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# Studies on post harvest handling of pomegranate (*Punica granatum* L.) during transit trials

**SS Patil, SA Ranpise and VP Kad**

**Abstract**
The present research work entitled "Standardization of protocol for supply chain management of pomegranate (*Punica granatum* L.)" was conducted at M/s. Sahyadri Farmers Producer Company Limited (SFPCL) - Way to sustainable Agriculture, At post Mohadi, Tal. Dindori, Dist. Nashik. and at Post Harvest Technology Centre, Department of Horticulture, MPKV., Rahuri-413722, Dist-Ahmednagar, Maharashtra during the year 2018-2020. The objectives of present research were to study the effect of post harvest handling of pomegranate fruit from field to packhouse and packhouse to market. The research work was divided in transit trial from field to packhouse and again transit trial from packhouse to market. In transit trial, the pomegranate samples were collected from field with minimum postharvest handling and transported to packhouse in refer van by maintaining cold chain (10 $^0$C) and another pomegranate samples were collected from same field with regular post harvest handling and transported to packhouse without cold chain. In transit trial when pomegranate samples were transported from field to packhouse and packhouse to market by cold chain retained high firmness and with minimum loss in sensory parameters.

**Keywords:** Harvest, pomegranate, transit, trials, *Punica granatum* L.

## Introduction
Pomegranate (*Punica granatum* L.) is a popular fruit of subtropical region. In Latin word 'pomegranate' means apple with number of seeds." It is grown all over India. However, it is commercially grown in Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Tamil Nadu and Rajasthan. It has enjoyed a reputation for its healthy dietetic and medicinal properties. The area under this crop has increased substantially, mainly because of the versatility, adaptability, drought resistance and high yield.

Pomegranate is referred to as 'super fruit' because of its high nutritive value, high antioxidant capacity, high potentially bioactive compounds, chemo- preventive properties having medicinal value and high consumers appeal (Hertog *et al*., 1997) [2]. Studies showed that pomegranate has chemo preventive properties such as antimutagenicity, antihypertension, antioxidative potential and reduction of liver injury due to its high anthocynin content (Basu and Penugonda, 2009) [1]. The edible portion of pomegranate is an excellent dietary source as it contains a significant proportion of organic acids, soluble acids, polysaccharides, vitamins, fatty acids and mineral elements of nutritional significance.

Post harvest losses in pomegranate occur due to lack of proper storage, packaging and improper handling during transport. Extension of shelf life can be possible by reducing the respiration rate, transpiration and microbial infection. Lac based wax coating is carried out for extending the shelf life of many fruit in addition of packaging and storage (Sarkar and Kumar, 2003) [3].

## Objectives
1. To study the effect of post harvest handling of pomegranate fruit from field to packhouse.
2. To study the effect of handling of pomegranate fruit from packhouse to market

## Material and Methods
This chapter deals with the material used and the methodologies followed for the investigation on post harvest handling through effective supply chain of pomegranate. The investigation was carried out in the "Sahyadri Farmer's Producer Company Limited (SFPCL) Way to sustainable agriculture", Gat No. 314, Near Water Tank, At/Post- Mohadi, Tal. Dindori, Dist. Nashik. and Post Harvest Technology, Department of Horticulture, MPKV., Rahuri, Dist- Ahmednagar, Maharashtra during 2018-19 and 2019-20. The details of the material, methodology employed and experimental techniques used for the study are presented below.

**Transit Trial Details**

The experiment was conducted in three parts that is transit trials from field to packhouse.

The transit trial details were showed in Table 1 and 2. The pomegranate samples were collected from field with minimum post harvest handling and carry to packhouse in refer van by maintaining cold chain. And another pomegranate samples were collected from same field with regular post harvest handling (no safety taken to prevent injuries on pomegranate) and carry to packhouse at ambient temperature. Sorting and packaging of pomegranates were carried out at packhouse. The same transit trial methods of handling of pomegranate fruits from field to packhouse were used for transit trials from packhouse to market.

**Part A: Farm to packhouse**

**Table 1:** Transit trial details

| Sr. No. | Parameters | Description |
|---|---|---|
| 1. | Farm to pack house (FP) | With Cold chain (Refer van) |
| | | Without cold chain |
| 2. | Travelling time | Twelve hours |

**Table 2:** Transit trial treatment combinations

| Sr. No. | Treatment combinations | Detail |
|---|---|---|
| 1. | $FP_1$ | Farm to packhouse with cold chain |
| 2. | $FP_2$ | Farm to packhouse without cold chain |

**Observations of farm to packhouse trial**

1. Temperature of pomegranate on field ($^0$C)
2. Transport temperature ($^0$C)
3. Transport hour
4. Temperature of pomegranate at packhouse ($^0$C)
5. Weight loss (%)
6. Firmness (N)
7. Organoleptic evaluation of pomegranate

**Part B: Packhouse to Market**

The transit trial details were showed in Table 3 and 4 The pomegranate samples were collected from packhouse and carry to market in refer van by maintaining cold chain and another pomegranate samples were carry from packhouse to market at ambient temperature.

**Table 3:** Transit trial details from Packhouse to Market

| SN | Parameters | Description |
|---|---|---|
| 1. | Farm to pack house (FP) | With Cold chain (Refer van) |
| | | Without cold chain |
| 2. | Travelling time | Twelve hours |

**Table 4:** Transit trial treatment combinations

| SN | Treatment combinations | Detail |
|---|---|---|
| 1. | $PM_1$ | Farm to packhouse with cold chain |
| 2. | $PM_2$ | Farm to packhouse without cold chain |

**Observations of packhouse to market trial**

1. Temperature of pomegranate ($^0$C)
2. Transport temperature ($^0$C)
3. Transport hour
4. Weight loss (%)
5. Firmness (N)
6. Organoleptic evaluation of pomegranate

**Results and Discussion**

**Effect of Post Harvest Handling of Pomegranate Fruits during Transit Trail from Farm to Packhouse**

The data on effect of post harvest handling of pomegranate fruits from farm to packhouse are presented in Table 5.

The harvesting temperature of pomegranate on field was 35.8 $^0$C for both $FP_1$ (Farm to packhouse with cold) and $FP_2$ (Farm to packhouse with ambient).

The temperature during transit from farm to packhouse of transport vehicle was 10 $^0$C for $FP_1$ (Farm to packhouse with cold) and 35 ± 2 $^0$C for $FP_2$ (Farm to packhouse with ambient). The temperature of pomegranate fruits at packhouse was 10$^0$C for $FP_1$ (Farm to packhouse with cold) and 33.2$^0$C for $FP_2$ (Farm to packhouse with ambient). More firmness (27.27 N) and less weight loss (0.137%) was observed in $FP_1$ (Farm to packhouse with cold). less firmness (25.60 N) and more weight loss (3.53%) was noted in $FP_2$ (Farm to packhouse with ambient).

**Table 5:** Observations of pomegranate fruits from farm to packhouse trial

| Sr. No. | Parameter | FP1 (Farm to packhouse with cold) | FP2 (Farm to packhouse with ambient) |
|---|---|---|---|
| 1. | Temperature of pomegranate fruits on field ($^0$C) | 35.8 | 35.8 |
| 2. | Transport temperature ($^0$C) | 10 | 35 ± 2 |
| 3. | Transport time (h) | 4 | 4 |
| 4. | Temperature of pomegranate fruits at packhouse ($^0$C) | 10 | 33.2 |
| 5. | Weight loss (%) | 0.137 | 3.53 |
| 6. | Firmness (N) | 27.27 | 25.60 |

Organoleptic evaluations were also taken as per 9 points Hedonic scale method at farm and at packhouse, to evaluate the quality changes during harvesting technique and transport methods. The difference of average score was given into the Table 4.3. The organoleptic score at farm for appearance, colour and taste was 8.9 for both $FP_1$ (Farm to packhouse with cold) and $FP_2$ (Farm to packhouse with ambient). After 12 hours of transport from farm to packhouse the appearance, colour, taste score was not changed from farm to packhouse with cold ($FP_1$) and farm to packhouse with ambient ($FP_2$). From farm to packhouse texture score was reduced (8.5) and (7.6) at $FP_1$ (Farm to packhouse with cold) and $FP_2$ (Farm to packhouse with ambient), respectively. From farm to packhouse the overall acceptability was reduced (8.8) and (8.57) at $FP_1$ (Farm to packhouse with cold) and $FP_2$ (Farm to packhouse with ambient), respectively. The data revealed that treatment $FP_1$ maintain better quality in transport than treatment $FP_2$ (Farm to packhouse with ambient).

**Table 6:** Organoleptic evaluation of pomegranate fruits at farm to packhouse trial

| Sr. No. | Parameter | $FP_1$ (Farm to packhouse with cold) | | $FP_2$ (Farm to packhouse with ambient) | |
|---|---|---|---|---|---|
| | | At farm | At packhouse | At farm | At packhouse |
| 1. | Appearance | 8.9 | 8.9 | 8.9 | 8.7 |
| 2. | Colour | 8.9 | 8.9 | 8.9 | 8.7 |
| 3. | Taste | 8.9 | 8.9 | 8.9 | 8.9 |
| 4. | Texture | 8.9 | 8.5 | 8.9 | 7.6 |
| 5. | Overall acceptability | 8.9 | 8.8 | 8.9 | 8.57 |

**Effect of Post Harvest Handling of Pomegranate Fruit from Packhouse to market Transit Trial**

These trials were carried out with the objective to maintain the best quality of pomegranate from packhouse to market.

**Packhouse to market**

The data on effect of handling of pomegranate from packhouse to market was shown in Table 7.

The temperature of product at packhouse was 6.2 $^0$C for $PM_1$ (at packhouse in cold storage) and 26.8 $^0$C for $PM_2$ (at packhouse in room tempererature). The transport temperature was 10 °C for $PM_1$ (at packhouse in cold storage) and 30±2 °C for $PM_2$ (at packhouse in room tempererature). Transport hours was 12 (hrs). It was found that firmness of treatment $PM_1$ (at packhouse in cold storage) was 22.40 N at packhouse and it was decreased to 21.92 N at market after 12 h. For treatment $PM_2$ (at packhouse in room tempererature), it was 20.23 N at packhouse and decreased to 18.32 N at market.

**Table 7:** Observation of packhouse to market trial

| Sr. No. | Parameter | At packhouse | | At market | |
|---|---|---|---|---|---|
| | | $PM_1$ | $PM_2$ | $PM_1$ | $PM_2$ |
| 1. | Temperature of pomegranate at packhouse ($^0$C) | 6.2 | 26.8 | 10 | 30±2 |
| 2. | Transport temperature ($^0$C) | 10 | 32±2 | 10 | 30±2 |
| 3. | Transport hour | 12 | 12 | 12 | 12 |
| 4. | Firmness (N) | 22.40 | 20.33 | 21.92 | 18.32 |
| 5. | Weight loss (%) | - | - | 0.017 | 1.12 |

Organoleptic evaluation was also taken at packhouse and market, to evaluate the quality changes in transport methods. The difference of average score was given in Table 4.33 and it was found reduced during transport from packhouse to market. It was observed that, treatment $PM_1$ was maintains better organoleptic quality of pomegranate throughout transport process than $PM_2$.

**Table 8:** Organoleptic evaluation of pomegranate at packhouse to market trial

| Sr. No | Parameter | $PM_1$ | | $PM_2$ | |
|---|---|---|---|---|---|
| | | At packhouse | At market | At packhouse | At market |
| 1. | Appearance | 8.3 | 8.0 | 7.3 | 7.0 |
| 2. | Colour | 8.3 | 8.0 | 7.3 | 7.0 |
| 3. | Taste | 8.3 | 8.0 | 7.6 | 7.6 |
| 4. | Texture | 8.3 | 8.0 | 7.0 | 6.6 |
| 5. | Overall acceptability | 8.3 | 8.0 | 7.3 | 7.05 |

The present investigation entitled "Standardization of protocol for supply chain management of pomegranate (*Punica granatum* L.) was conducted at sahyadri farmers producer company limited (SFPCL) - way to sustaianble Agriculture, GAT No. 314, Near water tank, At post Mohadi and at of Post-Harvest Technology, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.) during the year 2018-2019. In the present experiment, study the effect of post harvest handling of pomegranate fruit from field to packhouse and packhouse to market of pomegranate during supply chain was undertaken. Findings of the present investigation are summarized below under an appropriate headings and subheadings.

**Summary**

Pomegranates samples were harvested by minimum post harvest handling and carry from farm to packhouse and packhouse to market by cold chain and by ambient temperature.

When pomegranates were transported from farm to packhouse and packhouse to market with cold chain (with refervan 10$^0$C) it retained high overall acceptability and firmness.

**Conclusion**

The effective supply chain of pomegranate fruits were maintained by post harvest handling through cold chain.

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