IMPROVEMENT OF SEEDLING PRODUCTION AND QUALITY TRAITS OF PASSION FRUIT AND ITS APPLICATION TO CULTIVATION AND STORAGE TECHNOLOGY IN SOUTH AMERICA FOCUSING ON ECUADOR

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Abstract

The passion fruit (*Passiflora* L.) species belong to the Passifloraceae family. Worldwide, there are about 600 known species, and more than 500 species produce fruits for fresh consumption and industrial processing. Most of the species are found in South America in countries such as Brazil, Colombia, Peru, Ecuador, Argentina, Bolivia, and Paraguay; however, there are native species from the United States, Central America, Asia, Australia, and China as well.

Passion fruit (*P. edulis*) is an economical important crop in Ecuador because it is one of the main exporters of pulp concentrate in South America. However, there are problems related to passion fruit production such as the low efficiency in seedling production, high losses during storage, and the lack of information on quality characteristics when attempting to breed. To improve such situation, this thesis research was conducted on the method to improve seedling production and determine fruit quality indicators in passion fruit species focusing on Ecuadorian varieties.

Seed priming was examined to improve seedling production efficiency, and priming treatment with PEG 6000 was the most effective in improving germination rate and early seedling growth. Five priming treatments (dark conditions at 25°C) were applied and primed seeds with PEG 6000 (36 hours at −1.2MPa) and water imbibition (24 hours) both reached high percentages of germination (around 89%) in case of yellow passion fruit (*P. edulis* f. *flavicarpa*). However, in case of purple passion fruit (*P. edulis* f. *edulis*), the water imbibition indicated 35% germination though the priming with PEG showed 82% germination rate. For the effect on the root fresh weight, PEG treated seeds exerted 40% more biomass than the ones imbibed in water in the yellow passion fruit; on the other hand, there were no statistical effects in the purple passion fruit. Consequently, PEG 6000 could be considered as a hopeful method to improve the efficiency of seedling production in passion fruit. The priming treatment used in the study might well be adopted by Ecuadorian local farmers when demonstrated once and expected to extend as an appropriate technique.

The nutritional characteristics of 6 genotypes/varieties of passion fruit grown in Ecuador were investigated for breeding purposes to meet the increasing health consciousness since there is no more information about the phytochemical constituents. The results showed that the yellow type was rich in K (up to 2816 mg $100g^{-1}$ DW), and contained 22% more polyphenol, and the double of citric acid (around 25.00 g 100^{-1} DW)

in comparison with the purple type. On the other hand, the purple type showed the higher P (134 mg $100g^{-1}$ DW), Mg (196 mg $100g^{-1}$ DW) and vitamin C content (30.44 mg $100g^{-1}$ FW). Both types showed fairly high amount of Zn (around 2 mg $100g^{-1}$ DW), and had similar amount of flavonoids and carotenoids (around 0.5 and 45.0 mg $100g^{-1}$ DW, respectively). In terms of specific carotenoids, the yellow Ecuadorian genotype 'POR1' and the purple Asian cultivar 'Ruby Star' (*P. edulis x P. edulis* f. *flavicarpa*) showed high amount of β-cryptoxanthin (1613.76 and 1232.93 µg 100 mL^{-1} FW). Therefore, 'POR1' would be a good source of carotenoids for the food industry by juice making or concentrate; whereas 'Ruby Star' constitutes an option for carotenoid intake as fresh consumption. In addition, it was found that some underutilized species such as *P. maliformis* showed high amount of flavonoids and carotenoids, suggesting a possible incorporation into future breeding programs (cross pollination) focusing on fruit quality improvements. Since the characteristic of low peel thickness (3.85 mm) of this species, a trait that is highly appreciated by farmers and breeders, would also be greatly welcome. Furthermore, the cross breeding between the Ecuadorian and Asian genotypes may be expected to develop new varieties with enhanced carotenoid content.

In order to reduce postharvest losses, hypobaric (low pressure) storage technique can be adopted since it showed outstanding effects in comparison to cold (6°C) and ambient (25°C) storage; and the combination of 20 kPa at 4°C treatment could most successfully extend the storage period. The results showed that it had a positive effect in decreasing fruit weight loss (less than 70% compared to ambient storage), declining the loss of firmness, and reducing the degradation of vitamin C during the storage period. The respiration rate was suppressed to at least 50% of the ambient storage.

The abovementioned results are very new to the Ecuadorian farmers and breeders, which might well contribute to healthy seedling production, breeding for more nutritious and tasty new passion fruit cultivars, and might help traders and consumers to keep postharvest freshness of passion fruits, resulting in further promotion of domestic cultivation and enhancing international competitiveness of passion fruit industry in Ecuador.