Effect of Post-Harvest Coating Treatments on Ber (*Zizyphus mauritiana* Lamk.)

DISSERTATION-II REPORT

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CERTIFICATE

This is to certify that synopsis titled **"Effect of Post-Harvest Coating Treatments on Ber (*Zizyphus mauritiana* Lamk.) "** submitted in partial fulfilment of the requirement for the award of degree of **Master of Science** in the discipline of **Horticulture,** is a research work carried out by **Ankush Relhan (Registration No. 11719426)** under my supervision and that no part of this synopsis has been submitted for any other degree or diploma.

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INTRODUCTION

Ber (*Zizyphus mauritiana Lamk.*), a member of family Rhamnaceae, is one of the ancient and common fruits of Indo-China region and has been grown in Indian subcontinent since times immemorial for fresh fruits. Ber is one of the tough minor fruit crops appropriate for growing in arid and semi arid conditions. Fruit is belongs to Indo-Malaysian area of South-East Asia. It is at present broadly naturalized throughout the old world tropics from Southern Africa through the Middle East to the Indian Subcontinent and China, Indo-malaya, and into Australasia and the Pacific Islands. This is the famous fruit which Shabari, an old lady served Lord Sri Ram in Ramayana. The old Lady was so full of devotion, while serving Sri Ram that she tasted every Jujube fruit before serving it to Lord Ram. The Lord, being compassionate towards his devotee accepted those fruits with much love.

Fruit is of uneven size and shape. Fruit can be of egg-shaped, obovate, round, according to the variety. The flesh is crisp and white. When slightly under ripe, this fruit is a bit juicy and has a pleasing aroma. The fruit coat is smooth, silky, thin but tight. It is a fast-growing tree with a intermediate lifespan, which can speedily reach upto 11–41 ft or 3.35 to 12.49 meter tall. Ber is rich in B complex, Vitamin C & A. Ber fruit also having 5.6% digestible crude protein and 50% (approx.) overall digestible nutrients are there in the leaves making it a nutritive feed for animals. Ber is use to prepare pulp, beverage, candy, murabba, dehydrated ber, and jam.

Ber grows under varying climatic circumstances. It can survive in extremely warm situations but is susceptible to frost. High relative humidity is not suitable for ber cultivation. Ber grows on a wide range of soils like clayey, alkaline, sandy and saline soils. The major ber cultivation is done in Punjab, Rajasthan, Haryana, Karnataka, Tamil Nadu and Gujarat. The growing areas are given in the following:-

State	Growing areas
Punjab	Patiala, Sangrur
Rajasthan	Jaipur, Jodhpur, Bharatpur
Haryana	Hisar, Rohtak, Jind, Panipat, Mahindergarh
Karnataka	Gulbarga, Belagaum, Raichur Bijapur, Bellary
Gujarat	Banaskantha, Sabarmati
Tamil Nadu	Salem, Ramanathapuram, Tirunelveli, Dharmapuri

PROBLEM BACKGROUND

The small storage period of fruit and the quick degradation of the fruits is a drawback. At ambient condition (room temperature) a shelf-life of 3–6 days is common life period of fruit. During production season, there is a glut in the market and under lack of postharvest treatments and storage facilities, a large chunk of the production gets spoiled resulting in loss to the orchardist.

REVIEW OF LITERATURE

Lerdthanangkul and Krochta (1996) studied the postharvest effect of edible coating on green bell peppers. They concluded that none of the coatings significantly effected colour changes at the time of storage. Results showed that colour of treated green pepper bell did not change as compare to control.

Hoa *et. al.* (2002) recorded the impact of different coating treatments on the shelf life of mango and use four coating contained shellac, carnauba wax, zein and cellulose. Carnauba wax was superior then all other coatings which reduce the weight loss for long time. After 17 days of storage, fruits treated with carnauba wax showed less weight loss, 15.0% and 16.7% which is very less as compare to other coatings. Coating was the most successful for retarding weight loss. The reason for the weight loss reduction may be due to the blockage of stomata that results reduction in respiration and gas exchange.

Eissa (2008) studied the impact of chitosan treatment on storage life and quality of fresh cut mushroom. He reported that chitosan treatment improves the storage period and quality of fresh cut mushroom. He also suggested that the application of chitosan treatment (20g/kg) could be considered for marketable use in enhance the storage life, maintaining quality and reduce spoilage of mushroom. Use of chitosan for spoilage control, he considered that it may be appropriate in the treatment of mushroom stored for shorter periods for 3 days or for short distance transportation and distribution and for longer storage and marketing, chitosan coating to control discolouration and decay control in mushroom could be better.

Saputra *et. al.* (2009) studied the treatment of chitosan coating as preservatives on fruits. They concluded that the chitosan retarded the weight loss in mango fruit. After seven days of

storage, the weight loss of the control was 19.86% and 2% of chitosan coated sliced mango was 10.27% which is less then control. The coated fruits with chitosan modified the internal atmosphere, reduce transpiration and postponed the ripening of fruits.

Amal *et. al.* (2010) studied improving strawberry fruit storability by edible coating and they conducted five treatment which are dipping fruit in distilled water, soy protein plus thymol coating film, wheat gluten plus thymol coating film, soy protein plus $CaCl_2$ coating film and wheat gluten plus $CaCl_2$ coating film significantly decrease the weight loss of strawberries at the time of storage as compared to control. Comparing all treatments, thymol carried by soy or gluten soy plus $CaCl_2$ treatment significantly reduced weight loss of strawberries.

Hu *et. al.* (2011) studied the effect of wax coating on quality of pineapple fruit in cold storage and concluded that the weight reduces in both control and wax-treatment increased continuously with storage time, the weight loss of control was significantly high then wax treatment on the 7^{th} and 14^{th} day of storage. At the end of the storage, the control showed high weight loss that is 3.1% and 2.6% weight loss is recorded in wax treatment.

Marpudi *et. al.* (2011) studied the storage life enhancement and maintenance of quality of papaya fruits by using aloe vera based coating. Papaya fruits coated with aloe gel 50% and papaya leaf extract and 2.5% chitosan coating. For 15 days uncoated and coated fruits were stored at and 42-55% relative humidity and 30±3°C. He concludes that maximum reduction in size was found in uncoated fruits while size of coated fruits remains same up to 15 days.

Moalemiyan and Ramaswamy (2012) studied the effect of pectin based film coating on mediterranean cucumber for quality retention and shelf life extension. They concluded that the pectin based film coating delay spoilage and increase the shelf life of cucumber which was observed by external appearance, shrinkage, loss of colour, spoilage, and loss in weight. The loss of colour, spoilage, weight loss and wilting was high in uncoated then in coated cucumbers stored at both 12°C and 23°C. And most suitable storage period for uncoated fruits which was for 2 days at 23°C, the coated fruits maintained their acceptability at the same condition for 5 days. For fruits stored at 12°C, the uncoated fruits were acceptable for 10 days while the coated fruits were acceptable for 14 days. It is possible to enhance the storage life of cucumbers for long

time by using coating at the right time and manage the variations at the time of storage of fruits at different conditions.

Brishti *et. al.* (2013) studied the effect of bio-preservatives on storage life of papaya to evaluate the role of coating on ripening behavior and quality of papaya. Coated and uncoated fruits were stored and ripened at ambient conditions (25 ºC-29 ºC) and 82-84% RH. Fruit size was measured using Vernier Caliper with an accuracy of 0.05 mm and then average values calculated. The mean size value of aloe gel (86.73 mm) and papaya leaf extract included aloe gel (86.12 mm) coated fruits was significantly different from control fruits (69.99 mm) after 8 days storage water loss causes shrinkage and loss of weight. Size was measured to determine the effect of coated material on fruit shrinkage. There was maximum reduction (16.98 mm) in size of control fruits and minimum reduction in the papaya leaf extract included aloe gel coated fruits (0.45 mm) after 8 days storage. This was due to the greater water loss in control fruits and less loss in coated fruits.

Hassan *et. al.* (2014) evaluated the effect of wax coating on the quality of tangerine citrus and concluded that at the end of storage period at the low storage temperature that is 5°C, the decay percentage of coated fruits was lesser as compared to uncoated fruits and 15% wax coated fruits had highest spoilage percentage at ambient storage conditions (25°C).

Mahajan and Singh (2014) studied the effect of variable coatings on storage life of Kinnow fruits under ambient conditions. The weight loss percentage of fruits was increased at the time of storage. Citrashine coated fruits recorded minimum weight loss (5.40%) closely followed by terpenoidal oligomer coating (6.23%). The control fruits recorded the highest weight loss (12.20%). In case of Kinnow fruit, fruits show symptoms of shrinkage if weight loss is more than 5.5%. Therefore, it can be visualized from the data that citrashine and terpenoidal oligomer coated fruits can be marketed for about 15 days as compared to control which maintained marketable quality up to ten days only. The citrashine and terpenoidal oligomer coating has been reported to play an important role in lowering the weight loss of pear, sweet lime and apple.

Misir *et. al.* (2014) studied the impact of aloe vera gel as a edible coating on fresh fruit. They concluded that fruit colour is one of the important visual attributes. Aloe vera gel coating delayed the green colour loss on the fruit skin of apples stored at cold conditions (2°C) for 6 months.

Skin colour of grapes showed lower increment in aloe vera treated fruits than in control fruits. Grape fruit is rich in anthocyanin compounds, which account for their red colour. The ripening process of grape has been connected to the anthocyanin compounds. At the end of cold storage (1°C, 95% RH), untreated fruits exhibited a redder and dark colour than aloe treated fruits. The ethylene production rate is altered by the modified conditions created by the aloe vera gel coating, resulting delaying in ripening, chlorophyll degradation, anthocyanin accumulation and carotenoid synthesis and ultimately delay in colour change of fruits.

Puttalingamma (2014) studied the performance of edible coatings of carnauba wax for effective preservation and shelf life of fruits and vegetables and concluded that edible coatings like carnauba wax and resin can improve the shelf life of salad vegetables during storage at room temp as well as at low temperature. Coatings can extend shelf-life and make product available thought-out the season by delay the ripening processes, delay the colour changes, reduce the weight loss, maintain the texture, reduce the decay, and, simple technology.

Hossain and Iqbal (2016) in a study reported that a coating of chitosan @ 1% accorded 16.6 days shelf life of banana followed by 14.6 days with the application of chitosan @ 0.75% coating. The shortest shelf life of 12.4 days was recorded under control (untreated fruits). They concluded that chitosan @ 1% is most suitable coating for increasing the shelf life of banana.

Rokaya *et. al.* (2016) studied the impact of postharvest coating treatments on quality and shelf life of mandarin fruit. The decaying of fruits started in the first week of storage in control treatment whereas in other treatments, decay started in the second week only excluding bavistin treatment. In the third week, spoilage loss occurred in all treatments. The most efficient treatment in preventing the spoilage loss was bavistin (0.7%) followed by combination of wax (10%) + bavistin 0.1% (1.3%), and wax at 10% (3.6%) whereas the highest spoilage loss was recorded in the fruits with control at the end of storage.

PROPOSED RESEARCH OBJECTIVES

- To observing the impact of various coating on shelf-life of Ber (*Ziziphus mauritiana* L.).
- To observing the impact of various coating on Quality of Ber (*Ziziphus mauritiana* L.).

PROPOSED RESEARCH METHODOLOGY

The experiment is planned to be conducted in the Post Graduate Laboratory, Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara, India.

Experimental Details

Location : Agriculture lab, School of Agriculture, LPU

Treatment Details

Sr.No	Treatments	Symbol	Concentration
1.	Chitosan	T_1	1%
2.	$CaCl_2$	T_2	2%
3.	Aloe Vera	T_3	50%
4.	Bee Wax	T_4	12%
5.	Pectin	T_5	3%
6.	Guar Gum	T_6	6%
7.	Petroleum Jelly	T_7	-
8.	Control	T_8	-

Total Treatment Combinations : 8
No. of replications : 2
No. of fruits in one replication : 10
Design : CRD
Observation interval : 96 hours (4 days)

Observations to be recorded:

A. Sensory evaluation

Overall organoleptic rating (out of 9 marks)

The organoleptic evaluation of ber fruits was judged by visual method and on the basis of palatability, scored from 1 to 9 on Hedonic Rating Test Scale. For this purpose, a panel of five judges, who examined the skin colour, pulp colour, sweetness and overall acceptance of fruits. The organoleptic evaluation of ber fruits was examined at alternate day of storage (Rangana, 1978).

Category	Marks
Extremely acceptable	9
Very much acceptable	8
Moderately acceptable	7
Slightly acceptable	6
Neither acceptable nor unacceptable	5
Slightly unacceptable	4
Moderately unacceptable	3
Very much unacceptable	2
Extremely unacceptable	1

$$\text{Acceptance (\%)} = \frac{\text{Number of fruits per each degree of liking x 100}}{\text{Total number of fruit in each treatment}}$$

B. Physical Parameters:

- ***Fruit Length (cm)*:-** Length and breadth was measured with the help of Digital Vernier caliper then length and breadth were expressed in mm.
- ***Fruit Width (cm)***:- Length and breadth was measured with the help of Digital vernier caliper then length and breadth were expressed in mm.
- ***Fruit Weight (g)*:-** Weight of fruit was measured with the help of weighing machine and expressed in gm.
- ***Fruit Volume (cc)*:-** The volume of the sample was measured by using water displacement method. In order to measure volume, beaker is filled with water and then the sample is immersed in water. The amount of water increased from initial level is equal to volume of that sample.

$$\text{Volume of fruit} = \frac{\text{One millimetre (1 ml) of water has volume of one cubic centimeter (1 cm}^3\text{)}}{\text{Final water level} - \text{Initial water level}}$$

- ***Physiological Loss in Weight (%)***:- The weight of fruit was measured with the help of weighing machine. The loss in weight was measured by using the following formula:

$$\text{Weight loss percentage} = \frac{\text{Initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

- ***Fruit density:*** - Density of sample was measured if both the weight as well as volume is known as density. Density was measured by dividing the weight of sample to the volume of that sample. Mathematically, it can be calculated by using following formula:

$$\text{Density} = \frac{\text{Weight of the sample}}{\text{Volume of the sample}}$$

- ***Shelf life of ber*****:** - Shelf life of fruits is that period in which fruit can be consumed and stored for analyzing physical properties. Shelf life is the recommended maximum time for which products or fresh produce can be stored without affecting their market value. When any type of microorganisms, fungi etc. grow on the sample or any type of odor produced from them or any deviation from normal condition of that sample arises, then sample is considered as non-edible and shelf life of the sample ends at that period. The shelf-life of fruits was in days.

C. Chemical Analysis :-

- TSS (^{o}Brix)
- Vitamin C
- Sugars (Reducing and non-reducing)
- Acidity
- Anti-oxidants
- Tannins

Expected Research Outcomes

The research trial is expected to come up with a suitable coating material that can increase the shelf-life of ber under room temperature conditions (25 ˚C-35 ˚C) without altering the chemical properties of the fruit to a greater extent.