horticulturae

Editorial

Propagation and Postharvest of Fruit Crops

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Citation: Colombo, R.C.; Roberto, S.R. Propagation and Postharvest of Fruit Crops. *Horticulturae* **2022**, *8*, 246. https://doi.org/10.3390/horticulturae8030246

Received: 7 March 2022
Accepted: 8 March 2022
Published: 14 March 2022

1. Introduction

In fruit crops, plant propagation plays an important role as it allows the number of plants produced to be rapidly multiplied while retaining desirable characteristics from the mother plants and shortening the bearing age of plants. Depending on the fruit species, propagation can be achieved sexually by seed or asexually by utilizing specialized vegetative structures of the plant or by employing techniques such as cutting, layering, grafting, and using tissue culture.

Sexual propagation entails the recombination of genetic material. In nature, this results in progenies that differ from each other and from their parents. Vegetative propagation is clonal; progenies are genetic copies of the parent plant, and they are widely used in several fruit species, allowing for the production of high-quality nursery trees, free of diseases or pests, with the same genetic characteristics of the mother plant.

No matter which form of propagation is used, the profitability of a new orchard depends on the quality of its nursery plants, as uniform ripening and good fruit quality must be achieved.

Once the fruits reach the fully ripe stage, the primary concern is keeping them fresh and healthy for a long period of time. However, fruits are living biological organisms with a respiratory system, and they continue their living processes after harvest. Thus, adequate and advanced postharvest processing technologies are required for minimizing the qualitative and quantitative losses of harvested fruits. Nearly 40% of fruits are wasted every year due to improper handling, storage, packaging, and transportation. Postharvest handling necessitates, therefore, an understanding of all the operations concerned with it, from harvesting to distribution, so as to enable the application of the proper technology in each step to minimize losses and maintain the highest quality possible throughout the distribution chain.

2. Papers in This Special Issue

This Special Issue, "Propagation and Post-harvest of Fruit Crops", brings together some of the latest research results of new techniques in this field. It presents nine original papers, which cover a wide range of research activities.

The Special Issue was divided into two parts, as follows.

2.1. Fruit Crop Propagation

The In this section, just one contribution was published: "Propagation of an Epigenetic Age-Related Disorder in Almond Is Governed by Vegetative Bud Ontogeny Rather Than Chimera-Type Cell Lineage" by Gradziel and Shackel [1]. However, this paper presents an essential mechanism in plant propagation.

Noninfectious bud failure (NBF) is an economically important epigenetic disorder in almonds, causing symptoms of shoot failure with subsequent yield loss [2,3]. According to

Gradziel and Shackel [1], the almond (*Prunus dulcis* (Mill.) D.A. Webb) represents a model system for the study of epigenetic age-related disorders in perennial plants because NBF disorder is well-characterized and has been shown to be associated with the clonal age of the propagation source.

To test this developmental pattern, 2180 trees propagated from axillary buds of a known position within asymptomatic NBF budstick sources were evaluated for this disorder. All axillary buds within a given 'Carmel' shoot appeared to be similarly effective in transmitting the altered NBF phenotype, in marked contrast to the expected variability predicted by the chimera model. These results suggest that a different mechanism is involved that is more analogous to tissue 'imprinting', as seen with flower induction or phase changes in plants from juvenile to mature forms [1].

2.2. Fruit Crop Postharvest

The first contribution in this section explored the "Synergistic Effect of Preharvest Spray Application of Natural Elicitors on Storage Life and Bioactive Compounds of Date Palm (*Phoenix dactylifera* L., cv. Khesab)" by Ahmed et al. [4]. To attenuate postharvest changes in the quality of date fruit, strategies such as cold storage and modified atmosphere were explored in addition to an alternative approach involving the application of natural elicitors to enhance physiological adaptations and accelerate plants' defense system [5,6]. Among these natural elicitors, chitosan is one of the most recognized due to its antimicrobial, eliciting, and film-forming characteristics [6,7]. Calcium chloride and salicylic acid are also recognized as natural elicitors and can be used to mitigate the senescence in postharvested fruits. Pre/postharvest fruit treatments with these substances have been reported by several authors [8–11]; the synergistic effect of preharvest application of these elicitors in the date fruit 'Khesab' on its storage life and bioactive compounds was elucidated by Ahmed et al. [4].

Among the results found by the authors, we would like to highlight that the lowest weight loss, color change, and the least decay after 60 days of storage were achieved in the date fruits treated with chitosan (Ch) + salicylic acid (SA) followed by Ch and Ch + SA + Ca (calcium chloride). Ch + Ca-, SA-, and Ca-treated fruit exhibited significantly lower levels of total soluble solids and the highest total phenolic, tannin, and flavonoid contents compared to the control fruit. Antioxidant activities were found in all treatments, with a significantly higher effect seen for Ch + SA + Ca and Ch + SA compared to the control. Thus, these results provide evidence for a synergistic effect of elicitors' combinations in extending the shelf life of date fruit during cold storage by preserving quality and decreasing senescence/decay. It can therefore be recommended as a promising strategy.

The second paper, by Walse and Jimenez, concerned "Postharvest Fumigation of Fresh Citrus with Cylinderized Phosphine to Control Bean Thrips (Thysanoptera: Thripidae)" [12]. Fresh citrus fruits are widely consumed around the world and represent a beloved fruit crop found in many international markets. However, to ensure their readiness for the international market, it is necessary that the fruits are confirmed to be free of pests and diseases. According to Walse and Jimenez [12], bean thrips (BT), *Caliothrips fasciatus* (Pergande), is a pest of concern in certain countries that import fresh citrus fruit from California, USA. Thereby, fumigation remains an invaluable method for insect pest control [13] and can combined with other postharvest strategies to attain a good quality of fruits.

In this context, this article presents an evaluation of postharvest fumigation in fresh sweet oranges with cylinderized phosphine to control BT. Three formulations of cylinderized phosphine were used: 1.6% phosphine by volume in nitrogen, VAPORPH3OS®, and ECOFUME®. All were applied at two levels concentrations: ca. 1.5 g m^{-3} (1000 ppmv (μL L^{-1})) and 0.5 g m^{-3} (300 ppmv (μL L^{-1})).

The results provide evidence to support the control of adult BT infesting California sweet oranges at a pulp temperature (T) of $\geq$5.0 °C following fumigation with an applied dose of $\leq$1.5 g m^{-3} (1000 ppmv (μL L^{-1})) phosphine, at least when headspace levels are maintained at $\geq$0.4 g m^{-3} (250 ppmv (μL L^{-1})) for $\geq$12 h. The results were discussed in the context of commercial and operational features of quarantine and preshipment (QPS) uses of phosphine to treat fresh fruit, specifically for the control of BT in fresh citrus exported from California, USA, to Australia.

The last contribution is "Effect of Phytosanitary Irradiation Treatment on the Storage Life of 'Jiro' Persimmons at 15 °C" by Golding et al. [14]. Irradiation is a technologically proven, viable, and scientifically sound disinfestation treatment [15]. Moreover, irradiation is increasingly becoming an approved and popular treatment prior to the international shipment of food and horticultural products [16]. However, there have been very few studies on the effects of irradiation as a quarantine treatment with low doses of phytosanitary on persimmon fruit [17,18], with other studies conducted on higher irradiation doses above the phytosanitary limit (1000 Gy maximum) [14].

In this study, 'Jiro' persimmon fruit were treated with an average of 769 Gray (Gy) at a commercial phytosanitary irradiation X-ray facility to examine the effect of this market access treatment on fruit quality during storage. After treatment, fruit were stored in air at 15 °C and evaluated after 3, 7, 14, and 21 days. In general, irradiation treatment had no effect on fruit quality. As expected, storage time had an impact on fruit quality over time, with the fruit becoming softer, losing weight, and drying to a calyx appearance (i.e., browning) with longer storage times. Respiration rates were higher in treated fruit and indicated some fruit stress caused by the treatment, but this did not imply a lower fruit quality [14].

In summary, the authors emphasized that this study showed the promise of using low-dose irradiation as a phytosanitary treatment for 'Jiro' persimmons, but more work is required to test other persimmon cultivars and other storage and marketing environments.

3. Conclusions

This Special Issue, "Propagation and Post-harvest of Fruit Crops", highlights papers working towards development of propagation and postharvest strategies for the preservation of fruit crops. Regarding the present postharvest techniques, one may observe that they all contribute to increasing the shelf life of different fruit species without significant quality losses. Furthermore, the results for almond propagation elucidate genetic aspects related to noninfectious bud failure (NBF) in almond nursery production.

Author Contributions: The contribution to the programming and executing of this Special Issue was equally divided between R.C.C. and S.R.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: We thank all the authors of the Special Issue.

Conflicts of Interest: The authors declare no conflict of interest.

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