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EFFECTS OF STORAGE CONDITIONS ON SENSORY ATTRIBUTES OF PHALSA FRUIT (GREWIA ASIATICA) OF VARIETY SHARBATI

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ABSTRACT

This study was aimed to find out the shelf life of phalsa fruit cultivars (tall and dwarf) of Sharbati variety kept under various storage conditions. For fulfilling this purpose fruits were subjected to three different temperatures i.e. T_1, T_2 and T_3. T_1 is ambient temperature (40 to 45 ^{0}C), T_2 is refrigeration temperature (4 to 6 ^{0}C) and T_3 is deep freeze temperature (-5 to -6 ^{0}C). Physiological loss in weight (PLW) and visual characteristics were observed each day until the fruits were spoiled. The data revealed that deep-freeze proved quite effective in prolonging the shelf-life and maintaining the quality of phalsa cultivars. The highest shelf life was in deep- freeze (10 days) and the lowest was at ambient temperature (24hours). Among tall and dwarf cultivars, dwarf showed lower shelf life than tall. At T_1, PLW was 2.22% for tall and 7.18% for dwarf. At T_2, PLW was gradually increased from 0.45% to 2.22% for tall and 0.90% to 2.11% for dwarf. At T_3 PLW was increased from 0.05% to 0.80 for tall and 0.20% to 1.60% in case of dwarf. Thus deep-freeze storage showed minimum % of weight loss as compared to refrigeration and ambient temperature.

Keywords: Phalsa Cultivars, Shelf- Life, PLW, Visual Characteristics

I. INTRODUCTION

Phalsa (*Grewia asiatica*) belongs to family *Tiliaceae*, is a minor fruit crop which is grown on a very limited scale, mostly in the vicinity of towns [1]. Despite of a rich source of antioxidants such as flavonoids, anthocyanins, vitamins and phenolics compounds, this is still underutilized, as is evident from the lack of literature on this fruit. It is native to the Indian subcontinent and Southeast Asia [2]. This fruit is very delicate, highly perishable in nature and difficult to transport, so it is not available throughout the country. Dark red to purple colored roundish fruits called berries are available abundantly during summer season for a short span of time, causing a seasonal glut and become scarce during other seasons. The fruit is nonclimacteric with extremely short shelf life [3]. The phalsa plant is native to the Indian subcontinent and Southeast Asia but is cultivated on a commercial scale mainly in the northern and the western states of India [4]. This fruit is highly mouth watering and possesses sour to sweet taste like grapes, with a desired pleasant flavour [5]. Phalsa fruits are astringent, stomachic, mordant, aphrodisiac and alleviate inflammation, treat fever, diarrhea when unripe. Ripe fruits are consumed fresh, as dessert, processed into syrup, and extensively used in the production of soft

drinks [6]. Phalsa fruits are also administered in respiratory, cardiac, and blood disorders [7]. During hot summer months these fruits overcomes thirst and burning sensation as well as act as a good source of vitamin A and vitamin C, anthocyanin type cyanidin 3- glucoside [8] with fair amount of minerals like phosphorus, iron etc [9]. The underutilized fruits like aonla, bael, jamun, karonda, phalsa, pumpkin and tamarind etc. serve as the main sources of livelihood for the poor and play a valuable role in overcoming the problem of malnutrition [10]. Hence, in spite of its immense importance in Ayurvedic and traditional systems of medicine commercial exploration has been neglected. This superb fruit is studied here for the estimation of shelf life under various storage conditions, commercial utilization of the fruit and for stimulation of the researchers and scientists for further work on phalsa fruit. Transportation to a long distance and storage for a long period is a big problem for further utilization of this fruit. The marketability of this fruit is lost very rapidly after harvesting due to quick discoloration, fermentation as well as spoilage of fruits for its perishable nature. These fruits are sold by the roadside vendors, under the unhygienic environment, which cuts short its shelf-life drastically. The quantitative and qualitative losses in this seasonal fruit are tremendous and these can be minimized by appropriate storage and packaging. So the shelf life study will be indicative of how long samples can be stored at various temperatures before they drop below acceptable quality limits. At present, no information is available in the literature regarding storage of phalsa fruit cultivars in various temperature conditions. This will be preliminary information for further storage and packaging studies about this fruit.

II. MATERIALS AND METHODS

Phalsa fruits of Sharbati variety (tall and dwarf cultivars), to be studied in this study were collected from Central State Farm, Hisar (India) during the month of June and July. Fruits were picked up in early hours of the day in their commercial ripening state, which is when their peel presents a dark reddish or reddish black colour. These were transported in ice boxes from farm to laboratory due to extremely perishable nature. Arriving at the laboratory, fruits of uniform size, characteristic colour, free from physical flaws, mechanical damage or any visible microbial infection, were selected in order to form a homogenous sample for further estimations.

Prior to being tested, selected fruits were thoroughly washed with tap water, in order to remove the organic dirt adhering to the surface that comes from field and other undesirable materials then air dried for further estimations. Then the fruits of both cultivars were weighed using electronic weighing balance (Indosan, model no. 7029). For experimental assessment, 20 gram fresh fruits of each cultivar was weighed and packed in zip-lock pouches. Two replicates were maintained for each analysis. Three different storage temperatures (T_1, T_2, and T_3) were selected for this study. One set of fruit (tall and dwarf) was stored at ambient temperature at 40-45 ^{0}C (T_1), second at refrigeration temperature at 4-6 ^{0}C (T_2) and third in deep freeze at -5 to -6 ^{0}C (T_3). Then weight and some visual characteristics were observed each day until the fruits were spoiled.

2.1 Determination of Physiological Weight in Loss (PLW) percentage

Fruits from each treatment were weighed on first day of storage and then subsequently their weights were recorded each day up to the end of shelf life. The physiological loss in weight (PLW) was calculated on initial weight basis and results were expressed as the percentage loss of initial weight as per the standard method of AOAC [11] using following formula:

$$\text{Weight loss (\%)} = W_1\text{-}W_2 / W_1 \times 100$$

Where:

W_1 = Initial weight

W_2 = Final weight

During the entire storage period, the weight loss was determined by weighing the individual package on the day of observation using a laboratory level electronic weighing balance.

2.1 Determination of Visual Quality Characteristics

Organoleptic characteristics like color, flavor and texture of fruits were determined by visual inspection on each day during the storage period on the basis of visible fruit surface damage including fungal decay, softening or easily ruptured skin surface, shrinkage, freshness and color changes. Assessments were continued until fruit's condition was considered unacceptable in terms of colour, texture, flavour and general appearance under all storage conditions.

2.2 Shelf Life

The shelf life is a period of time that starts from harvesting and extends up to the start of rotting of fruits [3]. Shelf life of fruits was determined in terms of number of days the fruits retained acceptable appearance and quality as decided by visual observations.

2.3 Statistical Analysis

All the measurements were carried out in triplicates, and data were expressed as means values of triplicate results.

III. RESULTS AND DISCUSSION

3.1 Shelf Life

Tall and dwarf cultivars of phalsa stored at ambient temperature remained in acceptable condition up to 24 hours of storage. Off flavor, very pulpy texture and yellowish green color developed after 24 hours of storage. At 2nd day of storage fungus growth started on outer surface and fruits were discarded. In case of refrigeration tall and dwarf remains edible upto 8 and 7 days respectively. During refrigeration change in colour was less as compared to ambient temperature. In case of storage in deep- freeze condition of fruits remains good up to 10 days (tall) and 9 days (dwarf) of storage. Minimum PLW % was observed during deep-freeze storage and ambient temperature showed maximum PLW %.

3.2 Physiological Loss in Weight (PLW)

Physiological loss in weight is a strong indicator of storage deterioration, loss of freshness and quality in case of fresh produce like phalsa fruit. As days of storage progressed the produce continued to lose weight due to respiration. But, the rate of weight loss was found to be influenced by the storage conditions. The effects of various storage conditions are explained as follows. At T_1, PLW was 2.22% for tall and 7.18% for dwarf cultivar (Table 1). At T_2, PLW was gradually increased from 0.45% to 2.22% for tall and 0.90% to 2.11% for dwarf

(Table 2). At T_3, PLW was increased from 0.05% to 0.80 for tall and 0.20% to 1.60% in case of dwarf as depicted by table 3. Thus deep-freeze storage showed minimum % of weight loss as compared to refrigeration and ambient temperature because during deep-freeze storage the weight of the fruits was changed slightly. A progressive and significant increase in weight loss was observed from 1st day to last day of storage at each storage condition i.e. T_1, T_2 and T_3. Low temperature is the best storage treatment for retarding all physiological and pathological deteriorations and reduces the respiration rate and other metabolic activities [12].

Table 1: PLW (%) of Tall and Dwarf cultivars at Room Temperature

Storage period (days)	Tall		Dwarf	
	Weight (g)	PLA (%)	Weight (g)	PLA (%)
1st	19.4		19.22	
2nd	18.97	2.22	17.84	7.18

Table 2: PLW (%) of Tall and Dwarf cultivars at Refrigeration Temperature

Storage period (days)	Tall		Dwarf	
	Weight (g)	PLA (%)	Weight (g)	PLA (%)
1st	19.83		19.89	
2nd	19.75	0.40	19.71	0.90
3rd	19.74	0.40	19.70	0.95
4th	19.74	0.40	19.70	0.95
5th	19.72	0.55	19.67	1.10
6th	19.62	1.06	19.56	1.66
7th	19.53	1.51	19.47	2.11
8th	19.39	2.22	Discarded	Discarded

3.3 Shelf Life Studies of Phalsa at Room Temperature (40-45 ^{0}C)

For the tall cultivar color, flavor and texture changed to greenish, spoiled (fermented flavour) and very soft shrinked surface with some visual traces of fungus respectively after 24 hours of storage. But for dwarf cultivar color, flavor and texture changed to yellowish (dark purple color fed), spoiled (rotten flavour) and little bit shrinkage of texture respectively after 24 hours of storage.

3.4 Shelf Life Studies of Phalsa at Refrigeration Temperature (4-6 ^{0}C)

For the tall cultivar color, flavor and texture changed to greenish (somewhat purplish), spoiled (fermented) and very soft texture respectively after 8 days of storage. But in case of dwarf cultivar color, flavor and texture changed to yellowish (little bit reddish), fermented and pulpy (very soft outer surface) respectively after 7 days of storage was noticed.

Table 3: PLW (%) of Tall and Dwarf cultivars at Freezing Temperature

Storage period (days)	Tall		Dwarf	
	Weight (g)	PLA (%)	Weight (g)	PLA (%)
1st	19.96		19.91	
2nd	19.96	0.00	19.87	0.20
3rd	19.95	0.05	19.87	0.20
4th	19.93	0.05	19.85	0.30
5th	19.93	0.05	19.82	0.45
6th	19.93	0.05	19.82	0.45
7th	19.93	0.05	19.79	0.60
8th	19.91	0.25	19.78	0.65
9th	19.91	0.25	19.75	0.80
10th	19.80	0.80	Discarded	Discarded

3.5 Shelf Life Studies of Phalsa at Freezing Temperature (-5 to -6 ^{0}C)

Color, in case of both tall and dwarf cultivars was almost similar and not so much changed during storage in deep-freeze after 10 days of storage period. For tall cultivar flavour and texture fermented (rotten) and pulpy (soft outer skin) respectively was observed after 10 days of storage. But in case of dwarf cultivar flavor and texture changed to spoiled and pulpy respectively after 9 days of storage was noticed. In the present investigation significant variation was observed for the shelf life of tall and dwarf cultivar of phalsa. At ambient temperature the shelf life of both cultivars was 24 hours. In case of refrigeration storage, the shelf life of tall cultivar was 8 days and of dwarf cultivar was 7 days. During freezing condition, the shelf life of tall cultivar was 10 days and of dwarf cultivar was 9 days. The maximum shelf life was observed in freezing condition (10 days) whereas the minimum shelf life (24 hours) was noticed during storage at ambient temperature. It can be concluded from our study that tall cultivar of Sharbati variety has one day more shelf life during refrigerated and deep-freeze storage as compared to dwarf cultivar (Table 2, 3). Results of our study are in agreement with the findings of [13]. They observed that that quality of vegetables stored in freezing conditions remained better after 3 months of storage and concluded that shelf life of different vegetables were comparatively better in freezing conditions.

In another experiment, [14] estimated the storage life of fresh-cut melon and papaya by keeping them at lowers temperature. Effect of postharvest temperature on the shelf life of gabiroba fruit was studied by [15] and concluded that the fruits stored at 0 °C or 6 °C exhibited more stability as compared to ambient temperature.

IV. CONCLUSION

Considering % weight loss and visual characteristics during storage, it was concluded that the phalsa fruits of tall cultivar can be stored for 10 days in deep-freeze, 8 days in refrigerator and only a single day or 24 hours at ambient temperature as compared to dwarf which can be stored for 9 days in deep-freeze, 7 days in refrigerator and only a single day at ambient temperature. A slow rate of % PLW was observed during deep-freeze storage as compared to refrigerator and ambient temperature in case of both cultivars. Cold storage had a significant effect on physical and sensory quality of phalsa cultivars and improved their shelf life without any chilling injury and with slight change in color. Strategies to estimate the shelf life of this fruit under different storage

conditions will be very valuable information for the researchers, growers, postharvest technologists as well as for the sellers, market agents, importers and exporters.

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