Effect of phytosanitary irradiation on the quality of Chandler Pummelo (Citrus maxima (Burm.) Merr.)

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Abstract

Gamma Irradiation is increasingly being considered as an alternative to chemical phytosanitary treatments, such as methyl bromide. In this study, the chemical and physiological effect of low-dose gamma irradiation on the post-harvest quality of Chandler Pummelos (Citrus maxima (Burm.) Merr.), an emerging citrus in the U.S, was evaluated. Chandler pummelos from a local grower in California were irradiated at target doses of 150 Gy and 1000 Gy. Irradiated and untreated pummelos were stored at 12°C for 3 weeks and at 20°C for the 4th week to reflect temperature conditions during three weeks of sea shipment and an additional week of retail under ambient conditions. Color, titratable acidity, total sugars, juice content, weight loss and concentrations of organic acids were not different for the irradiated fruit in comparison to the untreated pummelos. Irradiation reduced firmness of the pummelo peel and firmness of the flesh. The external appearance of pummelos was negatively impacted by higher irradiation dose, longer storage time and higher temperatures as pitting and mold growth were evident on pummelos treated at 1000 Gy and following storage at 20°C. The results suggest that Chandler pummelo quality is compromised at 20°C and 1000 Gy treatment but irradiation with 150 Gy can serve as a potential phytosanitary treatment for Chandler pummelos.

Introduction

Pummelos (Citrus maxima or Citrus grandis) are popular in Asia for their desirable taste, flavor and juicy texture. Pummelo is one of the largest citrus fruits and is becoming commercially important in the U.S due to emerging consumer interest. USDA-APHIS is considering importing Pummelos from China. However, a phytosanitary treatment is needed to destroy insect pests such as moths, thrips, and fruit flies. Approved phytosanitary treatments include chemical control (fumigation), irradiation, cold and hot treatments (McDonald and others 2013), of which China. However, a phytosanitary treatment is needed to destroy insect pests such as moths, thrips, and fruit flies. Pummelos are accepted as part of the phytosanitary treatment for Chandler pummelos.

Gamma irradiation is considered as an alternative to chemical phytosanitary treatments, such as methyl bromide. In this study, the chemical and physiological effect of low-dose gamma irradiation on the post-harvest quality of Chandler Pummelos (Citrus maxima (Burm.) Merr.) was evaluated. Chandler pummelos from a local grower in California were irradiated at target doses of 150 Gy and 1000 Gy. Irradiated and untreated pummelos were stored at 12°C for 3 weeks and at 20°C for the 4th week to reflect temperature conditions during three weeks of sea shipment and an additional week of retail under ambient conditions. Color, titratable acidity, total sugars, juice content, weight loss and concentrations of organic acids were not different for the irradiated fruit in comparison to the untreated pummelos. Irradiation reduced firmness of the pummelo peel and firmness of the flesh. The external appearance of pummelos was negatively impacted by higher irradiation dose, longer storage time and higher temperatures as pitting and mold growth were evident on pummelos treated at 1000 Gy and following storage at 20°C.

Key Findings

Control

Figure 1. Control, 150 Gy and 1000 Gy pummelos after 4 weeks of storage: 3 weeks at 12°C and 1 week at 20°C. 1000 Gy pummelos had maximum damage. No differences in external damage were observed after 3 weeks of storage at 12°C. But after storage at 20°C for an additional week, external damage increased significantly for the 1000 Gy fruit. Peel injury and peel pitting were significantly higher for the 1000 Gy fruit, whereas the intensity of damage was similar (p=0.05) for control and pummelos treated with 150 Gy. Consumers rated the pummelos no differently for overall liking, overall flavor, sweetness, bitterness and juiciness.

Conclusion

Gamma irradiation at 1000 Gy negatively impacted the quality of Chandler pummelos. However, pummelos irradiated at 150 Gy can maintain quality similar to non-treated pummelos when stored at appropriate storage conditions and thus can serve as a potential phytosanitary treatment for Chandler pummelos.

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References