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RESEARCH PAPER

Influence of mulching materials on fruit quality of strawberry (*Fragaria ananassa* Duch.) cv. CAMAROSA grown under shade net conditions of coastal Andhra Pradesh

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Abstract : The effect of different mulching materials on quality of strawberry cv. CAMAROSA was studied during the year 2015-2016 with eight treatments replicated thrice in Randomized Block Design. The treatments comprised of coconut husk, black polyethylene, paddy straw, card board sheets, dried banana leaves, paddy husk, silver polyethylene and no mulch (Control). Among the treatments paddy straw recorded maximum TSS (8.83 ^{0}Brix), juice % (83.05 %), specific gravity (1.15 g/cm^3), vitamin-C content (58.88 mg/100g), total sugars (9.50 %) and minimum physiological loss in weight (13.5% at 1 DAH and 25.30% at 2 DAH), titrable acidity (0.61 %) and very less Albinism disorder (0.28%) as compared to other mulching treatments and control.

Key Words : Strawberry, Quality, Total soluble solids. Total sugars, Acidity, Specific gravity

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INTRODUCTION

Strawberry *(Fragaria ananassa*Duch.) belonging to family Rosaceae, is the softest fruit with 98 per cent edible portion. It is the important fruit of temperate region but cultivation of strawberry in subtropical and tropical climate is also gaining importance as day neutral and long day cultivars are introduced. In India, strawberry is grown in Himachal Pradesh, Uttar Pradesh, Maharashtra, West Bengal, Delhi, Haryana, Punjab and Rajasthan in an area of one million hectare with a production of 8 million tonnes (National Horticultural Board, 2015-16). In India, strawberry is usually planted in second fortnight of October with traditional methods, which restrict the fruit availability for a short period (one and half month). However, there are several reports available in the literature indicating that strawberry can be planted at different times of the year depending on variety, location and climate (Sharma and Sharma, 2004).

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Among different production practices of strawberry, mulching is considered as the most important cultural practice as it plays essential role in soil moisture conservation, weed control, regulation of soil hyderothermal regime, besides keeping the delicate fruit neat and clean as strawberry is a low growing perennial herb (Abbott and Gough, 1992; Gupta and Acharya, 1993 and Tarara, 2000). Investigations on impact of different mulching materials on fruit quality has indicated that strawberry is very responsive to the different mulching materials and climatic conditions (Wang *et al*., 1998; Raina *et al*., 2004 and Shylla and Sharma, 2010). Kour and Singh (2009) reported higher total soluble solids, sugar percentage and ascorbic acid when mulched with black polythene in temperate conditions. Keeping this above facts, the present studies were carried out to study the impact of different mulching materials on quality of strawberry cv. CAMAROSA grown under shade net conditions of coastal Andhra Pradesh.

MATERIAL AND METHODS

An experiment was conducted in the college of Horticulture, Venkataramannagudem during the year 2015-16 to elucidate information on the influence of mulching on growth, yield and quality of strawberry (*Fragaria ananassa* Duch.) cv. CAMAROSA under shadenet conditions. The experiment was laid out in a Randomized Block Design (RBD) with eight treatments replicated thrice. The treatments were randomized in each replication. The treatments comprised of coconut husk, black polyethylene, paddy straw, card board sheets, dried banana leaves, paddy husk, silver polyethylene and no mulch (Control). The quality parameters recorded during the investigation were as follows:

Total soluble solids (^{0}Brix):

Total soluble solids of fresh fruits were recorded by using a digital refractometer at room temperature and expressed in ^{0}Brix. The refractometer was cleaned with distilled water after each observation as suggested by Ranganna (1986).

Juice (%):

Healthy, 10 ripened fruits were collected and washed thoroughly with cool water. The fruits were weighed before sliced into 4 pieces and were crushed by using mortor and pestle. The juice content was calculated by using the following formula as suggested by Ranganna (1986).

$$\text{Juice content (\%)} = \frac{\text{Millilitres of fruit juice}}{\text{Weight of the fruit (g)}} \times 100$$

Total sugars (%):

Total sugars were determined by adopting Lane and Eyon method suggested by Ranganna (1986).Twenty five ml of fruit juice was taken into a 250 ml volumetric flask. Two ml of lead acetate (45 %) was added to the flask for precipitation of colloidal matter, later 5ml of potassium oxalate (22 %) was added to this solution to precipitate the excess lead and the volume was made upto 250 ml by using distilled water.

The contents were then filtered through Whatman No. 1 filter paper after testing a little amount of filtrate for its freedom from lead by adding a drop of potassium oxalate. Lead free filtrate was taken into a burette and titrated against a mixture of 10 ml of standard Fehling's solution A and B (1:1) by using methylene blue as an indicator till the end point was indicated by the formation of brick red precipitate.

The titration was carried out by keeping the Fehling's solution by boiling on heating mantle. The percentage of total sugars were calculated by using the following formula:

$$\text{Total sugars (\%)} = \frac{\text{Factor x Volume made up}}{\text{Titre value x Weight of the sample (g)}} \times 100$$

Specific gravity (g/cm^3) :

The specific gravity of strawberry fruit was assessed by water displacement method as suggested by Kumar *et al.* (2012).

$$\text{Specific gravity (g/cm}^3\text{)} = \frac{\text{Weight of the fruit (g)}}{\text{Volume of water displaced (ml)}}$$

Titrable acidity (%):

The titrable acidity of fresh fruit juice was estimated by diluting 10 ml of fruit juice with 10 ml of distilled water. The contents were filtered through Whatman No.1 filter paper. An aliquot of 10 ml was taken into conical flask, added 2-3 drops of phenolphthalein indicator and titrated with 0.1 N sodium hydroxide (NaOH) till a pink colour was obtained and persists at least for 15 seconds, as an end point. The titrable acidity was calculated by using the following formula as suggested by Ranganna (1986).

$$\text{Acidity (\%)} = \frac{\text{Titre value x Normality of NaOH x 0.0064}}{\text{Volume of aliquot taken (ml)}} \times 100$$

Ten grams of fresh fruit juice sample was blended with 3 per cent metaphosphoric acid (HPO_3) and made upto 50 ml with 3 per cent HPO_3. The contents were filtered through Whatman No.1 filter paper. An aliquot of 10 ml of HPO_3 extract was taken into a 50 ml conical flask and titrated against standard 2, 6-dichloro phenol indophenol dye upto a pink colour was persisted for 15 seconds as an end point as suggested by Ranganna (1986). The ascorbic acid was calculated by using the following formula:

$$\text{Ascorbic acid (mg/100 g)} = \frac{\text{Titre value x Dye factor x Volume made up}}{\text{Volume of aliquot taken x Weight of the sample}} \text{ x 100}$$

Physiological loss in weight (%):

Initial weights of 10 fruits in each treatment were recorded at the time of harvesting. Weight loss was recorded by weighing the fruits at one day interval at ambient temperature until the fruits become unmarketable, physiological weight loss was calculated by using the following formula and the results were expressed in percentage as reported by Bakshi *et al*. (2014).

$$\text{PLW(\%)} = \frac{\text{Initial fruit weight (g)} - \text{final fruit weight (g)}}{\text{Initial fruit weight (g)}} \text{ x 100}$$

Albinism disorder was observed in strawberry fruits due to lack of colour development during fruit ripening. Albinism incidence was recorded in five randomly selected plants in each treatment and in each replication. Total number of healthy fruits were counted from five randomly selected plants, from this, albino fruits were separated and calculated the percentage of albino fruits by using the following formula (Sharma *et al*., 2007).

$$\text{Albinism (\%)} = \frac{\text{Number of albino fruits}}{\text{Total number of fruits}} \text{x100}$$

The data recorded on various characters studied during the investigation were statistically analyzed by adopting procedures outlined by Panse and Sukhatme (1967). Critical differences values were calculated at 5 per cent level of probability, wherever the 'F' test was found to be significant.

RESULTS AND DISCUSSION

Influence of various mulches on fruit post harvest quality was found to be significant. Data presented in Table 1 revealed that the mulching treatments increased the TSS, ascorbic acid, total sugar and reduced fruit acidity and physiological loss in weight. Among the treatments paddy straw recorded maximum total soluble solids (8.83^{0}Brix), total sugars (9.50%), juice percentage (83.05%), specific gravity (1.15g/cm^3) and vitamin C (58.88mg/100g). Silver polythene mulch also recorded at par results with that of paddy straw mulch. Minimum values were recorded in black polythene and control. Regarding titrable acidity, fruits harvested from paddy straw mulch recorded less value (0.61%) and it was high in fruits harvested from black polythene mulch (0.73%). Other mulching treatments like coconut husk, paddy husk, dried banana leaves and card board sheets had intermediate effect on fruit post quality.

Higher fruit quality in strawberry when mulched

Table 1: Effect of different types of mulches on post harvest quality of fruits in strawberry cv. CAMAROSA grown under shade net condition

Treatments	TSS (° Brix)	Juice (%)	Specific gravity (g/cm^3)	Titrable acidity (%)	Vitamin-C (mg/100g)	Total sugars (%)	Albinism disorder
T_1: Coconut husk	7.91	76.72	1.08	0.65	52.40	7.98	0.70
T_2: Black polyethylene mulch	6.62	67.66	1.00	0.73	43.73	6.93	1.53
T_3: Paddy straw	8.83	83.05	1.15	0.61	58.88	9.50	0.28
T_4: Card board sheets	7.16	75.85	1.08	0.69	49.69	7.84	1.66
T_5: Dried banana leaves	6.96	72.12	1.06	0.70	49.50	7.55	1.76
T_6: Paddy husk	8.28	81.49	1.13	0.64	54.8	8.77	2.03
T_7: Silver polyethylene mulch	8.33	82.99	1.14	0.63	57.07	8.86	0.47
T_8: Control	6.63	71.74	1.04	0.70	47.74	7.49	0.54
S.E. $\pm$	0.24	2.47	0.02	0.02	2.11	0.36	0.05
C.D. (P=0.05)	0.73	7.58	0.07	0.06	6.47	1.10	0.16

with paddy straw is related to weed free environment, high moisture conservation, and maximum uptake of nutrients. The variation in juice percentage of strawberry fruit among the different mulches could be attributed to conservation and better supply of water and nutrients during fruit development. These results are in conformity with the earlier findings of Kumar *et al.* (2012) in strawberry cv. SWEET Charlie, Moor *et al.* (2004) in strawberry and Gaikwad *et al*. (2004) in Nagpur mandarin, Nath and Sharma (1994) in Assam lemon, Verma *et al. (*2005) in apple; Das *et al. (*2010) in guava and Singh *et al*. (2010) in aonla and Patil (2011) in strawberry. Ali and Gaur (2007) reported increased level of total sugars and ascorbic acid due to mulching treatments but the effect of was non-significant.

The data on physiological loss in weight of strawberry fruits are shown in Table 2. Significant differences were found among the treatments for physiological loss in weight of fruits. The physiological loss in fruit weight was more at 2 DAH (days after harvest) than at 1 DAH in all the treatments. The physiological loss in fruit weight was low in fruits harvested from the plants mulched with paddy straw both at first day (13.50 %) and second day (25.30 %) after harvest, which was statistically at par with silver polyethylene, paddy husk and coconut husk treatments at first and second day after harvest. Dried banana leaves also showed at par results with paddy straw in physiological loss in fruit weight (35.40 %) only at second day after harvest.

The physiological loss in weight was low in fruits harvested from the plants treated with black polyethylene mulch. The variation in physiological loss in weight of fruits harvested from the plants applied with various mulches could be attributed to variation in transpiration and respiration rates. These results are in agreements with earlier findings of Bakshi *et al. (*2014) in strawberry.

Albinism disorder (%):

The data on albinism disorder was shown in Table 1. The percentage of albinism disorder was found to be low in the present study. However, paddy straw recorded minimum values (0.28%).The albinism disorder was more in fruits harvested from the plants treated with paddy husk (2.03 %). The variation in albinism disorder percentage among the treatments could be attributed to variation in soil moisture content, soil aeration and light penetration through the crop canopy. These results are in conformity with the findings of Sharma *et al*. (2007) in strawberry.

From the present study, strawberry cv. CAMAROSA grown under shadenet conditions with different organic and inorganic mulches, it was concluded that plants mulched with paddy straw improved fruit quality in strawberry fruits followed by silver polyethylene mulch and paddy husk. Black polyethylene mulch gave lowest values for growth, yield and quality parameters due to increase in substrate temperature which is not congenial in tropical conditions like Andhra Pradesh. Therefore, paddy straw mulch can be recommended for commercial cultivation in shade net conditions of Andhra Pradesh.

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Table 2 : Effect of different types of mulches on physiological weight loss of strawberry cv. CAMAROSA grown under shade net condition

Treatments	Physiological weight loss (%)	
	Days after harvest	
	1	2
T_1: Coconut husk	17.05	27.30
T_2: Black polyethylene mulch	21.60	39.63
T_3: Paddy straw	13.50	25.30
T_4: Card board sheets	19.53	30.71
T_5: Dried banana leaves	20.51	35.40
T_6: Paddy husk	14.23	27.10
T_7: Silver polyethylene mulch	14.20	25.65
T_8: Control	21.53	37.15
S.E. ±	1.82	2.72
C.D. (P=0.05)	5.59	8.33

carrying out the work.

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