Western Australian Consumer Study:
NMBP Survey & Auction Experiment

To: Mrs Tara Slaven
Dept. Primary Industries and Regional Development, Western Australia

From: Associate Professor Robin E Roberts, Griffith Asia Institute, Griffith University
Associate Professor Alec Zuo, The University of Adelaide

Date: 30 April 2020
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Executive summary

This study provides an analysis of research conducted to understand & profile Western Australian purchasing behaviours & willingness to pay (WTP) for three new mango varieties (#1201, #1243, #4069) & to provide recommendations for broader research studies.

The report reveals that consumer responses to the new varieties are generally favourable. The results of the study support the need for a well-developed understanding of mango consumption for the new varieties to gain market acceptance. This will be achieved by presenting consumers with quality fruit, & by communicating the product benefits (offering & packaging) in order to deliver profitability for growers from the new mango varieties.

Five key insights into recognising the acceptance of new mango varieties were identified in this study:

1. The 3 most important factors that influence current mango purchase are: freshness, smell/fragrance & ripeness.

2. Participants WTP after tasting is significantly different from the before tasting for only 3 varieties in the study - #1243, #1201 & R2E2.

3. Overall, participants rated the
   - #4069 variety - highest for smoothness & texture
   - #1243 variety - highest for sweetness
   - #1201 variety - highest for seed size & sourness

4. Statistical modelling suggests - only seed size, sweetness & sourness significantly influence WTP for the new mango varieties.

5. Participants prefer the mango varieties #1243 & #1201 in comparison to #4069.
Executive summary (cont.)

Six recommendations will build on our understanding of consumer attitudes & motivations towards the new mango varieties & advance the competitive position for successful entry in domestic & export markets. In summary these are to:

• Determine more accurate WTP estimates by using a larger sample & multiple rounds of auctions across regions
• Understand more deeply consumer responses to the new mango varieties against existing mango varieties, seasonal windows, & to develop positioning strategies for domestic & export markets
• Recognise fundamental preferences around specific product attributes including varieties & packaging formats
• Evaluate & match mango varieties with evolving buyer needs including seasonality, storage, colour & size
• Investigate mango average weight of purchase in supermarkets to inform increased purchased occasions
• Evaluate issues associated with HWT for the new varieties as an alternative to VHT for export markets.
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Introduction

The purpose of this study is to present the analysis of research conducted to understand Western Australian consumers’ preferences towards three new mango varieties.

The report is structured in three key parts. First, the report presents the analysis from a consumer survey of 134 respondents to deliver a broad understanding of mango purchasing & consumption in Perth, Western Australia.

The second part delivers the analysis from a willingness to pay (WTP) study of the same 134 consumers using an experimental auction method. The report concludes with the overall summary of the study & recommends six future research directions to delve deeper into & understand more thoroughly consumers’ responses to the new mango varieties.

Key areas of study were to:

• assess consumer mango purchasing behaviours & attitudes
• understand preferences towards three new mango varieties
• estimate consumers’ WTP for mango attributes within & between the mango varieties.

Research questions:

• How does a consumer’s taste experience influence their WTP for the three new mango varieties?
• Will a consumer’s WTP change after tasting & how are these changes influenced by the taste experience?
• What other factors are important in influencing a consumer’s WTP for the three new mango varieties?
## Research study design

**Venue**
South Perth Office, DPIRD, Western Australia  
**Timing**
30 November & 1 December 2019  
**Elements**
1. Mango buying behaviour survey  
2. Experimental auction study – WTP  
   - Incentive compatible (4th-price, sealed-bid)  
   - Two rounds, before & after tasting  
   - Trial round, undertake before first-round auction with sweets (not included in final data)  
**Target sample**
134 mango consumers  
**Sessions**
9 groups  
**Product focus**
New mango varieties (unbranded) & control variety  
   - #1201 – hybrid cross between Irwin & Kensington Pride  
   - #1243 – hybrid cross between Irwin & Kensington Pride  
   - #4069 – hybrid cross between Van Dyke & Kensington Pride  
   - R2E2 – second most popular mango variety in target market  
**Recruitment**
Eventbrite online service – via DPIRD, WA  
Pre-screening evaluation
Research limitations & delimitations

This research study highlights the behaviours, attitudes & motivations held by Western Australian consumers in relation to fruit & mango purchasing in general.

The analysis has been undertaken by reviewing & evaluating the quantitative & auction studies captured on 30 November & 1 December 2019. The size of the study & amount of information collected was limited & consequently in some cases restricted the analysis & explanation presented in this report.
Mango buying behaviour survey

- socio-demographic characteristics
- place of purchase preference
- intended use of mangoes
- purchase frequency of mangoes
- avg. weight of purchase (piece)
Respondent profile

- 134 respondents
- **Gender (%)**
  - female 63.4
  - male 36.6
- **Education (%)**
  - high school 12.7
  - vocational & trades 16.4
  - tertiary 70.9
- **Age cohort (%)**
  - < 24 years 7.5
  - 25 to 34 years 32.1
  - 35 to 44 years 18.7
  - 45 to 54 years 16.4
  - 55 to 64 years 16.3
  - > 65 years 9.0

**Employment status (%)**
- full time 60.4
- part time 24.6
- retired 9.7
- other 5.3 (e.g. home duties, unemployed)

**Household income, avg. monthly (%)**
- Nil income 2.2
- $1 to 2,399 17.2
- $2,400 to 4,999 18.6
- $5,000 to 7,999 22.4
- >$8,000 39.6

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Results & discussion

- Respondents mainly purchase mangoes from supermarket stores (physical), independent fruit/vegetable stores
- to a lesser extend respondents purchase from farmer markets
- few respondents buy their mangoes online.

- All respondents eat mangoes as a piece of fresh fruit
- 35.1% of respondents use mangoes with other ingredients in a recipe
- 17.9% of respondents give mangoes as a gift to others.

Where do they shop?
(not mutually exclusive)

Intended use
(not mutually exclusive)

Source: author’s analysis
Note: n=134
Results & discussion

- 33.0% of respondents purchase mangoes once a fortnight
- just over ¼ of respondents purchase once a week
- 18.7% of shoppers purchase more than once a week
- the remaining respondents buy mangoes once a month or even less often.
- Almost half of the respondents buy 2 or 3 mangoes each shopping visit
- 23.1% of respondents buy 4 to 6 mangoes in a visit
- 20.6% of respondents purchase > 6 mangoes each purchase occasion
- few respondents buy only 1 mango each shopping visit.

**Purchase frequency**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than once a week</td>
<td>18.7</td>
</tr>
<tr>
<td>Once a week</td>
<td>26.1</td>
</tr>
<tr>
<td>Once a fortnight</td>
<td>33.0</td>
</tr>
<tr>
<td>Once a month</td>
<td>11.9</td>
</tr>
<tr>
<td>Less often</td>
<td>11.2</td>
</tr>
</tbody>
</table>

**Avg. mango purchase (piece)**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>9.0</td>
</tr>
<tr>
<td>Two to three</td>
<td>47.0</td>
</tr>
<tr>
<td>Four to six</td>
<td>23.1</td>
</tr>
<tr>
<td>More than six</td>
<td>20.9</td>
</tr>
</tbody>
</table>

Source: author's analysis
Note: n=134
Purchase frequency vs. place of purchase

- Mango purchase frequency differs slightly by retail outlet.
- Respondents purchase mangoes more frequently from fruit/vegetable stores than from community farmer markets or supermarkets.
- 52% of fruit/vegetable store shoppers buy mangoes more than once a week or once a week.
- 45% of mango shoppers buy from mainstream retail supermarkets more than once a week or once a week.

Purchase amount vs. place of purchase

- Community farmers market shoppers buy more mangoes, with 60% buying 4 or more mangoes on a single purchase occasion.
- 49% of consumers purchase only 2 to 3 mangoes from supermarkets & 45% from fruit/vegetable stores.

<table>
<thead>
<tr>
<th>Purchase frequency vs. place of purchase</th>
<th>Total surveyed n=134 (%)</th>
<th>Community farmers market n=50 (%)</th>
<th>Supermarket (physical store) n=106 (%)</th>
<th>Fruit/veg store n=80 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than once a week</td>
<td>18.7</td>
<td>20.0</td>
<td>17.9</td>
<td>20.0</td>
</tr>
<tr>
<td>Once a week</td>
<td>26.1</td>
<td>24.0</td>
<td>27.4</td>
<td>31.3</td>
</tr>
<tr>
<td>Once a fortnight</td>
<td>32.1</td>
<td>36.0</td>
<td>35.9</td>
<td>26.3</td>
</tr>
<tr>
<td>Once a month</td>
<td>11.9</td>
<td>8.0</td>
<td>10.4</td>
<td>11.3</td>
</tr>
<tr>
<td>Less often</td>
<td>11.2</td>
<td>12.0</td>
<td>8.5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purchase amount (piece) vs. place of purchase</th>
<th>Total surveyed n=134 (%)</th>
<th>Community farmers market n=50 (%)</th>
<th>Supermarket (physical store) n=106 (%)</th>
<th>Fruit/veg store n=80 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>9.0</td>
<td>0.0</td>
<td>9.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Two to three</td>
<td>47.0</td>
<td>40.0</td>
<td>49.1</td>
<td>45.0</td>
</tr>
<tr>
<td>Four to six</td>
<td>23.1</td>
<td>32.0</td>
<td>25.5</td>
<td>26.3</td>
</tr>
<tr>
<td>More than six</td>
<td>20.9</td>
<td>28.0</td>
<td>16.0</td>
<td>22.5</td>
</tr>
</tbody>
</table>
Results & discussion

Factors influencing mango purchase

<table>
<thead>
<tr>
<th></th>
<th>Total Surveyed n=134</th>
<th>Community farmers market n=50</th>
<th>Supermarket (physical store) n=106</th>
<th>Fruit/veg store n=80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ripeness of the fruit</td>
<td>8.0</td>
<td>7.9</td>
<td>7.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Smell</td>
<td>8.3</td>
<td>8.5</td>
<td>8.3</td>
<td>8.4</td>
</tr>
<tr>
<td>Size of the fruit</td>
<td>6.8</td>
<td>6.6</td>
<td>7.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Freshness</td>
<td>8.3</td>
<td>7.9</td>
<td>8.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Amount of blemishes</td>
<td>6.7</td>
<td>6.1</td>
<td>6.9</td>
<td>6.8</td>
</tr>
<tr>
<td>Colour of the fruit</td>
<td>7.4</td>
<td>6.9</td>
<td>7.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Price</td>
<td>7.7</td>
<td>7.2</td>
<td>7.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Health benefits of the fruit</td>
<td>5.6</td>
<td>5.5</td>
<td>5.9</td>
<td>5.6</td>
</tr>
<tr>
<td>Variety</td>
<td>5.9</td>
<td>5.6</td>
<td>5.9</td>
<td>6.2</td>
</tr>
<tr>
<td>Source of assurance (knowing who has grown your mango)</td>
<td>6.0</td>
<td>6.0</td>
<td>6.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Being certified organic</td>
<td>3.9</td>
<td>4.4</td>
<td>4.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Food safety inspected</td>
<td>6.3</td>
<td>6.3</td>
<td>6.5</td>
<td>6.2</td>
</tr>
<tr>
<td>Store customer service</td>
<td>4.3</td>
<td>4.2</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Good visual presentation/packaging</td>
<td>5.2</td>
<td>5.0</td>
<td>5.5</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Overall, top 3 factors influencing mango purchase
1. freshness
2. smell
3. ripeness of the fruit

It is important to note this is the same for purchasing at supermarkets, farmers markets & fruit & vegetable stores

Overall, the least important factors influencing mango purchase
- certified organic status
- store customer service
- good visual packaging/presentation

Question
On a scale of 0 to 10, which of the following characteristics influence you when buying mangoes?
0 = least important
10 = extremely important
Experimental auction

Willingness to pay for 3 new mango varieties
Research method

Session steps

1. Participants complete survey questionnaire
2. Introduction of mangoes
3. Auction rule explanation & trial auction
4. Participants observe the mangoes (A, B, C & D) on display & are told relevant information for each mango
5. First round auction
6. Tasting session & evaluation
7. Second round auction
8. Random draw to select one binding bid among eight bids (A, B, C & D, from the first & second rounds)

A. #4069 variety
B. #1243 variety
C. #1201 variety
D. R2E2 variety

Image not taken
Research method (cont.)

**Auction rules (4th price auction format)**
- After two rounds (before tasting & after tasting) of bidding, the after tasting round & mango B are randomly chosen to be binding.
- Bidding prices of the after tasting round for mango B are listed from high to low.
- The three top bidders (participants 9, 3, 2 in this case) will need to purchase one mango B at the fourth highest price $2.50.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Before tasting</th>
<th>After tasting</th>
<th>After tasting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>1</td>
<td>1.0</td>
<td>0.0</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>3.5</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>3.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>4</td>
<td>0.0</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>5</td>
<td>1.5</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>2.0</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>7</td>
<td>2.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>1.5</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>9</td>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>3.0</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>11</td>
<td>1.0</td>
<td>0.5</td>
<td>4.5</td>
</tr>
<tr>
<td>12</td>
<td>0.5</td>
<td>0.0</td>
<td>1.5</td>
</tr>
<tr>
<td>13</td>
<td>3.0</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>14</td>
<td>2.5</td>
<td>3.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Research analysis

The WTP elicitation mechanism is named the $n^{th}$ ($n=4$ in this study) price auction & is one of the elicitation mechanisms that are incentive compatible.

This means participants are incentivised to bid their true value for the auctioned mango.$^\text{^}$

The best strategy under this elicitation is to honestly bid exactly what each mango is worth by the participant.

If one bids more than the mango is worth, he/she may end up having to pay more than he/she really wants to pay.

Conversely, if a participant bids less than the mango is really worth, he/she may end up not winning the auction even though he/she could have bought a mango at a price they were actually willing to pay.

Thus, the best strategy is for the participant to bid exactly what they feel the mango is worth.

Research analysis (cont.)

Regression method was used to model bidding prices from the auction.

Specifically, equation (1) was for the bidding price before tasting; equation (2) was for the bidding price after tasting. Before tasting:

\[ Y_{B_{ij}} = \text{Variety}_j \cdot \rho + X_i \cdot \beta + \alpha_i + \varepsilon_{ij} \]  
(1)

\[ Y_{A_{ij}} = \text{Taste}_{ij} \cdot \mu + \theta \cdot Y_{B_{ij}} + \alpha_i + \varepsilon_{ij} \]  
(2)

Where:

- \( Y_B \) is the bidding price before tasting
- \( Y_A \) is the bidding price after tasting
- \( X \) is a vector of participant characteristics
- \( \text{Taste} \) is a vector of taste evaluation scores (0-10);
- \( \alpha_i \) is participant individual effects; \( \rho, \beta, \mu, \) & \( \theta \) are parameters or vector of parameters to be estimated; & \( \varepsilon_1 \) & \( \varepsilon_2 \) are classical error terms
- Variety is variety dummies.

It should be noted that equation (1) includes a range of participant characteristics (vector \( X \)) as independent variables to explain the bidding price.

For equations (1) & (2) \( \alpha_i \) can be treated as a fixed effects or random effects.

A major shortcoming of the fixed effects is that any individual characteristics \( (X_i) \) that do not vary across bids for the four mangos cannot be estimated.

As we are still interested in knowing whether individual characteristics affect consumer bidding prices, random effects were used for equation (1).

Fixed effects however have the advantage of unbiased estimation for other independent variables such as \( \text{Taste}_{ij} \). Therefore equations (2) was estimated by fixed effects; & the before tasting bidding price was used as a control variable.
Results & discussion

Participants bid differently (statistically significant) between before- & after-tasting rounds for #1243 (p<0.10), #1201 (p<0.01) & R2E2 (p<0.01).

There was no statistical significance between before- & after-tasting bid for #4069.

Specifically, on average, participants bid for their mangoes after tasting -

- **26 cents more** for a #1243
- **49 cents more** for a #1201
- **64 cents less** for a R2E2.

Multivariate equal mean tests (mv-test) suggest differences in ratings for seed size (p<0.01), texture (p<0.10), sweetness (p<0.01) & sourness (p<0.05) were statistically significant while for smoothness it was not.

- #4069 rated highest on smoothness & texture
- the largest difference in smoothness, being 0.36, evidenced with R2E2
- with texture, being 0.55, with R2E2.

- #1243 rated highest on sweetness with the largest difference in sweetness, being 1.26, with R2E2.

- #1201 rated highest on seed size & sourness,
  - largest difference in seed size, being 0.96 with #4069, & in sourness, being 0.75, with R2E2.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Seed size</th>
<th>Smoothness</th>
<th>Texture</th>
<th>Sweetness</th>
<th>Sourness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (#4069)</td>
<td>5.85</td>
<td>7.89</td>
<td>7.80</td>
<td>6.70</td>
<td>6.13</td>
</tr>
<tr>
<td>B (#1243)</td>
<td>5.88</td>
<td>7.86</td>
<td>7.54</td>
<td>7.54</td>
<td>6.46</td>
</tr>
<tr>
<td>C (#1201)</td>
<td>6.81</td>
<td>7.78</td>
<td>7.57</td>
<td>7.36</td>
<td>6.63</td>
</tr>
<tr>
<td>D (R2E2)</td>
<td>6.28</td>
<td>7.53</td>
<td>7.25</td>
<td>6.28</td>
<td>5.88</td>
</tr>
<tr>
<td>mv-test</td>
<td>p&lt;0.01</td>
<td>NS</td>
<td>p&lt;0.10</td>
<td>p&lt;0.01</td>
<td>p&lt;0.05</td>
</tr>
</tbody>
</table>

Note: Rating is on a scale of 0 = do not like at all to 10 = like it very much.
Results & discussion

Regression results suggest -

**Before tasting**, none of the socio-economic & attitude variables are significantly associated with WTP.

**Using variety A (#4069) as the base** -
- WTP for variety B (#1243) is statistically significantly more by 18 cents/mango
- WTP for R2E2 is statistically significantly more by $1.30, due to its larger size
- WTP for variety C (#1201) is not statistically significantly different.

____________

**After tasting**, controlling for before-tasting WTP, seed size, sweetness & sourness are statistically significantly associated with WTP.
- For one scale increase in likeness in seed size, WTP increases by 6 cents/mango.
- For one scale increase in likeness in sweetness, WTP increases by 22 cents/mango.
- For one scale increase in likeness in sourness, WTP increases by 9 cents/mango.

**Note**

**p<0.05; ***p<0.01**
Insights & next steps
Study summary

A number of insights have emerged from the results of this study. These insights form the first steps in understanding & defining acceptance of the new mango varieties by Western Australian consumers.

Consumer attitudes & preferences

- The 3 most important factors influence mango purchase are
  - freshness
  - smell/fragrance
  - ripeness

- Participants **WTP after tasting** is significantly different from their WTP before tasting for 3 varieties in the study – #1243, #1201 & R2E2.

- Overall, participants rated the
  - #4069 variety - **highest for smoothness & texture**
  - #1243 variety - **highest for sweetness**
  - #1201 variety - **highest for seed size & sourness**

- Statistical modelling suggests
  - **only seed size, sweetness & sourness significantly influence WTP** for the new mango varieties.

- Participants prefer #1243 & #1201 to #4069.
Future research

The WTP auction & purchasing behaviour survey findings combined create an early profile of the Western Australian consumers’ response to three new mango varieties. It is recommended further market observations be undertaken to delve deeper into consumer attitudes & motivations towards the new varieties, product attributes & the effect of marketing stimuli, as well as close any knowledge gaps that have emerged from this study.

The key areas of focus recommended for further research are:

- More accurate WTP estimates are needed, & this can be achieved using a larger sample & multiple rounds of auctions & across regions.
- Study & evaluate consumer responses to the new mango varieties against existing varieties in the same seasonal window to identify market positioning.
- Examine responses to a range of levels of fruit maturity to understand consumer preferences in more detail.
- Evaluate & match mango varieties with evolving buyer needs & opportunities, with consideration for emerging urban domestic demands for seasonality, storage, colour, size, taste & texture that traditional varieties may not satisfy.
- International market development planning by testing consumer preferences & WTP for the new varieties in the key export destinations, for example Hong Kong.
- Evaluate varietal issues associated with market entry protocols (hot water dipping as a low-cost alternative to vapour heat treatment) to inform export development opportunities.
Contact details

This study was undertaken by Griffith University & The University of Adelaide in collaboration with Department of Primary Industries and Regional Development, Western Australian.

Enquiries for this study should be directed to:

**Associate Professor Robin E Roberts**
Griffith Asia Institute, Griffith University
South Bank campus, Brisbane, Queensland
Email: robin.roberts@griffith.edu.au

**Associate Professor Alec Zuo**
Centre for Global Food and Resources, The University of Adelaide
North Terrace campus, Adelaide, South Australia
Email: alec.zuo@adelaide.edu.au