

REPORT

WEBINAR SERIES ON TROPICAL FRUITS

PASSIONFRUIT

29 September 2022

Enhancing Global Consumption and Trade of Passionfruit



UPM
UNIVERSITI PUTRA MALAYSIA
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International Tropical
Fruits Network (TFNet)

INTERNATIONAL WEBINAR SERIES ON MINOR TROPICAL FRUITS: 'ENHANCING GLOBAL CONSUMPTION AND TRADE OF PASSIONFRUIT'



**International Tropical
Fruits Network (TFNet)**

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1.0. EXECUTIVE SUMMARY

The passion fruit is still considered an underrated commodity eclipsed by prominent trade commodities such as the banana, avocados and mangos among other fruits. In recent years, however, the fruit has gained popularity due to its undisputed taste as well as its health and nutritional benefits, and a steady expansion of its production and trade in many countries in the tropical and subtropical regions, with new producing regions emerging.

In TFNet's second webinar under its series of international webinars on minor tropical fruits, focus is given to the exotic passion fruit with the theme 'Enhancing Global Consumption and Trade of Passion fruit'. The webinar was held on the 29th September 2022 in collaboration with the Guangxi Academy of Agricultural Sciences (GAAS), China, Universiti Putra Malaysia (UPM) Bintulu Campus, Malaysia and the Fruit Tree Research Institute, Guangdong Academy of Agricultural Sciences (GDAAS), China.

The objectives of the webinar were:

1. To share information among passion fruit researchers, producers, processors and exporters on the current production, processed products, market trends and challenges in developing the fruit.
2. To share information among stakeholders on the various initiatives that can be taken to increase passion fruit production and markets, including varietal development, best farm practices, postharvest management, inputs for the food industry, research and development focus and policies to encourage its cultivation.
3. To discuss on initiatives to enhance the visibility of passion fruit in global markets.

The webinar featured five presentations from China, Malaysia, Indonesia, and Vietnam with a maximum number of 163 attendees from 20 countries.

Main takeaways from the webinar were:

- There is global demand for passionfruit, both for fresh and processed products.
- The passionfruit industry is well developed and sustainable in countries where there is good domestic demand and export market. The many producing countries are in different stages of developing the fruit. Research and development on the fruit is therefore largely dependent on the status of the industry in the producing countries.
- The need of establishing solid breeding programmes and production of disease-free planting materials, across producing regions (focused on resistance breeding and ecological suitability) which can influence the direction of the passion fruit sector in countries.
- A better understanding of the adaptive features of passion fruit cultivars is required for expanding production areas to new locations which have different agroclimatic conditions.
- To build up the industry, there needs to be more consumptive demand, therefore the general public should be made more aware of the health and nutritional benefits of passion fruit, including aggressive local promotion by making it available in school feeding programs and hospitality businesses.
- Strong government support is essential through planned programmes that aid farmers to improve productivity and in connecting to markets.
- There is great potential for developing and expanding the passion fruit processing sector which can serve as a complementary trade opportunity in addition to fresh produce.
- The need to focus on varieties for targeted market requirements, both fresh and processed.
- The importance of integrated control strategies in preventing the spread of pests and diseases cannot be overstated.

The five presentations offered well-grounded evidence to the potential of passion fruit which can be further developed to take on a more significant position in terms of its value and trade, despite some challenges which persist. The session also demonstrates the presence of abundant research opportunities in passion fruit, the necessity of extending research outputs to people who will benefit from them, particularly smallholders, and matching these outputs with industry needs. The webinar gave an indication of the various stages of development of the passion fruit industry in producing countries, with China and Vietnam leading the way due to high market and export demand, while Malaysia and Indonesia are just getting started with efforts to increase current production and demand. Generally, there is relatively good demand for passion fruit both for fresh consumption and processed products, however production has reportedly been

inconsistent. While demand has been consistent for the main producing countries, the industry is also faced with production challenges particularly in terms of insufficient healthy planting materials, spread of pests and diseases, lack of suitable cultivars, and food safety and quality issues. The webinar successfully elicited the significant potential of this minor fruit commodity and, also some critical needs that stakeholders should prioritise in order to further develop the passion fruit industry.

In the panel discussion, three topics were discussed covering data collection and standardization for passionfruit and other tropical fruit, recommendations to improve consumption and market, and passionfruit as an intercrop with other fruit or short-term crops.

2.0. WEBINAR PRESENTATIONS

2.1. ‘Overview of the Passion fruit Industry in Guangxi province’ - Dr. Deng Biao, Guangxi Academy of Agricultural Sciences, PR China.

Dr. Deng’s presentation focused on industry development, cultivars, breeding, seedlings, marketing, and processing of passion fruit in the province with the largest cultivated area in China. He began by providing a brief description of the Guangxi passion fruit industry. As a crop recommended in a poverty alleviation program of the government in 2008, the process of developing the fruit involved three stages. In 2015, the cultivation area in Guangxi was 8,700 hectares. He proceeded to illustrate Guangxi’s production data from the year 2017 to 2021. Total hectareage grown from 2017 to 2021 has hovered between 20,000 to 30,000 hectares, peaking in 2019, then decreasing to 25,000 ha in 2021. However there had been a substantial increase in yields in 2020 and 2021 to about 350,000 tons. Passion fruit has been certified as a national geographical indication product for Guangxi province. The 3 main cultivars of passion fruit in Guangxi are the ‘Tainon 1 Hao’ Passion fruit, the ‘Gold’ Passion fruit, and the ‘Mantianxing’ passion fruit. However, the main cultivar ‘Tainon 1 Hao’ was reported to not grow well in local climatic conditions. Among of the challenges faced in passion fruit cultivation in Guangxi province included the difficulty in bearing fruits in high or low temperatures, susceptibility to green mottle mosaic virus, inconsistent yield and market olfactory and taste preferences. This prompted efforts in selection and breeding of elite germplasm possessing target traits. A breeding program through recurrent selection, population selection and hybridization provided some positive results. Dr. Deng presented the first batch of passion fruit cultivars that has obtained new plant variety right in China, while also deliberating on the individual traits of the cultivars. These cultivars were the ‘Guibai 1 Hao’ (which blooms all year round and is an excellent fresh food source); Jindubaixiang 1 Hao (good flavor, high yield, and excellent processing variety); ‘Jindubaixiang 3 Hao’ (highest edible rate reported, stable quality of fruits, annual average yield of 18.53kg per plant). Recently in July 2022, a new variety – ‘Zhuangxiangmibao’, which has higher tolerance to low temperatures, sweet, mellow with a strong aroma has been given the national plant variety protection rights certificate. Another popular new variety is the ‘Qinmi 9 Hao’.

To commercialize and encourage more takers for the new varieties, 10 enterprises have been appointed to produce certified healthy seedling for distribution to growers. Online e-commerce sales of the fruit have increased tremendously with the involvement of 300 companies. Guangxi

province accounts for 76 percent of the online sales of passion fruit in China. The province is also home to 16 enterprises and another 20 enterprises producing passion fruit pulp (juice and preserved passion fruit respectively).

2.2. 'Current status and Prospects of passionfruit Cultivation in Malaysia'

- Dr. Shiamala Devi, Universiti Putra Malaysia, Bintulu Campus, Sarawak, Malaysia

Dr. Shiamala Devi's presentation was based on her own experience and research findings over the last decade. She began by providing a botanical description of the species, including its floral characteristics, strong aroma, fruits which possess a unique flavor, while also containing nutritional values with extracts acting as phytotherapeutic agents. She also singled out passion fruit as a potential high-value export crop since its fruits and byproducts are highly prized in the pharmaceutical and nutraceutical industries. With 18 genera under the Passifloraceae family, there are over 500 species under the *Passiflora* genus consisting of passion fruit, with only 50 of them produce edible fruits, and only two of them are widely dispersed in the tropics and economically important – the purple and yellow passion fruit varieties. Dr. Shiamala said that passion fruit is native to South America which is center to 84 percent diversity of all the species with Brazil accounting for 50 – 60 percent of global production. On the history of passion fruit cultivation in Malaysia, Dr. Shiamala mentioned that the first cultivation by the Department of Agriculture can be traced back to 1914 in Gunung Angsi, in Negeri Sembilan, which then expanded to other parts of the country with commercial farms established in Johor and Cameron Highlands. However, production and expansion were affected by the passion fruit woodiness diseases (PWD). She added that production of the fruit made a comeback in 2006 and at present, the fruit has been acknowledged to have significant health market potential and sells for MYR 12-20/kg. (2.50 – 4.20 USD/kg). Dr. Shiamala then gave a detailed introduction to some of the species that have been recorded in Malaysia to date and those that are commonly available in the local markets. Out of 9 species recorded in Malaysia, the most common species that is cultivated in Malaysia and the region is *Passiflora edulis*, both purple and yellow varieties. The other species of notable interest was the *Passiflora quadrangularis* (Giant Granadilla), the largest in its species with strong aroma, possessing a taste similar to the honey dew, crunchy mesocarp, and juicy pulp. This species is reported to have significant nutritional properties and is less acidic. Most of the other passion fruit species such as *Passiflora lingularis* and *Passiflora caerulea* are commonly grown in backyards, while the *Passiflora incarnata* is highly valued for its medicinal properties. *Passiflora suberosa* is a newly recorded species in Malaysia, a wild species producing purple berries. On the status of the production of passion fruit in Malaysia, Dr. Shiamala noted that the total production areas were not well documented, and most often the fruit is commonly cultivated in small scale prevalent in integrated agricultural systems. The FAO Outlook 2020 report estimated that Malaysia produces an average of 5,000 metric tons of passion fruit from 2015-2017. She mentioned that with priority given to other fruit types such as the durian, jackfruit, watermelon, and mango among other fruits, less attention is given to the development of passion fruit. She attributed this to the lack of information on its feasibility, and lack of awareness among the population. She cited the significant potential of the fruit, especially in regard to commercial cultivation globally, with prices of passion fruit comparable with that of rambutan, lychee, and guava. According to Dr. Shiamala, the potential for commercial growing of the fruit in Malaysia is underpinned by the high global demand, climate suitability, plant growth vigor, good yields and it has to be profitable. Targeted research in these areas include

studying flowering behavior and utilization of plant parts besides the fruit. including the seeds which are valued for food dietary fiber and rich in oil content, and rinds which are used in flours as stabilizing agents. Dr. Shiamala listed poor market linkage, low productivity, lack of awareness and lack of knowledge in cultivation practices as constraints to developing the fruit in Malaysia. In her conclusion, she outlined some useful strategies in awareness creation, identification of quality planting materials, adoption of good cultivation practices, developing market linkages, and encouraging greater collaboration among stakeholders. She further concluded that production methods, grower adoption and product innovation are inextricably linked and are areas that can serve as catalysts to boost the industry in Malaysia.

2.3. 'Status of production, consumption, and market of passion fruit in Indonesia'

- Dr. Ellina Mansyah, Research Center for Horticulture and Estate Crops, National Research and Innovation Agency, Republic of Indonesia

Dr. Ellina Mansyah began by presenting the 2020 data on the position of passion fruit among other fruits in Indonesia focusing on its production and harvested area. Passion fruit was ranked 25th, one of the lowest ranked fruits in Indonesia. The status of both production and harvested area from 2015 to 2020 showed a drastic decline from 1,600 ha and production of 113,125 tons in 2015 to 717 ha and production of 53,319 mtons respectively, in 2020 (more than 50%). This decline has been attributed to pest and diseases incidences, volcano eruptions, low price, farmers switching to growing vegetables and limited interest. The passion fruit is cultivated in almost all of the regions, with varietal differences from the lowlands to high land areas. 2020 data showed that the largest production center for the *Passiflora lingularis* (yellow variety) is in West Sumatera (Solok region) with 36,500 tons in production, accounting to 68% of Indonesia's production. *Passiflora edulis* (purple variety) is mostly cultivated in North Sumatera. The cultivation system often practiced in West Sumatera is the horizontal system, using either the wooden or iron pole, and a wire stretched horizontally. She then elaborated on the characteristics of the five common passion fruit species in Indonesia – *P. edulis* (yellow), *P. edulis* (purple), *P. lingularis*, *P. quadrangularis* and *P. foetida*, each with different botanical and physiological characteristics. Among the common diseases affecting passion fruit production in Indonesia include the wilt disease complex, anthracnose, and brown spot disease. Pests affecting passion fruit include the *Macrosiphum* species affecting the leaves, fruit fly, and *Aphis gossipii* affecting the stem. For the marketing of passion fruit, fresh fruits are often traded in the local and traditional markets. For the export of fresh and processed products, she highlighted the difficulty in obtaining export data. However, some past data showed export being undertaken for fresh fruit, syrup and frozen pulp to Australia (2008) and Singapore and Germany from 2018 to 2020, when exports were curbed due to the COVID 19 logistical disruptions. In terms of processed product, the frozen pulp has been produced in many regions in Indonesia. Besides the commonly available products such as passion fruit syrup, passion fruit concentrate, and purees, there are other myriad processed products produced by home-based industries such as the traditional dessert *dodol*, jams, and snacks. It is also used in the perfume industry, aromatherapy and cosmetics. Agrotourism serves to also promote the potential of passion fruit in Indonesia. Notwithstanding the high demand both for the domestic and export market, there are existential challenges that need to be addressed., These include the decrease in harvest area and production, insufficient supply of raw materials, and prevalence of pests and diseases. However, government programs undertaken to boost the passion fruit industry include initiation of R&D efforts of new varieties and pests

and disease management, rehabilitation and replanting in previously planted areas, production and distribution of good planting materials, and training programs to upgrade farmers capacity. Support is also provided for farmers, especially young entrepreneurs to link to markets.

2.4. 'Current trends and challenges in passion fruit research and development in China'

Dr. Ruibin Kuang, Fruit Tree Research Institute, Guangdong Academy of Agricultural Sciences, Guangzhou, PR China

Dr. Ruibin Kuang shed some light on the importance of passion fruit, by providing a summary on the functional properties and potential industrial applications. The production of passion fruit was first recorded in the 1920s in China, and has since been widely planted in South China in the last decade due to its rich nutrient contents, varied processed products, easy storage and long shelf life, convenient for the e-commerce platform, and long harvest period. In 2020, the harvest area for passion fruit in China was approximately 53,000 hectares with yields of 1.5 million tons. The fruit is mostly cultivated in South China, with Guangxi province being the main production center, followed by the provinces of Fujian, and Guangdong. Guizhou, and Yunnan provinces have been noted as the two new cultivation areas at present. Dr. Ruibin then described the three main production systems in China, which were the mixed cropping system often observed in smallholdings and resource poor agricultural systems, homestead production system, and intensive monoculture production system which is now widely used. The four major cultivars in South China, are the 'Tainong1', 'Mantianxing', 'Bale Huangjin', and 'Dahuangjin'. Based on Dr. Ruibin's research, the four varieties were reported to have rich nutritional composition, and strong in aroma. She explained that harvest standards were determined based on market requirements in relation to distance and shelf life. A range of passion fruit products have also been developed included jams, jelly, wine, yoghurt and other products. However, there were limited medicinal based products due to lack of research. Based on her field study, major limitations were cited in production including lack of healthy seedlings, inefficient cultivation techniques, pests and diseases, and extreme climatic effects including high temperatures in summer, and extreme cold in winter affect the yield and quality of fruits. She then focused on the prevalence of the collar rot disease in passion fruit caused by *Fusarium oxysporum solani* which first emerged in the 1990s. She elaborated on ongoing research conducted on the study of this disease, which included isolation and molecular characterization of the pathogen. The disease is now reported to have spread to almost all of the passion fruit production areas in China, leading to a 10-16% reduction in production. She further illustrated some of the integrated control measure in place. Training courses have been introduced for farmers, extension officers, and production companies to create more awareness and increase preparedness to the disease. In addition, monitoring systems are being set to identify and control the spread of the disease. As part of IPM approaches, she emphasized on the need to understand disease epidemiology and the mechanism of soil suppression. The use of healthy seedlings, tissue cultured or bud grafted plants using resistant rootstocks have also been advocated as effective ecological control measures. Besides eradication of infected plants, changes in crop production systems (i.e., rotation and intercropping) is also an effective measure to control the disease. At present, Dr. Ruibin's team is also conducting resistant breeding programs by actively screening the passion fruit germplasm for the identification and selection of cultivars which display collar rot resistance. Future plans for research include functional analysis of the identified pathogen, the need for better understanding of the evolving nature of plant-pathogen, plant-Fusarium

interaction mechanisms at gene, cytological and molecular levels, and developing and applying effective diagnostic tools for plant pathogen detection and management.

2.5. ‘Passionfruit development for the fresh and processing industry in Vietnam’ Dr. Nguyen Van Viet, NaFoods Research and Development Institute for Agriculture, Hanoi, Vietnam

Dr. Nguyen Van Viet pointed that passion fruit was initially planted by farmers in home gardens in Vietnam in the 1990s. Passion fruit is currently ranked 17th among fruit crops in Vietnam. Cultivation area is distributed in the Central Highlands sub-region of Central Vietnam. 2020 data from MARD showed that in 2019 production area for passion fruit was estimated at 10,500 hectares. A rapid expansion in passion fruit areas was noted in 2019 especially in the Central Highlands with a 348% increase, and Dr. Van Viet forecasted that production of passion fruit in Vietnam will continue to exhibit an increasing trend with the planted area expected to exceed 15,000 hectares by 2022. The increase he highlighted was dependent on location, and the monocropping system of cultivation practiced by farmers and geared towards export-oriented production to China. The yield varied between regions and locations with average yield at 26.1 tons/ha in Central Highlands, while lower yields were reported in the northern provinces of Vietnam due to the colder climate. The highest reported yields was 50-60 tons/ha, especially for purple varieties have also been recorded in the Central Highlands. In some areas passion fruit is also intercropped with crops such as coffee, black pepper, and rubber. Passionfruit is widely consumed fresh and processed for the domestic and export markets. The main processing products are concentrated juice, puree, frozen and dried forms. The products are exported to almost 50 countries, mainly to China, EU, USA, and the Middle East. Different food safety certificates such as IRMA, BRC, Kosher and Halal certificate and SGS are applied for these products. The value of exports of passion fruit in 2019 reached USD 99 million, with China serving as the largest export market (accounting to 33.5%), followed by Netherlands (21.9%), UAE (13.3%) and France (10.4) and 25.4% to other markets. An increase in exports of processed products was observed in the last three years. The NaFood company which Dr. Viet represents is the number one passion fruit concentrate producer in Asia, besides products such as Gac fruit juice and different kinds of fruit and vegetables. He advised on the importance of diversifying varieties for the promotion of the domestic and export markets, capitalizing on the diverse characteristics of each variety, citing that some varieties suited for fresh consumption, while others targeted for processing. Aspects such as improving quality and food safety required due attention. Dr. Van Viet then proceeded to explain on the breeding of varieties and seedling production. Previously, the Tai Nong 1 variety from Taiwan was the main variety grown across Vietnam. After 2021, two new passion fruit varieties were registered by MARD (Ministry of Agriculture and Rural Development), namely ‘Nafoods 1’ and ‘Que Phong 1’, which are both purple varieties and have outstanding characteristics over the previous Taiwan variety in terms of fruit size and can be used both for fresh and processed products. He went on to say that Nafoods is the leading company in Vietnam with sufficient capacity and facilities to produce disease-free seedlings, with the main sources for seedlings now fully produced domestically. He explained that the production model used to control quality and safety for the export market is by securing contract supplies from farmers and cooperatives who are VietGAP or GlobalGAP compliant. In addition to this, NaFood and other companies have been granted area codes by the Chinese customs to facilitate exports to China. NaFoods has also facilitated some plantations to meet global standards. As a conclusion, Dr. Van Viet pointed that one of the industry’s most

significant constraints is the unsustainable production and markets. Other limitations included the severity of pests and diseases and insufficient resistant varieties against viral, and fungal diseases. There is also a need for varietal development suitable for the different agro-climatic areas. These are all issues which require strategic efforts and focus for further boosting and putting Vietnam's passion fruit industry on a strong footing.

3.0. QUESTION AND ANSWER SESSION

The Q and A session and panel discussion was moderated by TFNet advisor, Mr. Yacob Ahmad.

1. Dr. Deng Biao was directed a question on the control of the T mosaic virus on passionfruit, which he responded by stressing on the importance of proper selection, screening and distribution of planting materials that are disease free.
2. To a question on preventing seed germination to prevent varieties from being exploited, Dr. Shiamala replied that nowadays vegetative cuttings are used for propagation.
3. Dr. Shiamala also indicated that there are currently no reports of virus diseases on passionfruit, in response to another question on whether virus attacks are a problem in , Malaysia.
4. Dr. Shiamala added that passionfruit varieties were first grown, in Johor and Cameron Highlands, however, nowadays it is grown all over Malaysia. Passion fruit production is affected by climate, especially pertaining to the cycle of the flowering and taste of the fruit. Adequate rainfall and full sunlight are crucial for ensuring good yield and quality.
5. To a question on declining production in Indonesia, Dr. Ellina mentioned lower yields in Indonesia are due to low planting density and different systems of planting, besides pest and diseases incidences, volcanic eruptions, low price, limited interest and switching to other crops.
6. Dr. Viet confirmed that elevation plays a role in the performance of varieties. For example, he cited that the purple variety performs better on higher elevations (more than 400 meters above sea level).
7. To a question on consumption of passionfruit leaves, Dr. Shiamala responded that most parts of the plants can be consumed, for example, the leaves can be dried and made into tea for treating insomnia. In some countries such as India, the leaves are used for treating inflammation and asthma attacks, whereas in Europe, leaves are boiled to treat dysentery and hypertension.
8. To a question on conserving and maintaining vigour of planting materials, Dr. Ruibin said that in China planting materials are raised in greenhouses, and field, also to prevent diseases transported by insects. Healthy plant materials are selected for cleft grafting. Tissue culture is also used a complementary strategy, especially for the yellow variety. Similarly in Vietnam, for the same reason, planting materials are raised in net-houses and greenhouses.
9. Responding to a query on fertilizer type and application schedule, Dr. Viet gave a brief guideline on fertilizing of passionfruit in Vietnam which includes a mix organic and chemical fertilizers during the nursery stage. The growing plants are then fertilized with NPK fertilizers every 15 days.
10. On the preference for the green, yellow and purple varieties, panellists pointed out that this is dependent on the purpose, either for processing or fresh consumption. The yellow variety is sweet and popular, however the most preferred variety is the purple variety.
11. Being a perennial, passionfruit plants can last more than 2 years, moderator sought for confirmation from presenters on the period the plant is on the ground. Dr. Viet responded

- that in Vietnam, farmers are recommended to cultivate passionfruit for 15 months with some possibility of extending to a maximum of 2 years. The plants are then removed and replanted. This is to avoid disease spread.
12. In China, crop rotation is sometimes used to reduce disease incidences. The usual rotational crops are rice, corn, and soybean. On a related note, intercropping with Chinese leek and ginger is recommended to minimize fusarium wilt in banana.
 13. Ms. Lilibeth Danan, passionfruit grower from the Philippines commented that she is leading a group of farmers in Batangas province to revive the industry after it slowed down due to lack of interest in the last few years.
 14. Ms. Christine from the New Zealand Passionfruit Association shared her views on the status of the industry in New Zealand. Christine responded that the passion fruit industry in New Zealand is small and that production is still limited due to diseases (*Fusarium oxysporum*), forcing growers to leave the industry. This has prompted sourcing for more resistant varieties. Passionfruit used to be exported to the US but post covid and logistical disruption challenges have yet to be overcome. The fruit is now more available domestically and is getting popular.

4.0. PANEL DISCUSSION

All speakers were invited to give their views on 3 questions posed by Mr. Yacob, the session moderator.

1. How do we standardize the collection of data for passionfruit - planted area and production?
2. The expansion of passionfruit consumption will depend on market demand. Are there specific recommendations needed to promote and expand its consumption in your country, both for the domestic and export market (for fresh and processed products)?
3. Passionfruit is mainly planted as a monocrop. Can passionfruit be recommended in mixed fruit cropping in combination with other fruit crops. Either as an intercrop or rotational crop or in a mixed crop combination. Is it possible to have it as an intercrop for example: passionfruit/jackfruit, or passionfruit/pitaya and other examples?.

Moderator :

4.1. As in many other fruit crops, getting accurate data can be sometimes challenging.

How do we standardize and improve the collection of data for passionfruit especially area planted and production?

Dr. Ruiben :

No specific data such as harvest area, yield or commercial trade is found in FAO statistics website on passion fruit, though it such a big production in South America and Asia region. In China, we refer to data collected by local agriculture promotion research center, from town, to city, then province. The data is always delayed to about 1-2 years. Our local government realizes the importance of systematic investigation of this data collection and sets specific projects to support it, which may help to distribute production data to guide their planting plan to reduce risk of excessive production.

Dr. Ellina :

In Indonesia, the national statistical data on production is calculated based on hectare and specific for Konyal (*Passiflora ligularis*) with an average production of between 69 to 82 tons/ha/

year. We use the average data of 75 tons/ha/year. North Sumatra's Agricultural service recorded production data of 46 tons/ha, which was dominated by *Passiflora edulis*. The national planted area is measured in hectares, while the Agricultural Services of West Sumatra province measures the planted area by number of trees.

Data standardization needs to be determined based on 3 categories, namely:

- a. Based on the variety of fruits, *P. edulis* or *P. lingularis* or others, because they have different weights. *P. edulis* is smaller than *P. lingularis*. Indonesian national data are only available for *P. lingularis*.
- b. Based on the planting system and space between trees. Production and planting area with trellis system different to the horizontal system because they are different in space. For horizontal system the farmers in many places use 4 x 4 meters spacing.

Dr. Viet :

In Vietnam we collect the data of passion fruit production officially from Department of Crop Production belonging to Ministry of Agricultural and Rural Department. For research purposes we standardize the collection of data for passionfruit according to - planted area and production with popular planting density (833 plants/ha with row spacing 4 m apart and interrow 3 m apart). Thus, a plot of intercropping passion fruit with intercropping plants (coffee, pepper, rubber) with a density of 450 - 550 trees/ha will be reduced from a density of 833 trees/ha for calculation.

Dr. Biao Deng :

At present, China's statistical data is mainly official statistics by the National Bureau of Statistics, and there are data collection standards. Since passion fruit basically adopts the annual planting mode at present, the collection of planting area and yield data is according to the standard of woody fruit trees, and the statistical data is not accurate, so it is suggested to follow the short-term crop data collection method.

Dr. Shiamala :

In Malaysia, the Department of Agriculture is responsible for the data collection, validation, and dissemination of data and information related to passion fruit. Therefore, DOA needs an extensive effort to collect relevant national statistical information on passion fruit on a regular basis. Collected data needs to be shared with FAO so that the data can be freely available to all.

Moderator :

As we notice, it is sometimes challenging to obtain accurate data on minor fruits especially on area, production and trade. This may be attributed to the different ways data are represented or that some fruit types are clustered together according to their botanical or production characteristics. Moderator invited Sabine Altendorf from FAO-UN to comment on this.

Sabine Altendorf (FAO-UN) :

FAO, under the Intergovernmental group for banana and tropical fruits analyses production and trade data to provide insights for policies to improve production and trade of the commodities. FAO has had challenges in obtaining data for minor fruits due to the insignificant amounts produced and lack of international trade. With the lack of data, some of the minor fruits have been categorized under the harmonized system (HS), where some minor tropical fruits are grouped into categories according to their botanical and other related characteristics. This has been the basis for making production and trade estimates of the minor tropical fruit types.

However, recently there has been an upsurge in the production and trade of such tropical fruit categories, with some Asian countries already providing real data and information on such types. FAO very much supports improvement in data collection and has embarked on a program to improve the HS system (custom code) with re-categorization of the fruit types.

Besides this, Sabine mentioned that an annual survey questionnaire is sent to countries to provide feedback on the latest production and trade data. The survey questionnaire is important as it provides updates to the data collected and recently the response rate by producing countries has increased. Sabine hopes that all countries can respond in time for better updates and more accurate data on minor tropical fruits. Actual data also does not consider once-in-a-while natural calamities that destroy or affect yields.

Moderator :

Countries normally maintain separate production and trade data for each minor fruit type, which is then aggregated into the harmonized system (HS), now used by FAO. The harmonized system is now in the process of being reviewed, and it is hoped that with increasing production and trade, and more countries collecting and reporting on these fruit types, global data will be available and representative.

4.2. The expansion of passionfruit consumption will depend on market demand. Are there specific recommendations needed to promote and expand its consumption in your country, both for the domestic and export market (for fresh and processed products).

Dr. Ruiben :

The market guides the expansion of consumption in China. The problem is the accumulated harvest and availability of passion fruit, mostly from August to November. In other times, the market has to import fruits for other Asia countries, such as Vietnam or Thailand. Hainan has the weather advantage to develop off-season passion fruit. Breeding different maturities cultivars is also necessary, to meet the requirement of the local market. Besides, downstream processing technology is urgently needed to reduce wastage, especially during excessive harvest.

Dr. Ellina :

The specific recommendations needed to promote and expand its consumption in Indonesia for the domestic market are:

1. Currently, public awareness of healthy life is increasing. So the socialization of the health benefits of passionfruit as a source of vitamins and minerals will increase interest in consumers.
2. Promotion of fresh and processed products to the public through local exhibitions.
3. Used passionfruit product as a drink at various events/meetings
4. Promotion of other benefit of passionfruit for processed products such as flour, syrup, puree, cosmetics, aromatherapy, animal feed, etc. All of the bioindustry products can create job opportunities and could be increase farmers income.

The specific recommendations needed to promote and expand its consumption in Indonesia for the export market are:

1. Improving the quality of fresh and processing products according to export standards
2. Increasing quantity and continuity through increasing planting area and production
3. Improve packaging and branding for export market
4. Introducing fresh and processed products to the export market through exhibitions, webinars, etc.

Dr. Viet :

- a. Breeding new varieties with diverse characteristics to meet different uses (for fresh, for processing) as well as to meet different consumer tastes.
- b. Diversify of products (processed products such as concentrated, puree, frozen, fresh juice, dried, material for pharmaceuticals) and fresh.
- c. Improve food quality and food safety through application of production according to GAP to create consumer confidence.

Dr. Deng Biao :

- a. Increase the passionfruit nutrition functional component, downstream processing and nutrition health food manufacturing, rapid detection of fruit quality and safety, safety risk assessment and control quality of fruit, fruit nutritional quality evaluation and precise control on research and technology innovation, to improve the quality of fruit and processed goods, flavor quality, nutrition quality and functional components. To meet consumers' continuous demand for fruit diversification and quality, expand and promote passionfruit as high value, high quality and nutritious.
- b. Cultivate passionfruit varieties with high yield, high quality, that are cost saving and efficient in management, high resistance to diseases and pests, and suitable in different climatic regions.
- c. To encourage more to cultivate passionfruit and to meet consumers continuous demand - develop sensitive, stable and efficient low-cost passionfruit virus rapid detection technology and supporting products, build a standardized virus-free seedling cultivation technology system, take advantage of different climatic characteristics of different regions, adopt a cultivation mode of one year, using efficient passionfruit cultivation technology.

Dr. Shiamala :

In my opinion, creating awareness is very important among Malaysians to boost the passion fruit industry in this region. The first foremost step to be taken up is to create awareness among the people and give a wide range of publicity. In this regard, the government may initiate some steps to link the producer or processor with the hotels, restaurants, or even airlines in order to have as assured supply chain. Some assistance may also be extended to the producers for advertising their products on mass media and social media.

Moderator :

Passionfruit is relatively 'new' and needs further introduction or promotion for it to be included in the diversified tropical fruit market. It needs to be promoted more as it has a good exotic taste, has high nutritious value when eaten fresh or consumed as juice, including other processed products. Passionfruit should be more available in the market and promotional activities to popularize it should be intensified.

4.3. Can passionfruit be recommended in mixed fruit cropping system. For example, what is a good combination, passionfruit/jackfruit, or passionfruit/pitaya or is it better as a monocrop.

Dr. Ruiben :

Generally, monoculture is the major planting system in China. It is easy to manage and reduce cross infection of pests and diseases. But in some orchard, they use intercropping for better economic value. Intercropping with citrus is recommended, to utilize their fruiting-time difference. Intercropping with short and small crops such as herbal plants or potato, ginger, soybean, etc., is also recommended, to optimize planting space. More attention should be given to avoiding plants with the same disease host to avoid spread of the virus disease.

Dr. Ellina :

A Combination of passionfruit intercropped with other plants depend on 2 things:

- a. Altitude (high land and lowland)
- b. Planting system (trellis/vertical or horizontal).

In Indonesia, passionfruit is generally planted with horizontal system using wooden or iron poles and a wire or plastic rope that is stretched horizontally.

Based on the two categories, our recommendations are as follows:

- i. For the highlands with horizontal system, passionfruit can be combined with other plants that are adapted to the highlands, adapted to shade, and the plants height is below one meter. In Solok, West Sumatra the passionfruit at an altitude of about 1,500 meters is natively combined with bell pepper and taro (*Colocasia* sp.). Combination with other fruit plants, have not been found.
- ii. If planted in the highlands with a trellis system, combination of passionfruit/ strawberries can be recommended by adjusting the spacing between trellis
- iii. Using a horizontal system in the lowlands, we recommend passionfruit/ cayenne pepper and passionfruit/ *Colocasia* sp. The *Colocasia* (Taro) show good adaptation both in high and lowland.
- iv. For the lowlands with a trellis system, a passionfruit/papaya combination can be recommended with a spacing between passionfruit rows about 4 x 4 meters.

Dr. Viet :

- a. For exporting the fresh fruit to China, we have to apply the monocropping because we can use only the insecticides and fungicide recommended for passionfruit, not for intercropped crops.
- b. Some farmers intercrop passionfruit with coffee, black paper, rubber and some fruit trees in the first 1-2 years of intercropped crops.

Dr. Deng Biao :

Early interplanting of woody fruit trees can be considered, such as litchi, longan, jackfruit, etc. There is a litchi plantation in Guangxi in 2021, with more than 120 hectares. After planting litchi seedlings in the first one to three years, it is interplanted with Qinmi No. 9 passionfruit. This year, the output is about 15,000 kg/ hectares, and the output value is about 270 thousand yuan/ hectares.

Dr. Shiamala :

Passion fruit can be recommended in intercropping with jackfruit, coconut, mango and others, however, penetration of sunlight is very important to ensure optimal production. Besides, passion fruit is also a suitable candidate for integrated farming, especially for apiculture, and livestock integrated farming.

Moderator :

In short, passionfruit is a good candidate as an intercrop up to a period of 1 to 3 years, with fruit trees such jackfruit, mango and others, as long there is enough sunlight. Passionfruit is also suitable with short term vegetable or field crops as intercrops. Intercropping is more suitable for smallholders for crop diversification, while it is noted that for big commercial farms, monocropping is more efficient and productive.

5. CLOSING REMARKS

In closing the webinar, panel moderator Yacob reiterated that even though demand is high, passionfruit is relatively underdeveloped as compared to other main minor tropical fruits. It, however, has the potential to be developed considering the increase in production and market in countries such as China and Vietnam and the renewed interest in the Philippines, Malaysia and New Zealand. Passionfruit is relatively easy to cultivate, has reasonable shelf life, nutritious and adds diversity to the tropical fruit market. However, it will take time to be developed into a popular minor fruit.

TFNet is of the opinion that passionfruit has the potential to be developed and improved further. With research and development focused on breeding for suitable cultivars, best field practices, effective pest and disease management and good postharvest management, it is envisaged that passionfruit will be more visible in the coming years, and it certainly has a colorful bright future. TFNet introduced this webinar series on minor fruits to gauge the potential of minor tropical fruit types that can be developed into the mainstream global fruit list and at the same time to share and discuss among producing countries on ways to improve their market visibility.

He hoped that the webinar had been useful and would be able to provide impetus to further develop the passionfruit. On behalf of the TFNet team, Yacob congratulated all speakers for their informative and engaging presentations. He also thanked partners the Guangxi Academy of Agricultural Sciences, the Fruit Tree Research Institute, Guangdong Academy of Agricultural Sciences both from China, and University Putra Malaysia Bintulu branch, for their assistance and support in organizing this webinar. He also extended his gratitude to network colleagues in Australia, Fiji, China, India, Vietnam, Philippines, Malaysia, Indonesia, and others for assisting in promoting the webinar.

Yacob also reminded all to look out for the next fruit in the series which will focus on rambutan.

6. APPENDICES

6.1. Program

Date: 29 September 2022 (Thursday).

Time: 2.00 pm (Kuala Lumpur, Nanning), 11.30 (Delhi,) 1.00 pm (Ho Chi Minh City, Jakarta), 7.00 pm (Suva), 4.00 pm (Brisbane)

Time	Content
2.00 – 2.15 pm	Introduction Dorothy Chandrabalan (TFNet)
2.15 – 4.30 pm	Presentations
Dr. Deng Biao Guangxi Academy of Agricultural Sciences, PR China	Development status of the passionfruit industry in Guangxi province and progress in the breeding of new varieties
Dr. Shiamala Devi Universiti Putra Malaysia, Sarawak, Malaysia	Current status and initiatives to develop passionfruit as a potential fruit crop in Malaysia
Dr. Ellina Mansyah National Research and Innovation Institute, Indonesia	Status of production, consumption and market of passionfruit in Indonesia
Dr. Ruibin Kuang Guangdong Academy of Agricultural Sciences, PR China	Current trends and challenges in passion fruit research and development in China
Dr. Nguyen Van Viet NaFoods RDIA, Vietnam	Passionfruit development for the fresh and processing industry in Vietnam
4.30 – 4.50 pm	Q&A, Panel Discussion Challenges and opportunities in developing passion fruit for the global market Moderator: Yacob Ahmad (TFNet)

6.2. Photos

Fig. 1. TFNet Acting CEO Dorothy Chandrabalan introducing the webinar



Fig. 2. Dr. Deng Biao, Guangxi Academy of Agricultural Sciences, PR China



Fig. 3. Dr. Shiamala Devi, Universiti Putra Malaysia, Sarawak, Malaysia

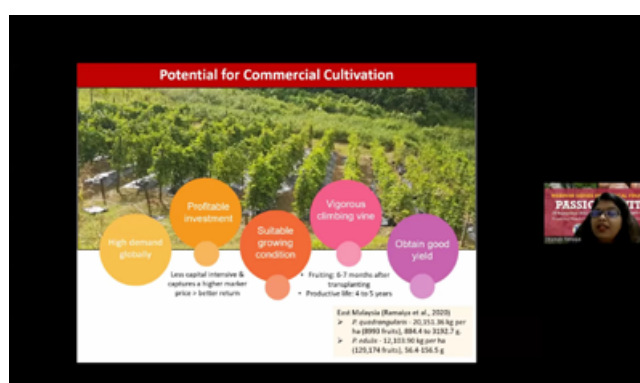


Fig. 4. Dr. Ellina Mansyah, National Research and Innovation Institute, Indonesia

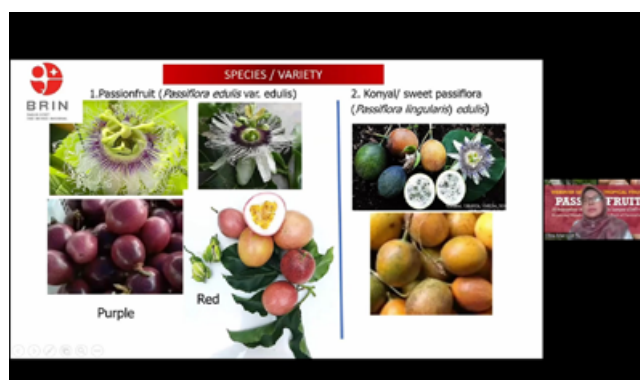


Fig. 5. Dr. Ruibin Kuang, Guangdong Academy of Agricultural Sciences, PR China



Fig. 6. Dr. Nguyen Van Viet, NaFoods RDIA, Vietnam

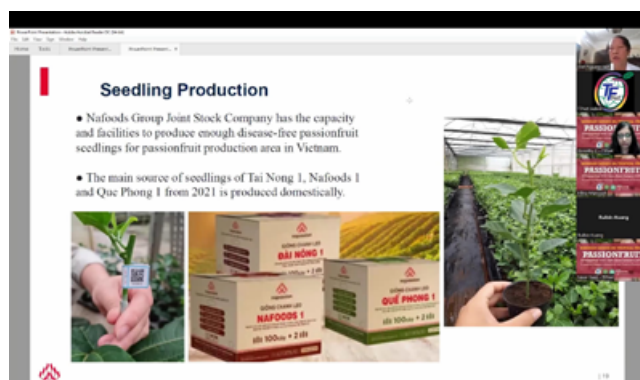
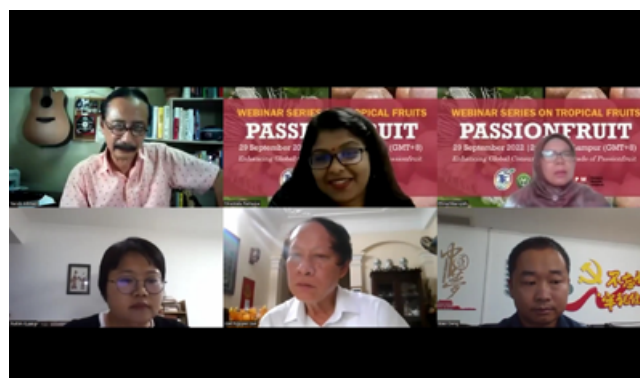


Fig. 7. Panel Discussion



6.3. Powerpoint Presentations

Dr. Deng Biao, Guangxi Academy of Agricultural Sciences, PR China

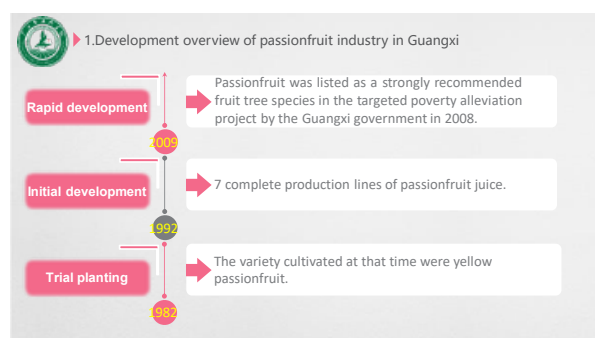
Development status of the passionfruit industry in Guangxi province and progress in the breeding of new varieties



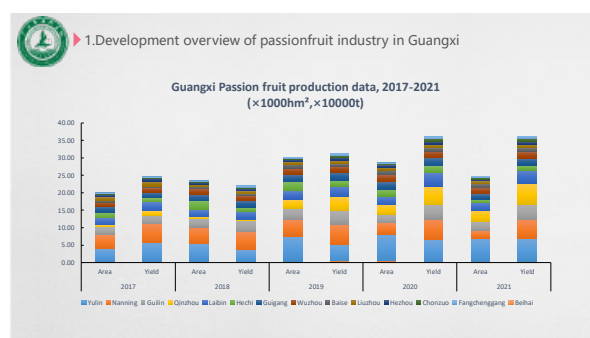
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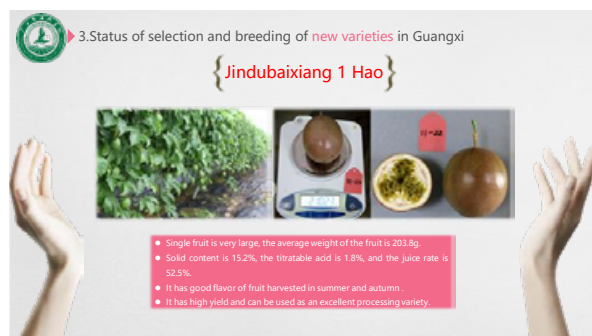
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Dr. Shiamala Devi, Universiti Putra Malaysia, Sarawak, Malaysia

Current status and initiatives to develop passionfruit as a potential fruit crop in Malaysia

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AGRICULTURE • INNOVATION • LIFE

Current Status and Prospects of Passion Fruit Cultivation in Malaysia

Dr. Shiamala Devi Ramaiya
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Department of Crop Science
Faculty of Agriculture and Food Sciences
Universiti Putra Malaysia Bintulu Sarawak Campus
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ILMU BERAKT
www.upm.edu.my


1

Passiflora Species

- Passion fruit may well be the most fascinating plant in the tropics.
- High-value export-oriented crop
- Family Passifloraceae, comprises 18 genera including the genus *Passiflora* > 500 species and their numbers are continuously increasing e.g., *Passiflora guayaquilensis* from coastal Ecuador (Cornejo & Kuethe, 2022).
- There are about 50 species cultivated (Veeramohan & Haron, 2015), and only 2 forms are economically important.
- Minor tropical fruits together with guava, durian, lychee, and rambutan (FAO Economic and Social Development Department 2016).



Flowers of *Passiflora* species
(Source: <https://myyoungfreshgreens.co.ke/>)



P. edulis Sims
(Purple Passion fruit)
P. edulis f. *flavicarpa*
(Yellow passion fruit)

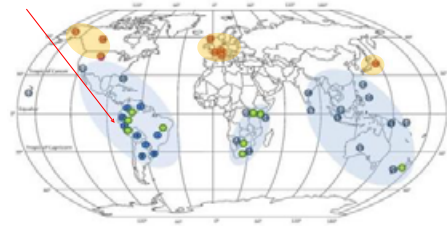
2

Origin and Distribution

Native to South America and center of diversity 84% of all the species

Brazil accounts for 50-60% of world production

USA, Germany, Japan, NZ: Main Importers (yellow)



Geographical distribution of passion fruit (Ramaiya et al., 2016)


World production increased from 1.05 million tonnes in 2005 to 1.70 million tonnes in the year 2019 with an average global price is about \$ 4.50 USD per kg (6-7 fruits) (Food Look, 2020)

3

Uniqueness of Passion Fruit

Edible fruit: Unique flavour & Aroma
The juice contain ranged 31 to 35%. The variety is known for its quality in term of flavour and nutrient content.
"A passion fruit a day keeps insomnia away" (Oshifuye, 2011)

Ornamental & propagation purpose
✓ Aesthetic value
✓ Propagation materials
✓ Seeds trade




1 cup = 247 g

	g	247.48
Water	g	211.48
Energy	kJ	326
Protein	g	0.96
Total fat	g	0.12
ash	g	0.84
Carbohydrate	g	33.59
Dietary fiber	g	0.5
Sugars, total	g	33.1
Calcium, Ca	mg	10
Iron, Fe	mg	0.59
Phosphorus, P	mg	32
Potassium, K	mg	687
Zinc, Zn	mg	0.12
Vitamin C	mg	29.6
Vitamin A, IU	IU	1771

(Ramaiya et al., 2016)

Nutritional & medicinal properties



✓ **Highly in demand**

Jamir et al., 1999; Ripa et al., 2009; Machado et al., 2010; Akanbi et al., 2011; Rong Gao et al., 2016; Phamwion and John, 2016

4

History of Passion Fruit in Malaysia

But then, the population is affected by passion fruit woodiness diseases (PWD) which discourages further expansion of this fruit

Cameron Highlands (Pahang) and Ayer Hitam (Johor) in 1960s become a commercial cultivation

First growing was in 1914 by DOA at Gunung Angsi, Negeri Sembilan

✦ In 2006 this fruit gaining back its popularity in Malaysia

Planting areas of passion fruit in Malaysia

Country	Price/kg (7-8 fruits)
Malaysia	RM 12-20
Turkey	RM 59.90
Argentina	RM 6.30

(Food Look, 2018)

- US\$250/metric tonne in US and European markets (2007)
- US\$400-600/metric tonne (Anonymous, 2022)
- the demand for passion fruit puree will continue to rise until 2027 (The Insight Partners, 2020).

5

Passion Fruit Species in Malaysia

- nine species recorded in Malaysia
- 2 forms are widely cultivated

***Passiflora edulis* (Markisa)**

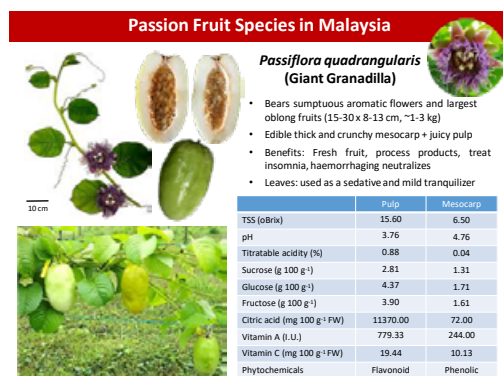



Cholesterol-free
Low fat
Low-sodium
High-fiber
vitamin A, C
High antioxidant



(Ramaiya et al., 2013 & 2016)

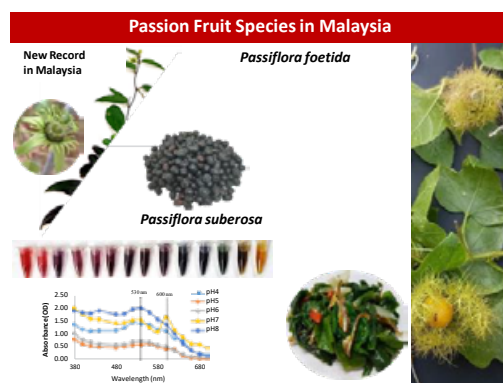
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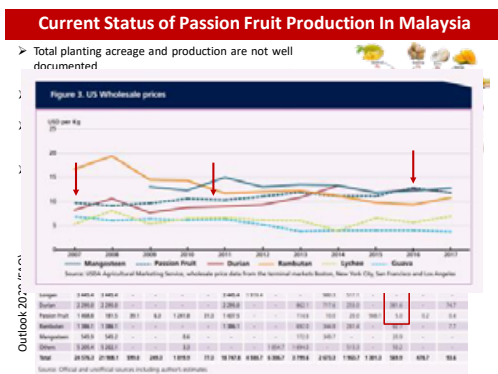
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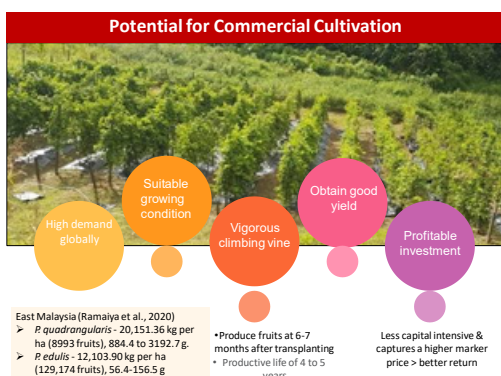
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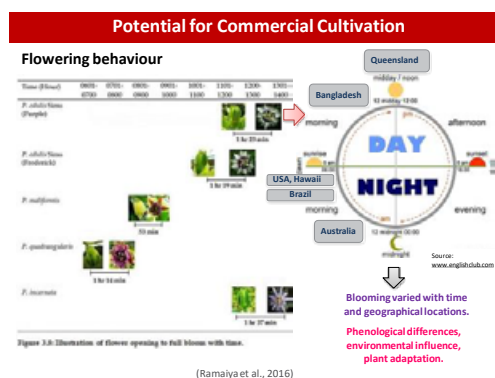
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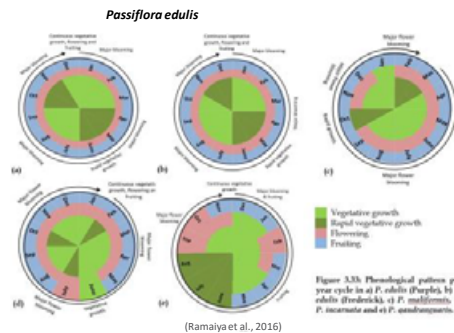


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Potential for Commercial Cultivation



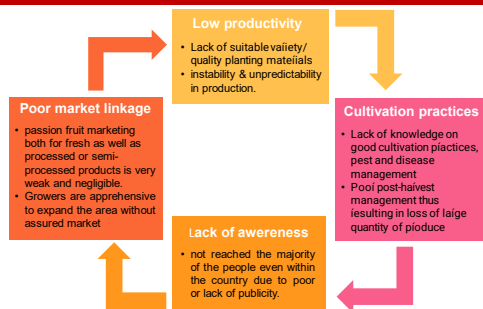
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Utilization of Passion Fruit Plant Parts



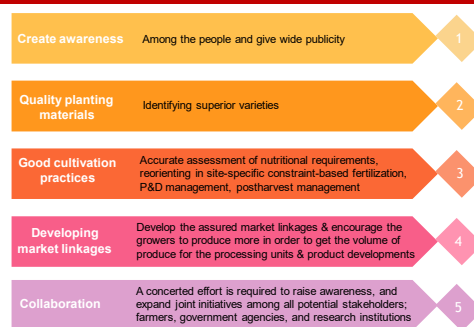
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Constraints



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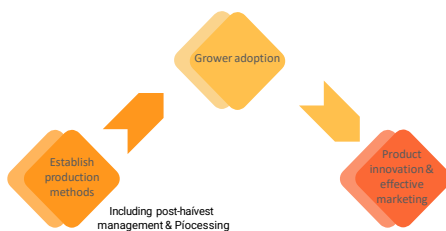
Strategies



16

Conclusion

- It is possible to infer that the cultivation and processing of passion fruit are technically feasible and can be expanded in Malaysia
- Passion fruit industry can bring about much-needed employment opportunities for small- and large-scale farmers in Malaysia, not only through cultivation but also through the establishment of more processing and semi-processing units



17

Acknowledgement



18

Dr. Ellina Mansyah, National Research and Innovation Institute, Indonesia

Status of production, consumption and market of passionfruit in Indonesia



STATUS OF PRODUCTION, CONSUMPTION AND MARKET OF PASSION FRUIT IN INDONESIA



Ellina Mansyah, Sri Hadiati, NLP Indriyani,
Jumjunidang, Riska, Tribudiyanti, Irwan Muas

NATIONAL RESEARCH AND INNOVATION AGENCY. REPUBLIC OF INDONESIA
2022

International webinar on enhancing global consumption and trade of passionfruit
Tropical Fruits Network (TFNet), 29 Sept 2022

1



OUTLINE

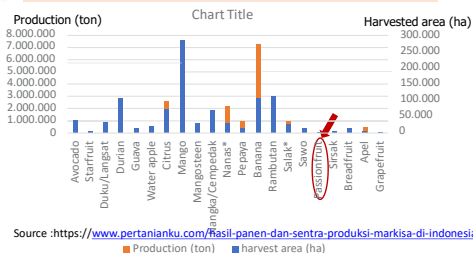
- I. INTRODUCTION
- II. STATUS OF PRODUCTION and CONSUMPTION
 - a. CULTIVATED AREA
 - b. VARIETY
 - c. PROBLEM
- III. MARKET
 - a. LOCAL & TRADITIONAL MARKET
 - b. EXPORT MARKET
 - c. PROCESSED PRODUCT
- IV. GOVERNMENT PROGRAMS

2



I. INTRODUCTION

POSITION OF PASSIONFRUITS AMONG OTHER FRUITS (2019)



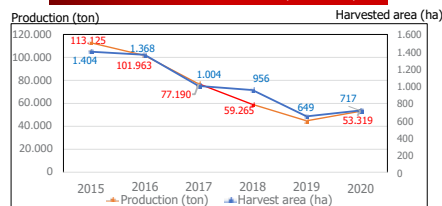
Source: <https://www.pertanianku.com/Rasil-panen-dan-sentra-produksi-markisa-di-indonesia/>

3



II. STATUS OF PRODUCTION

HARVEST AREA AND PRODUCTION (2015-2020)



Source: Dan statistik Pertanian 2015- 2019
BPS 2021, Data 2020,
<https://www.bps.go.id/indicator/55/62/2/produksi-tanaman-buah-buahan.html>

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CULTIVATED AREA



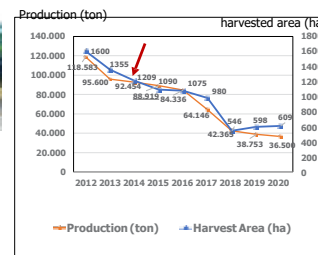
PROVINCES	PRODUCTION (TON) (Passiflora lingularis)
1. WEST SUMATERA	36,500
2. EAST JAVA	8,891
3. SOUTH SULAWESI	3,410
4. ACEH	1,084
5. WEST JAVA	970
6. NORTH SUMATERA	837
8. EAST NUSA	426
TENGGARA	
9. WEST PAPUA	329
10. BALI	125
11. LAMPUNG	122
12. YOGYA	116
13. SOUTH EAST	110
LAWESI	

Passiflora edulis var. edulis
Passiflora lingularis
Source: BPS 2021, Data 2020
<https://www.bps.go.id/indicator/55/62/2/produksi-tanaman-buah-buahan.html>

5



CULTIVATED AREA (WEST SUMATERA)



PASSIONFRUIT GROWING AREA

6



THE DECREASE OF HARVEST AREA AND PRODUCTION

1. Limited of rejuvenation,
2. Pests and diseases
3. Volcanic eruptions
4. Low Price
5. Many farmers move to grow vegetable

7



VARIETY

Five Types Passiflora in Indonesia :

1. Passion fruit (*Passiflora edulis* var. *edulis*)
 - purple : Highland of North Sumatera and South Sulawesi
 - red : Low land to high land
2. Yellow Passionfruit (*Passiflora edulis* var. *flavicarpa*) : Low Land
3. Konyal/ sweet Passiflora (*Passiflora lingularis*): Highland
4. Erbis (*Passiflora quadrangularis* L.) : Low land
5. *Passiflora foetida* (Markisa hutan)

8



VARIETY

1. Passionfruit (*Passiflora edulis* var. *edulis*)



Purple



Red

2. Konyal/ sweet passiflora (*Passiflora lingularis*) *edulis*)



9



4. Yellow variety (*Passiflora edulis* var. *flavicarpa*)



5. Erbis (*Passiflora quadrangularis* Simson)



4. *Passiflora foetida* markisa hutan



10



DISEASES



WILT DISEASE COMPLEX (Fusarium, Phytophthora)



ANTRACNOSE



BROWN SPOT (Alternaria)



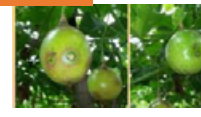
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PESTS



Macrosiphum sp



Fruit fly (*Bactrocera tau*...)



Aphis gossypii

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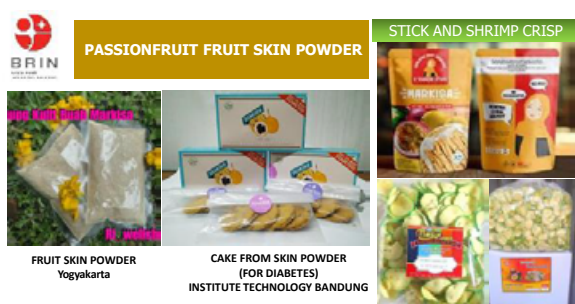
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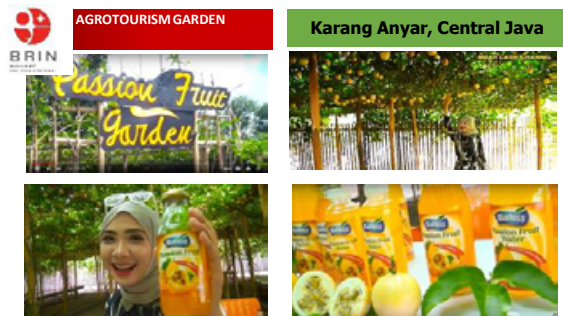
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CHALLENGES

The demand for passion fruit juice processed product is very high both for local and international market

The problems are :

- ❖ The harvest area and production decreases year by year
- ❖ The supply of raw materials for passion fruit industry is still insufficient and supply is not continuous
- ❖ Pests and diseases

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GOVERNMENT PROGRAMS

1. Research and Development of New variety and Pests and diseases
2. Expanding area / replanting in the areas previously planted with passion fruit
3. Support for good quality of seedlings production and distribution
4. Supporting Training for Cultivation, Controlling Pests and Diseases
5. Linking farmers to the market
6. Assisting young entrepreneur
7. Facilitate access to the plantation area in the high land

29

CHALLENGES

Terima Kasih

Informasi lebih lanjut dapat menghubungi
Sekretariat Program BARISTA Tahun 2022,
melalui surat elektronik: baristatimor@brin.go.id

PROFESIONAL
OPTIMIS
PRODUKTIF

30

Dr. Ruibin Kuang, Guangdong Academy of Agricultural Sciences, PR China

Current trends and challenges in passion fruit research and development in China



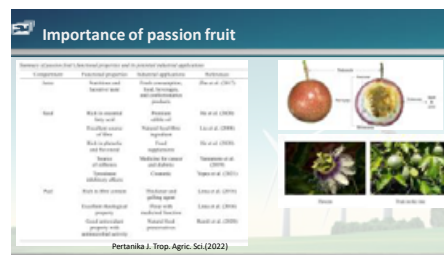
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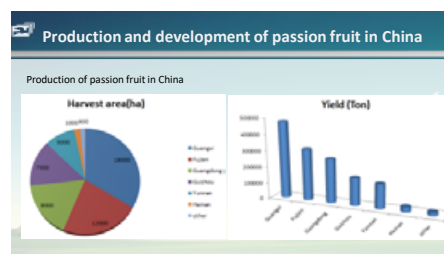
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6

Production and development of passion fruit in China

Three main production systems

mixed with other crops in distant fields


- Cultivating passion fruit mixed with other crops for subsistence
- produced on smallholdings (farm sizes <1 ha)
- Resource-poor with limited inputs

Production next to homestead in the rural areas or in backyards in the urban centers

- Became popular to shade and beautify living surrounding.

Monoculture production

- Intensive production in monoculture
- Inorganic fertilizers are applied, plots are kept weed free and diseases and pests are controlled
- Produce destined for urban and domestic markets.




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Production and development of passion fruit in China

Major cultivars produced in South China


Tainong 1




Mantianxing



Bale Huangjin



Dahuangjin



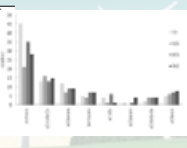
Production and yield of main passion fruit cultivars in Guangdong

8

Production and development of passion fruit in China

Nutrient and aroma contents of main passion fruit cultivars

Nutrient	Tainong1	Bale Mantianxing	Dahuang1
Soluble solids (%)	17.1	18.3	17.1
Titratable acid(%)	3.36	2.02	2.46
Soluble sugar (%)	9.8	10.1	9.4
Sucrose (g/100g)	4.9	4.3	3.0
reducing sugar (g/100g)	4.7	5.6	6.2
Vit. C(mg/100g)	20.1	25.4	19.8
Protein(%)	2.34	2.13	1.86
Ca (mg/kg)	4.53	9.67	5.6
K (mg/kg)	1400	2640	1590
Fe (mg/kg)	6.34	7.32	5.91



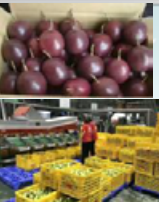
(Kuang et al, 2020)

9

Production and development of passion fruit in China

Harvest and processing of passion fruit in China

Index	Description
Size (Diameter)	Small (5 cm)
	Medium (5.5 cm)
	Large (6 cm)
Pulp colour	Green – not ripe
	50% purple colour – acceptable for market
	75% purple colour – acceptable for market
Soluble solids concentration	100% purple colour – highly desirable
	13–18 °Brix



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Production and development of passion fruit in China



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Production and development of passion fruit in China

Major problems in production

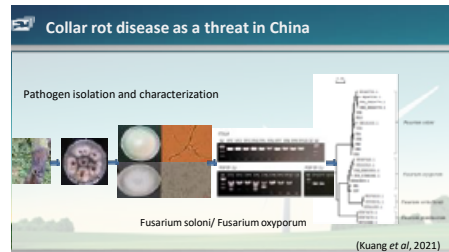
Seedlings;
Processing technique;
Disease and pest;
Extreme climate effects



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Collar rot disease research and integrated control measure

- IPM approaches
 - ✓ Epidemiology: understanding mechanism of soil suppression;
 - ✓ Healthy plantlet and seedlings--Tissue culture/ grafting with resistant rootstocks;
 - ✓ Cutting and eradication;
 - ✓ Crop Production System (rotation; intercropping)




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Collar rot disease research and integrated control measure

- To screen passion fruit germplasm for collar rot resistance;

Resistance screening



Resistance breeding program

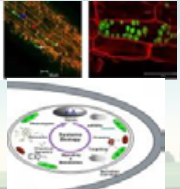


(Kuang et al, unpublished)

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Future work plan


- Functional analysis in *fusarium passiflorae*;
- Better understanding of evolution of plants and pathogens, plant-Fusarium interaction mechanism at gene, cytological and molecular level.
- To develop and apply appropriate diagnostic services/Intelligent recognition



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Future work plan

- Breeding program using as parental lines resistant genotypes.
- "classical" breeding programs: cross breeding, cell engineering breeding (chemical/physical mutation);
- Earlier-screening assay; resistance evaluation methods and standard;
- Resistance mechanisms and molecular probe development

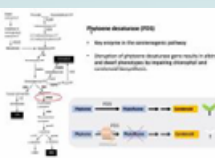


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Future work plan

- Non-GM gene editing in passion fruit


Knockouts, substitutions or insertion;
No 'foreign' DNA;
Transient expression of Cas9 and guide RNA;
Multiple gene editing technologies.



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Dr. Wei's lab, IFTR, GDAAS
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Current trends and challenges in passion fruit research and development in China

PASSIONFRUIT DEVELOPMENT FOR THE FRESH AND PROCESSING INDUSTRY IN VIETNAM

Nguyen Van Viet, Pham Duy Thai, Hoang Manh Hung
Nafoods Joint Stoks Compagny, Vietnam

nafoods



1

I. INTRODUCTION

•Passionfruit (*Passiflora edulis*) is a remarkable new fruit tree in Vietnam that has nutritional and commercial significance as a cash crop.

•Some farmers in South Vietnam have been planting passion fruit trees in their backyards since 1990.



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II. PRODUCTION

2.1. Area of Passionfruit in Vietnam

•Currently, passionfruit trees are planted mostly in the Central Highlands and Northwest. With a production area of approximately 10,500 hectares in 2019,

• The passionfruit tree is now ranked 17th among fruit plants.

•The area under passionfruit cultivation is distributed in the Central highland provinces (Dak Lak 10%, Gia Lai (29%), Dak Nong (16%), Lam Dong (12%) and the Northwest provinces (Son La (19%), Nghe An (4%), and other provinces (9%).

• The area of passionfruit is expected to exceed 15,000 hectares by 2022.



AREA (2015 – 2019 (HA)
Source: Crop Production Dept., MARD 2019

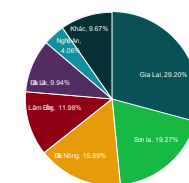
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Area of Passionfruit in Vietnam

• Area under passionfruit cultivation is distributed in the:

•Central highland provinces (Dak Lak 10%, Gia Lai (29%), Dak Nong (16%), Lam Dong (12%)

•and the Northwest provinces (Son La (19%), Nghe An (4%), and other provinces (9%).



DISIRIBUTION OF PASSION FRUIT GROWING AREAS
Source: Crop Production Dept., MARD 2019

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Area of Passionfruit in Vietnam

The growing area of passionfruit in 2019 has risen significantly in the Central Highlands and Son La provinces, including Son La (348%), Dak Lak (134%), Gia Lai (118%), Lam Dong (34%), Dak Nong (26%), and Nghe An (9%).



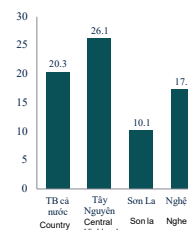
AREA VARIATION (2015 – 2019 (HA) GROWTH IN AREA 2015-2019 (%)
Source: Crop Production Dept., MARD 2019

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2.2. The Yield of Passionfruit in Vietnam

•The yield of passionfruit has great variation between regions, in which the average yield is 20.3 tons/ha; in the Central Highlands 26.1 tons/ha, in Son La 10.1 tons/ha, Nghe An 17.3 tons/ha.

•However, the highest yield of passionfruit in the Central Highlands provinces can reach 50-60 tons/ha, the Northwest provinces can reach 30 tons/ha.

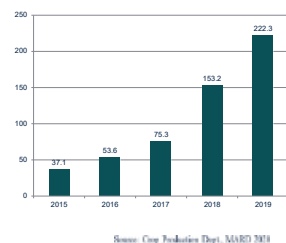


Source: Crop Production Dept., MARD 2019

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2.3. The Production of Passionfruit in Vietnam (Thousand Ton.)

Passionfruit production has increased rapidly over the years, from 37.1 thousand tons (2015) to 222.3 thousand tons (2019).



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- In Vietnam, passionfruit is consumed fresh and processed in the domestic market and for export.

- The main processed products are concentrated juice, puree, frozen, and dried.

- The consumption and export market of passion fruit has been expanded to more than 50 countries, mainly China, EU, USA, Taiwan, Hong Kong and Middle East countries...

- A small part is processed beverage for domestic consumption.



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Food safety certificates



Juice Quality Control/
International Raw Material
Assurance



KOSHER Certificate



HALAL



BRC - Global
standard for
Food Safety and
Quality



ISO 26000:2005/
HACCP: Food Safety
Management System

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III. PROCESSING OF PASSIONFRUIT



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PRODUCTS

Puree/ NFC/ Concentrate

IQF

Fresh fruits



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IV. MARKET AND EXPORT OF PASSIONFRUIT

4.1. Market

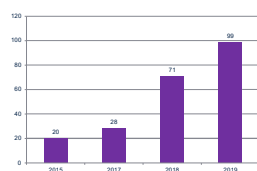


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4.2. Export of Passionfruit in Vietnam (Mil. USD)

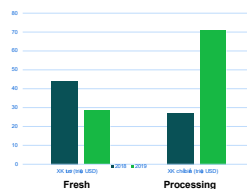
• The exports of passionfruit in 2019 reached \$99 million,

• China is the largest export market of Vietnam's passionfruit, accounting for 33.5%, followed by the Netherlands (21.9%), the UAE. (13.3%), France (10.4%) and other markets account for 25.4% of Vietnam's total passionfruit exports.



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Export of Passionfruit in Vietnam (Mil. USD)



Export Passionfruit to EU following EVFTA



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A pioneer in the export market



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V. BREEDING OF VARIETIES AND SEEDLING PRODUCTION

• Before 2020 the purple passionfruit variety Tai Nong 1 imported from Taiwan is mainly variety grown in the main growing areas in Vietnam.

• The main source of seedlings for planting are imported from Taiwan.



Tai nong 1

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New Varieties of Passionfruit

• From 2021, there are 2 new passionfruit varieties are registered officially by the Ministry of Agriculture and Rural Development of Vietnam such as Nafoods 1 and Que Phong 1.



Que Phong 1



Nafoods 1



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New Varieties of Passionfruit

• Nafoods Group Joint Stock Company is leading company in Vietnam in breeding new passionfruit varieties, production of disease-free seedlings and development of passionfruit value chain.

• The Ministry of Agriculture and Rural Development of Vietnam has funded to Nafoods to research on breeding of passionfruit varieties for the main growing areas in Vietnam. New passionfruit varieties such as Nafoods 1, Que Phong 1, Gia Lai 1, Pleicu 1 and some other promising lines has been successfully selected by Nafoods.

• These varieties have some outstanding advantages over Tai Nong 1 such as bigger fruit (120-130 gr/fruit) than Tai Nong 1 (70-80 gr/fruit), specialized for fresh eating (Nafoods 1, Que Phong). 1) and for processing.



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Seedling Production

●Nafoods Group Joint Stock Company has the capacity and facilities to produce enough disease-free passionfruit seedlings for passionfruit production area in Vietnam.

●The main source of seedlings of Tai Nong 1, Nafoods 1 and Que Phong 1 from 2021 is produced domestically.



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VI. PRODUCTION MODEL

●In order to control food quality and food safety, Nafoods has organized contracted models with farmers and cooperatives specializing in growing passion fruit tree to produce passion fruit according to VietGAP and GlobalGAP standards.

●Nafoods and other companies has organized passion fruit plantation that have been granted over 50 planting area codes by the General Department of Chines Customs and Vietnamese Plant Protection Department, which are qualified to export passionfruit to China.

●Nafoods has also organized plantations that meet GlobalGAP standards, which are qualified to export fresh fruit to France and some EU countries.



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VII. LIMITATIONS

- The biggest limitation in passion fruit production in Vietnam is unsustainable production and market.
- The effects of pests and diseases
- Insufficient resistant varieties to pests and diseases (especially resistant to *East Asian Passiflora virus*, *Passionfruit Vietnam virus*; resistant to fungal and bacterial diseases (such as *Alternaria passiflorae*, *Phytophthora* sp, *Pseudomonas* sp.).
- Insufficient variety for different ecological regions (especially varieties for lowland areas below 500 m above sea level)
- These are issues that need to be focused on in the future.



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Thanks
For Your
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