Status and Challenges of Dragon Fruit Production in Malaysia

BY:
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Malaysia GDP

- The agriculture sector contributed 8.2 per cent or MYR 96.0 billion to the Gross Domestic Product (GDP) in 2017
Fruits in Malaysia

- Total area planted with fruits in Malaysia is about 208,590 ha (2017)
- Eight major fruits given more emphasized for domestic as well as for export markets are pineapple, papaya, watermelon, starfruit, mango, banana, jackfruit, mangosteen and durian.
SUPPLY AND UTILIZATION

• Papaya recorded the highest SSR of 158.7 per cent followed by watermelon (153.6%) and starfruit (140.1%)

• Per capita consumption (PCC) of coconut was the highest followed by durian, pineapple and banana per year respectively.
## Fruit Production Statistic

<table>
<thead>
<tr>
<th>Item</th>
<th>2014</th>
<th>2015’</th>
<th>2016</th>
<th>2017</th>
<th>2018*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hectarage (Ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>199,570</td>
<td>203,562</td>
<td>194,970</td>
<td>208,590</td>
<td>209,295</td>
</tr>
<tr>
<td>Semenanjung Malaysia</td>
<td>147,594</td>
<td>151,764</td>
<td>143,617</td>
<td>155,573</td>
<td>156,099</td>
</tr>
<tr>
<td>Sabah</td>
<td>16,659</td>
<td>16,296</td>
<td>16,951</td>
<td>17,593</td>
<td>17,652</td>
</tr>
<tr>
<td>Sarawak</td>
<td>35,073</td>
<td>35,280</td>
<td>34,238</td>
<td>35,249</td>
<td>35,368</td>
</tr>
<tr>
<td>W.P Labuan</td>
<td>244</td>
<td>222</td>
<td>165</td>
<td>176</td>
<td>176.19</td>
</tr>
<tr>
<td><strong>Production (metric tones)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>1,621,975</td>
<td>1,768,722</td>
<td>1,664,793</td>
<td>1,492,601</td>
<td>1,639,622</td>
</tr>
<tr>
<td>Semenanjung Malaysia</td>
<td>1,326,364</td>
<td>1,442,350</td>
<td>1,368,880</td>
<td>1,232,651</td>
<td>1,354,067</td>
</tr>
<tr>
<td>Sabah</td>
<td>139,409</td>
<td>142,223</td>
<td>145,240</td>
<td>108,918</td>
<td>119,646</td>
</tr>
<tr>
<td>Sarawak</td>
<td>155,659</td>
<td>183,623</td>
<td>150,289</td>
<td>150,689</td>
<td>165,531</td>
</tr>
<tr>
<td>W.P Labuan</td>
<td>544</td>
<td>527</td>
<td>384</td>
<td>344</td>
<td>378</td>
</tr>
<tr>
<td><strong>Production value (RM ‘000)</strong></td>
<td>4,368,594</td>
<td>4,383,241</td>
<td>4,196,260</td>
<td>5,302,725</td>
<td>5,825,045</td>
</tr>
</tbody>
</table>

(USD 1.00 = MYR 4.20)
Fruit Hectarage 2017

<table>
<thead>
<tr>
<th>Category Name</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(12,598 ha)</td>
</tr>
<tr>
<td></td>
<td>(10,406 ha)</td>
</tr>
<tr>
<td></td>
<td>(34,895 ha)</td>
</tr>
<tr>
<td></td>
<td>(5,097 ha)</td>
</tr>
<tr>
<td></td>
<td>(3,617 ha)</td>
</tr>
<tr>
<td></td>
<td>(6,048 ha)</td>
</tr>
<tr>
<td></td>
<td>(3,219 ha)</td>
</tr>
<tr>
<td></td>
<td>(72,391 ha)</td>
</tr>
</tbody>
</table>

Source: Department of Agriculture, 2018
Dragon fruit in Malaysia

- Introduced to Malaysia through Vietnam 20 years ago.
- Local name buah mata naga/buah naga
- Public sector driven and was not concerted in development plan for Malaysia’s government.
National Production (2017)

<table>
<thead>
<tr>
<th>Production Area</th>
<th>513 ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total production</td>
<td>6,407 tons</td>
</tr>
<tr>
<td>Production value</td>
<td>MYR 25,309,360.00 (USD 6.1 million)</td>
</tr>
</tbody>
</table>

Source: Department of Agriculture, 2018
Dragon Fruit Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Hectarage (Ha)</th>
<th>Production (mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1790</td>
<td>5296</td>
</tr>
<tr>
<td>2008</td>
<td>2267</td>
<td>9016</td>
</tr>
<tr>
<td>2009</td>
<td>15701</td>
<td>1762</td>
</tr>
<tr>
<td>2010</td>
<td>10192</td>
<td>1526</td>
</tr>
<tr>
<td>2011</td>
<td>963</td>
<td>963</td>
</tr>
<tr>
<td>2012</td>
<td>6,252</td>
<td>815</td>
</tr>
<tr>
<td>2013</td>
<td>8,577</td>
<td>152</td>
</tr>
<tr>
<td>2014</td>
<td>6,042</td>
<td>451</td>
</tr>
<tr>
<td>2015</td>
<td>5,475</td>
<td>563</td>
</tr>
<tr>
<td>2016</td>
<td>4,402</td>
<td>313</td>
</tr>
<tr>
<td>2017</td>
<td>6,407</td>
<td>513</td>
</tr>
</tbody>
</table>

Department of Agriculture, 2018
Average yield

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield (Tonne/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>7.7</td>
</tr>
<tr>
<td>2013</td>
<td>19.0</td>
</tr>
<tr>
<td>2014</td>
<td>13.4</td>
</tr>
<tr>
<td>2015</td>
<td>9.7</td>
</tr>
<tr>
<td>2016</td>
<td>8.6</td>
</tr>
<tr>
<td>2017</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Department of Agriculture, 2018
## Export Market 2018

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>VALUE (MYR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>28,705.0</td>
</tr>
<tr>
<td>Bahrain</td>
<td>848.0</td>
</tr>
<tr>
<td>Germany, Federal Republic Of</td>
<td>368.0</td>
</tr>
<tr>
<td>Spain</td>
<td>135,450.0</td>
</tr>
<tr>
<td>France</td>
<td>473.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>3,301.0</td>
</tr>
<tr>
<td><strong>Hong Kong</strong></td>
<td>319,567.0</td>
</tr>
<tr>
<td>Hungary</td>
<td>141.0</td>
</tr>
<tr>
<td>Japan</td>
<td>315.0</td>
</tr>
<tr>
<td>Kuwait</td>
<td>734.0</td>
</tr>
<tr>
<td>Maldives</td>
<td>134,362.0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>328.0</td>
</tr>
<tr>
<td>Qatar</td>
<td>1,808.0</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>30,816.0</td>
</tr>
<tr>
<td><strong>Singapore, Republic Of</strong></td>
<td>10,810,688.0</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1,939,214.0</td>
</tr>
<tr>
<td>Vietnam, Socialist Rep. Of</td>
<td>46,386.0</td>
</tr>
<tr>
<td><strong>TOTAL VALUE (MYR)</strong></td>
<td><strong>13,453,504.0</strong></td>
</tr>
</tbody>
</table>

USD = 3.2 million

MOA, 2019
Dragon fruit in Malaysia

• Species

- Red skin white flesh: *Hylocereus undatus*
- Red skin red flesh: *Hylocereus polyrhizus*
- Yellow skin variety: *Selenicereus megalenthus*
Malaysia Registered Variety

- National Listings

HU1
Pink Dragon Sunlike

HU2
Iguana
Why it's popular?

- High demand and offer good price
- Can be harvested all year round (peak April and September)
- Bears fruits after one year of planting
- Fast return on investment
Production system

- Height of stakes: 6 feet
- Cuttings per stakes: 4 cuttings
- Top framework: Concrete/wood/used motorcycle tyre
- Planting distance: 3.3m x 3.3m
- No. of stakes: 1000/ha.
- No. of cuttings: 4000/ha.
Production system
Marketing Channel

• What is marketing channel?:
  • It is a chain of businesses or intermediaries through which a good or services passes until it reaches the final buyer or end consumer.

• Marketing channel can be short or long. It divided into 2 types: direct or indirect channels.
  • Direct marketing (1 layer): grower / producer sell directly to individual system.
  • Indirect marketing (2 or more layer or integrated/multiple): grower to wholesaler to retailers to consumers.
  • More intermediaries involve will hike up the price for a good. Conversely, short channel may mean lower cost for consumers because buying directly from grower or manufacturer.
  • Conflict between partners in distribution channel must be ignored for long run relationship.
  • Marketing channel involved domestic and international channel. International more complex due to widely crossing of different social, economic and political partners.
Domestic market

• In local market, dragon fruit often sell as a fresh produce (farm or retail price). It also can be turned as value-added products (i.e. jam, juice, dried fruit and cordial) normally at processor level.

• Price range as below:

<table>
<thead>
<tr>
<th>Ex-farm price</th>
<th>Wholesale price</th>
<th>Retail price</th>
</tr>
</thead>
<tbody>
<tr>
<td>MYR 3.50 – RM 4.00/kg (USD 0.80 - USD 0.90)</td>
<td>MYR 4.50/kg (USD 1.10)</td>
<td>MYR 5.00 – RM 6.00/kg (USD 1.20 – USD 1.50)</td>
</tr>
</tbody>
</table>

*Price may change due to size and grading

• In commercial market dragon fruits are sold by weight (kg), however in wet market it is in a bulk (3 to 4 pieces), priced at MYR 10(USD 2.40)/bulk.

• Online shopping is also available for consumers (i.e. Supply bunny.com, Jaya Grocer, MBG Fruit Shop)
MARKETING CHANNEL

Retail market: Supermarket/Hypermarket (selling fruits normally by weight)

Retail market: Wet/Night market (selling fruits either by weight or by in a bulk)
ONLINE MARKETING

Supply Bunny.com: https://www.supplybunny.com


MBG Fruit shop: https://mbg.com.my/products/malaysia-red-dragon-fruit-m
International market

• Malaysia export dragon fruits to the main traditional export market (Singapore, and Hong Kong).

• Export trend shows an increasing, with 33% average growth rate from 2013 to 2018. Malaysia export 4,256 mt dragon fruits or RM 13.45 million in 2018.

• Market demand for fruits as whole including dragon fruits is expected to increase 3% for local and export market by 2025.

[Graph: Malaysian dragon fruit export, 2013-2018]
Main constraints

1. Disease outbreak - Current disease and pest scenario in Malaysia
2. Government policy - Funding on R&D are limited
CURRENT PEST AND DISEASE SCENARIO

- This pioneering local dragon fruit farming venture went downhill when disease targeting the crop struck in late 2009.
- Dragon fruits are susceptible to diseases caused by fungi, bacteria and virus.
- Several complex diseases found in Malaysia includes:-
  - (i) Anthracnose
  - (ii) Stem necrosis
  - (iii) Stem canker
  - (iv) Stem rot
  - (v) Bacterial soft rot
  - (vi) Reddish brown spot disease
  - (vii) Viral spot disease caused by Cactus virus X
MAJOR PEST & DISEASE OF PITAYA IN MALAYSIA

- ANTHRACNOSE

- Most common disease; causes huge losses in quality of the fruits (52% disease incidence, 47% disease severity)
- Two species involved: C. gloeosporioides and C. truncatum
- Attack stem and fruit
- Symptom - red brown concentric lesions with ascervuli developed near ribs of vine, in particular where the spines emerged from the rib edge
Symptom of anthracnose and morphological characteristics of *C. gloeosporioides* and *C. truncatum*: A) Brown lesion on pitaya stem caused by *C. gloeosporioides*; B) Brown lesion on pitaya fruit caused by *C. gloeosporioides* (*Masyahit et al. 2009*); C, D) Colony appearance and pigmentation of *C. gloeosporioides*; E) Straight, cylindrical to slightly curve and hyaline conidia of *C. gloeosporioides*; F) Brown lesion on pitaya stem caused by *C. truncatum*; G, H) Colony appearance and pigmentation of *C. truncatum*; and J) Falcate with acute apex and narrow truncate base conidia of *C. truncatum* (Suzianti et al. 2014)
STEM CANKER

- Most destructive disease
- First reported by Mohd et al. (2013b) with up to 60% disease incidence, 55% disease severity
- Causal agent: *Neoscytalidium dimidiatum*
- Initial symptoms: brown sunken lesion, became dark brown with age
- Orange spot and black pycnidia formed on the surface of the canker, the infected stem subsequently rotted

Image by Mohd et al. 2013
Symptom of stem canker and morphological characteristics of *N. dimidiatum*: A, B, C) Sunken lesion with black pycnidia and rotted stem; D, E) Colony appearance and pigmentation; F, G) Straight, cylindrical to slightly curve and hyaline conidia; F) Conidia were ellipsoid to ovoid, rod shaped or round shaped and G) Contiguous arthroconidia.

(Mohd et al. 2013)
STEM NECROSIS

- Occurrence reported in Kelantan, Melaka, Negeri Sembilan, Penang, and Perak (41% disease incidence, 25% disease severity)
- Symptom: spots or small, circular, faint pink-to-beige necrotic lesions that generally coalesced as symptoms progressed
- Causal pathogen: Curvularia lunata

Symptom of stem necrosis and morphological characteristics of *C. lunata*: A, B, C) Beige and pink necrotic lesions; D, E) Colony appearance and pigmentation and F, G) Fusiform, cylindrical or slightly curved conidia of *C. lunata* with one of the central cells being larger and darker

( Mohd et al. 2009)
STEM ROT

- Serious disease (36% disease incidence, 25% disease severity)
- Causal pathogen: *Fusarium proliferatum* (Mohd et al. 2013a) and *Fusarium fujikuroi* (Mohd et al. 2017)
- Symptom: circular, brown sunken lesion with orange sporodochia and white mycelial formation on the lesion surface
- The causal pathogen of stem rot produced dense-cottony, whitish aerial mycelium and purplish pigments

Stem rot symptoms caused by *F. proliferatum* observed in the fields. (A) Circular symptom, (B) brown lesion symptom, (C) lesion became darker with age and (D) infected stems became rotted (Mohd et al. 2013)
**STEM ROT**

- New fungal disease of stem rot caused by *Bipolaris cactivora*
- Symptom: lesion on stem, yellow spot formed with a reddish margin below the lesion part
- Infected region: swollen but its surface is dry with few of red spots
- Young stems are susceptible to *B. cactivora*, mature stems are relatively resistant to infection
- Most severe on mature and ripe fruit

Image by Shanariah 2019
BACTERIAL SOFT ROT

- Caused by *Enterobacter cloacae*
- Also known as black rot, because the infected tissue turns to a dark black or brown color
- The disease causes the stem to rot in soft state, occasionally delimited by chlorotic haloes
- Two dragon fruit species (*Hylocereus undatus* and *H. pupusii*) were found to be susceptible, the first species being more susceptible than the latter
- Plants deficient in calcium and nitrogen could develop more severe symptoms of the disease
**REDDISH BROWN SPOT DISEASE**

- New disease on the stems of dragon fruit in Malaysia (Kee et al. 2019)
- Causal pathogens: *Nigrospora laticolonia* and *N. sphaerica*
- Occurred in Negeri Sembilan and Johor with 20% disease incidence and 10% disease severity
- Only can be found on the stem

Symptom of reddish-brown spot disease and morphological characteristics of *Nigrospora sphaerica*:

A) Yellow lesion with red spots; B) Reddish-brown spots; C, D) Colony appearance and pigmentation; E) Spherical or broadly ellipsoidal and black conidia; F) Branched, flexuous and colourless to brown conidiophores and monoblastic, conidiogenous cells.
**VIRAL SPOT DISEASE**

- Reported by Masanto et al. (2018)
- Caused by *Cactus virus X*
- Widely detected in dragon fruit-growing areas in Peninsular Malaysia
- Symptom: necrotic small mottle or spot on base of young shoots and unripe fruits which later turned orange and rotted
- Severe disease occurred in the state of Malacca; fewer occurrences were recorded in the state of Terengganu
Symptoms of necrotic spot disease on infected young shoot (a), mature stem (b) unripe fruit (c) and ripe fruit (d) of dragon fruit
(Image by Masanto et al. 2018)
Other pest?

- Ants, beetle, scale insects, mealybugs, borers - affecting almost all plant parts
- Beetles occasionally attacks the young succulent stem and may caused necrosis
- Ants feed on sap from fruits and may caused blemishes
- Fruitfly – causing damage to the shoots and fruits
- Unwrapped and overripe fruits may be eaten by birds if left unharvested
CURRENT MANAGEMENT PRACTICE

- Chemical control:
  - Benomyl and thiabendazole showed the most effective fungicides against *F. proliferatum* and *F. fujikuroi* causing stem rot on dragon fruit
  - Mancozeb, captafol and propineb recommended fungicides for stem necrosis and stem canker
  - Application of copper based-fungicide for anthracnose control
CURRENT MANAGEMENT PRACTICE

- Good agricultural practice:
  - proper technique of pruning
  - selection of disease-free seedlings
  - soil type and condition
  - sanitation and drainage system
  - Limiting canopy wetness by irrigating in the morning so plant surfaces can dry quickly throughout the day
  - Maintain a weed free planting and discard diseased plant promptly when symptoms occur
  - **Fruit bagging**
  - **Quarantine measures**
  - Controlling insect pests – ex: Aphids and mites are common pests that can transmit bacteria and viruses to healthy plants
Farms should be cleaned from weeds as it becomes hosts to many insects vectors like trips and mites.
open-center pruning is encouraged to produce good ventilation.
Plant canopy should not be too compact.
After pruning been done, all diseased and discarded branches should be destroyed and burnt; they should not be left lying in the farms as this might cause pathogen built up.
Government policy

- Lack of R&D funding for pitaya especially at MARDI.
- Dragon fruit is not priority crop like papaya, pineapple, starfruit, watermelon, rambutan, mango, jackfruit and banana that listed as priority in 11th Malaysia Development Plan (2016-2020).
Current Effort

- Malaysian Standards (SIRIM) has produced standard operating procedures (SOP) and specifications on planting materials.
My GAP

The Department of Agriculture had also come out farming practices with Good Agriculture Practices through My GAP or SALM.
STRENGTH

- Red pitaya variety-high demand local and export
- Downstream activity-enzyme/wine/culinary
- Potential export market EU/East Asia/US
FUTURE

- Control disease
- Implementation of GAP on pitaya cultivation.
- Implementation of planting materials production protocols
- R&D support-Agronomy/P&D/Breeding/Post harvest
- Policy support