



Fruit Bagging in Mango: A Smart Pre-harvest Technology for Premium Quality Fruits

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ABSTRACT

Mango (*Mangifera indica* L.) is one of the most commercially important fruit crops, but its marketability is often reduced by insect pests, diseases, sunburn, dust deposition, mechanical injuries, and pesticide residues. Pre-harvest fruit bagging has emerged as an effective, eco-friendly technology to improve fruit quality while minimizing chemical pesticide use. The technique involves enclosing developing fruits in specially designed paper or fabric bags to create a protective microenvironment that regulates temperature, humidity, and light intensity. Fruit bagging protects mangoes from fruit fly infestation, anthracnose, stem-end rot, bird damage, and sunburn, resulting in cleaner, blemish-free fruits with enhanced size, weight, firmness, color, and shelf life. Studies have demonstrated that reddish-brown paper bags and double-layer brown paper bags, when applied approximately three months after fruit set, produce superior fruit quality and greater market acceptance. Besides improving food safety by reducing pesticide residues, fruit bagging increases export potential and economic returns through premium-quality produce. As an integral component of Good Agricultural Practices (GAP), Integrated Pest Management (IPM), and residue-free production systems, fruit bagging offers a sustainable approach for enhancing mango productivity, profitability, and competitiveness in domestic and international markets.

Keywords: Mango Fruit Fly, Fruit Bagging, Pre-harvest Management, Fruit Quality, Integrated Pest Management

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1. INTRODUCTION

Mango (*Mangifera indica* L.), popularly known as the “King of Fruits,” is one of India’s most important fruit crops because of its delicious taste, rich nutritional value and high export potential. India ranks first in mango production, cultivating the crop on more than 2.3 million hectares and contributing nearly 40–45% of global production. However, a considerable proportion of fruits lose market value due to fruit fly infestation, fungal diseases, sunburn,

bird damage, mechanical injuries, dust deposition and pesticide residues. In recent years, consumers have become increasingly conscious about food safety and demand fruits that are attractive, residue-free and environmentally safe. Consequently, fruit bagging has emerged as one of the most effective pre-harvest technologies for improving fruit quality while reducing dependence on pesticides. This simple practice creates a protective barrier around developing fruits and has become increasingly

popular in mango-producing countries for producing premium-quality fruits suitable for domestic and export markets.

2. WHAT IS FRUIT BAGGING?

Fruit bagging is the practice of enclosing individual developing fruits in specially designed paper or fabric bags during their growth. The bags act as a protective cover against insects, diseases, dust, excessive sunlight, birds and mechanical damage while creating a favorable microenvironment around the fruit. This microclimate improves fruit development and enhances external appearance without affecting normal growth. Unlike chemical control measures, fruit bagging is an eco-friendly and residue-free technology that forms an important component of Good Agricultural Practices (GAP) and Integrated Pest Management (IPM).

3. WHY SHOULD MANGO GROWERS ADOPT FRUIT BAGGING?

Developing mango fruits remain exposed to several biotic and abiotic stresses throughout the growing season. Fruit flies (*Bactrocera dorsalis*), anthracnose, stem-end rot, sunburn, hailstorms, rubbing of fruits against branches and dust accumulation reduce fruit quality considerably. Frequent pesticide applications may provide temporary protection but often leave residues that reduce consumer confidence and limit export opportunities. Fruit bagging provides physical protection against these problems while allowing fruits to develop under a more favorable environment. The result is cleaner, healthier and more attractive fruits that command premium market prices. The bag creates a modified microenvironment around the developing fruit by regulating light intensity, temperature and humidity. This favorable environment promotes better cell division and cell enlargement, resulting in improved fruit growth. Research has shown that even a slight increase in temperature inside the bag can accelerate fruit development and increase fruit size and weight. The bag also minimizes direct exposure to sunlight, thereby reducing sunburn and peel blemishes while maintaining fruit quality.

4. BENEFITS OF FRUIT BAGGING

Fruit bagging offers numerous advantages to mango growers:

- i. Protects fruits from fruit fly infestation and insect damage.
- ii. Reduces fungal diseases such as anthracnose and stem-end rot.
- iii. Prevents sunburn and improves peel appearance.
- iv. Produces cleaner fruits free from dust, stains and blemishes.
- v. Minimizes pesticide residues and improves food safety.
- vi. Enhances fruit size, weight, firmness and market quality.
- vii. Improves shelf life and transportability.
- viii. Increases consumer acceptance and export potential.
- ix. Fetches higher market prices for premium-quality fruits.

5. SUITABLE BAGGING MATERIALS

Various materials are available for fruit bagging, including butter paper bags, brown paper bags, double-layer paper bags, newspaper bags, cloth bags, non-woven polypropylene bags and biodegradable paper bags. The bag should be strong enough to withstand rainfall and wind while allowing adequate ventilation to prevent moisture accumulation. Research has demonstrated that reddish-brown paper bags and two-layer brown paper bags provide superior protection and significantly improve fruit quality compared with several other bagging materials. These bags maintain a favorable microenvironment and protect fruits effectively throughout their development.

6. OPTIMUM TIME FOR BAGGING

Timing plays a crucial role in obtaining maximum benefits from fruit bagging. Experimental studies have shown that bagging approximately three months after fruit set is more effective than earlier bagging in improving fruit growth and quality. At this stage, fruits are sufficiently developed to withstand handling while still receiving protection during the critical period of fruit development.

7. HOW TO BAG MANGO FRUITS

Select healthy and uniformly developing fruits free from insect or disease damage. Carefully place the paper bag over the fruit without damaging the pedicel. Secure the bag loosely around the fruit stalk using a soft wire, twist tie or stapler. Ensure that the bag has adequate ventilation holes for proper air

circulation and drainage. Periodic orchard inspection should be carried out to replace damaged bags and monitor fruit development. Research has shown that pre-harvest fruit bagging significantly improves mango fruit quality. Reddish-brown paper bags, followed by two-layer brown paper bags, produced larger, heavier, firmer and more attractive fruits than unbagged fruits. These bagging materials also enhanced shelf life and marketability, making them suitable for commercial mango production.

8. ECONOMIC ADVANTAGES

Although fruit bagging requires additional labour and material costs, the practice provides higher economic returns through improved fruit quality and reduced losses. Premium-grade mangoes fetch considerably higher prices in domestic and export markets due to their attractive appearance, uniform colour, absence of blemishes and lower pesticide residues. The reduction in pesticide sprays also lowers production costs and minimizes environmental contamination.

9. SCOPE FOR COMMERCIAL MANGO PRODUCTION

Fruit bagging has immense potential for commercial mango cultivation, particularly in export-oriented orchards and organic production systems. The technology can be effectively integrated with Good Agricultural Practices (GAP), Integrated Pest Management (IPM) and residue-free production systems. As international food safety standards become more stringent, fruit bagging is expected to become an indispensable practice for producing export-quality mangoes.

10. CONCLUSION

Fruit bagging is a simple, economical and environmentally friendly technology that significantly improves mango fruit quality while reducing dependence on pesticides. By protecting fruits from insects, diseases, sunburn, dust and mechanical injuries, it enhances fruit size, firmness, appearance, shelf life and market value. Research has demonstrated that reddish-brown paper bags and two-layer brown paper bags applied approximately three months after fruit set provide the best results for producing premium-quality mangoes. Wider adoption of this technology can help Indian mango growers produce safer, high-value fruits, increase profitability and strengthen the country's

competitiveness in domestic and international markets.

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