

From Orchard to Export: Pre-Harvest Strategies for Premium Fruit Quality Production

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SUMMARY

The quality, appearance and nutritional characteristics of fruits are critical factors determining their marketability and export potential. However, pre-harvest problems such as fruit cracking, sunburn, surface spots and damage caused by insect pests can significantly reduce fruit quality and economic returns. The adoption of suitable pre-harvest management techniques, including fruit bagging, application of oil-based formulations, plant growth regulators, elicitors and essential nutrients and micronutrients, can effectively minimize these losses. Fruit bagging protects developing fruits from excessive sunlight, moisture loss and pest damage, while oil-based formulations and chitosan help to maintain peel moisture, improve fruit glossiness, colour and antioxidant properties. Plant growth regulators and elicitors such as ethephon and salicylic acid promote desirable colour development and enhance the accumulation of anthocyanins, phenolic compounds and sugars. Similarly, the application of calcium, boron and potassium improves the peel strength, firmness, fruit colour, total soluble solids and shelf life. Thus, the integration of these pre-harvest techniques can play a significant role in producing attractive, high-quality fruits with enhanced consumer acceptance, market value and export potential.

INTRODUCTION

From the export point of view as well as for marketing, the fruit appearance, rind colour, texture, flavor, nutritive and biochemical content are the most important quality attributes contributing to the marketability of fruits. During pre-harvest stage, damages caused by cracking, sunburn, spots and fruit sucking moth will negatively affects the fruit quality and decreases the market value of the fruits in domestic as well as in international market. Hence, these problems can be overcome by pre-harvest treatment techniques. The pre-harvest treatments viz., fruit bagging and foliar application of oil-based formulations, growth regulators and micro-nutrients are considered to be the most effective and eco-friendly techniques which help in producing high quality fruits with respect to brightness, colour, size, nutritive contents, storage property and also protects from disease and pests incidence (Sharma and Sanikommu, 2018).

Pre-Harvest Strategies for Improving Fruit Quality, Marketability and Export Potential

1. Fruit Bagging

Fruit bagging is an important pre-harvest technique in which developing fruits are covered with suitable bags. It helps to maintain the moisture status of the fruit surface by reducing excessive transpiration and preventing direct exposure to harmful solar radiation. Consequently, fruit bagging can minimize problems such as fruit cracking and sunburn or sunscald (Farid *et al.*, 2019). In addition, the bag acts as a physical barrier against the entry of insect pests and protects the fruits from pest damage. As a result, superior quality fruits can be produced, thereby improving their marketability and enabling growers to obtain higher market prices.



Fig.1. Fruit bagging in different fruit crops

2. Application of Oil-Based Formulations

Pre-harvest spraying of oil-based formulations such as chitosan, pongamia oil and other suitable plant or mineral based oils can provide protective benefits for developing fruits. These formulations may act as protective surface coatings and help to reduce moisture loss from the fruit surface while minimizing the adverse effects of

excessive solar radiation. This helps in maintaining peel moisture and reducing the incidence of fruit cracking and sunburn. Certain oil-based formulations may also act as repellents or suppressive agents against insect pests such as aphids and mites (Rantsiou *et al.*, 2020). Chitosan, in particular, has been reported to play an important role in improving fruit colour, glossiness and antioxidant content, thereby contributing towards better fruit quality and consumer appeal.



Fig.2. Oil Based Formulations

3. Spraying of Plant Growth Regulators and Elicitors

Pre-harvest application of plant growth regulators and elicitors such as ethephon and salicylic acid can influence the development of desirable fruit colour and biochemical constituents. These treatments may enhance the accumulation of red pigments and stimulate the activity of enzymes such as phenylalanine ammonia-lyase (PAL). This can promote the synthesis and accumulation of anthocyanins, phenolic compounds and sugars, ultimately resulting in attractive fruit colour and improved quality (Baghdady *et al.*, 2020). Salicylic acid may also enhance the tolerance of fruits to physiological disorders such as cracking and improve their resistance against certain pest and stress-related damages.



Fig.3. Plant Growth Regulators and Elicitors

4. Application of Nutrients and Micronutrients

The combined application of nutrients such as calcium and boron plays an important role in improving fruit peel strength, thickness and firmness by supporting cell wall development and pectin stabilization. Consequently, the incidence of fruit cracking can be reduced in treated plants. Similarly, the combined application of calcium, boron and potassium sulphate can contribute to improved accumulation of sugars and other total soluble solids in fruits. Potassium is particularly important for improving fruit colour and may promote the accumulation of anthocyanin pigments in the peel, resulting in an attractive red colour (Chidananda *et al.*, 2020). Furthermore, the combined application of calcium and boron helps maintain the water balance and structural integrity of fruits, which can contribute to improved fruit quality and extended post-harvest shelf life.



Fig.4. Nutrients and Micronutrients

CONCLUSION

Pre-harvest treatment techniques are essential for improving the quality, marketability and export competitiveness of fruit crops. The strategic use of fruit bagging, protective oil-based formulations, plant growth

regulators, elicitors and balanced nutrient management can reduce major physiological disorders and pest-related damages while enhancing fruit appearance, colour, firmness, nutritional quality and storage life. These techniques offer an effective and relatively eco-friendly approach to producing premium-quality fruits that meet the increasing requirements of both domestic and international markets. Therefore, the adoption of an integrated pre-harvest management strategy can help fruit growers minimize quality losses, obtain better market prices and strengthen the overall export potential of the crop.

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