



HIDDEN BEACH, MARIETAS ISLAND, NAYARIT, MEXICO

# HANDLING OF REFRIGERATION (TEMPERATURE AND TIME) DURING SHIPPING OF 'ATAULFO' MANGO EXPORTED FROM MEXICO TO THE USA

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## INTRODUCTION

Mango shipping from Mexico to the USA is done by truck refrigerated containers taking up to seven days to reach the furthest market. Normally the refrigeration temperature is over the cold damage threshold. Because of that, it is hypothesized that it is possible to export mango in higher ripening stage under relatively warm temperatures without affecting quality and shelf- life. The purpose of this assay was to evaluate the effect of temperature and refrigeration length on quality and shelf-life of 'Ataulfo' mango fruit intended for exportation from Mexico to the USA.

## MATERIALS AND METHODS

Fruit treated with quarantine hot water treatment (115.0 °F for 75 min) and hydrocooling (69.8-73.4 °F for 30 min) were collected from a packing line in a commercial packinghouse. Fruit had uniform size, good external appearance and freedom from mechanical damage, pests, and diseases. Ten batches of 35 fruit were submitted to refrigeration at 53.6, 57.2, or 60.8 °F (12.0, 14.0, or 16.0 °C) and three times of shipping simulation (3, 5, or 7 days). One of the batches was the control treatment without refrigeration. After finishing the respective shipping times, fruit were kept under market simulation (71.6 ± 3 °F [22 ± 2.0 °C]; 75 ± 10 % RH) until full ripeness. Variables analyzed were: weight loss, peel color, firmness, pulp color, total soluble solids, titratable acidity, and ratio °Bx/Acidity. Sampling was done before refrigeration, at the end of the refrigeration period, one week after, and at consumption stage. The experimental design was a factorial (temperature X shipping simulation) with 10-fruit replications for weight loss and five for the other variables.

## RESULTS AND DISCUSSION

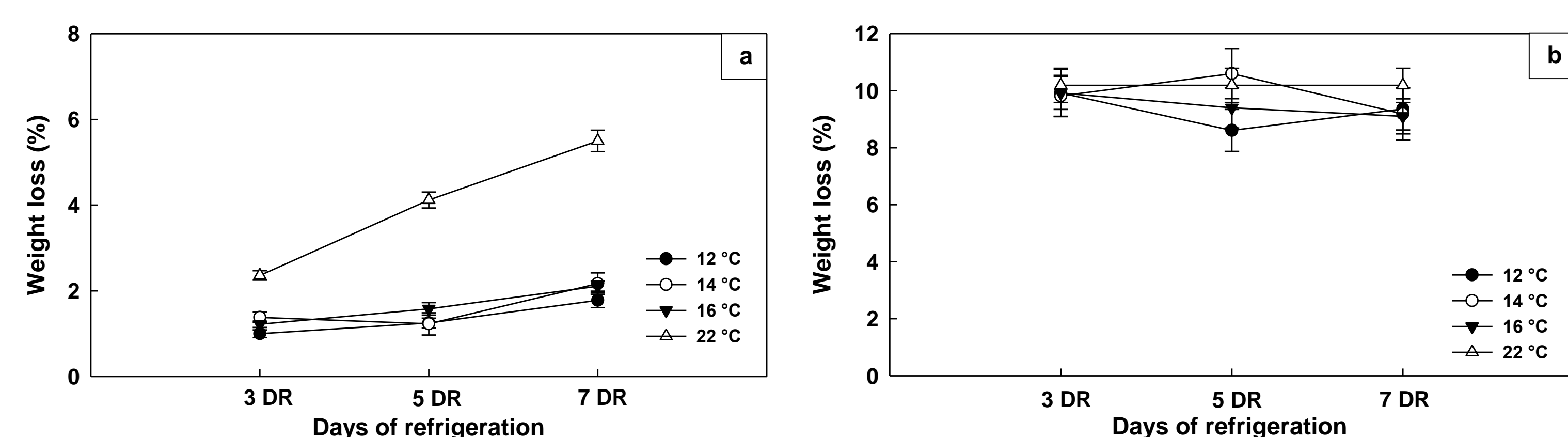


Figure 1. Effect of temperature and refrigeration days on weight loss (%) of 'Ataulfo' mango fruit at the end of shipping simulation (a) or at consumption stage (b). Each point is the mean of five observations ± Standard Error. Nayarit, Mexico. 2014 Season.

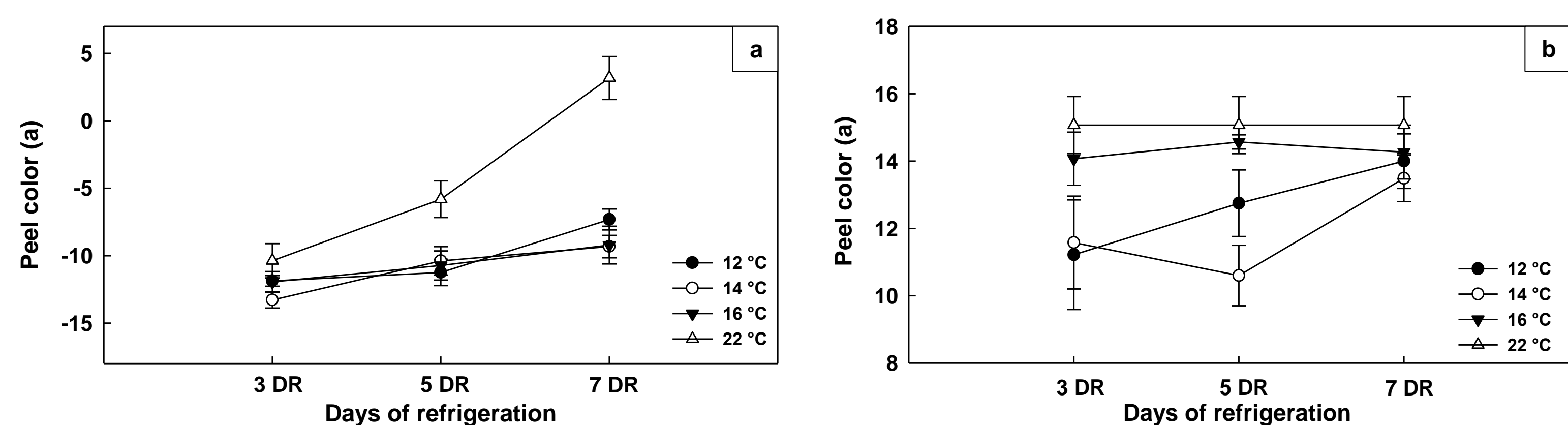


Figure 2. Effect of temperature and refrigeration days on peel color (a) of 'Ataulfo' mango fruit at the end of shipping simulation (a) or at consumption stage (b). Each point is the mean of five observations ± Standard Error. Nayarit, Mexico. 2014 Season.

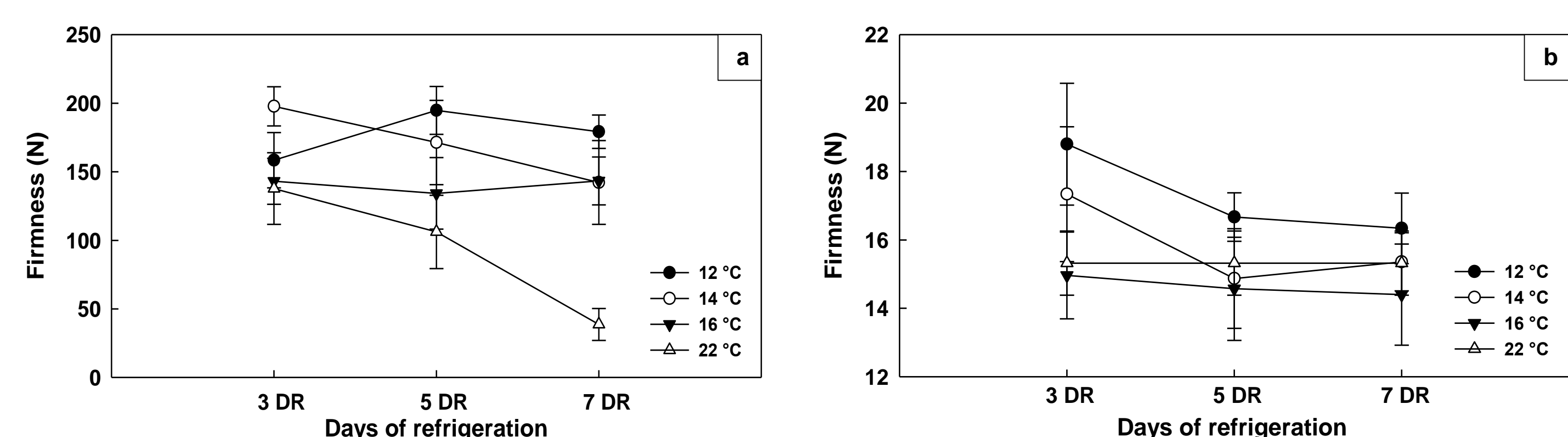


Figure 3. Effect of temperature and refrigeration days on pulp firmness (N) of 'Ataulfo' mango fruit at the end of shipping simulation (a) or at consumption stage (b). Each point is the mean of ten observations ± Standard Error. Nayarit, Mexico. 2014 Season.

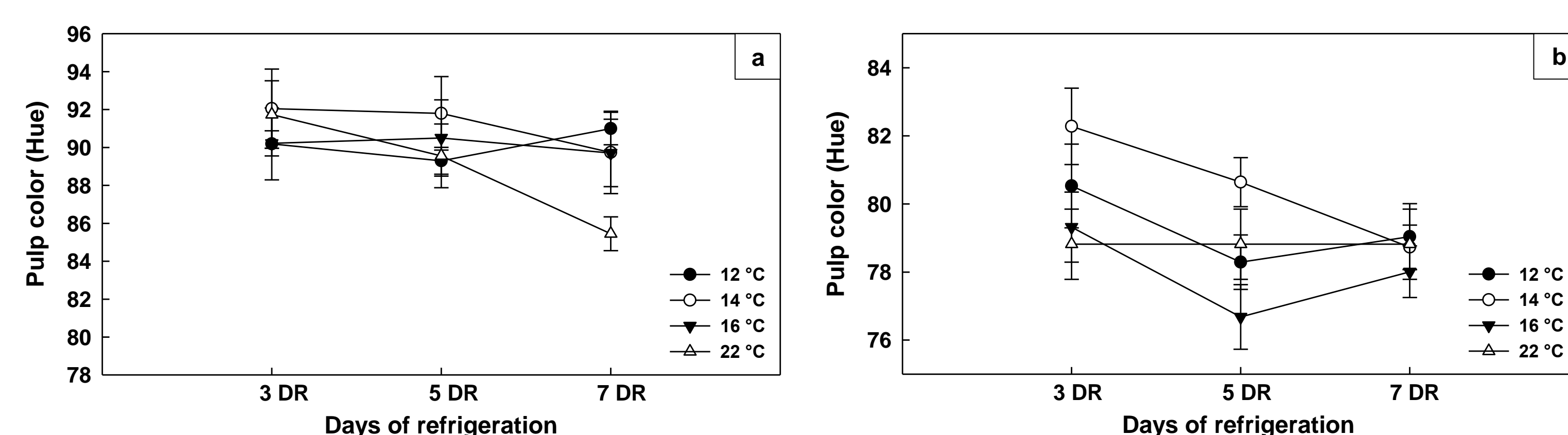


Figure 4. Effect of temperature and refrigeration days on pulp color (Hue) of 'Ataulfo' mango fruit at the end of shipping simulation (a) or at consumption stage (b). Each point is the mean of five observations ± Standard Error. Nayarit, Mexico. 2014 Season.

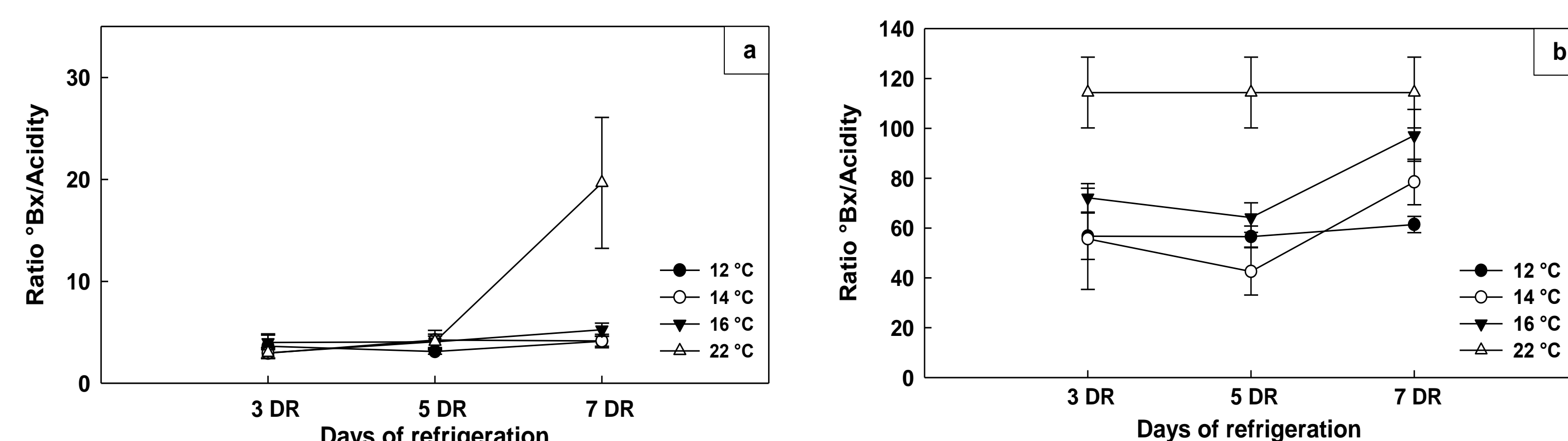


Figure 5. Effect of temperature and refrigeration days on ratio °Bx/Acidity of 'Ataulfo' mango fruit at the end of shipping simulation (a) or at consumption stage (b). Each point is the mean of five observations ± Standard Error. Nayarit, Mexico. 2014 Season.



Figure 6. External appearance of 'Ataulfo' mango fruit at consumption stage. Nayarit, Mexico. 2014 Season.

## CONCLUSIONS

➤ 'Ataulfo' mango fruit for exporting from Mexico to the USA can be shipped under relatively warm temperatures (53.6 to 60.8 °F) without affecting quality and shelf-life.

## REFERENCES

- Brecht J.K., Sargent S.A., Kader A.A., Mitcham E.J., Arpaia M.L. 2009. Monitoring and evaluation of the mango supply chain to improve mango quality. Final report. National Mango Board. 19 p.
- Brecht J.K., Sargent S.A., Kader A.A., Mitcham E.J., Maul F., Brecht P.E. and Menocal O. 2010. Mango postharvest best management practices manual. National Mango Board. 73 p.
- Brecht J.K., Nunes M.C.N. and Maul F. 2012. Time-temperature Combinations that Induce Chilling Injury of Mangos. Final report. National Mango Board. 21 p.

## ACKNOWLEDGMENTS

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