mulch (200 gauge) with (117.55 cc) and silver polythene mulch (200 gauge) with (103.33 cc) volume respectively. All the treatments significantly increased the fruit volume as compared to control with (99.67 cc) volume which was at minimum levels.

Total soluble solids (^{o} Brix)

Maximum TSS (10.10^{o}Brix)was recorded with black polythene mulch (100 gauge) followed by green polythene mulch (100 gauge) with (9.23^{o}Brix). Treatment of paddy straw mulch (15 cm) registered (8.77^{o}Brix)which was more than 10 cm and 20 cm. TSS content of the fruits under control was the least amounting to (8.36^{o}Brix). The most desirable changes in quality parameter viz. TSS might be due to the proper availability of soil moisture content continuously during the experimentation period and improved soil nutrient status while in control the fluctuation in temperature and lower soil moisture content with severe weed infestation is the main cause of low quality fruitwhich resulted in higher enzyme activity for breakdown of carbohydrates (Hassan *et al.,* 2000). These findings are in agreement with the results of Shirgure *et al.,* (2003) in Nagpur mandarin, Manoj *et al.,* (2015) in kinnow and Moor *et al.,* (2008) in strawberry. The resemblance of the findings of Pandey *et al.,* (2016) in strawberry plants also justified the present results.

Titratable acidity (%)

It is clearly indicated from the data that the acidity of fruits was reduced by the application of all the soil covers as compared to control. However, maximum reduction (0.21%) was noted with black polythene mulch (100 gauge). The fruits under control registered the maximum acidity of 0.38 per cent. 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.,* (2016).

TSS: acid ratio

The maximum TSS: acid ratio (47.45) was calculated in the plants treated with black polythene mulch (100 gauge) followed by (38.24) with green polythene mulch (100 gauge). The minimum TSS: acid ratio (21.99) was found under control. 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. The research findings of Bakshi *et al.,* (2015) in anola cv. NA-7 also corroborates the present results.

Total sugars (%)

Significantly higher total sugars (10.03%) were registered from the fruits applied with black polythene mulch (100 gauge) which were more than green, white and silver polythene mulch. Control registered the lowest total sugar percentage pertaining to 8.15 per cent. It might be assumed that the response of black polyethylene mulch in terms of improvement of fruit sugars might be due to changes in substrate temperature more than reflected light as a result of which there was high ion concentration in the cell which increased the osmotic pressure at the cell solute which resulted in increase in proportion of sugars .The research findings of Bakshi *et al.,* (2014) and Singh *et al.,* (2006) reported the same in strawberry. The present results are in agreement with Pande *et al.,* (2005) in apple, Das *et al.,* (2010) in guava cv. L-49 and Kumar *et al.,* (2012) in strawberry.

Reducing sugars (%)

From the perusal of data, it is clear that plastic mulch exerted the highest percentage (4.92%) of reducing sugars recorded in the fruit trees applied with black polythene mulch (100 gauge) as compared to other coloured polyethylenes. Minimum reducing sugars (4.46%) were recorded in the fruits under control. 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 (Kasperbauer *et al.,* 2001). These findings are in line with the research study of Pandey *et al.,* (2016) and Bakshi *et al.,* (2014) in strawberry.

Ascorbic acid (mg/100 g)

The data indicated that the highest vitamin C content (190.88 mg/100g) was obtained from the plants applied with black

polythene mulch (100 gauge) which was followed by (189.09 mg/100g) with green polythene mulch (100 gauge), (184.78 mg/100g) with white polythene mulch (100 gauge) and (183.74 mg/100g) with silver polythene mulch (100 gauge) respectively. Other mulches tried recorded less amount of vitamin C but minimum range of ascorbic acid (175.34 mg/100g) was obtained under controlled conditions. The most desirable changes in ascorbic acid might be due to the proper availability of soil moisture content continuously which improved soil nutrient status while in control the fluctuation in temperature and lower soil moisture content with severe weed infestation is the main cause of low quality fruit. These findings were in agreement with the results of Manoj *et al.,* (2015) in kinnow and Moor *et al.,* (2008) in strawberry. Results of these findings are also confirmed by Maji and Das (2008) and Das *et al.,* (2010) in guava cv. L-49.

Number of fruits per tree

Significantly higher number of fruits (320.71) were obtained from the plants applied with black polythene (100 gauge) followed by green, white and silver polythene mulch (100 gauge) with 311.49, 305.50 and 299.61 respectively. Minimum number of fruits (225.60) were recorded in the fruits under control. 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.,* (2006) and Bakshi *et al.,* (2014) in strawberry plants and Das *et al.,* (2011) in guava cv. L-49.

Fruit yield per tree (kg)

Significantly higher fruit yield (42.45 kg) was obtained from the plants applied with black polythene (100 gauge) which was followed by followed by green, white and silver polythene mulch (100 gauge) with 40.46, 37.37 and 34.30 kg respectively. Other treatments registered lower yield but more than control which showed the lowest (23.26 kg) yield. Higher yield under black polyethylene mulch was due to an increase in availability of nutrients and highly suppressed weeds as reported by Sharma and Khokhar (2006) in strawberry and Nagalakshmi *et al.,* (2002) in chilli. Pandey *et al.,* (2016), Soliman *et al.,* (2015) and Bakshi*et al* (2014) also reported the same results in strawberry. In conformity of this, similar findings have been reported by Patil and Patil (2001) and Maji and Das (2008) in guava.

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