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Synopsis of Thesis/Dissertation Work Report of Post-Graduate Student

M.Sc. – Agri. Horticulture (Fruit Science)

IMPACT OF DIFFERENT PACKAGING MATERIAL AND CHEMICALS ON SHELF LIFE & QUALITY OF AONLA FRUITS (*Emblica officinalis* Geartn)

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CERTIFICATE

I certified that this synopsis **Hardeep Singh** with registration no. 11718663 has been formulated and finalized by the student on the subject. **“Impact of different packaging and chemicals on shelf life & quality of Aonla fruit(*Emblica officinalis* Geartn)**

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DECLARATION

I hereby declare that the project work entitled “**Impact of different packaging material and chemical on shelf life & quality of Aonla fruits (*Emblica officinalis Gaertn*)**” is an authentic record of my work carried out at Lovely Professional University as requirements of project work for the award of degree of Master of Science in Horticulture, under the guidance of Dr. Homraj Anandrao Sahare, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

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IMPACT OF DIFFERENT PACKAGING MATERIAL AND CHEMICALS ON SHELF LIFE & QUALITY OF AONLA FRUIT(*Emblica officinalis Geartn*)

1.INTRODUCTION:

Aonla(*Emblica officinalis Geartn*) is also known as Indian gooseberry and it belongs to family Euphorbiaceae. It is oldest minor sub-tropical fruit tree,originated in India. It can be mainly grown in dry regions of Indiadue to its hardy nature and adaptability to different kind of wastelands like saline soils, saline sodic soils.It is tolerant to harsh climatic conditions like freezing and drought conditions in hot summer months.In India total area under *aonla* is 50,000 ha from which production is about 2,00,000 MT(Goyal *et al*; 2008). Due to favorable climatic conditions, high productivity and good varieties, India becomes the world's largest *aonla*producer.

Aonla gets ready for harvesting during November-December. The major harvesting period in Northern India is second week of December to third week of January. Cultivation of *aonla* is mainly done in salt affected soils of UttarPradesh including the area of Agra, Fatehpur, Mathura, Ethwah. It is also cultivated in semi –arid regions of Gujrat, Maharashtra, AndhraPradesh, Tamil Nadu,Haryana, Karnataka, Rajasthan andkandi area of Punjab.

Aonla fruit is rich in vitamin C, it contains 500-1500 mg ascorbic acid in 100 gm of pulp(Chauhan *et al*; 2005),probably good source of polyphenols, pectin, tannins, antioxidants and contains essential minerals like calcium, iron, phosphorus. Its fruit is very nutritious in nature and having good medicinal properties due to which it is used to cure many health problems like diabetes, colic, asthma, leprosy, headache, depression, dyspepsia, cough, flatulence, skin problems, bronchitis. Dried candy of fruit is also useful in chronic dysentery, diarrhea, anemia and jaundice. Aonla is used in making of very popular products like Trifla, AmritKalash, Chavanprashwhich is mention in many digestive problems. The fruit contains more vitamin C than guava, tomato, citrus (after the Barbados cherry contains 1400mg vit C per 100gm of pulp), a single fruit of *aonla* have 20 time more vit C than the orange fruit and 3 times rich source of protein than the apple fruit.

Aonla is known as king of arid fruits. Fruit is very less consumed in fresh form it is mainly consumed after its processing into different products like pickles, murraba, candy, squash, jam, chutney, jellies. It is also used in making of many cosmetic products such as shampoo, hair dyes, hair oils, toothpaste etc.Fruits are also used as an indigenous medicine. Harvesting time of fruits are very less due to which market glutsare comes and producer sale their fruits at very low price. Aonla fruit is non-climacteric and perishable in nature, due to which it is very difficult to store it for long time at room temperature and to transport it to distant markets. Therefore, it requires proper postharvest operations by which we can reduce the postharvest losses and increase the shelf life of fruits.

If we want to get good market returns than it is very essential to preservethe fruits under adequate conditions for considerable period of time. About 20-30% of fruits are decays till they reach to the consumer due to the inadequate transportation facilities, harvesting methods, handling, storage conditions, packaging and due to market problems. Extension of shelf life and reductionof postharvest losses without deteriorating fruit quality is very important.Reduction of postharvest

losses are possible by control the rate of respiration, transpiration and by check microbial infection. Different PGRs, fungicides, chemicals can also increase the shelf life and improves the fruit quality without postharvest losses in *aonla*.

Packaging material are very important in reducing the postharvest losses during storage, transportation and marketing. Different packaging material creates different atmosphere which shows different results in related to fruit quality and their storage life. In India various types of packaging materials are used for storage of *aonla* fruits, existing packaging material was gunny bags which results in more mechanical injury and economic loss to fruits. In gunny bags more loss takes place due to huge amount of fruits per pack (50-100 kg), poor dimensional stability, impact, compression and vibration during transportation. Wooden crates are mainly used for fruit transportation. Without any cushioning material in crates bruising will takes place (Bruising is mechanical injury to fruits during harvesting and post harvesting when fruits are transported from one place to another place). Corrugated fiber boxes are more commonly used for storage and transportation with proper ventilation. CFB boxes are appropriate to storage due to proper ventilation, printable information on box, recyclable and less fruit spoilage. Maximum fruit spoilage takes place in gunny bags without any liner (30.19%) and minimum loss takes place in CFB boxes (16%). Polythene bags are more ideal for fruit storage for longer time at room temperature and it is less economic way.

2. PROBLEM BACKGROUND:

- 1 More transpiration, respiration loss during storage.
- 2 Infestation of various pathogens during storage period.
- 3 Deterioration of fruit quality like T.S.S., acidity, total sugars, antioxidants, ascorbic acid after harvesting.
- 4 Mechanical injury to fruits like bruising during fruit transportation.
- 5 Inadequate packaging material and stored condition for long period storage.
- 6 About 20-30 % fruits are not reach to consumers after harvesting due to inadequate packaging and storage conditions.
- 7 Due to rotting, shriveling and bruising market value of fruits are reduced.
- 8 Market glut due to short harvesting period.

3. REVIEW OF LITERATURE:

Aonla (*Emblica officinalis* G.) takes an important position in indigenous fruits due to its versatile use in human diet. Postharvest losses are major factors by which farmers are not go for *aonla* cultivation (Bahadur et al; 2009). Fruits become attacked by various diseases during storage, marketing, packaging by which tons of fruits are lost.

Postharvest life of fruit is affected by methods of harvesting, handling, packaging, storage, transportation and diseases (Haard&Salunkhe 1975).

Shelf life of fresh fruit is very less in tropics and estimated that about 25 to 35 % of fruit are lost due to inadequate storage, transportation and packaging (Pantastico, 1975).

(Singh et al ;2003) studies the physio-chemical changes and shelf life of various cultivars of *aonla* like “Banarasi”, “Chakaiya”, “NA 7” and “Francis” by store them at room temperature conditions of Gujarat. They noted the reduction of physiological weight, acidity, ascorbic acid and increase in spoilage percentage, TSS, total sugar and reducing sugar in all the samples during storage. In Chakaiya and NA7 least physiological weight loss (3.42-17.20% and 3.92-8.23%) is noted than other cultivars, spoilage percentage (6.36-16.00% and 7.30-17.00%) and 7 days more shelf life in storage conditions.

(Dhuma et al; 2008) conduct an experiment on the effect of wax in combination with chemicals and various packaging materials on physiochemical changes and market value of *aonla* at room temperature storage. They note that fruits which are untreated and packaged in nylon bag the physio-chemical properties are changes at very faster rate. Fruits which are treated with 6 % waxol + 400 ppm CCC and pack in polyethylene bag have storage life of 15 days at room temperature conditions. This combination having highest score for marketing.

(Nath et al; 1992) observed the effect of calcium nitrate (1 %), GA-3 (50 ppm) and borax (4%) on postharvest shelf life of *aonla* fruits, they found that physiological weight loss and attack of pathogens was increased with storage period. In Calcium nitrate at 1%, weight loss is very low during the storage and no pathogen attack was noted by Borax up to 9 days.

In 2001-2002 a research was conducted to note the impact of different physical and chemical treatments on storage life of *aonla* at room temperature. And found the reduction in acidity, ascorbic acid, physiological weight of fruit and increment in spoilage percentage, total soluble solids, total sugar, reducing sugar level in all samples during storage period of experiment. In calcium nitrate 1.5 % + perforated PE bag and GA3 100ppm + perforated PE bag physiological loss of weight is very less (2.12-16.00 and 2.15-16.34%), spoilage percentage (2.40-15.00% and 2.50-15.60%) and have more shelf life up to 11 days than other samples.

Among all other packaging materials for *aonla* fruit storage, LDPE bags at 15 °C stored fruits for 21 days as it gives ambient atmosphere to fruits. In the combination of different packaging material at cold conditions, high retention of fruit nutrients like ascorbic acid, acidity, total sugars, T.S.S, phenols were noted and fruits gives good physical appearance for 21 days under

storage conditions. In other fruits which was stored at high temperature they were badly affected in textural appearance, chemical and physical properties. Higher respiration rate was observed in HDPE, PP films and in control due to the higher gas and vapour transmission rate. In low temperature conditions at 5 and 10 °C, PLW, shriveling and rotting are more than 10%. These fruits are not good for marketing due to reduction in moisture, firmness, vitamin C and sugars level. Fruits packaged in LDPE maintained quality up to 21 days so it would be the most appropriate packaging material to reduce the losses.

(Singh *et al*; 2008) noted the average fruit weight 42.27 gm and volume 39.40 ml in *aonla* cv. Banarasi.

(Bhosle 2002) conducted an experiment on storage behavior of fruits under room temperature, cool chamber and cold storage conditions and observed that fruits stored at room temperature show higher spoilage (60%). In cold storage minimum spoilage was observed (18.12%) followed by cool chamber (24.2%).

(Singh *et al*; 2008) recorded that concentration of ascorbic acid was very low in untreated fruits of Cv. Chakaiya (260.20 mg/100g) while it was higher (338.47 mg/100g and 342.14 mg/100g) in fruits dipped in solution of calcium nitrate (1% and 1.5%) and followed by fruits dipped in solution of 50 and 100 ppm concentration of gibberellic acid (320.17 mg/100g and 335.13 mg/100g) on the final day of storage (13th day).

(Prajapati *et al*; 2011) showed that ascorbic acid concentration is not affected by any pre-treatments. Maximum ascorbic acid concentration 277.5 mg/100 g was recorded when fruits have a good amount of KMS.

(Choudhary *et al*; 2006) observed that T.S.S. and titratable acidity of *aonla* syrup was increasing with storage time.

(Reddy and Chikkasubbanna 2009) noted the increment of T.S.S. of *aonla* syrup during storage.

(Yadav *et al*; 2015) reported that total acidity of *aonla* syrup was increasing with storage.

(Kambale 2014) did an experiment on storage of *aonla* juice and observed the pH level of juice during storage period. pH was 2.72 to 2.86 at 60 days of storage and reduced to 2.84 at 120 days and 2.81 at 180 days of storage period.

(Choudhary *et al*; 2006) reported that ascorbic acid content was decreased in *aonla* syrup and *aonla* squash when stored for 8 months at room temperature conditions.

(Priya and Khadatar 2013) conducted an experiment on the impact of processing methodologies on keeping quality of *aonla* syrup at ambient temperature and noted that vitamin C content in syrup reduced from 41.800 mg/100 ml to 29.500 mg /100 ml during storage period of 3 months.

(Yadav *et al*; 2015) observed that ascorbic acid content is decreased in *aonla* syrup during storage. There was not any change in ascorbic acid content up to 1 month. After 1 month it was decreasing continuously up to 6 months.

(Johar and Anand 1952) observed that *aonla* preserves were fermented during storage, which caused spoilage and emitting foul smell. They observed that bacterial contamination in fresh fruit was eventually suppressed by yeast and mould growth in the final product.

(Sagar and Kumar 2006) noted that *aonla* preserves infested are by *Aspergillus* sp. and *Penicillium* sp. at 80% R.H. and above.

(Gupta and Mukherjee 1982) noticed that GA₃ (100 mg/lit) was very effective in control browning and thereby, marketability of fruits was increased. Minimum market value was noted in treatment of WE + 100 mg/lit GA₃ due to high infection of *Aspergillus* spp. and *Penicillium* spp.

(Nath *et al*; 1992) observed that physiological loss of weight was increased during storage period and treatment of 50 ppm GA₃ maintains the good concentration of vitamin C during storage of cv. Chakaiya.

(Patel and Sachan 1995) during studies on shelf life of *aonla* cv. Deshi, they observed the reduction of PLW (16.44 %), rotting (10.35 %) and highest Vit. C (543.90 mg/100 g) concentration on 15th day of storage period, when fruits were dipped in GA₃ (40 ppm) + packaging in perforated P.E. bags and stored at ambient temperature.

(Singh and Kumar 1997) found that fruits of Cv. Chakaiya treated with Gibberellic acid (10 and 25 ppm) for 10 minutes and stored at ambient temperature were effective in decreasing PLW, T.S.S. and acidity were significantly increased continuously and ascorbic acid concentration reduced during storage period.

(Nath *et al*; 1992) found no pathological infestation up to 9th day of storage at room temperature in *aonla* fruits cv. Chakaiya, treated in 4 % Borax or 500 ppm Cycocel solution.

(Gupta and Mukherjee 1982) observed the marketability qualities of *aonla* fruits cv. Banarasi after treated with WE and noted that fruits treated with WE and 10 mg/lit morphactin had minimum market value.

(Upadhyay and Dixit 1996) recorded that *aonla* fruits cv. GA-1 when dipped in 100 ppm bavistin and/or 100 ppm aurofungin results in the minimum pathological attack on fruit, higher shelf-life and have good outer appearance.

(Premi *et al*; 1999) observed that 0.04 % KMS and 10 % iodine solution was impactive in checking the formation of white specks (WS) on fruit skin, with higher retention of fruit nutrients during storage.

(Yadav and Singh 1999) observed that pre-harvest treatment of 0.1 % Topsin-M and 0.1 % Bayleton controlled *Penicillium oxalicum* for 10 days and *Aspergillus niger* for 20 days and increase the shelf life of *aonla* fruits at room temperature.

4. OBJECTIVES OF STUDY:

- 1 To study the impact of different packaging materials on shelf life & quality of *aonla* fruits.
- 2 To study the impact of different levels of chemicals on shelf life & quality of *aonla* fruits.
- 3 To find standardized economical method to store the *aonla* fruits for longer durations under room conditions.
- 4 To study about the microbial growth of different pathogens during the postharvest storage of *aonla* fruits.
- 5 To study about the physio-chemicals changes of *aonla* under different storage conditions.

5. PLAN OF WORK:

The present experiment has been planned during *November-December* 2017-2018 at Horticulture laboratory of Lovely Professional University, Jalandhar, Punjab. Material and method implemented during the experiment are described in this.

5.1 Experiment I. Optimization of packaging and storage of *aonla* fruits

5.1.1 Procurement of raw material

The hand-picked, fully mature and healthy fruits of *aonlacv*. “Balwant” of uniform size, free from pest and diseases, injuries, bruises and blemishes were selected from the orchard.

5.1.2 Preparation of the fruits

After sorting, the fruits are washed in fresh water and packed in polyethylene pouches containing 10 fruits made up of low density poly ethylene (LDPE) of 50 μ , high density poly ethylene (HDPE) of 50 μ , poly propylene (PP) of 30 μ , shrink film of 25 μ , nylon bags, corrugated fiber box (CFB). The fruits in packaging material without any chemical treatment are treated as control.

5.1.3 Storage and sampling

The packed fruits and the control will keep at room temperature (22 to 28 °C and 58-60 % R.H) for storage in different packs and each pack contains 10 fruits. At the start of the experiment these ten fruits were kept in two lots of five fruits each. One pack of fruits will be for calculating the physical parameters, general conditions and other pack of fruits for analysis of chemical parameters during storage at 0, 7, 14 and 21 days after harvesting. The experiment will conduct by using completely randomized design with 3 replications in a factorial layout.

5.2 Experimental design

The experiment will laid out in Completely Randomized Block design, CRD (Analysis in 1 way classification) with the following details:

Crop: Aonla

Design: Analysis in 1 way classification (CRD)

Replications: 3 (three)

Total treatments: 5 chemicals \times 6 packaging = 30

Number of fruits per treatment in each replication = 10

Number of fruits per treatment in each three replications = 30

Total number of fruits used: 10 \times 6 \times 5 = 300.

5.2.1 Packaging material

- (i) LDPE Film
- (ii) HDPE Film
- (iii) Shrink Film
- (iv) Net Bag
- (v) PP Film
- (vi) Corrugated Fiber Box

5.2.2 Chemicals

- (i) Contol (untreated)
- (ii) 6% Waxol + 100ppmGA3
- (iii) 6% Waxol + 1% Ca[No3]2
- (iv) 6% Waxol + 400 ppm CCC
- (v) 6% Waxol + 0.1% Carbendazim

5.2.3 Treatments

- (i) LDPE Film + 6% Waxol + 100ppmGA3
- (ii) LDPE Film + 6% Waxol + 1% Ca[No3]
- (iii) LDPE Film + 6% Waxol + 400 ppm CCC
- (iv) LDPE Film + 6% Waxol + 0.1% Carbendazim
- (v) HDPE Film + 6% Waxol + 100ppmGA3
- (vi) HDPE Film + 6% Waxol + 1% Ca[No3]2
- (vii) HDPE Film + 6% Waxol + 400 ppm CCC
- (viii) HDPE Film + 6% Waxol + 0.1% Carbendazim
- (ix) Shrink Film + 6% Waxol + 100ppmGA3
- (x) Shrink Film + 6% Waxol + 1% Ca[No3]2
- (xi) Shrink Film + 6% Waxol + 400 ppm CCC
- (xii) Shrink Film + 6% Waxol + 0.1% Carbendazim
- (xiii) PP Film + 6% Waxol + 100ppmGA3
- (xiv) PP Film + 6% Waxol + 1% Ca[No3]2
- (xv) PP Film + 6% Waxol + 400 ppm CCC
- (xvi) PP Film + 6% Waxol + 0.1% Carbendazim
- (xvii) Net Bag + 6% Waxol + 100ppmGA3
- (xviii) Net Bag + 6% Waxol + 1% Ca[No3]2
- (xix) Net Bag + 6% Waxol + 400 ppm CCC
- (xx) Net Bag + 6% Waxol + 0.1% Carbendazim
- (xxi) Corrugated Fiber Box + 6% Waxol + 100ppmGA3
- (xxii) Corrugated Fiber Box + 6% Waxol + 1% Ca[No3]2

- (xxii) Corrugated Fiber Box +6% Waxol + 400 ppm CCC
- (xxiv) Corrugated Fiber Box + 6% Waxol + 0.1% Carbendazim
- (xxv) LDPE + control (untreated)
- (xxvi) HDPE + control (untreated)
- (xxvii) Shrink + control (untreated)
- (xxviii) PP film + control (untreated)
- (xxix) Net Bag + control (untreated)
- (xxx) Corrugated Fiber Box + control (untreated)

5.3 Observations

The following observations will be recorded for determining the keeping quality of the fruits in various packages stored at room temperatures.

5.3.1 Physiological quality parameters

- (i) Physiological loss in weight (PLW)
- (ii) Fruit size by measuring fruit length and breadth
- (iii) Fruit volume
- (iv) Marketability score (Hedonic scale)

5.3.2 Physio-chemical quality parameters

- (i) Total soluble solids
- (ii) Total Sugars
- (iii) Reducing Sugars
- (iv) Non- reducing sugars
- (v) Titratable acidity
- (vi) Ascorbic acid
- (vii) Antioxidants
- (viii) Phenols

5.3.3 Pathological studies

- (i) Fruit rotting
- (ii) Fungi associated with fruit rots

6. EXPECTED OUTCOMES:

1. Retain good outer appearance of fruits for marketing.
2. Maintaining physical quality like fruit weight, volume, size by checking transpiration, respiration losses.
3. Reduce microbial growth.
4. Increment in shelf life of fruits up to 20 days during storage.
5. Maintain proper quality traits like T.S.S., ascorbic acid, phenols, antioxidants, sugar level to desirable level.

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