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Effect of different packaging materials on shelf life and quality of Banana cultivar var. cavendish

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Abstract
This study was conducted to evaluate the effect of different packaging materials on shelf life and quality of Banana cultivar var Cavendish. A laboratory experiment was laid out at Department of Horticulture, SHUATS, Prayagraj from the period October 2020. The packaging materials were Paper bag, Low density Poly-bag, High density poly-bag, Banana leaf, cardboard, news paper and open air as a control. The experiment was conducted in Randomized Block Design (RBD), with seven treatments, replicated thrice. The treatments were T_0 : Control, T_1 : Paper bag, T_2 : Low density Poly-bag, T_3 : High density poly-bag, T_4 : Banana leaf, T_5 : Cardboad, T_6 : Newspaper which are locally available at community level. From the present experimental findings it is found that the T_2 : Low density Poly-bag was found superior over other treatments in terms of Post harvest and quality of banana crop.

Keywords: banana, different packaging material, flavour, shelf life & quality attribute

Introduction
Bananas are a helpful method for adding key supplements to our eating regimen. They are high in sugars, nutrients, potassium, solvent fiber and protease inhibitors, which help to eliminate the stomach microbes. Studies have demonstrated that consistently eating banana organic product, help to keep up with heart work, circulatory strain levels, bone thickness, vision, absorption and kidney wellbeing (Jadhav *et al.*, 2018) [3].

Banana (*Musa paradisiaca* L.) having a place with the family Musaceae, is one of the main natural product yield of the world. It is tropical, herbaceous, monocotyledonous and monocarpic natural product crop. In India banana is dominating and famous among individuals as they are savored and devoured by all sort of individuals. Considering the nourishment and organic product upsides of banana it is accepted to be the "Helpless Man's Apple" (Patel *et al.*, 2010).

Banana is portrayed as a delightful and nutritive organic product, being an incredible wellspring of sugars, fiber, potassium and nutrients and furthermore detailed that a 100 g banana contains around 89 Kcal energy, 74 g water, 1.1 g protein, 0.3 g lipid, 21.8 g starch, 2 g fiber, 1 mg sodium, 385 mg potassium, 8 mg calcium, 30 mg magnesium, 0.4 mg iron, 22 mg phosphorus, 11.7 mg ascorbic corrosive, 40 µg thiamin, 70 µg Riboflavin, 610 µg Niacin, 80 600 µg Pantothenic corrosive, 470 µg Pyridoxine and 23 µg Folic corrosive (Rahman *et al.*, 2020) [7].

Banana has turned into a piece of diet It is helpful in overseeing patients with hypertension and heart sicknesses. It is likewise helpful for joint pain, kidney sicknesses, ulcer and gastroenteritis detailed by (Singh *et al*., 2008)

The significant banana producing states of India are Tamil Nadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Bihar, Assam and Madhya Pradesh. India is one of the significant producer of bananas developing in a space of 83 lakh hectare with a creation over 2.9 million tons revealed for (Prasad *et al.*, 2015) [6].

Banana organic product grows better tone, surface, smell, and pleasantness as it matures later gather. In summer, banana natural product might mature all the more rapidly, while their aging is more slow in the colder time of year season. There are ways of accelerating and dial back the aging system. Once aged, banana organic product has a time span of usability of two days before it starts to rot.

Quality is a significant element in the advertising of banana, particularly when planned for new utilization. Banana physical and substance qualities are affected by a few variables, for example, evaluating the nature of advertised foods grown from the ground these are inside the guidelines needed by buyers, is vital that the main credits of the organic products, as per the

shopper inclinations at buying banana, are the flavor, time span of usability and appearance (length, breadth and shading announced by Rana *et al.*, 2018) [8].

The post-harvest losses of fresh banana fruits go up to 30-40% due to improper handling, storage and other reasons like browning, abrasion, senescence, skin discoloration, fungal decay etc. Banana is a very perishable fruits and it possess very short shelf life nearly 10-12 days under ambient condition, both ripe and unripe banana is very susceptible to mechanical damage. Banana is hardly compatible with other crops in mixed load in storage or during transport because it produces high amount of ethylene and also susceptible to chilling injury. Lack of storage facilities, limited access to transportation and risk of high losses, growers are often forced to dispose of their produce over a short period of time (Kumari *et al.*, 2018) [4] which causes an economic loss of banana.

The banana fruits ripen quickly at high temperature and their shelf life is short. Thus, there is a need to develop inexpensive methods for delaying ripening and extending the shelf life under ambient conditions without affecting eating quality of the fruit. Its fruits are perishable in nature and cannot be stored for long time. Due to short shelf life it cannot be transport to for off places and this result in glut in the local market. The shelf life of fruits can be enhanced by various methods and proper packaging is one of them. The use of paper for packaging is getting popular these days.

Materials and Methods

The Experimental was conducted in Completely Randomized Design (CRD) with 7 treatments of Banana with three replications in the Post-Harvest Laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during October 2020. Total number of treatments were seven *viz.* T_0: Control, T_1: Paper bag, T_2: Low density Poly-bag, T_3: High density poly-bag, T_4: Banana leaf, T_5: Cardboad, T_6: Newspaper.

S. No.	Treatment Symbols	Treatment combination
1	T_0	Control
2	T_1	Paper bag
3	T_2	Low density Polybag
4	T_3	High density Polybag
5	T_4	Banana leaf
6	T_5	Cardboad
7	T_6	Newspaper

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ºC- 48 ºC and seldom falls as low as 4 ºC- 5 ºC. The relative humidity ranges between 20 to 94%. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Experimental Methods

Banana were purchased from fruit market, of Allahabad on October, 2020 and stored in the Post-Harvest Laboratory of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad at room temperature. The different locally available packaging material are Paper bag, plastic bag, Low density Poly-bag, High density poly-bag, Banana leaf, Cardboad, Newspaper and open air as a control.

Results and Discussion

The results of Physico-chemical analysis of fruits packed in Different packaging materials have been presented in the present chapter in detailed manner. Post-harvest storage behavior namely Total soluble solids (^{0}Brix), Physiological weight loss, Starch (%), Flavour, Sweetness, Overall acceptance and Shelf life of banana as observed during the study have been presented and discussed.

Maximum Physical analysis in term of Total soluble solids (^{0}Brix). TSS content of fruit pulp of different packaging material were found to be statistically significant. The maximum score of TSS was observed in the T_2 (Low density poly-bag) with (15.77, 23.00 and 26.23) ^{0}Brix followed by T_3 (High density poly-bag) with (14.23, 21.10 and 25.41) ^{0}Brix and the minimum TSS was observed in T_0 (Control) with (10.45, 16.65 and 21.47) ^{0}Brix respectively 3, 6 and 9 days that the conversion of starch into sugars to be the most important change in ripening bananas. Un-perforated Low-density Poly bags are known to reduce loss of moisture and hydrolysis of polysaccharides resulting in less increase in TSS (Kumari *et al.*, 2017) [4].

Significantly higher, The minimum weight loss of banana was observed in the T_2 with (2.65, 4.59, 6.85)g at 3, 6, and 9 days respectively, followed by the treatment T_3 with (3.35, 6.25, 8.56)g and the maximum weight loss was observed in T_0 Control with (8.00, 11.35, 14.25)g at 3, 6, and 9 days respectively. Respiration causes a weight reduction because a carbon atom is lost from the fruit, each time a carbon-dioxide molecule is produced from an absorbed oxygen molecule and evolved into atmosphere. Banana fruits loss weight due to respiration and transpiration as a result of the appearance, textural and nutritional qualities of the fruit were negatively affected (Martha and Daniel 2019) [5].

In terms of Starch (%) of fruit pulp of different packaging material were found to be statistically significant maximum score of starch percentage was observed in the T_2 (Low density polybag) with 8.06% followed by T_3 (High density polybag) with 7.59% and the minimum starch percentage was observed in T_0 (Control) with 4.26%. An increase in starch content of banana during different packaging material Starch with high amylose content requires a higher temperature to destroy its internal structure, leading to the gelatinization temperature being positively related to amylose content. The high gelatinization temperature of peel starch might be relative to its high amylose content reported by (Zheng *et al.*, 2018) [9].

As the Flavour content the maximum score of Flavour was observed in the T_2 (Low density polybag) with (4.02, 4.40, and 4.60) at 3, 6 and 9 days of interval followed by T_3 (High density polybag) with (3.73, 4.00, and 4.12) and the minimum score for flavour was observed in T_0 (Control) with (3.15, 3.35, and 3.41) at 3, 6 and 9 days respectively The pattern of continuously decrease in flavour score during storage might be due to the loss of highly volatile aromatic compound which is very sensitive to high storage temperature (Bharai *et al.*, 2019).

The maximum score of sweetness was observed in the T_2 (Low density polybag) with (4.53, 4.85 and 4.30) at 3, 6 and 9 days of interval followed by T_3 (High density polybag) with (4.06, 4.26 and 4.60), and the minimum score for sweetness was observed in T_0 (Control) with (3.06, 3.21, and 3.41) at 3, 6 and 9 days respectively. taste during storage might be due to

the biochemical changes like increase in TSS, sugars and acidity as well as decrease ascorbic acid during storage. These observations were also similar to finding of Sin *et al.*, (2006) [10].

The maximum score of acceptance was observed in the T_2 (Low density polybag) with (8.5, 7.6 and 7.0) at 3, 6 and 9 days of interval followed by T_3 (High density polybag) with (7.8, 7.0 and 6.5) and the minimum score for acceptance was observed in T_0 (Control) with (5.6, 5.0, and 4.8) at 3, 6 and 9 days respectively. The pattern of continuously decrease in overall acceptability score during storage might be due to the decline the all sensory parameters like colour, taste and flavour with increasing storage period. Such identical findings were also revealed by Egwim *et al.*, (2013) [2] clarification of banana juice.

The maximum score of shelf life was observed in the T_2 (Low density polybag) with 10.25 days followed by T_3 (High density polybag) with 9.80 days and the minimum score for shelf life was observed in T_0 (Control) with 8.25 days. These extended shelf life due to low temperature and modified atmosphere packaging were possibly due to the inhibition of ripening rates as contributed by the reduced physiological process, decay and weight loss.

Table 1: Effect of different packaging materials on shelf life and quality of Banana

Symbol	Treatment	TSS at 9 days	Physiological weight at 9 days	Starch %	Flavour at 9 days	Sweetness at 9 days	Acceptance at 9 days	Shelf life
T_0	Control	21.47	14.25	4.26	3.41	3.41	4.8	8.25
T_1	Paper bag	22.33	12.55	5.33	3.89	4.30	5.0	9.1
T_2	Low density Polybag	26.23	6.85	8.06	4.60	5.20	7.0	10.25
T_3	High density polybag	25.41	8.56	7.59	4.12	4.60	6.5	9.8
T_4	Banana leaf	24.58	12.34	6.25	3.93	4.10	6.0	9.65
T_5	Cardboard	23.52	11.64	6.64	4.38	4.40	6.2	9.45
T_6	Newspaper	23.88	12.37	7.27	3.75	3.75	6.8	8.45

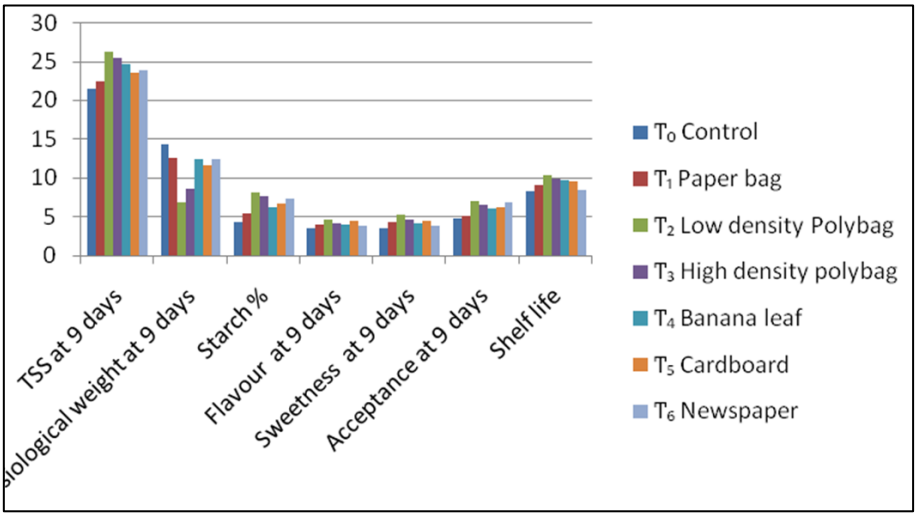

Fig 1: Figure: Effect of different packaging materials on shelf life and quality of Banana.

Conclusion

On the basis of results obtained, It is concluded that the treatment T_2 (Low density poly-bag) found to be best in terms of Total Soluble Solid, Physiological weight loss of banana, Starch Percentage, Flavour, Sweetness, Overall Acceptance and Shelf life**.** Low density of poly-bag tools to modify several physiological processes in banana fruit which are extensively and profitably used in post-harvest crops. They are also used for increasing storage life.

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