Experience in commercialising *Canarium odontophyllum* Miq.: A potential superfruit of Sarawak

Pearlycia Brooke, Lau Cheng Yuon and Rajmah Muzli Razili

Fruit and Postharvest Technology Section
Agriculture Research Centre Semongok
P.O Box 977, 93720 Kuching, Sarawak
Presentation Outline

1) Introduction
2) Production of dabai (*Canarium odontophyllum*) in Sarawak.
3) Nutritional properties and economic potential of dabai
4) Commercial enterprises and local market
Dabai-The tree

- Family : Burseracea

- Contains about 75 species of trees - mainly found in Asia, the Pacific, and tropical Africa (Leenhouts, 1956).

- Tree is resiniferous, 8 to 25 meters tall with a girth of 15 to 60 cm (d.b.h).

- The stem is a straight bole with erect, semi-erect or horizontal branches (Sim and Lau, 2011)
The fruit of dabai is ovoid to ellipsoid, slightly triangular in cross-section, 25-35mm (length) × 17-20mm (diameter) and glabrous (Lemmens et al., 1995).

- Aril= yellow, exocarp=dark purple to black.

- Endocarp is a hard shell and the seed can also be eaten as a nut.

- Rich source of protein, fat, carbohydrates and minerals like sodium, calcium and iron (Shakirin et al., 2012).

- Is sought after because it has a delicious creamy taste and a unique aroma.
• One of the six most popular local indigenous fruits in Sarawak that have good potential for commercialisation (Voon, 2003).

• Relatively pest and disease free.

• Has the ‘green marketing’ advantage and can be produced under the Integrated Fruit Production (IFP) system (Lau, 2011).
Major problem: Short shelf life

- Has high respiration production rate—has a short life under non-cold chain handling practices (Ding and Tee, 2011).

- Dabai with pedicel removed can only last for two or three days under ambient temperature (Sim and Lau, 2011).

- Frozen dabai, after one year, can still retained acceptable appearance, flavour and taste when prepared by blanching in boiling water for five minutes (Lau and Fatimah, 2007).
Production of Dabai in Sarawak

- Found naturally along river banks in Sibu, Sarikei, Kapit and Limbang divisions.

- Primarily concentrated in the central region of Sarawak.

- Good standing trees = 13, 012 trees (based on 20% sampling size) with estimated average production of 650.6 metric ton per season (C.Y. Lau, personal communication, November 12, 2009).
Since 1985, the institution has performed number of studies on the collection, documentation, conservation and improvement of this fruit (Chai et al., 2008).
Superior clones—Laja & Lulong

- 2 selected dabai clones were launched in 2006.

- Vigorous and they begin to bear fruits five years after planting.

- Initial yield- 10 kg/tree and can gradually increase to 80-100 kg/tree when the tree reaches 10 years and above (Lau and Voon, 2007).

- ‘Laja’ is triangular with concave sides while the seed of ‘Lulong’ is more rounded or convex on its sides.
### Nutritional Values of Fruit

<table>
<thead>
<tr>
<th>COMPONENT (%/100 gm)</th>
<th>LAJA</th>
<th>LULONG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>6.8</td>
<td>5.5</td>
</tr>
<tr>
<td>Fat</td>
<td>44.3</td>
<td>33.9</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>37.2</td>
<td>45.6</td>
</tr>
<tr>
<td>Fibre</td>
<td>8.1</td>
<td>11.6</td>
</tr>
<tr>
<td>Ash</td>
<td>3.8</td>
<td>3.4</td>
</tr>
</tbody>
</table>

### Physical Characteristics of Fruit

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>LAJA</th>
<th>LULONG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual fruit weight (g)</td>
<td>18.9</td>
<td>13.9</td>
</tr>
<tr>
<td>Fruit length (cm)</td>
<td>4.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Flesh thickness (cm)</td>
<td>0.35</td>
<td>0.31</td>
</tr>
<tr>
<td>Seed weight (g)</td>
<td>7.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Edible portion (%)</td>
<td>61.5</td>
<td>64.0</td>
</tr>
</tbody>
</table>

- In terms of size, the fruit of ‘Laja’ is bigger with individual fruit weight of 18.9 g.
- Lau *et al.* (2008) also reported that these dabai clones are rich in fat and also carbohydrate.
• Dominated by smallholders, who grow the plant in mixed orchards called ‘dusun’.

• Managed the orchards on a small-scale ranging from several trees to several hectares.

• Recently, larger orchards of several hectares have emerged.
• Initial fresh fruit yield of dabai trees is low at 10-20 kilogram/tree/season.

• Dabai price varies greatly depending on the season, quality and demand.

• During bumper season, the price of dabai could drop to RM 5 or less per kilogram during the peak period.

• A highly appreciated crop.
Intervention: Technical support

- Seed propagation may result in fruits with variable traits and would give male trees which do not produce fruit.

- Seed propagation is not recommended, can be propagated by asexual methods.

- Private nursery operators and growers were given technical support and mother plants of selected dabai clones.
• DOA Sarawak regularly monitored the production of grafted dabai

• 3 commercial nursery in Sarikei, Sibu and Sri Aman divisions were engaged and promoted as main producers of high quality dabai planting materials in the region.

• Three commercial growers in Sarawak were already identified to grow these quality planting materials.

• Generated more income and also made quality grafted dabai plants available to the masses.
Field survey on productive trees in the central region was conducted in 2008.

5 clusters of 200 trees each could be organised to supply quality fruit for product development, promotion and marketing in new markets (Lau, 2009).

Few nucleus dabai growers with selected seedlings in Sarikei and Kanowit divisions were identified.

24 smallholders with the estimated average production of 10 metric ton per season (T.H. Tie, personal communication, July 10, 2012).
Nutritional Properties: Potential superfruit?

Dabai fruit is highly nutritious and is rich in protein, fat, energy and carbohydrate (Voon and Kueh, 1999).

It is also high in phenolic compounds and vitamin E such as γ-tocopherol (Azrina et al., 2010; Shakirin et al., 2010).

The fruit also possesses high antioxidant capacity (Amin et al., 2007).

In recent years, due to the high nutritional quality, the fruit of dabai had been promoted as a specialty fruit by the DOA Sarawak (Leipzig, 1994; Lau, 2009).

(Wild Fruits & Vegetables in Sarawak, 2010)

<table>
<thead>
<tr>
<th>Proximate composition per 100g fresh edible portion</th>
<th>Dabai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>339</td>
</tr>
<tr>
<td>Moisture (g)</td>
<td>41.3</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>3.8</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>26.2</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>22.1</td>
</tr>
<tr>
<td>Crude fibre (g)</td>
<td>4.3</td>
</tr>
<tr>
<td>Ash (g)</td>
<td>2.3</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>65</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>810</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>200</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>106</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>1.3</td>
</tr>
<tr>
<td>Manganese (mg)</td>
<td>0.8</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>0.7</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Fatty acid composition (Pulp Oil)

Composition: 43.42% saturated fatty acid, 42.53% monounsaturated fatty acid and 14.05% polyunsaturated fatty acid (Azrina et al., 2010)

Pulp oil were comparable to palm oil, due to their near equal percentage of saturated, monounsaturated fatty acids and also polyunsaturated fatty acids (Azrina et al., 2010).

May possess comparable nutrient content as the palm olein.

Substitutes for conventional oils that are used in the production of soap and shampoo (Azrina et al., 2010).
Fatty acid composition (Kernel oil)

- Oleic acid (41.9%) was the main constituent of monounsaturated lipids in dabai kernel oil.

- The polyunsaturated fatty acid was in small amount, with linoleic acid of 14.05%.

- The major saturated fatty acid present in dabai kernel oil was palmitic acid (40.31%) with small amount of myristic acid, stearic acid and arachidic acid (Liew et al., 2011).

- Dabai kernel oil has high tendency to be solid at room temperature (Azrina et al. 2010).

- Fatty acid composition of the kernel oil was similar to cocoa butter, suggesting the oil as a cocoa butter equivalent (CBE).

<table>
<thead>
<tr>
<th>Composition per 100g sample</th>
<th>Dabai kernels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>27.05</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>15.8</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>26.20</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>10.75</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>47.24</td>
</tr>
<tr>
<td>Ash(g)</td>
<td>3.35</td>
</tr>
<tr>
<td>Energy (Kcal)</td>
<td>499.36</td>
</tr>
</tbody>
</table>

Nutritional, Physical and Sensory Analysis of Processed Dabai Kernel (Liew et al., 2011)
Antioxidant Properties

• In 2007, Amin et. al. carried out a preliminary work where the different parts of dabai fruit were analysed for antioxidant properties.

• Based on the β-carotene bleaching assay, the highest antioxidant activity was observed in the skin of dabai, with mean antioxidant activity of 89.31% O.I.

• The total phenolic content were higher in the skin and whole fruit with 25.07 and 5.43 mg GAE/dried sample respectively, compared to the flesh (3.38 mg GAE/g dried sample) and kernel (2.14 mg GAE/g dried sample).

• The high antioxidant capacity of dabai could be due to the presence of phenolic compounds in the skin.

High total anthocyanin contents was determined in methanol and water extracts of defatted dabai parts (Khoo et al., 2012).

Defatted pulp was found to be rich in phenolics, while the purplish defatted dabai peel has high amount of anthocyanin (Khoo et al., 2012).

It was proven that dabai is a potential antioxidant source—can be exploited in nutraceutical and functional food industry.

The high antioxidant capacity has led to dabai being investigated as a potential cholesterol lowering agent.

Rabbits receiving defatted pulp of dabai showed the greatest cholesterol lowering effect—reduced plasma LDL-C, TC and thiobarbiturate reactive substance (TBARS) level as well as atherosclerotic plaques (Shakirin et al., 2012).

The positive effect on hypercholesterolemic rabbits—70 mg of polyphenolic compounds and the presence of high dietary fiber (Khoo et al., 2012).
GI Certification of Dabai

• A potential superfruit which Sarawak can develop with competitive advantage.

• DOA to designate dabai as one of the priority crops in the region.

• Recently been granted Geographical Indication (GI) protection certification by the Malaysian Intellectual Property Corporation (MyIPO).

• The certification gives dabai the recognition necessary to the creation of a high quality product.
Commercial Enterprises & Local Market

• Sold primarily in domestic markets- international market was not very much developed.

• Potential exists to develop it as a superfruit for wider domestic and regional markets.

• Emigrants from Sarawak in West Malaysia and other South East Asian countries would be a ready market for this fruit (Lau, 2009).

• Majority of the small-scale local manufacturers prefer to cater to niche markets.
Economic Potential-Value added products

- Frequently used as ingredients in cakes, cookies, sandwiches and pizza.

- Besides using the pulp and kernel for food products, the seeds can also make attractive keychains when polished and painted.

- The shell can be recycled to produce charcoal.

Mariam Cake House outlets

Visit by Crown Prince of Perak, Raja Dr. Nazrin Shah Ibni Sultan Azlan Muhibbuddin Shah
Borneo To The World Sdn. Bhd.

Borneo To The World kiosk in Kuching International Airport
• DOA Sarawak continues to pursue industry development in its desire to improve the dabai supply chain and boost commercialisation.

• Favourable environment was created to encourage involvement of private sector in the supply chain operations of dabai fresh fruits and products.

Launching of Dabai Month by Deputy Chief Minister YB Datuk Patinggi Tan Sri (Dr.) Alfred Jabu (12th July 2012)

Dabai Festival in Kapit (13th-14th November 2012)

Launching of dabai as a signature fruit of Sarawak during MAHA International by Governor of Sarawak (November 2012)
Conclusion

• The high nutrient content and antioxidant quality made dabai a potential superfruit for commercialisation.

• Highly nutritious and is rich in protein, fat, energy and carbohydrate. Also high in antioxidant.

• Quite a substantial amount of the fruit is now available in many forms i.e. food products and non-food products

• It is envisaged that commercialisation activity of this special fruit will increase substantially in the next few years.

• It is hoped that dabai will be sold into international trade and will be ranked with other commercial fruits in the world market.
Acknowledgement

This publication is an output from a project called the Key Focus Activity (KFA)-4 2012 by DOA Sarawak, Malaysia.

The authors would like to thank the staff of Fruit and Post-harvest Technology Section of ARC Semongok for their assistance and all private stakeholders of the project who agreed to participate and have contributed so generously with their time and information.
THANK YOU