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### **DRAGON FRUIT PRODUCTION IN VIETNAM: ACHIEVEMENTS AND CHALLENGES**

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#### **ABSTRACT**

*In Vietnam, the total production area of dragon fruit is approximately 50.000 ha with White Flesh variety accounting for about 95% and Red Flesh variety accounting for about 5%. Dragon fruit is mainly grown in Binh Thuan, Long An and Tien Giang provinces with more than 37.000 ha. The average yield is 22.7 tons/ha with the total annual production of nearly 700.000 tons. Fresh dragon fruit is used primarily for domestic consumption (15-20%) and for exportation (80-85%) to 40 countries and territories. In addition to traditional markets such as China, Thailand, Indonesia, Malaysia, the Netherlands and Taiwan, dragon fruit is exported to fastidious markets like USA, Italy, Japan and Singapore, and some new markets (India, New Zealand, Australia and Chile). In the first 8 months of 2016, China - the main export market of dragon fruits, accounting for 91.2% of total turnover - reached 518.1 million USD; USA - the second largest dragon fruit export market of Vietnam - reached 11.64 million USD, accounting for 2.1% of total turnover. Thailand became Vietnam's third largest dragon fruit export market with a turnover of US\$1.09 million. However, dragon fruit production in Vietnam is facing many difficulties including: (i) The impact of climate change, diseases and insect pests, (ii) The price of inputs (fertilizers, pesticides) always tend to increase. This leads to the increase in the production cost and reduction in the competitiveness of dragon fruit both in the domestic and international markets, (iii) The price of dragon fruits is unstable and always depends on the cropping season and other market factors. The expansion to other markets meets high requirements mainly due to technical barriers, while the ability to meet quality standards, pre-processing technologies, preservation and long-distance transport in the dragon fruit production chain is slowly being improved, (iv) Major competitors in dragon fruit production such as China, Indonesia and Thailand are developing raw materials and penetrating bigger markets, especially in China and Indonesia. To develop the dragon fruit industry, the following solutions are necessary: diversification of products, organization of production, enhancing the effectiveness of pests and diseases management, development of diversity distribution channels, management of dragon fruit business, development of cooperation in dragon fruit production and procurement, and investment into processing of dragon fruit products.*

**Keywords:** Dragon fruit, disease and insect pests, market, processing

## DRAGON FRUIT PRODUCTION AND CONSUMPTION IN VIETNAM

Vietnam has the largest area and output of dragon fruit in Asia and is the leading exporter of dragon fruit in the world. Dragon fruit is currently being grown in almost all provinces, but it has grown into large-scale intensive farming areas in Binh Thuan, Tien Giang and Long An provinces. The planting-area of dragon fruit in the three provinces accounts for about 92% of the total area and about 96% of the country's output (Table 1).

Binh Thuan province has the largest area and output of dragon fruit accounting for 63.2% of the total area and 68.4% of the country's output, followed by Long An (accounting for 17.3% and 14.2%) and Tien Giang province (accounting for 10.9% and 13.7%, respectively). The remaining planting-areas are in some southern provinces such as Vinh Long, Tra Vinh, Tay Ninh, Ba Ria-Vung Tau and some provinces in the north such as Lang Son, Vinh Phuc, Hai Duong, Quang Ninh, Thanh Hoa and Ha Noi (Table 1).

Most of the dragon fruit grown in Vietnam is *Hylocereus undatus*, with red or pink/white skin and White Flesh accounting for about 95%, the rest is Red Flesh accounting for about 5%. Dragon fruit planted in recent years has high yields that brings high income to the growers. It can now be available all year-around through an off-season production technology that mainly happens by manipulating the environment through artificial lighting lamps. The price of fruit from off-season is usually from US\$0.15 to US\$0.25 higher in comparison with that from the main-season, which is very favorable for export. The dragon fruit season is from April to October, the most from May to August. Many dragon fruit varieties are bred to increase productivity, quality and suitability of land and climate. As a result, dragon fruit become economically viable and have a high competitive advantage over other crops.

Dragon fruit is mainly marketed in the form of fresh fruit in which the domestic market accounts for 15 - 20% of the output; while the remaining 80 - 85% of the output is from exports.

### Domestic market

Dragon fruit has been present in most of the domestic market, with much concentration in the north, south and central Coastal provinces. The purchasing of dragon fruit in the market is conducted by businesses, the purchasing and packing dragon fruit through the distribution channels, wholesale markets in the provinces and cities. Dragon fruit is also present in all domestic supermarkets, but always be in high competitive with many other kinds of fruit. It is estimated that dragon fruit consuming in the domestic market is only about 15 - 20% of total production (Binh Thuan Dragon Fruit Association, 2016).

Table 1. Growing area, yield and production of dragon fruit in Vietnam in the year 2015

Location	Growing area (ha)	Yield (quintal/ha)	Productivity (tons)
<b>Whole country</b>	<b>41,164.6</b>	<b>227.0</b>	<b>686,195.4</b>
<b><i>Northern</i></b>	<b><i>1,412.1</i></b>	<b><i>93.7</i></b>	<b><i>7,780.0</i></b>
<i>Red River Delta</i>			
Ha Noi	74.2	60.4	305.0
Hai Phong	40.1	208.1	573.0
Vinh Phuc	154.6	75.1	692.1
Hai Duong	163.0	125.0	1,500.0
Ha Nam	13.1	116.3	123.3
Nam Dinh	15.0	121.5	158.0
Ninh Binh	46.3	169.8	174.9
<i>Northeast</i>			
Cao Bang	34.8	38.2	69.7
Lao Cai	33.0	31.3	47.0
Bac Can	1.0	0.0	0.0
Lang Son	10.5	35.4	17.1

Tuyen Quang	103.7	46.5	337.0
Yen Bai	14.7	67.8	65.8
Thai Nguyen	40.0	282.9	792.0
Phu Thọ	41.1	105.6	258.8
Bac Giang	30.0	132.5	265.0
Quang Ninh	141.5	25.7	193.4
<i>Northwest</i>			
Lai Chau	3.4	31.3	10.0
Đien Bien	8.9	148.6	72.1
Son La	57.0	32.6	62.0
Hoa Binh	45.6	65.0	123.5
<b><i>North Central Coast</i></b>	<b>340.8</b>	<b>101.1</b>	<b>1,940.3</b>
Thanh Hoa	97.0	151.2	821.0
Nghe An	110.3	93.9	612.0
Ha Tinh	73.0	63.1	227.0
Quang Binh	13.6	58.9	44.2
Quang Tri	30.9	67.6	119.7
Thua Thien Hue	16.0	103.0	116.4
<b>Southern</b>	<b>39,752.2</b>	<b>230.8</b>	<b>678,415.4</b>
<b><i>South Central Coast</i></b>	<b>229.4</b>	<b>35.1</b>	<b>723.8</b>
Quang Nam	29.0	37.4	71.0
Quang Ngai	16.0	62.7	52.0
Binh Đinh	3.3	44.0	6.6
Phu Yen	10.5	110.6	116.2
Khanh Hoa	170.6	28.6	478.0
<b><i>Central Highland</i></b>	<b>442.7</b>	<b>111.1</b>	<b>4,132.5</b>
Kon Tum	12.0	70.0	84.0
Gia Lai	100.4	80.4	733.4
Đak Lak	213.5	124.1	2,102.0
Đak Nong	70.0	98.6	631.0
Lam Đông	46.8	165.0	582.2
<b><i>South East</i></b>	<b>26,964.7</b>	<b>218.4</b>	<b>478,635.3</b>
Ho Chi Minh	12.0	70.0	84.0
Ninh Thuan	24.9	21.3	44.6
Binh Phuoc	7.9	-	8.9
Tay Ninh	130.0	52.2	564.0
Đong Nai	525.4	226.8	5,966.0
Binh Thuan	26,026.4	219.9	469,532.0
Ba Ria-Vung Tau	245.1	145.3	2,501.8
<b><i>Mekong River Delta</i></b>	<b>12,115.7</b>	<b>282.4</b>	<b>194,923.8</b>
Long An	7,126.5	322.8	97,469.2

Đông Tháp	36.0	43.2	121.0
An Giang	11.7	154.3	115.0
Tien Giang	4,493.9	263.2	94,008.5
Vinh Long	84.1	115.7	561.5
Ben Tre	20.0	103.1	134.0
Kien Giang	25.0	0.0	0.0
Tra Vinh	107.9	243.5	2,000.6
Soc Trang	6.0	165.0	33.0
Bac Lieu	2.7	64.7	11.0
Ca Mau	202.0	36.7	470.0

Source: MARD, 2015

### International market

Vietnam's dragon fruit is exported to 40 countries and territories such as China, Thailand, Indonesia, Malaysia, the Netherlands, Taiwan, USA, Italy, Japan, Singapore, India, New Zealand, Australia, Chile, etc. According to the statistic data, Vietnam exported about 900,000 tons of dragon fruit in 2015; in the first eight-months of the year 2016, dragon fruit export of Vietnam accounted for 49.8% of the total fruit export turnover, reaching US\$567.88 million that up to 123% over the same period of the year 2015.

#### *In the first 8 months of 2016:*

China - the main export market of dragon fruits, accounted for 91.2% of the total turnover, reached US\$518.1 million, up 165.3% compared with 8 months of 2015.

US - the second largest dragon fruit export market of Vietnam, reached US\$11.64 million in the first eight months of 2016 accounting for 2.1% of the total turnover, up 48.2% over the same period of 2015.

Notably, Thailand became Vietnam's third largest dragon fruit export market with a turnover of US\$1.09 million, a surge of 73.3%. The first eight months of 2016 reached US\$9.73 million accounting for 1.7% of the total (Table 2, Binh Thuan Dragon Fruit Association, 2016).

Table 2. Key export markets for dragon fruits in the first eight months of 2016 (*Unit: thousand USD*)

Market	August 2016	Compared with August of 2015 (%)	Percentage (%)
China	518,126	165.3	91.2
USA	11,646	48.2	2.1
Thailand	9,739	-16.7	1.7
Indonesia	6,786	1.9	1.2
Holland	3,329	9.8	0.6
Hong Kong	3,243	-74.8	0.6
Canada	3,072	5.9	0.5
Singapore	2,748	-7.5	0.5
Japan	1,675	-52.6	0.3
Korea	1,612	-23.1	0.3
India	1,290	0.8	0.2

UAE	1,222	-2.0	0.2
Malaysia	1,036	-0.8	0.2
Germany	511	-22.9	0.1
France	494	26.1	0.1
UK	371	57.2	0.1
Swiss	192	9.2	0.0
Italia	154	-40.1	0.0
Belgium	133	-23.9	0.0
Norway	133	664.7	0.0
Spain	104	45.8	0.0
New Zealand	56	-18.8	0.0
Myanmar	46	26.9	0.0
Chile	38	170.9	0.0
Taiwan	24	69.7	0.0
Russia	22	-61.7	0.0
Saudi Arabia	21		0.0
Sec	4	-57.2	0.0
Oman	2		0.0
Qatar	1	-55.3	0.0
Laos	1		0.0

Source: MARD, 2015

## DIFFICULTIES OF DRAGON FRUIT PRODUCTION IN VIETNAM

### Production

Although dragon fruit production area under GAP standards is about 9,000 ha; however, the abuse of pesticides and growth regulators on dragon fruit is still occurring and not meeting the demand of markets for food safety. Infrastructure for intensive production of dragon fruit has not been invested properly, lack of electricity and irrigation systems, especially in drought and water shortage conditions. This has led to the decrease on the planting area of dragon fruit in Vietnam in recent years.

The brown spot disease (also known as white spot disease that caused by the fungus *Neoscytalidium dimidiatum*) (Nguyen and Quan, 2017) - infected area has recently decreased, but the risk of spread and outbreak of the disease is still high since there is no specific pesticides to control effectively the brown spot disease; the disease inoculum in the infected plant debris is still available in the field and there is no method for completely destroying the debris.

Although there were many enterprises and farmer organizations (such as the associated group, the cooperative group, the dragon fruit alliance) were established and went into operation; however, the associations have not formed effective links to promote sustainable production and consumption of dragon fruit in Vietnam. The dragon fruit growers sell products mainly through traders where they do not get good price, especially in main-season. Not being able to spread the crop in dragon fruit production to regulate the quantity of dragon fruits for consumption (Binh Thuan Dragon Fruit Association, 2016).

### Consumption and processing of dragon fruits

The domestic market has not been expanded, main export categories are low, export markets depend mainly on

the Chinese market that will be high risk for dragon fruit production in Vietnam. The expansion of the export market is still limited. The volume of dragon fruits exported to China in the form of border trade accounts for a large proportion, but unregulated, the phenomenon of congestion and stagnation of goods at the border causes many risks for enterprises. Dragon fruit exports to the Chinese market in the form of cross-border trade do not require high quality, transport procedures, delivery and easy payment. The majority of dragon fruit exporters in Vietnam are medium and small scale with limited foreign trade knowledge, limited funds for trade promotion activities. In addition, the provincial budget for marketing and trade promotion for dragon fruit products has not been strong and has not meet the demand of the market.

In the management of dragon fruit trade, consumption is still limited, lack of tight; especially, the lack of management in intermediate traders causes many problems such as scramble for purchase rights, price disputes, quality and depreciation rates, etc. This contributes to the price fluctuation of dragon fruit in the markets.

The propaganda and promotion of trade in dragon fruit products is weak, not regular and not bring into play the geographical indications of Vietnamese dragon fruit in the international markets.

The technology of packing, preserving and processing of dragon fruits are also simple leading to the reduction in the competitiveness of Vietnamese dragon fruit. Dragon fruit is mainly consumed in the form of fresh fruit, processing factories from dragon fruit is limited and in small scale (Binh Thuan Dragon Fruit Association, 2016).

## CHALLENGING

From 2009 to 2010, brown spot disease has appeared in small areas in Binh Thuan province. Until 2012, the disease has re-emerged in Ham Thuan Nam and Ham Thuan Bac districts of Binh Thuan province and is now widely spread in the dragon fruit growing areas of the Binh Thuan, Long An and Tien Giang provinces causing great damage, high yield loss and reduction in quality and price of dragon fruit in the markets. At the end of 2012, the total infected area of Binh Thuan province reached to 827,5 ha and up to 1,393 ha in 2013 and 12,870 ha in 2014 accounting for about 50% of the total dragon fruit growing area of the province (VAAS, 2016).

In addition to brown spot disease, other disease and insect pests such as anthracnose, bacterial soft rot diseases, oriental fruit fly (*Bactrocera dorsalis* H.) and guava fruit fly (*Bactrocera correcta* B.) are also important pests of dragon fruit in Vietnam. From 2015, the root rot disease has occurred and severely damaged, serious threaten to dragon fruit production (Hien et al., 2011, 2016).

The main causes of the increase in the number and the incidence of pests are due to:

- (i) The high level of investments in intensive but unsustainable cultivation (use of many chemical fertilizers and less organic fertilizer);
- (ii) The level of over-exploitation of fruit in both main-season and the off-season using electricity technology has led to the loss of resistance of plant;
- (iii) Farmers are not interested in integrated pest management measures, especially pruning, removing and destroying of the infected debris, but rather focusing on using pesticides;
- (iv) the inoculum of brown spot disease is existing in the field; however, farmers are not actively doing hygienic practices in their farms as recommended by the agricultural sector in the rainy season, this leads to the spread of diseases rapidly to new areas.
- (v) There are no biological products or specific pesticides for controlling of brown spot disease, and the efficacy of current chemical pesticides is low due to the smooth characteristics of dragon fruit that is very difficult for pesticides to stick on the surface of branches and fruits. The efficacy of pesticides is reduced especially in the rainy season. In addition, farmers use plant growth regulators that lead to the reduction of plant resistance against pests and decrease in product quality;
- (vi) Vietnamese farmers produce dragon fruit spontaneously in small scale by traditional methods and beyond their experiences, using inappropriate pesticides; so that the quality does not meet the demand of the big international markets. Farmers sell their product to the traders which is very risky for farmers especially in the "high yield but low price" situation;
- (vii) the price of dragon fruits is unstable and always depends on the cropping season and other market factors. The expansion to other markets meets high requirements mainly due to technical barriers, while the ability to meet quality standards, pre-processing technologies, preservation and long-distance transport in the dragon fruit production chain is slowly being improved;

- (viii) the price of inputs (fertilizers, pesticides) always tend to increase. This leads to the increase in the production cost and reduction in the competitiveness of dragon fruit both in the domestic and international markets;
- (ix) major competitors in dragon fruit production such as China, Indonesia and Thailand are developing raw materials and penetrating bigger markets, especially in China and Indonesia (Binh Thuan Dragon Fruit Association, 2016).

## **PROSPECTIVES**

### **Diversification of products**

In addition to the White Flesh variety, there are other varieties such as Red Flesh variety named LD1, Purple and Pink Flesh variety named LD5. Diversification of varieties will contribute to diversified products in the market while reducing competition pressure for traditional White Flesh variety. This is true especially for the LD5 variety which have the advantages of long-term preservation, good quality, beautiful appearance, high disease resistance that promise a new potential future for the dragon fruit production in Vietnam. In addition, this variety is being monopolized and will be highly competitive and not dependent on the import market.

### **Organization of production**

- (i) Strengthening the management of dragon fruit - growing area according to the approved plan; advise people not to develop new growing areas but focus on improving product quality and ensuring food safety;
- (ii) The production of dragon fruit must be oriented in accordance to GAP standards, with emphasis on quality not to follow quantity to ensure quality, food safety for export;
- (iii) To carry out synchronously from the production to processing stages under the provisions of the Law on Food Safety; absolutely no abuse of plant growth regulators and pesticide use on dragon fruit products.
- (iv) Link to form the production chain, the dragon fruit consumption on the basis creating the best conditions for enterprises to associate with the farmer organizations and strengthen cooperatives producing dragon fruit to improve the production capacity and link with the business (Binh Thuan Dragon Fruit Association, 2016).

### **Promoting trade activities**

#### ***For Domestic markets***

The enterprises handle the distribution and consumption of dragon fruits in provinces and cities throughout the country. The demand for dragon fruit in the domestic markets is still capable of further development. Therefore, it is necessary to focus on marketing and promoting Vietnamese dragon fruits in the form of participating in fairs and exhibitions in different regions, provinces and cities in the whole country to develop distribution systems in wholesale markets, supermarket; especially, focus on the markets of big city such as Hanoi, Ho Chi Minh and some coastal provinces in Central Vietnam and Central Highlands.

Dragon fruit production and trading cooperatives and dragon fruit trading enterprises should closely coordinate with the implementation of cooperative programs between dragon fruit - growing provinces and markets on the supply and consumption of Vietnamese dragon fruit and other products (Binh Thuan Dragon Fruit Association, 2016).

#### ***For international markets***

Continue to boost exports to the Chinese market to maintain the form of cross-border trading, to promote the formation of linkages with traders who are specialized in fruit and vegetable distribution in Lao Cai (Vietnam), Ha Khau (Yunnan, China) to strengthen exportation of dragon fruit to the Southwest markets of China.

Noi Bai - Lao Cai expressway has been completed, which will facilitate the transportation of export goods to develop this market. Along with that, the trade opened stronger through the Thanh Thuy border gate of Ha Giang province - Thien Bao (Yunnan, China). Encourage businesses to boost export of dragon fruit by sea to inland China

such as Shanghai, Beijing, Tianjin, Shenzhen, Zhejiang, Hubei and Qingdao (Binh Thuan Dragon Fruit Association, 2016).

### **Management of dragon fruit business, development of cooperation in dragon fruit production and procurement**

In the coming time, it is necessary to review and list all of dragon fruit business enterprises. Cooperate closely with relevant authorities to identify and closely monitor the activities of traders.

Dragon Fruit Group according to VietGAP (VietGAP Group) standard should appoint representatives to provide services to produce dragon fruit to work directly with the consumption business to limit through intermediary traders. Mobilizing the farms, the VietGAP Group priority to sell products to enterprises in the system.

Reorganizing the supply chain of the enterprise to control the trader objects to limit the situation of competition between enterprises together, disrupt the supply chain of each other. Enterprises should thoroughly understand about international traders before deciding to sign trading contracts; only dealing with reputable traders, knowing the business, having financial power;

Enterprises must really unite, closely coordinate with each other to penetrate market expansion, coordination of delivery plans; it is important to avoid competing massively at the same time at a border gate. Interested to associate with the producers by the hard contract - consumption products to actively develop business plans - consumption (Binh Thuan Dragon Fruit Association, 2016).

### **Investments into processing of dragon fruit products**

The State should set out guidelines for attracting investments; encouraging and supporting enterprises to invest in factories for heat treatment and dragon fruit irradiation according to the technical requirements of markets. This is an important condition for dragon fruit to be exported to these difficult but potential markets.

In addition, it is necessary to encourage and support businesses to invest in processing dragon fruit products to reduce the pressure on fresh fruit consumption and to have policies to support and solve problems of the enterprises who have invested in processing dragon fruits for stable operation. This leads to the expansion in scale and improvement in the processing capacity of quality products. At the same time it ensures food safety and encourages the practice of proper hygiene to meet market requirements.

To mobilize enterprises in the provinces who have financial capability, have markets and experience in the international markets to set up enterprises to invest in processing and export business to create new consumption capacity, contribute more actively into dragon fruit sustainable development (Binh Thuan Dragon Fruit Association, 2016).

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