New Agricultural Policy: Towards Better Pitaya Industry in Taiwan

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- Bottlenecks and Challenges
- New Agricultural Policy in Taiwan
- The Better Pitaya Industry in Taiwan
- Conclusion
Pitaya Industry in Taiwan
Pitaya Industry cultivation

- Explored amount
- Planted area (ha)

<table>
<thead>
<tr>
<th>Year</th>
<th>Explored amount (tons)</th>
<th>Planted area (ha)</th>
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<tbody>
<tr>
<td>1999</td>
<td>5,000</td>
<td>100</td>
</tr>
<tr>
<td>2000</td>
<td>10,000</td>
<td>200</td>
</tr>
<tr>
<td>2001</td>
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<td>2004</td>
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<td>35,000</td>
<td>700</td>
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<td>2006</td>
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<td>800</td>
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<td>2007</td>
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<tr>
<td>2008</td>
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<tr>
<td>2009</td>
<td>55,000</td>
<td>1,100</td>
</tr>
<tr>
<td>2010</td>
<td>60,000</td>
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<td>2011</td>
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<tr>
<td>2012</td>
<td>70,000</td>
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<tr>
<td>2013</td>
<td>75,000</td>
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<tr>
<td>2014</td>
<td>80,000</td>
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<tr>
<td>2015</td>
<td>85,000</td>
<td>1,700</td>
</tr>
<tr>
<td>2016</td>
<td>90,000</td>
<td>1,800</td>
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</table>
Pitaya Trade Partners of Taiwan 2016

Exports

- China: 70.90%
- Hong Kong: 21.58%
- Others: 0.22%
- United Arab Emirates: 1.08%
- Bahrain: 0.14%
- Singapore: 0.33%
- Canada: 2.36%

Source: 2017 Liu
## Major Export Countries of Pitaya

<table>
<thead>
<tr>
<th>Year</th>
<th>Export countries</th>
<th>2016</th>
<th>2015</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount (kg)</td>
<td>%</td>
<td>Amount (kg)</td>
<td>%</td>
<td>Amount (kg)</td>
</tr>
<tr>
<td>China</td>
<td>78,426</td>
<td>70.89</td>
<td>156,642</td>
<td>92.07</td>
<td>133,931</td>
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<tr>
<td>Hong Kong</td>
<td>23,870</td>
<td>21.58</td>
<td>7,200</td>
<td>4.23</td>
<td>6,132</td>
</tr>
<tr>
<td>Japan</td>
<td>3,750</td>
<td>3.39</td>
<td>1,332</td>
<td>0.78</td>
<td>918</td>
</tr>
<tr>
<td>Canada</td>
<td>2,610</td>
<td>2.36</td>
<td>2,864</td>
<td>1.68</td>
<td>16,171</td>
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<tr>
<td>United Arab Emirates</td>
<td>1,200</td>
<td>1.08</td>
<td>1,928</td>
<td>1.13</td>
<td>-</td>
</tr>
<tr>
<td>Bahrain</td>
<td>-</td>
<td>-</td>
<td>140</td>
<td>0.08</td>
<td>24</td>
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<tr>
<td>Macau</td>
<td>-</td>
<td>-</td>
<td>18</td>
<td>0.01</td>
<td>209</td>
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<tr>
<td>Others</td>
<td>250</td>
<td>0.22</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Total</td>
<td>110,622</td>
<td>100</td>
<td>170,124</td>
<td>100</td>
<td>157,565</td>
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</tbody>
</table>

Source: 2017 Liu
# Major Import Countries of Pitaya

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2015</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount (kg)</td>
<td>Value (thousand dollars)</td>
<td>Amount (kg)</td>
<td>Value (thousand dollars)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>574,892</td>
<td>20,832</td>
<td>216,093</td>
<td>12,049</td>
</tr>
<tr>
<td>Vietnam</td>
<td>129,127</td>
<td>5,166</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>678,019</td>
<td>25,998</td>
<td>216,093</td>
<td>12,049</td>
</tr>
</tbody>
</table>

Source: 2017 Liu
Bottlenecks and Challenges

Although hand pollination requirement, unstable fruit size, crack and serious diseases are the major weakness of red pitaya, but it still the most popular one in Taiwan.
Dilemma and Challenges

Manpower
- Farmer ageing
- Short of labor

Agriculture

Land
- Small Scale
- Climate change
- Nature resource exhausted

Industry
- Trade liberalization
- Food security
- Food safety
Environmental Challenges

• Climate change and extreme weather
• Environmental resources depleted
• Increasing competition in the international trade market
• The aging labor and lack of professional management
• Agricultural value is underestimated and farmers’ income is low
• Industry's urgent need for cross-domain technology
• Food safety issues
• Diversification of consumer demand
Production Cost of Pitaya in Taiwan

- Labor cost: 335,425, 61%
- Fertilizer: 80,485, 15%
- Material: 21,545, 4%
- Chemical and herbicide: 19,691, 4%
- Fuel: 8,117, 1%
- Irrigation: 772, 0%
- Production fee before harvest: 11,894, 2%

Source: COA, 2017
The proportion of labor costs in pitaya

- Flower forcing: 1.33%
- Bagging: 8.77%
- Fertilizing: 10.19%
- Weeding: 8.30%
- Pruning: 31.00%
- Pest control: 13.28%
- Harvesting and selling: 22.50%
- Others: 4.62%

Source: COA, 2017
Challenges of Pitaya Industry in Taiwan

- Planted area increased too fast (2009-2015 increase 2000 ha)
- Inappropriate pesticide used
- Small Scale production
- High production cost: labor cost is higher than Vietnam, Malaysia and China
- Competition with other countries
New Agricultural Policy in Taiwan
New Agricultural Policy

- For upgrade agriculture in Taiwan
- Look forward to protecting farmers, agricultural development, and environmental sustainability
- Through the principles of innovation, employment, distribution, and sustainability to stabilize the supply chain
Domestic Situation – New Agricultural Policy

Goal: Happy Farmers, Safety Agriculture and Rich Rural

10 Critical Policy

3 Scheme of Administration

- Improve agricultural marketing capabilities
- Construct agricultural security system
- Establish model for agriculture

- Improve Grain safety
- Increase Internal & external sales multiplex
- Environment friendly
- Sustainable agricultural resources
- Raising Competition of livestock industry
- Technological innovation
- Stabilize farmers’ Income
- Promote green environmental benefits
- Increase agricultural added value
- Ensure Food safety
- Increase agricultural added value
Stabilize farmers income

- **Original Strategy**
  - Implement agricultural insurance
  - Increase professional farm income and take care of old farmer welfare

- **Strengthen science & technology project**
  - Smart Technology Cooperate to Improve Efficiency and Reduce Disaster Damage

1. Develop agricultural production equipment and smart production management models to increase productivity per unit area.
2. Introduce the basic database of agricultural environment and smart analysis technology to improve the immediateness and effectiveness of disaster prevention and early warning mechanisms.
3. Establish disaster damage assessment technology and assessment mechanism and implement clear agricultural insurance operation mode.
Authorization strategy

Unpaid promotion

- Cultivar: Pineapple Tainung No.20
- Technology: papaya and cowbean management and guava year-round technology

Free authorization

- Cultivar: wax apple Tainung No.2
- The R&D results can directly promote the use of farmers, but the technology and derivative products will be subject to relevant laws and regulations. Through the signing of the authorization contract, farmers’ sales behaviors will be regulated.

Paid authorization

- R&D results cannot directly authorize or promote the use of farmers; they must produce products through professional seedlings manufacturers or improve product manufacturing process efficiency technologies.
- With variety authorization as a means to combine small-scale farmers for common brand management and improve promotion efficiency
- Variety: papaya, wax apple, litchi, cabbage, mustard ... etc.
- Technology: Disease Resistance Screening Technology...etc
Typhoon Fanapi

Year 2010
Typhoon Megi

Year 2016
中華民國建築師公會全國聯合會建築師簽證

UBP 型溫室  UTP 型溫室  VBP 型溫室  SP 型溫室  VTP 型溫室  WTG 型溫室

捲揚式塑膠布溫室
- 每公頃最高補助450萬元

鋼骨結構加強型捲揚式塑膠布溫室
- 每公頃最高補助550萬元
Environment friendly cultivation

❖Original Strategy
Increase cultivation area of environment friendly and decrease chemical

❖Strengthen science & technology project
Establish multiple ecological farmer system

1. Develop diversified planting and aquaculture co-production technologies to promote the maximum application of agricultural areas.
2. Develop technologies for natural resources reuse and strengthen the evaluation and verification of the efficacy of biological fertilizers and pesticides.
3. Construct environmental database and interpretation technology to improve management of agricultural water resources and effective land use.
Soil Analysis is The Best Way

Sampling by Farmer, Analysis by TARI or other Stations

Free Charge
Sustainable agricultural resources

- **Original Strategy**
  - Inventory of Agricultural and Agricultural Resources
  - Improve agricultural work shortage and cultivate new farmers
  - Persistent Fisheries Promoting Habitat Conservation

- **Strengthen science & technology project**
  - Development of a quality agricultural production system

1. Integrate diversity planting and aquaculture co-production techniques to implement environment friendly production models.
2. Establish systematized assessment techniques for agricultural productivity, and improve the application functions of regional agricultural ecosystems.
3. Apply agricultural cloud and blockchain integration technologies to improve the quality and safety monitoring of agricultural products throughout the supply chain.
Establishment of integrated productive information network

Constructing productive information databases of *pitaya*, *guava*, *wax apple*, and *mango*, providing real-time dynamic information for farmers
Establishment of integrated productive information network
### Effects of Different Treatments of Pitaya Shoots for Canker diseases

<table>
<thead>
<tr>
<th>Treatment</th>
<th>15 days (%)</th>
<th>30 days (%)</th>
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</thead>
<tbody>
<tr>
<td>4-4 Bordeaux mixture</td>
<td>0/40</td>
<td>1/40</td>
</tr>
<tr>
<td>500X Oxine-Copper</td>
<td>1/40</td>
<td>1/40</td>
</tr>
<tr>
<td>ck</td>
<td>2/40</td>
<td>8/40</td>
</tr>
</tbody>
</table>

Source: 2017 Lin Unpublished data
Management of Pitaya Canker in Taiwan

- Using disease-free seedlings; Seedlings are the major primary inoculum in the orchard.
- Canker stems and fruits should be removed
- Pruning and Spraying at Dry or cold season
- Bordeaux mixture can be used but care of blue-green discoloration

Source: 2017 Lin
Management of Wet Rot in Pitaya

- Occurrence and frequency of the raining
- Flowers and fruits with wet rot symptoms should be excised and removed immediately.
- Harvesting the fruits on the raining day should be avoided.
- Fruits should be dried before packaging.

Source: 2017 Lin
Technological Innovation

- **Original Strategy**
  - 1.6.1 Using cross-domain technology to enhance R&D capabilities

- **Strengthen science & technology project**
  - 1.6.1 Using cross-domain technology to enhance R&D capabilities

1. Optimize programming algorithms that are in line with agricultural production and improve the degree of automation of machinery.
2. Strengthen the integration and application of information and communication technologies, promote the friendly communication of agricultural and industrial bridges, and automate the collection of agricultural production data.
3. Strengthen functional verification of active ingredients to improve nutrition, health and safety for all people.
Technological innovation

- Automatic collection of agricultural data
- Simple interface to increase farmers' willingness to use
- Accurate interpreting ability
- Improve machinery automation

New cross-domain service system

Data standardization

Optimization algorithm (Fit agricultural production)
Multiplex RT-PCR Identified ZVX, PVX and CVX

Cactus virus X, CVX (Liou et al., 2001)
Zygocactus virus X, ZVX (Mao, 2008)
Pitaya virus X, PVX (Li, 2010)

Source: 2003 Liao and 2017 Lin
High stand or Doubt stand cultivation
Shielding or Net House Cultivation

- Avoid of Bird Harm and Oriental Fruit Fly
- Saving Bagging Labor
Increase the Multiple Pathways for Domestic and Foreign Markets

**Current strategy**
- 3.1.1 Establishing product modern logistics and trade system
- 3.1.2 Promoting ”New Southbound Agriculture”
- 3.1.3 Establishing Taiwan Agriculture Development company

**Technology-aided strategy**
- 3.1.4 Integrated digital supply chain and e-commerce channel

1. Combining multidisciplinary technology such as ICT to create various transportation path and enhance trade safety
2. Optimizing the post-harvest packaging and storing to maintain the quality and meet up modern logistics
3. Develop various processing product to fulfill different demands.
Policy-promoting and leading demands, linking small-holders for robust source management
Certificated and localized foods first, connecting “Food and Agriculture Education”

- Consolidating domestic market
- Policy-promoting demand
- Local foods
  - Seasonal foods
  - School lunch
  - Certified producer database
  - Certified monthly supply database
  - Area-customized menu database
  - Certificated cultivation and supply chain database
  - Local foods education
  - Local safe foods
  - Government leading
  - Parents aware

- Enhancing meal fee
- Organic meal promotion
Increasing Additional Value of Agriculture

- **Current strategy**
  - 3.2.1 Establishing processing zone

- **Technology-aided strategy**
  - 3.2.2 Functional application development

1. Applying processing and functional techniques, developing localized and safe functional crops
2. Combining local specialty producing mode and certificate mark, elevating additional values
3. Combining sale big data, establishing consuming behavior database
Flower Bud Can Be Used as Vegetables
行政院農業委員會農業試驗所

BACARDI DRAGON BERRY

INTRODUCING STRAWBERRY RUM INFUSED WITH DRAGONFRUIT

果汁與果醬

紅龍果

紅龍果

Pitaya Whitening Mask

龍花精華

Dragon Flower

JL-66
New Vision of Agriculture

Sustainable Agriculture

- Green environment benefits
- Organic agriculture
- Water and soil conservation
- Recycling agriculture

Consumer Safety

- Traceability of agricultural products
- Transparent food safety management

Modern Farmers

- Good agricultural practices
- Industrial Value Chain
- Smart agriculture
- Marketing of agricultural products

Happy Farmers, Safety Agriculture Rich Rural

Modern Farmers

New Vision of Agriculture
The Better Pitaya Industry in Taiwan
Young Shoot Grafting Cut Down Juvenile
# Pitaya Virus Detection

## Sampling

- 1

## Grinding

- 2

## Homogeneous Detection

- 3

## Result

- 4

### Table: Pitaya Virus Detection

<table>
<thead>
<tr>
<th>Sample</th>
<th>CT</th>
<th>Buffer H Low</th>
<th>Buffer H High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td></td>
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<tr>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Diagram:

- (A) Immunostrip
- (B) Multiplex 0.5 RT-PCR
- (C) ELISA value

**Short as 5~10 mins**

- ZVX (549 bp)
- PIVX (483 bp)
- CVX (300 bp)
- Mt (216 bp)
Pitaya Tainung No. 1 (Candy Candy)

- Selected from the offspring of thornless yellow skin.
- Average fruit weight 350g. With self-affinity, strong growth potential and easy to peel off thorn from skin.
- Flavor is tasty and contain more scented.
- Non-exclusive authorization, the total amount of authorization is 250,000.
Enhances the fruit appearance and the quality -- bagging

- Reduce pest diseases, bird, snail damage, and the human damage
- Epidermis smooth, even coloration
- Prevents the dust, the pesticide pollution

Improve quality
Reduce costs
Bagging

Protect the fruit

Enhance the appearance

Increase costs
Various bagging materials

- Kraft paper bag
- Non-woven fabric bag
- White paper bag
- Velcro bag
- Knitted net bag
- Black net bag
- Half net bag
- Drawstring bag
# Comparison of various bag material

<table>
<thead>
<tr>
<th>Bag type</th>
<th>Pest-proof</th>
<th>Rain-proof</th>
<th>Color enhancing</th>
<th>Ventilation</th>
<th>Observability</th>
<th>Recyclability</th>
<th>Price (NTD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net bag</td>
<td>◎</td>
<td></td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>0.7~1.5</td>
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<tr>
<td>Paper bag</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td></td>
<td>◎</td>
<td></td>
<td>0.5~1.5</td>
</tr>
<tr>
<td>Non-woven fabric bag</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>3.0~3.5</td>
</tr>
<tr>
<td>Half net bag</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>◎</td>
<td>(Estimating)</td>
</tr>
</tbody>
</table>

- **w/o bag**
- **Black net bag**
- **Non-woven fabric bag**
- **Kraft paper bag**
- **Half net bag**
Stages and Quality of Pitaya
Bacillus subtilis
Integrated Pest Management for Pitaya

- **Orchard clean**: Tidy up sticks and any possible habitat for pest around orchards
- **Environment**: Choosing soil with good drainage。
- **Healthy seedling**: Choosing healthy seedlings without pest or virus。
- **Monitoring**: Recording the pest type, period and amount to prevent.
- **Non-pesticide management**: By regular monitoring, suppressing the pest with non-pesticide material at early moment.
Intelligence, Energy saving, and Low input

Intelligent Agriculture

- Food safety
- Standard production
- Precise logistics
- Agricultural big data
- Electronic commerce
- Information management
- Intelligent farm
- IOT

Intelligent Agriculture
Pitaya industry of Taiwan is facing big challenges about over expanding and productivity, competition of other countries

The pitaya industry of Taiwan should be enhancing the fruit quality, safety and quietly for balance the output capacity

Varieties, technical service supporting, higher quality fruits can be survival.
Follow QR-code implementation, GAP labeling, organic farming, and traceability systems, which would get the trues from consumers and significantly differentiate from imported one.

Establishment of facilities to reduce unstable weather conditions may be a good way to made sure income of pitaya grower,

Improving the equipment of supply chain would enhance competitiveness in the international market.
Thank You For Your Attention