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STUDIES ON POSTHARVEST QUALITY OF ‘BUOI’ MANGOES DURING COLD-STORAGE

A thesis submitted in partial fulfilment of the requirements for the degree of

Master of Applied Science

in

Agricultural Engineering

at

Institute of Technology and Engineering

Massey University

Palmerston North, New Zealand

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1998
Mango (Mangifera indica L.) - King of Oriental Fruits
ABSTRACT

The objective of this thesis was to characterise the postharvest quality attributes of 'Buoi' mangoes by: (1) providing a detailed review of the literature on postharvest handling and storage of mangoes; (2) studying the effects of harvest date, storage temperature, length of storage, and postharvest treatments on postharvest quality of 'Buoi' mangoes; and (3) developing regression models for predicting postharvest quality attributes of 'Buoi' mango fruit as a function of storage temperature and length of storage.

A review of the literature showed that considerable research has been carried out during the last 20 years on several aspects of postharvest handling and storage of mangoes. The literature review included maturity assessment, ripening behaviour of mangoes at low temperature storage, and postharvest treatments for controlling diseases and disorders. Many researchers have recommended storage conditions and postharvest treatments for various mango cultivars such as 'Alphonso', 'Carabao', 'Kensington', 'Haden', 'Keitt', 'Kent' etc., however, there was a dearth of information on the storage requirements for the important cultivars grown in Vietnam.

Samples of 'Buoi' mango grown in Hoa Loc area, Cai Be District, Tien Giang Province (latitude: 10° 5', longitude: 102°), Vietnam, were harvested at commercial maturity on three harvest dates based on uniform peel colour and morphological characteristics such as size and shape and transferred to laboratory at the Postharvest Technology Institute (PHTI) in Hochiminh city. To study the effects of harvest date on mango quality, fruit samples from the three harvests were stored at 12 ± 1°C (RH 85-90%) for 25 days. At 5-day intervals, sub-samples were randomly removed from cold storage and assessed for weight loss, peel and pulp colour, soluble solids content (SSC), total acidity, flesh firmness and crushing stress, chilling injury (CI) and eating quality. Another sub-sample was assessed after 4 days ripening at 25°C. The results showed that increasing storage time led to a significant (P <
increase in weight loss, peel and pulp colour development, and incidence of chilling injury. However, both fresh firmness and crushing stress, and total acidity declined during storage. Soluble solids content and eating quality increased up to around 20 days, but declined afterwards.

Harvest date influenced weight loss, CI and fruit texture (both firmness and crushing stress), but did not affect peel and pulp colour, SSC, total acidity, and eating quality. Early harvested fruit lost more weight compared with the mid- and late harvested fruit. However, there was no significantly difference in weight loss between mid- and late harvested fruit. Up to 10 days storage, fruit texture in early harvested fruit was significant higher than in mid- and late harvested fruit, but after this period the difference disappeared. Early harvested fruit were more susceptible to CI than mid- and late harvested fruit. Compared to fruit kept in cold storage, fruit ripened at 25°C had higher SSC but were lower in total acidity. In addition, ripening fruit at 25°C increased the severity of CI.

To study the effects of storage temperature on mango quality, fruit samples from second harvest were stored at 7, 12, 17 ± 1°C (RH 85-90%), and room temperature (27°C, RH 75-85%) for 25 days. Storage temperature had a significant effect on fruit quality attributes. Increasing storage temperature led to increase in weight loss, and yellow colour development in peel and pulp tissue; however, firmness, crushing stress, total acidity and incidence of CI declined. In cold-stored fruit, soluble solids content and eating quality increased with increase in storage temperature. Storing fruit at 12°C up to 20 days and 17°C up to 15 days, respectively, maintained the quality and minimized the incidence of postharvest disorders in ‘Buoi’ mangoes. Regression models for predicting postharvest quality attributes of ‘Buoi’ mangoes as a function of storage temperature and storage time were developed, applicable for fruit storage in the range 7 - 27°C up to 15 days and 7 - 17°C up to 25 days.
To assess the effect of hot water treatment (HWT) for controlling of postharvest diseases and disorders in 'Buoi' mango, fruit samples were randomly assigned to the following treatments prior to cold storage at 12 ± 1°C (RH 85-90%): treatment 1 = fruit dipped in hot water at 52°C for 5 min; treatment 2 = fruit dipped in hot water at 52°C for 10 min; treatment 3 = fruit placed in PVC plastic bag; and treatment 4 = control (untreated) fruit. After 24 days storage, fruit were removed from cold storage and assessed for weight loss, peel and pulp colour, SSC, anthracnose, stem-end rot, shrivel and Cl. HWT at 52°C for 5 or 10 min significantly reduced the incidence of anthracnose, stem-end rot and Cl compared to fruit in plastic bag or untreated fruit. Fruit in plastic bag lost less weight than the other treatments. HWT at 52°C for 5 min was recommended for reducing the incidence of anthracnose, stem-end rot and Cl in Vietnamese ‘Buoi’ mangoes.
ACKNOWLEDGEMENTS

I would like to express my gratitude to my chief supervisor, Dr. Linus U. Opara for his valuable advice, supervision and support throughout this study. My sincere thanks are also given to Associate Prof. Cliff J Studman, my co-supervisor, for his important suggestions and kind assistance during investigation, especially his guidance at beginning of this project. My special thanks to Prof. Gavin L. Wall, Head of the Department for his permission to use Departmental fruit quality measurement equipment during my experiments in Vietnam.

I would also like to thank Prof. Le Van To, Director of Postharvest Technology Institute (PHTI), Hochiminh City, Vietnam for his useful advice and financial support during the time I carried out the experiments at his Institute.

Thanks are also due to the following who contributed to this study:

Prof. Pham Van Lang, Director of the Vietnam Institute of Agricultural Engineering, Hanoi, Vietnam for his advice and supervision during my experiments in Vietnam;

Ms. Bay, Researcher at Long Dinh Fruit Research Centre, for field assistance in obtaining fruit samples;

Mr. and Mrs. Tam, Hoa Loc area, Cai Be District, Tien Giang Province, Vietnam, for their permission to collect fruit from their commercial orchard.

My special thanks to all the staff and postgraduate students in the Department of Agricultural Engineering for their assistance and encouragement.

Finally I would like to thank NZODA for travel assistance and award of a Postgraduate Scholarship.
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<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ANOVA</td>
<td>analysis of variance</td>
</tr>
<tr>
<td>a</td>
<td>blade radius, m</td>
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<tr>
<td>b</td>
<td>blade width, m</td>
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<tr>
<td>CA</td>
<td>controlled atmosphere</td>
</tr>
<tr>
<td>CI</td>
<td>chilling injury</td>
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<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
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<tr>
<td>EQ</td>
<td>eating quality</td>
</tr>
<tr>
<td>HHHA</td>
<td>high humidity hot-air</td>
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<tr>
<td>HI</td>
<td>hyperthermal injury</td>
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<tr>
<td>HWT</td>
<td>hot water treatment</td>
</tr>
<tr>
<td>ISFV</td>
<td>International Standardisation of Fruits and Vegetables</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standard Organisation</td>
</tr>
<tr>
<td>k</td>
<td>coefficient of individual acid</td>
</tr>
<tr>
<td>M</td>
<td>maximum moment produced when the aim is horizontal</td>
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<tr>
<td>MA</td>
<td>modified atmosphere</td>
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<tr>
<td>MAP</td>
<td>modified atmosphere packaging</td>
</tr>
<tr>
<td>min</td>
<td>minutes</td>
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<tr>
<td>n</td>
<td>amount of NaOH 0.1 N</td>
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<tr>
<td>O₂</td>
<td>oxygen</td>
</tr>
<tr>
<td>P</td>
<td>weight of the sample</td>
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<td>PE</td>
<td>pectinesterase</td>
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<tr>
<td>PG</td>
<td>polygalacturonase</td>
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<tr>
<td>RH</td>
<td>relative humidity</td>
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<tr>
<td>R²</td>
<td>regression coefficient</td>
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<tr>
<td>SAS</td>
<td>statistical analysis system</td>
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<td>sec</td>
<td>seconds</td>
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<tr>
<td>SSC</td>
<td>soluble solids content</td>
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<td>T</td>
<td>storage time</td>
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<tr>
<td>TA</td>
<td>total acidity</td>
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<tr>
<td>Temp.</td>
<td>temperature</td>
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</table>
VHT = vapour heat treatment
Wr = weight loss rate
Wi = initial weight
Wa = weight after removal from cold storage
$\sigma_{cr}$ = flesh crushing stress