



REPORT

WEBINAR SERIES ON TROPICAL FRUITS

GUAVA

9 November 2023

Prospects of expanding guava production and trade



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CONTENTS

1.0	Executive Summary	1
2.0	Webinar Presentations	3
3.0	Q&A Section and Panel Discussion	11
4.0	Appendices	16
	- Program/Invite sample	
	- Powerpoint Presentations	

1.0. EXECUTIVE SUMMARY

Guava, often labelled as a “minor” tropical fruit in global markets, holds intrinsic value despite its relatively smaller presence compared to major tropical fruits. The term “minor” does not diminish its significance, and concerted efforts from farmers, government agencies, researchers, and the private sector are crucial for its development and recognition on the international stage. Incidentally, guava is also categorized as a major fruit category along with ‘mango and mangosteen’, under code HS 080450 of FAO-UN trade data.

In the fourth instalment of TFNet’s ongoing series of international webinars focusing on minor tropical fruits, the webinar centered around guava under the theme ‘Prospects and Expansion of Guava Production and Trade.’ Held on 9th November, 2023, the aim was to gather valuable insights to understand the current state of guava production and markets and formulate actionable recommendations for elevating its status in the global fruit market. The webinar provided a comprehensive exploration of various aspects of developing guava including production, consumption, trade, challenges, and future prospects.

Dr. Vasugi of the Indian Council of Agricultural Research, India provided a comprehensive overview of India's efforts to sustain guava production for both domestic consumption and export markets. The presentation focused on extensive research in crop improvement, covering various aspects such as clean planting material production, good agricultural practices, canopy management, high-density planting, integrated nutrient-water management, and disease management. The discussion included an insightful examination of challenges faced by the guava industry and explores future directions. Future plans, including ongoing research on disease-resistant varieties, precision farming development, collaborations with international institutions, and enhanced marketing strategies were also outlined.

Dr. Xuehua Shao from the Fruit Tree Research Institute, Guangdong Academy of Agricultural Sciences presented developments related to China's status of guava cultivation and market. The development of guava in China has witnessed substantial growth in the past two decades. The dominant variety, Zhenzhu guava, has fuelled rapid growth, with Guangdong Province leading in production. China, a major player, contributes 4,366,300 tons annually, primarily from Southern provinces. The presentation outlined the diverse guava varieties, each with unique characteristics contributing to China's guava diversity. The cultivation techniques emphasized soil management, organic fertilizer application, and pruning techniques, playing a crucial role in China's success as a major guava producer and exporter to Hong Kong.

Prof. Dr. Sobir from Bogor Agricultural University, Indonesia stated that guava is still considered a minor fruit in Indonesia, ranking 13th in production among other fruit types in 2002 and maintaining the same position in 2021. However, there has been a significant 3.3-fold increase in production from 2002 to 2021, with notable surges linked to the popularity of the Crystal guava variety and increased demand during the COVID-19 pandemic, due to consumers' interest in fruits with high vitamin C content. The presentation details guava varieties, cultivation techniques, processing into juice, challenges faced by farmers, and the increasing popularity of guava in Indonesia.

Mr. Ahmad Hafiz Baharom from the Malaysian Agricultural Research and Development Institute (MARDI), Malaysia provided an overview of guava production in Malaysia, emphasizing the ongoing guava breeding program at MARDI. Guava production in Malaysia has faced a substantive decline in the recent years. Mr. Hafiz emphasized the potential for further expansion of the guava industry in Malaysia, driven by consistent demand in domestic and international markets. Key factors for growth include the implementation of good agricultural practices, research and development support, and government policy backing under the National Agricultural Policy 2.0 (2021-2030).

Mr. Shalendra Prasad from the Research Division of the Ministry of Agriculture, Fiji shared the success of Fiji's focus and initiatives on guava to expand the fruit industry, emphasizing the government's commitment to diversify agriculture. The presentation covers guava cultivation initiation, production, marketing strategies, challenges, and future prospects, showcasing the transformative power of strategic government support and sustainable practices.

Besides good farm practices, the presentations also highlighted several innovative techniques, especially those practiced in India, including leaf cuttings for vegetative propagation, branch bending for enhanced shoot development, high-density planting like the meadow orchard approach, and scheduled production manipulation for strategic market engagement. The

presentations emphasize the importance of sustainable practices, government support, and innovative strategies for guava cultivation.

The Q and A and panel discussion session covered various crucial aspects of guava cultivation and development, offering insights from different countries and perspectives. The panel also addressed questions on optimal pruning time, effective strategies for controlling fruit flies across different countries, post-harvest technology for guava export, associated costs of bagging, feasibility of guava as a mixed crop, and funding availability for guava development.

The panel discussion delved into the possibility of elevating guava to mainstream fruit status, emphasizing the need for resource allocation, research efforts, and energy toward this goal. The consideration of the primary consumer base for guava was deemed crucial for export destinations like Europe or the US.

Panellists discussed the possibility of developing a selected popular guava variety, as ‘Hass’ is to avocado, ‘Cavendish’ to banana, ‘Musang King’ to durian and MD2 to pineapple. This drew mixed responses and the discussion concluded with optimism about guava’s potential mainstream status in the next decade. The emphasis was on targeted research and development, efficient production systems, mechanization, and assertive market commercialization. Guava was positioned as a valuable component of daily fruit intake, complementing other fruits for a nutritious and appealing combination. Overall, the panel discussion provided a comprehensive overview of guava cultivation, addressing challenges and opportunities on a global scale.

2. WEBINAR PRESENTATIONS (MODERATED BY DOROTHY CHANDRABALAN, TFNET)

2.1. Sustaining guava production for the domestic and export market in India – Dr. C. Vasugi, IIHR-ICAR, Bangalore, India

In her scientific presentation, Dr. Vasugi, discussed India’s endeavours in sustaining guava production for both domestic consumption and export markets.

Psidium guajava holds a significant position as the fifth most important fruit crop in India. Despite being introduced, it thrives in various Indian regions due to its adaptability, drought resistance, and prolific nature, providing nutritional security throughout the year. Rich in vitamin C, vitamin A, and antioxidants, guava has gained importance with wider consumption preferences and diverse value-added products. The primary challenges faced are in containing guava wilt disease and nematode infestation. Analysis of trends in area production and productivity revealed an increasing trend, emphasizing the need for continuous research in this field. Leading guava-producing states, including Andhra Pradesh, Bihar, Chhattisgarh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, and West Bengal, collectively contribute to the production of approximately 5.2 million metric tons, covering an area of 346,000 hectares. Prominent Guava varieties in India, such as Allahabad Safeda, Sardar, Surkha, and Arka varieties (different states have different preferences), were discussed. Guava breeding work was initiated in the Ganeskhind Fruit experiment Station in Pune (Sardar Guava), and is now being carried out by various organizations for guava improvement in India. Some private entities have been documented to grow varieties from Thailand.

The adoption of improved varieties is prescribed as one of the main strategies for sustaining the guava industry. Broadly, guava varieties are classified into two groups – the white pulp and the red pulp varieties. White pulp varieties are preferred for fresh consumption, and these include Arka Amulya and Arka Mridula with Allahabad Safeda being one of the parents. Arka Kiran and Arka Rasmi are red-fleshed varieties deemed suitable for fresh consumption and also processing (high in lycopene). Arka Poorna is a recently developed white-pulp variety which has high pulp content, more outer rind thickness and less inner core. It is suited for fresh consumption and processing. Other improved varieties include Lalit, Shweta, Dhawal and Lalima. Lalima is gaining popularity in North India due to attractive appearance and color development during cooler months. The Allahabad Safeda is the most popular variety in India, and is the progenitor for many popular guava varieties. Many breeding programmes, include Allahabad Safeda (a time-tested variety) as the male or female parent due to its excellent characteristics in terms of size of fruit, quality, yield, and taste, and performed well in farmers' fields.

The use of clean planting material and lack of quality planting material are some of the challenges faced by farmers in India. In tandem with these issues is the existence of wilt and nematode infestation, with nursery soil potting mixture being a source of inoculum. Hence, the aim is production of clean and quality planting material, free from the source of inoculum and this is being done through the certification of nurseries where improved varieties are licensed to. It is normal practice for scientists to regularly visit these nurseries to assess genetic purity and quality of planting material, with the absence of pests and diseases. In addition, advice is provided on adoption of standard nursery management practices for the production of clean planting material. There is a need for the use of rootstocks that are resistant to biotic stresses mainly from wilt and nematode infestation for high density planting. If ever planting materials are imported, prescribed regulations must be adhered to.

Dr. Vasugi highlighted the significance of producing large quantities of planting material, a problem faced by many farmers. At present, only a total of 40-50% planting material is produced from 4,500 nurseries, thus more effort needs to go into the multiplication of planting materials. The adoption of propagation techniques involving leaf cutting, nodal cutting, herbaceous cutting or semi hard wood cutting (with limited mother plant), are deemed as efficient and fast ways for multiplication, instead of the conventional grafting technique. These newer techniques allow for the efficient multiplication of material, meeting the demand from guava growers.

Dr. Vasugi delved into good agricultural practices, referring to the standards outlined in Indian Standard (IS) 15930 specific to guava crops. These practices aim to ensure food safety, occupational health, and welfare. Benefits include a uniform approach irrespective of farm holdings, basic infrastructure development, traceability in the food chain, soil fertility maintenance, and enhanced worker safety. Adhering to good agricultural practices also aids in overcoming technical barriers and gaining reputation in the international market.

Dr. Vasugi then discussed crop regulation for quality fruit production, considering guava's seasonal flushes and the ability to produce crops in response to market demands. Winter season crops were generally found to be of better quality than rainy season crop when there is the prevalence of pest and disease infection. Various crop regulation methods are location-specific across the country, including withholding irrigation in Peninsular India (to induce flowering), and root exposure and root pruning in West India (for suppressing the rainy season crop and

obtain winter season crop). These practices are tailored to the market demand in the specific areas. For North India pruning is undertaken at the third quarter and middle of the season shoot growth of spring flush. Chemical applications are also pursued for desired flowering and fruit set retention. In relation to inducing new fruit bearing shoots for any season, the 'branch bending' technique is used to regulate fruit production on demand. This technique is used on 2 to 8 years old trees, results in the dilution of accumulated auxins at branch tips activating dormant buds, thus promoting the growth of new lateral shoots. Branch bending is only possible for plants grown in wider spaces (5m x 5m).

The presentation moved on to canopy management and rejuvenation techniques for older orchards. Hard pruning is done to activate dormant buds.

High density planting/ultra-high density/ or commercially described as 'meadow orchards' have been recommended for productivity increase. The increased number of trees characterized by close plant spacing remove the requirement for large planting areas. This planting system however involves judicious canopy management. This is demonstrated in the Meadow Orchard technique developed by a company, CISH, Lucknow, promotes better light distribution and photosynthesis, leading to higher yield per unit area. Under this concept 5000 plants are planted in 1 hectare of land at 2.0 x 1.0 m spacing, managed by regular topping and hedging, especially during the initial stages. The presenter reported that better yields were obtained with higher plant densities or closing spacings. Dr. Vasugi provided in-depth insights into pruning practices (i.e. back pruning for activation of dormant buds), emphasizing the importance of maintaining a single trunk (meadow orchard), canopy height control, and regular pruning to achieve desired plant height and light penetration.

Integrated water and nutrient management strategies were presented, including water-saving techniques like drip irrigation, partial root zone drying and sub irrigation which deliver the exact quantity of water to the root zone. Under rain-fed conditions, in-situ moisture conservation (mulching, coconut husks) in the root zone can be practiced.. The application of fertilizer through fertigation has the potential of saving N and K fertilizers. She reminded that guava is a heavy nutrient requirement crop, and if nutrient requirements as per local conditions are not met, the crop can face severe nutrient deficiency and yield cannot be sustained. Micro-nutrient deficiencies, especially boron, were highlighted, and the benefits of organic and inorganic fertilizers, along with microbial consortia and biofertilizers, were discussed for enhanced nutrient efficiency.

Dr. Vasugi then highlighted the critical aspects of pest and disease management in guava cultivation, emphasizing the complexities such as Fusarium and guava wilt, and the ongoing efforts to develop guava wilt resistant rootstocks and varieties.. The importance of integrated approaches, such as the management of fruit fly infestations, is underscored to ensure market acceptance and prevent crop loss. Recommended package of practices have been developed for the production of quality fruits.

Support for small and marginal farmers, knowledge-based centres, and human resource development are identified as key components for sustaining guava crop yields. The marketing aspect was discussed, showcasing India's position as a major exporter of guava, both in fresh and processed forms. Dr. Vasugi emphasized the need for suitable varieties to meet export standards,

ensuring cleanliness, pest-free produce, and compliance with quality regulations.

Challenges faced in Indian conditions, include physiological disorders, nutrient deficiencies, inadequate inputs, and fragmented land holdings, and strategies such as water harvesting, precision farming, and improved orchard management have been proposed to overcome these challenges.

The presentation concluded by outlining future plans, including continued research on disease-resistant varieties, precision farming development, collaborations with international institutions, and enhanced marketing strategies. The aim is to position India as a significant guava producer and exporter through resource allocation, infrastructure development, research and development, technological upgrades, and improved policy frameworks. The emphasis on sustainable practices, technological advancements, and farmer training highlights the multifaceted approach required for the successful cultivation and export of guava in India.

2.2. Recent developments in guava production and market in China – Dr. Xuehua Shao FTRI-GDAAS, China,

Dr. Xuehua Shao covered four key points: the development course, crop status (in reference to the overall fruit industry), variety introduction, and cultivation techniques. The introduction of guava to China dates back over 300 years, with its initial presence in Taiwan during the late 7th century, followed by its spread to Fujian and subsequently to Guangdong, Yunnan, Hainan, and Sichuan and Guizhou. Notably, Guangdong, Guangxi, Hainan, and Taiwan boast significant cultivation areas, being main production centres. Over the past two decades, Guangdong has seen rapid development in its guava industry. Traditionally, the Yan Zhihong guava dominated before the 1990s, characterized by small, sweet, soft, and smooth fruits with a thick skin. However, the introduction of guava from Thailand in 1979 marked a pivotal shift, leading to a significant increase in planting population and a transition from traditional to cultivated guava varieties. However, due to lack of propagation technology and other factors, China halted the production of the Thai variety. In the late 1980s, Taiwan's Xin Shiji guava was introduced into mainland China, with guava becoming a common fruit in the Chinese market. Once again during the same period, another variety from Taiwan, the Zhenzhu guava was introduced. This variety was favoured by farmers because of its yield and good quality, thus becoming the dominant variety till present. In the last 10 years, guava production has seen rapid growth, with Guangdong's guava area reaching 13,333,000 hectares in 2021.

In the global context, China is a major player in guava production and export, contributing 4,366,300 tons annually. The primary production areas in China are mainly in the Southern provinces of Guangdong, Fujian, Guangxi, and Hainan. Guangdong, in particular, has experienced substantial growth, with a planting area of approximately 30,900 hectares and production reaching 488,400 tons in 2021. Zhenzhu guava is the predominant variety, constituting around 80% of the production, with other varieties like red-purple guava and Yan zhihong guava also present. Fujian's Zhengzhou city, due to its mild climate and proximity to Taiwan, serves as a platform for agricultural exchange and grows predominantly the Zhenzhu guava, covering over 95% of its 1,866-hectare planting area. Guangxi's Yulin city and Hainan's Qionghai city are also notable guava-producing regions, emphasizing the diversity and scale of guava cultivation in China.

The variety introduction section outlines several guava varieties, including Zhen zhu (introduced from Taiwan; main variety), Di wang (introduced from Taiwan; promotional variety), Fei cui (selected from Zhen zhu), Shui Mi (no or few seeds), Mu gua (introduced from Taiwan; no seeds), Si Jihong (new variety), Jin douxiang (new variety), Hong baoshi (introduced from Taiwan), Chao hong (new variety), and Yan Zhihong (famous local variety in Guangzhou; large production areas in Guangdong and Guangxi). Each variety possesses unique characteristics, such as fruit size, sweetness, and shelf life, contributing to the overall diversity of commercial guava varieties in China.

Moving on to cultivation techniques, Dr. Shao emphasized soil management (i.e., through soil loosening), and organic fertilizer application. These improve physical and chemical soil properties, thus, also improving plant health that can enhance disease resistance. In addition, fertilizer and water management were integral for the effective production of guava trees. Common fertilizer placements for guava around the tree crown are circular fertilization, radial fertilization, hole (pocket) fertilization, and strip fertilization.. In addition, Dr. Shao discussed the pruning technique which keeps the plants to a manageable height for easy picking, balances branch dispersion, maintains branch length and allows sufficient light through the canopy. The significance of cultivation techniques and the strategic selection of guava varieties for market demand are highlighted as crucial factors contributing to China's success in becoming a major guava producer and exporter.

2.3. Recent developments in guava production and market in Indonesia – Prof Sobir, IPB, Bogor, Indonesia

Prof Sobir examined the production, consumption, and trade of guava in Indonesia. With data indicating that guava can contain up to 200 mg of vitamin C per 100g, its introduction and adaptability have led to widespread cultivation across the archipelago. Despite its long history in the region, guava is still considered a minor fruit in Indonesia, maintaining the 13th position in production rankings among other fruit types, in both 2002 and 2021. A notable increase (3.3-fold) in guava production occurred from 2002 to 2021, rising from 162,120 tons to 420,000 tons. Within these annual figures, a surge in 2004 was attributed to the growing popularity of the crystal guava (tropical apple), which reached a production level of 327,896 tonnes. Furthermore, the years 2019-2020 saw an upswing in guava production and demand, linked to heightened consumer preference for high vitamin C fruits during the COVID-19 pandemic. In saying this, Prof Sobir indicated that this factor could be considered to promote guava into becoming a major tropical fruit commodity. Distribution patterns align with Indonesia's population concentration, with Java Island leading at 64%, followed by Sumatra at 16%, Maluku and Papua at 6%, Bali and Nusa Tenggara at 6%, Sulawesi at 5%, and Kalimantan at 3%. Guava cultivation predominantly occurs in wet areas, such as Sumatra, Java, Maluku, and Papua, where rain fed agriculture is prevalent. Three main provinces in Java Island share the highest guava production, followed by the West Papua province. He also detailed the guava production pattern throughout the crop year, with production and harvest occurring highest during quarter I, attributed to higher water availability. Highest yields were often observed in quarter III. Most guava in the country are grown with a spacing of 3m x 2m (2000 trees/ha) in lowland small orchards practicing intensive husbandry, especially in floral induction and fruit development, and reportedly has good production. The two main varieties grown in Indonesia are the Crystal Guava and the Pink Guava. He also cited a very large orchard in Lampung province (150ha) operated by the

Great Giant Pineapple company. Prof Sobir then proceeded to describe results of an experiment to test the production of guava in low-land and mid-land areas. The results indicated that production can be targeted based on consumer requirements, for example production of guava fruits with higher vitamin c and active compounds were more favourable when planted in mid land areas, while for better taste, production fared better in low land areas. The importance of plant material, pruning, and fruit bagging as crucial components of guava production was emphasized. The presentation highlighted the challenges faced by guava farmers in pests and diseases management, including fruit fly infestations and other pests like the mealybug, *Lepidopteran* pests, and diseases such as Anthracnose. Other abiotic and physiological factors impacting production include sunburn and fruit cracks due to overwatering or rain after a drought period coupled with calcium deficiency.. Fruit bagging was underscored as an effective method to control fruit flies, reduction in pesticide use, and enhance fruit quality. This is often done using Styrofoam and plastic bagging material. He then went on to explain the harvesting and post harvesting process. Harvesting time of mature fruit was determined based on time of bagging and colour of skin.

Thus far, six varieties have been released in Indonesia, with three varieties introduced from Taiwan. These are the Deli, Wijaya Merah, Mega Merah, three introduced varieties which are the Mutiara, Kristal and Bipara. The Crystal variety (introduced from Kaoshiung STaiwan) is the most popular variety.

In 2021, guava consumption has witnessed an uptick, ranking eighth in overall fruit consumption in Indonesia. The trend may be attributed to increased awareness of guava's immunity-boosting properties during the COVID-19 pandemic. The presentation also delved into guava marketing channels, revealing the three types of prevalent channels in Indonesia. The channel involving local collectors selling direct to retailers including supermarkets, was reported to be the most lucrative for farmers. In conclusion, the presentation provided a comprehensive overview of guava production, consumption, and challenges in Indonesia. The increasing popularity of certain varieties and the growing awareness of guava's health benefits offer promising avenues for the fruit to transition from a minor to a major tropical fruit in the Indonesian market.

2.4. The status of guava production in Malaysia and the breeding program in MARDI – Mr. Ahmad Hafiz Baharom, MARDI, Malaysia

Mr. Hafiz provided an overview of the current status of guava production in Malaysia and highlighted the ongoing guava breeding program at the Malaysian Agricultural Research and Development Institute (MARDI).

He began by providing some background to the fruit. Guava, recognized as a superfruit, boasts high antioxidant content, including lycopene and anthocyanin, and holds the highest vitamin C content among tropical fruits. Guava offers health benefits such as lowering cholesterol, regulating blood sugar levels, controlling blood pressure, and enhancing the immune system.

Guava is considered a minor crop compared to the top five popular crops in Malaysia. Mr Hafiz further reported that guava production in Malaysia has faced a declining trend. The planted area has decreased by 58.2% since 2017, resulting in a 55.7% decrease in total production from 84,288 metric tons in 2017 to 37,342 metric tons in 2022. This was attributed to the shift by farmers to plant other lucrative fruit types such as durian. The most planted areas for guava in Malaysia are

Johor (532 ha), Perak (486 ha), and Sabah (195 ha).

Mr. Hafiz illustrated the guava products which are widely available in fruit shops, wet markets, night markets, supermarkets, and hypermarkets. Various guava-based products, such as concentrated guava cordial, solar-dried guava, pickles, and tea leaves, cater to diverse consumer preferences.

While Malaysia achieves a self-sufficiency ratio (SSR) of 98%, there is still a 13.1% import dependency ratio (IDR) for guava. Export markets primarily are to neighbouring countries like Singapore, with some presence in Maldives, Germany, the UK, and Brunei. With declining production rates over the recent years, export volumes have also experienced a 47% decline from 1798 metric tons in 2020 to 945 metric tons in 2022.

The selling price of guava at the farm wholesale retail level has increased by 28% to 30% over the past five years (2018-2023), indicative of the sales potential and rising demand. While the wet market typically offers guavas within the price range of 5.00 to 6.00 Malaysian ringgit per kg, at the retail level, it is noteworthy that higher prices are prevalent at hypermarkets such as Jaya Grocer or MBG, which also extend their fruit sales to online platforms.

Malaysia currently has 20 registered guava clones with the Department of Agriculture, with recommended varieties such as GU8 (Kampuchea), GU16 (Lohan), GU9 (Klom Toon Klao), GU10 (Klom Sali). At present, Lohan is the most planted variety in Malaysia. The GU 19 (Pingu) is a new variety (pink guava) registered by a company in the state of Johor.

In terms of accreditation, Mr. Hafiz highlighted that Malaysia through SIRIM BHD (formerly the Standard and Industrial Research Institute of Malaysia) developed standard operating procedures for fresh guava, with the Department of Agriculture introducing comprehensive farming and good agricultural practices through its MyGAP, and before that, SALM.

For meeting export requirements, Malaysia has phytosanitary certificates for the export of guava to destinations like Hong Kong, the Middle East, Singapore, and Canada, and EU countries, while negotiations for certification are underway for South Korea.

Guava cultivation in Malaysia faces challenges such as diseases (scab, anthracnose, nematodes, brown rot), pests (fruit fly, white fly, mealy bug, *Helopeltis*), and increase in production costs, including labour costs (fruit bagging; pruning). In addition, the guava industry is faced with the problem of the lack of superior clones. Furthermore R&D agencies are unable to pursue much research on guava due to the lack of funding and focus by the government for this minor fruit crop. Mr. Hafiz then focused on the nematode infestation on guava. The root-knot nematode is said to be the most pathogenic nematode infecting the fruit. To address some of these challenges, MARDI has focused on a guava breeding program since 2004, with ongoing efforts to address nematode infestation and explore superior cloning resistant to nematodes.

Mr. Hafiz concluded that guava in Malaysia has the potential for further expansion, with consistent demand in domestic and international markets, especially targeting countries such as Brunei, Singapore and Europe. The implementation of good agricultural practices, research and development support in agronomy, P&D and breeding, together with government policy backing under the National Agricultural Policy 2.0 (2021-2030) are crucial for the industry's

growth. Continued evaluation for multi-locational studies for the selection of potential hybrids into the market can also boost the success of the guava industry in Malaysia.

2.5. Developing guava to diversify tropical fruits production, consumption and exports in Fiji – a success story, Mr. Shalendra Prasad, Ministry of Agriculture, Fiji

Mr Shalendra Prasad shared the success of Fiji's guava initiative in expanding the fruit industry. Agriculture forms 8.1% of Fiji's GDP valued at USD690 million, supporting 27% of the population and providing livelihoods for over 83%. Papayas, pineapples, and bananas dominate, yet the Fijian government, recognizing the need for diversification, sets its sights on tropical fruits, with the aim of transforming the agricultural landscape. Fiji's fresh fruit market is valued at USD9.7 million (22 million Fijian dollars), with an import bill of USD 7.5 million (17 million Fijian dollars), predominantly for oranges, apples, grapes, and pears, constituting 80% of consumed fruits. Fijian guava, particularly the white variety was introduced from India and Thailand. The pink guava is cultivated widely across the country, with fruits harvested from the wild and sold at local markets, and used in processing.

Mr. Shalendra then focused his presentation on the white guava which is commercially cultivated. Guava, a resilient choice for tropical climates, thrives in Fiji's warm and humid conditions. Its adaptability and nutritional richness make it a strategic commodity. In addition, its long shelf-life can eliminate or reduce post-harvest losses while also facilitating the extended marketing periods. As part of the Fijian's government's efforts for diversification, guava has been identified as one of the commodities of potential.

The development of guava began with research on varieties from Taiwan, culminating in the release of the 'Green Pearl' variety, tailored for the fresh market. Commercial farming commenced in 2014, marking the onset of guava production in 2015. Experimentation, including grafting, optimal fertilizer use, plant spacing, pest control, bagging of fruits, and tree management via pruning, formed the basis of successful cultivation. The government's policies facilitated orchard establishment, with farmers responsible for land preparation, proper management, application of all recommended inputs in addition to harvesting and marketing of produce. The Fijian Ministry of Agriculture on the other hand was to provide support, seedlings, and regular training, in tandem with the monitoring of orchards. All these are done with the aim of developing the capacity of farmers involved and upskilling. The common practices involved in Fiji for guava production were the raising of rootstock (from seeds of pink guava) and its management, followed by grafting which is undertaken in a nursery. When seedlings are ready for transplanting, staff from the ministry of agriculture assist farmers in the process. This is followed by regular monitoring. Mr. Shalendra too reiterated the importance of fruit bagging for quality fruit production, in addition to the usage of proper crates and equipment for maintaining quality after harvest. Regular field days are also organized for farmers to learn of specific practices that can be undertaken. Marketing strategies encompass supermarkets, hotels, local markets, roadside markets, online sales, and export initiatives.

Guava production witnessed a steady rise after 2014 (nil) to 200 tonnes in 2022, largely attributed with the government policy for establishing orchards and conduct training for farmers, with ongoing efforts to double or triple production in the next five years to reduce imports of other fruits.

Among some of the key success factors were the strong government commitment, selection of committed and resourceful farmers, proper site selection (ideal soil conditions; water source; accessibility), regular trainings (to counter the prevalent perception of farmers that guava is a wild fruit in addition to suitable management practices), and effective monitoring and evaluation for gap identification. Other factors include the commitment of research and extension services in this particular commodity. Support from local business for marketing of the produce was also integral for the marketing of produce.

Some challenges still persist, including pest pressures, particularly mealy bugs and fruit flies, soil fertility maintenance, and limited access to quality planting materials. The future holds promise with guava's potential in organic farming, climate resilience, and heightened health awareness. As a conclusion, Mr. Shalendra stated that guava presents a promising avenue for agricultural diversification, offering farmers in Fiji the opportunity to reduce dependence on a single crop and address the challenges posed by market fluctuations and climate-related risks. Positioned as a climate-resilient crop, guava emerges as a valuable commodity, prompting the government's efforts to encourage the establishment of guava orchards nationwide and raise awareness about its health benefits. The global health concerns underscore the nutritive value of guava, driving demand for both fresh guava and various guava-based products. While Fiji's current focus is not on organic guava production, there exists untapped potential in organic and sustainable farming practices that can be explored, he added. To fully harness these opportunities, it is imperative to bolster research and innovation initiatives. In light of international developments, collaboration through networks like TFNet becomes essential. The wealth of information exchange and mutual assistance within the network can contribute significantly to addressing challenges. Additionally, there is a prospect for certification, taking inspiration from Malaysia's successful My GAP program. Fiji stands to benefit by establishing a certification in quality assurance, especially as Fiji embarks on export ventures. Negotiations are already in progress with several countries.

3.0. Q & A AND PANEL DISCUSSION (MODERATED BY MR. YACOB AHMAD, ADVISOR, TFNET)

The moderator first proceeded to recap some of the key points which emerged from the presentations, which are crucial for consideration.

- a. One notable observation is the practice of leaf cuttings in India, a relatively new approach for Guava cultivation compared to the more traditional methods like marcotting or regular cuttings. Dr. Vasugi highlighted the significance of leaf cutting as an innovative technique.
- b. Additionally, the effectiveness of branch bending in India to enhance shoot development, emphasizing its potential benefits.
- c. Another noteworthy strategy discussed was the adoption of high-density planting, exemplified by the commercially developed 'meadow orchard' approach. This method is viewed as an efficient way to increase yearly productivity in a confined space, suggesting its relevance for practitioners in Malaysia, Fiji, and Indonesia.
- d. Moreover, the concept of schedule manipulation was explored, whereby plants can be manipulated to produce at specific times of the year through the use of hormones, water management, or adjustments in fertilizer application. This strategy, practiced in India, offers the flexibility to optimize production schedules, allowing for strategic market engagement.
- e. Regional variations were noted to influence guava cultivation, such as elevation influencing

quality of fruit and levels of active compounds. These nuances provide interesting avenues for further exploration and consideration.

- f. Bagging, a common practice in Indonesia, Malaysia, and Fiji, was discussed, noting variations in the use of Styrofoam (or none) and plastic bag. The purpose of bagging, particularly in controlling fruit flies, was highlighted as a crucial aspect of fruit cultivation. Moderator acknowledged the need to assess the economic feasibility of bagging considering the labour cost involved.

The moderator then proceeded to address some of the questions posed by participants in attendance:

- a. Optimal time for hand pruning older guava plants –
 - India: Best for pruning to be undertaken during the rainy season. After pruning is done, it was advised to irrigate and apply fertilizers for the production of new shoots.
- b. Effective strategies for controlling fruit flies –
 - India: Integrated management was proposed, and has to start before the harvest of the fruits from the tree (30-45 days prior). Male fruitfly pheromone traps (Methyl Eugenol) should be installed (5-6 traps per acre). It was also important to ensure that fruits are not ripened on the tree. To eliminate completely the source of inoculum, fallen fruits must be properly disposed. Bagging was not frequently practiced in India. However, if needed, its cost effectiveness for Indian conditions had to be ascertained first.
 - Indonesia: In Indonesia, the approach involves wide-area management of orchard areas. Healthy young fruits are selected before bagging and sprayed to prevent both diseases and insect infestations. For red varieties, newspapers are utilized, while for crystal guava, recycled plastic bags and netted Styrofoam covers are repurposed. This not only safeguards against fruit flies but also protects from issues like sun scorch and physical damage especially for the high-value crystal guava.
 - Malaysia: Focus on early intervention, targeting young fruits. Employing integrated pest management (IPM), fruit fly traps are utilized, pre-bagging, insecticide sprays, and meticulous selection of uninfected fruits before bagging to ensure high-quality produce.
 - Fiji: Fruit cleaning and bagging are performed on the white guava variety which is the predominant variety in Fiji. From prior knowledge. Mr. Shalendra stated that bagging is difficult for the pink variety, which has higher fruit load. For such situations IPM technology should be integrated.
 - China: Insecticide is sprayed before bagging.
- c. Post-harvest technology for guava export -
 - India: Pre-harvest standards must be adhered to, especially the control of pests and diseases. Guavas are harvested at colour break stage, when matured but not ripened. Cutting of fruits during harvest should be done with care to ensure no bruising. After sorting and grading based on size, washing with approved chemicals is crucial. Hot water treatment, cooling, and packing in labelled cardboard boxes are standard procedures. Additionally, ethylene absorbents, salicylic acid and 1-MCP are employed to enhance shelf life.
- d. Associated costs of bagging – Dependant on variety; varieties of good market appeal could be bagged (i.e., Crystal guava in Indonesia); bagging leads to lesser use of insecticides; less problem of scorching; bagging also ensures colour of fruit is maintained. In some cases, bagging is not economical

- e. Funding for guava development – Funding in agriculture depends on each country’s priorities. Each country has targeted funding measures for developing the fruit industry further, depending on fruit types, scale, priority, and policy focus;
- f. Suitable size of fruitlets before bagging -
 - Indonesia: 2-2.5cm in size
 - India: Medium sized fruits preferred (bigger than a lime); approximately 180 to 200g
 - Fiji: the size of a chicken egg
 - Malaysia: the size of a ping pong ball
- g. The availability of wilt disease resistant varieties in China – The local variety (Yan Zhihong) is observed to be resistant to wilt;
- h. Adoptability of the Mu Gua variety in China – Not popular in China
- i. Maturity indices of guava for export and for local market –
 - India: Harvested at colour break stage; for distant market need to ensure fruit does not ripen on the tree;
- j. Feasibility of guava as a mixed crop:
 - India: Guava is grown under wide spacing, with conventional spacing (5x5m) it takes 4 to 5 years for canopies to interlock. Hence during this period, interspaces can be utilized for other short term fruit crops such as papaya (1.8m X 1.8m) ; for humid conditions pineapples can be cultivated. However, need to take note of the different spacing being used to cultivate guava. The above recommendation is only useful in wide spacing only.
 - Indonesia: Most orchards in the country produce guava as a monocrop. However, some farmers plant sweet potato as intercrops, prior to canopy interlocking, consequently reducing the costs of weeding.
 - Fiji and Malaysia: Guava is mostly planted as a monocrop due to its non-seasonal nature and profitability (i.e, Fiji)

Currently, guava faces challenges in categorization, often being grouped with mangoes in trade data (FAO-UN data under code HS 080450). However, efforts are underway to recategorize and establish guava separately as a distinct fruit. The central question emerged: should guava be considered a minor or major fruit? The answer to this question depends on one’s perspective and the interpretation of trade data.

The moderator further explored the strategy for elevating guava to the status of a mainstream fruit. This involves delving into the allocation of resources, research efforts, and energy toward this goal. An essential consideration is the primary consumer base for guava. Is it limited to Asians or Asians in the diaspora, or does it extend globally? This becomes crucial when contemplating export destinations like Europe or the US. Understanding whether guava consumers are predominantly Asians or if the fruit resonates equally with Westerners is vital. The dynamics of export trade often originate from Asian countries where guava is cultivated, reaching consumers abroad. Scrutinizing these aspects is imperative.


Taking inspiration from successful models for other fruits, such as Cavendish for bananas, MD2 for pineapples, and Montong and Musang King for durians, and Haas for avocados, there is potential in identifying specific, globally embraced varieties for guava. This approach could contribute to the broader recognition and acceptance of guava as a mainstream fruit. Going along this point, the moderator posed the question on the possibility whether one main ‘super guava’ variety can be developed.

Responses gathered from panellists included -

- a. India: Viable possibility to strategically identify clusters for guava cultivation, distinguishing between traditional guava growing areas and non-traditional ones, taking into account soil and climatic requirements. By pinpointing these areas, a comprehensive package of cultivation practices, support mechanisms, and other necessary resources can be provided. Simultaneously, the development of an effective marketing channel and value chain becomes crucial for the success of guava cultivation. This approach aims to streamline the entire process from cultivation to market distribution, and ensures year-round market availability.
- b. Indonesia: Guava should be considered as a tropical apple. Crystal guava has the potential of being introduced to the global market. However, better cultivation practices etc need to be in place to improve the shelf life of the fruit. Thus, more R&D needs to be devoted on specific varieties (better taste, longer shelf life, medium sized).
- c. Malaysia: Currently, at MARDI, the emphasis remains on seeded guava varieties, with ongoing efforts to explore and develop seedless varieties. This strategic focus is driven by considerations such as global demand, particularly from regions like Europe, and the preferences within the supply chain. Understanding whether there is a preference for seeded or seedless guava varieties is crucial in catering to diverse consumer tastes and market demands. When navigating the development of guava varieties, aligning with global preferences becomes a key factor in ensuring the success and acceptance of these cultivated varieties in the market.
- d. Fiji: Inclined towards promoting guava as a health-oriented fruit, specifically focusing on varieties suitable for fresh consumption. While it is possible, achieving this goal will require significant effort. Notably, in Fiji's promotion efforts, white guava is positioned as a fresh table guava, with a primary focus on its appeal in fresh consumption rather than processing. Pink guava and other guava varieties are prioritized for processing purposes. In the current context, it's essential to acknowledge that while there are other fruits with similar considerations, guava stands out as a fresh and table-friendly fruit.
- e. Potential of guava varieties from China to enter global market: The guava production landscape is distinctly divided into two categories. On one hand, there are smallholders who engage in guava cultivation, often catering to specific purposes such as tourism. On the other hand, a significant portion of the market is controlled by large companies. These major players predominantly focus on commercial guava production intended for the broader market.

The moderator highlighted that major players, often large companies like Dole and Del Monte, typically drive initiatives in the fruit industry. Drawing parallels to the success of Cavendish and MD2, both associated with prominent companies, it raises the question of whether a similar approach is needed to stimulate the growth of the guava industry. The suggestion is that a strong, influential company might be essential to catalyse the development of guava. While this remains a point for discussion, the observation highlights the potential impact of significant industry players in driving the trajectory of guava's market presence and growth.

As a conclusion, the moderator congratulated all panellists for the comprehensive presentations, and sharing unique experiences from their respective countries. While these experiences varied, they collectively conveyed a positive signal for the global expansion of guava. The moderator further put forth the notion of guava obtaining mainstream status within the next decade, acknowledging that this aspiration is easier said than done. Nevertheless, considering the evolving dynamics of global fruit trends, international trade, and geopolitical landscapes, there



is optimism for increased opportunities for guava in the future. To capitalize on this potential, focus should be on:

- a. targeted research and development for superior guava varieties, implementing efficient production and management systems, embracing mechanization,
- b. adopting an assertive approach in commercializing the guava market.
- c. The emphasis also lies in integrating guava as a valuable component of a diverse daily fruit intake. The aim is to position guava as a complementary choice that pairs well with other fruits, offering a nutritious and appealing combination for consumers.

4. SLIDES - SUSTAINING GUAVA PRODUCTION FOR THE DOMESTIC AND EXPORT MARKET IN INDIA - DR. C. VASUGI, IIHR-ICAR, BANGALORE, INDIA



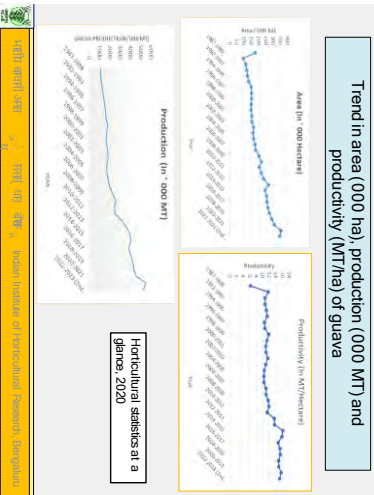
1

- Why guava cultivation?**
- Highest anti-oxidant activity (496 mg/100 g) among the fruits (Source: Steeranu et al., 2011; Food Res. Internl.)
 - Value addition and wide consumer preference
 - India is the world leaders in guava production (4.4 million metric tonnes with a share of 45%)
 - Important commercial fruit crop (fifth most crop) of India
 - Number of problems that impact guava productivity and quality like guava wilt (up to 80 % loss)& nematode and Lack of adoption of modern H-tech horticultural practices.

4

- Topic Division**
- ❖ Background
 - ❖ Guava production scenario: India
 - ❖ Improved varieties
 - ❖ Ways to sustain guava production (clean planting material , GAP, Canopy management, HDP, INM, IPM/IDM, PHT and Marketing)
 - ❖ Challenges- Problems
 - ❖ Conclusion
 - ❖ Way forward

2



5

- Why guava cultivation?** *Parium guajaval.*
- Native : Southern Mexico to Central America
 - Wider adaptability and hardy nature to withstand drought and salinity
 - It is precocious & prolific bearer
 - Made available throughout year due to current season bearing
 - Offers nutritional security Vitamins (A, B and C), minerals (Iron, calcium, phosphorus, potassium, magnesium) and anti-oxidant (Carotenoids such as phytofluene, β-carotene, β-cryptoxanthin, γ-carotene, lycopene, rubixanthin, cryptoflavin, lutein, and neochrome)

3

Selected State-wise Area, Production and Productivity of Guava in India (2022-2023-2nd Advance Estimates)

States/UTs	Area (in '000 Hectare)	Production (in '000 Metric Tonne)	Productivity (in MT/Hectare)
Andaman & Nicobar Islands	015	0.41	2.78
Andhra Pradesh	31.2	488.21	15.00
Assam	5.92	130.22	16.8
Bihar	29.85	431.87	14.5
Chhattisgarh	20.47	199.64	9.75
Gujarat	14.52	178.08	12.26
Haryana	15.98	189.71	11.89

6

- Arka Rashmi**
(Kansari x Purple Local)
- Fruit weight: 200-220g
 - TSS: 12° Brix
 - Fruit shape: Round
 - Pulp: Deep pink with good flavour
 - Seed softness: Medium (4-6 kgf)
 - Ascobic acid: 235mg/100g
 - Lycopene: 6.3 mg/100g
 - Semi-vigorous -Amenable for high density planting
 - Bearing : Precocious and prolific bearing
 - Suitable for both table and processing



13

- Arka Pooma (H 13-14)**
It is from the cross Purple local x Allahabad Safeda
- Fruit weight: 200-220g
TSS: 11° Brix
- Fruit shape: Round with smooth shiny peel
- Pulp: White with thick outer pulp, good flavour and keeping quality
- Seed softness: Medium (4 to 6 kgf)
- Ascobic acid: 190-200 mg/100g FW
- Semi-vigorous & prolific bearing -Amenable for high density planting, suitable for both table purpose and processing (Osmotic dehydration of rind)



Arka Pooma



Arka Pooma
(H 13-14)

14

- Pusa Anarshi:**
Selection from Pant Prabhat x Arka Kiran.
- Fruits are pink pulped, round in shape, less seeded with small seed core having excellent nutritional and fruit quality traits.



- Pusa Pratiksha:**
Selection from Hesar Safeda x Purple Guava.
- Fruits are large in size, round in shape soft seeded, white pulped with small seed core having excellent nutritional and fruit quality traits



Pusa Pratiksha

17

Improved varieties-QSH, Lucknow

Lalit

- High yielding variety, responsive to pruning and HDG
- Round fruits, 150 g, pink pulp,
- Suitable for both table and processing

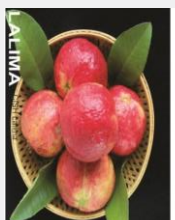


Shweta

- Semi-vigorous, medium height and prolific bearer
- Round fruits, 225 g, white pulp,
- With good keeping quality



15



DHAWAL

Half sib selection from Allahabad safeda. Fruits are round, medium in size (200,250 g) with smooth surface, pulp is white with few soft seeds, sweet in taste with a TSS of 13-14° Brix.

GISH LALIMA

Half sib sib from Allahabad safeda, heavy bearer, Medium fruits, white pulp soft & less seeds

16

Allahabad Safeda

It is the most popular variety of India and the progenitor of many Indian varieties with less seeds

Fruits are medium in size (180to 200 g)

Pulp is sweet with pleasant flavour



Allahabad Surkha

It is an outstanding variety of large uniform pink fruit with deep pink flesh

The plant produces up to 200g fruits in the sixth year of fruiting.

These are vigorous, dome-shaped and compact.

The fruit is sweet and strongly flavoured with a few seeds



18

19

L-49 (Sunder)
Pear Probhut

20

Kohir safed
 Kohir X Allahabad safeda
 High yielding
 Vigorous
 Big sized fruits
 Soft seeds

Safed jam
 Allahabad safeda X Kohir
 Soft seeded
 Good quality
 Large fruits

21

Hisar Surkha
 Apple colour X
 Banarasi Surkha
 Fruits are round,
 average fruit weight 86g,
 pulp pink, seed count medium,
 skin yellow with red dots.

Hisar safeda
 Allahabad Safeda X Seedless
 Upright tree growth with compact
 crown.
 Fruits are round with smooth
 surface.
 average fruit weight 92 g,
 creamy white pulp, less
 seed content

22

MPUAT S1
 Seeding selection, Round frs, red skin & attractive, medium hard seeds with low density

MPUAT S2
 Seeding selection, Round frs, greenish yellow skin, gritty, medium size with 200 g wt, TSS is 16.5 B

23

Varieties from ICAR Umiam, NER, Meghalaya.

Megha Seedless : Selection from local germplasm. Less seeded, high yielding, suitable for fresh fruit consumption and processing.

Megha Supreme : Sour type X Red fleshed : High yielding, suitable for fresh fruit consumption and processing. Moderately tolerant to fruit fly and stem borer

Megha Magenta : Red Fleshed X Allahabad Safeda : Coloured high yielding, suitable for table purpose and processing. Moderately tolerant to Anthracnose fruit rot, fruit fly and stem borer and tolerant to frost and moisture stress.

Megha Wonder : Lucknow 49 X Pear Shaped : Drooping nature and high yielding, suitable for table purpose and processing.

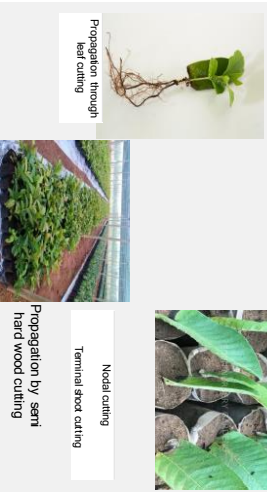
24

2. Use of clean planting material

- ❖ Obtaining quality planting material through certified nurseries (Mitigating biotic stresses, Minimizing use of plant protection chemicals)
- ❖ Learning of varieties to certified nurseries and regular visit of subject specialists to the licensed nurseries for quality checking - genetic purity, freedom from pests and diseases, Adoption of recommended nursery standards
- ❖ Rootstock breeding (Resistant to biotic stress, Dwarfing to suit HD?)
- ❖ Import of planting materials with prescribed regulations

Visit to certified nurseries

3. Mass multiplication of by adoption of advanced propagation techniques



25

4. GAP (Good Agriculture Practices) for quality fruit production

- Covers the control points and compliance criteria necessary to be followed by the producers
- Ensure food safety, occupational health/safety and make farming practices environment friendly
- Enables traceability through complete integration of food chain
- Record keeping - starting from cropping site to harvest & marketing
- Reputation in the international market for quality produce

26

4. GAP (Good Agriculture Practices) for quality fruit production Indian Standard IS 6930 (Part 1) : 2010

- ❖ Indian Standard (Part 1) has been formulated to standardize crop based agricultural practices in India keeping in mind the best of international practices and suiting the needs of the Indian farmer.
- ❖ It covers the control points and compliance criteria necessary to be followed by the producers (individual growers and/or members of a grower group) of crops.
- ❖ Objective: to ensure food safety, occupational health/safety/welfare

27

Benefits of following standards in good agricultural practices

- ❖ Development of basic infrastructure at the farm level
- ❖ Build up culture for good agricultural practices by the farmers
- ❖ Uniform approach across farms regardless of their sizes
- ❖ Increased awareness among the farmers as well as the consumers about the need for consumption of good quality and safe food
- ❖ Traceability through complete integration of food chain
- ❖ Improvement in the environment as well as soil fertility
- ❖ Worker's safety and welfare
- ❖ Reputation in the international market as a producer of good quality and safe fruit produce
- ❖ Removal of Technical Barriers to Trade (TBT) faced by exporters of agro products.

28

5 Crop regulation for quality fruit production

- ⊗ Sub-tropical: **Two bahars** (flowering) in a year
 - ⊗ Tropical : **Three bahars**
- ⊗ Ambe bahar: **spring** ⊗ Mig bahar : **monsoon** ⊗ Hasli Bahar-**Autumn**
- (February-March) (June -July) (October-November)
- rainy(July-Sept.) winter (Nov-Jan) spring(Feb-April)
- ⊗ **Rainy** season crop of guava is of **poor fruit quality** and is affected by many insect-pests compared to winter crop.

29

- Crop regulation Techniques
- ❖ **Withholding irrigation** : In Pennsular India : (Dec to June or until the beginning of monsoon).
 - ❖ **Root exposure and root pruning** : In West India: to suppress rainy season crop & to get a good winter crop.

- ❖ **Pruning** : In Northern India : **Pruning 3/4th and half of current seasons** shoot growth of spring flush during 1st week of May to avoid rainy season crop.
- ❖ **Flower and fruit thinning**: Manual & naphthalene acetic acid (NAA), at 100-800 ppm, Naphthalene acetamide @50-75 ppm, carbaryl at 300 ppm, ethephon 300-500 ppm, 2,4-dichlorophenoxy acetic acid (2,4-D) 30-50ppm and urea 10-15% (North India) Use of CCC (500 ppm) induced the **earliest flowering** and increased number of flowers, fruit set retention and yield.

30

- ❖ **Branch bending**
- ❖ Induce **new fruit bearing shoots** in **any season** and can regulate fruit production according to local market.
- ❖ **Auxin** accumulated in the tip of the branches **gets diluted** and helps in enormous number of **new lateral shoots**.
- ❖ **Dormant lateral buds** get **activated** by means of suppressing the **apical dominance**.
- ❖ **More flowering** is induced by maintaining **higher C: N ratio** and stimulating **proline biosynthesis** under an episode of stress.
- ❖ Branch bending is usually practiced at **conventional plant density (5x5m spacing)** as it requires more space.
- ❖ It is practiced from **2 years to 8 years** old plants to get crop as per the desired time.

31



Shoot Bending : An Unique Technique of Crop Regulation in Guava



32



Shoot Bending : An Unique Technique of Crop Regulation in Guava



33



Bending of branches



Untying of bent branches

34



35



36



6 Rejuvenation of old and unproductive guava orchard



37

7. Productivity increase through HDP

How to increase return per unit area?

- High density planting /ultra high density/meadow orcharding
- Canopy architecture
- Increase nutrient use efficiency through fertigation linked to crop growth stages



38

Concept

- ❖ Planting at closer spacing
- ❖ Higher and quality production through judicious canopy management and adoption of suitable tree training systems
- ❖ **CSH, Lucknow** developed Meadow Orcharding technique
- ❖ Better light distribution
- ❖ Promote photosynthesis that leads to high yield per unit area.
- ❖ Enhancing productivity with reduced production costs.
- ❖ 5000 plants/ha planted at 2.0 x 1.0 m spacing and managed with regular topping and hedging especially during initial stages
- ❖ Topping and hedging in guava are helpful in controlling tree size and extending fruit availability.

39

Conventional

- Yield after **two** years
- Average yield is **12-20t/ha**
- **Difficult** to manage due to large tree size
- **Large canopy, poor sunlight penetration** and poor quality fruits.

Meadow

- Yield from **first** year
- Average yield is **40-60 t/ha**
- Easy to manage due to small tree size
- **Easy**, Small canopy, better air and sunlight penetration, minimum disease incidence and high quality fruits with good colour development

40

Plant densities under high density & ultra high density

- ❖ 3.0m (row to row) x 15m (plan to plant) : **2222 plants ha-1**
- ❖ 3.0m (row to row) x 3.0m (plant to plant) : **1111 plants ha-1**
- ❖ 6.0m (row to row) x 3.0m (plant to plant) : **555 plants ha-1**
- ❖ 2.0 x 1.0m spacing (Ultra high Density/ meadow) : **5000 plants ha**

41

Yield under different densities (CSH, Lucknow)

Density	3 rd year	4 th year	5 th year	6 th year	7 th year
3.0 x 1.5 m (2222 plants)	26.0	38.0	47.0	52.0	55.0
3.0 x 3.0 m (1111 plants)	18.0	26.0	30.0	35.0	38.0
6.0 x 3.0 m (555 plants)	11.0	17.0	24.0	28.0	31.0
6.0 x 6.0 m (277 plants)	6.0	12.0	15.0	19.0	27.0
Yield under meadow orchard system (cones/ ha)					
2.0 x 1.0 m (5000 plants)	13.0	25.0	40.0	50.0	60.0

42

Canopy Management

- ❑ Untrained or unpruned guava trees become **huge and unmanageable** after a couple years of growth.
- ❑ The **bearing area is reduced** and the interior portion of the plant becomes entirely devoid of fruiting.
- ❑ Trees are pruned to increase the yield of quality fruits by **eliminating crowded and criss-cross** branches.
- ❑ Pruning begins at an early stage of plant growth to develop **single trunk trees** with well spaced scaffold branches to form the frame work.
- ❑ **Apical growth** is to be controlled within the first year of planting for better canopy architecture.
- ❑ Trees are topped to a **uniform height of 60 - 70 cm from the ground level**, two-three months after planting (under **medium/high density**) to induce the emergence of new growth below the cut point. In **meadow orchard**, it is topped at **30 to 40 cm**

43

- #### Harvesting (Meadow orchard)
- ❖ Generally done in **January-February** from the May-June pruned shoots
 - ❖ After harvest, the **pruning is done above** fruiting points.
 - ❖ **New shoots emerge** after pruning of shoots during January-February.
 - ❖ On these shoots, **flowering** takes place and fruiting is obtained during July-September.
 - ❖ **Second** time pruning is done in **May-June**.
 - ❖ After pruning, once again shoots emerge and flowering take place, which yields fruits during **December-February**.
 - ❖ These shoots are further pruned for the **third** time in **September - October**.

46

- > As a result, new shoots emerge.
- > Three to four equally spaced shoots are retained around the stem to form the main scaffold limbs of the tree.
- > These shoots are allowed to grow for 4-5 months after topping until they attain a length of about 40 - 50 cm.
- > The selected shoots are further pruned to 50 per cent of their length for inducing multiple shoots from the buds below the cut end.
- > Newly emerged shoots are allowed to grow up to 40-50 cm and are pruned again for the emergence of new shoots.
- > After two years, the short branches within the tree canopy produce a compact and strong structure.
- > All the plants are confined to a hedge shape of 2 m inter-row width and 2.5 m height for which pruning is performed in January-February and May-June every year.

44


- #### Harvesting (contd.,)
- ❖ It is done primarily for better canopy architecture.
 - ❖ As a result of **pruning in October**, fruiting is obtained in March-April.
 - ❖ This is the technique for maintaining the meadow orchard for optimum production and dwarf tree size.
 - ❖ The height of plants is restricted to **10m**, while an average production of **10-12kg fruits/plant** is obtained every year.
 - ❖ As harvesting is easy in a meadow orchard, no damage occurs to the fruits.

47

- ### Pruning
- ❖ In **meadow** orcharding shoot pruning is done **thrice** a year.
 - ❖ This leads to **desired canopy** development.
 - ❖ Though fruiting starts in the same year, one can not expect fruits on each and every shoot.
 - ❖ Pruning is continued so that **plants remain dwarf**.
 - ❖ After a year, pruning operation is done especially in May-June, September-October and January-February.

45

Meadow orchard- Guava



5000 plants/ha, planted at 2.0 x 10 m
12-20 tons Vs 40-60 tons (5 - 6m - 400 plants/ha)
8 months first crop

48



Field view of Meadow orchard

49



Meadow orchard in fruiting

52



Field view of Meadow orchard after pruning

50



Meadow orchard - Single trunk

53



Field view of meadow orchard after pruning- close up

51



After 5 years (Back pruning)

54



After back pruning, emergence of new shoots

55



Retain only two shoots in each main branch after back pruning, then repeat as per flow chart- Part A (GSH, LKO)

56



Canopy management under Different Density Planting in guava

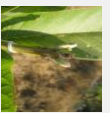
Factor - 1 Plants in different spacing

57

Pruning of shoot for flowering and fruit setting



Point of pruning

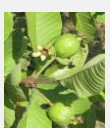


Sprouting of pruned shoot



Fruit setting

New shoots emerge with profuse flowering



58

8. Integrated water and nutrient management

- ❑ Water saving : Drip irrigation, Partial Root Zone Drying, Sub irrigation
- ❑ Rainfed conditions: *In situ* moisture conserving (mulching, coconut husk)
- ❑ Application of nutrients through Fertigation - About 75-80% recommended N & K through water soluble fertilizers at 15 days interval and P through soil application (savings of 20-25 %N and K fertilizers)
- ❑ Creation of water resources, individual and community tanks
- ❑ Deficiencies of zinc and boron are common in guava. Soil application of ZnSO₄ as per soil test or foliar spraying of 0.5 %ZnSO₄ and 0.4 %boric acid 10-14 days before flowering is effective in managing deficiencies.

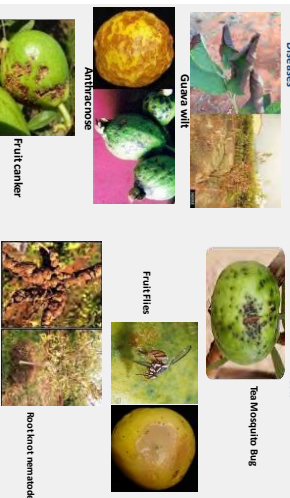
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8. Integrated water and nutrient management

- Integrated Nutrient management & organic farming**
- ❑ Application of organic manures as well as inorganic fertilizers
 - ❑ F/M: 10 kg +M:C 20 g +N:em cake 250 g need to be applied in pits two weeks before planting and to be repeated every year
 - ❑ F/M enriched using bio agents viz, *Trichoderma harzianum*, *Pseudomonas spp* +Phosphate Solubilizing Bacteria (PSB) @one kg each per tonne of F/M
 - ❑ Green manuring & cover cropping (Sun hemp or green gram or velvet bean can be grown as green manure crop)
 - ❑ Enhanced Nutrient Use Efficiency Through foliar fertilization, Bio-fertilizers Nutrient solubilizing microorganisms (mycorrhiza)

60

9 Integrated Pest and Disease management



61

10 Support to marginal and small farmers including women 11. Knowledge based centres of excellence and HHD support

Marketing aspects in India

As processed products

1. Guava jelly
2. Guava leather (Red and White pulp)
3. Guava pulp
4. Guava puree
5. Blended FRS Beverages (20% Apple pulp, 30% orange and dairy products)
6. Guava Ketchup
7. Tofees
8. Guava leaf powder



Fresh fruits



62

Export of fresh/processed guava from India

Minimum Quality Standard Requirement For Export as per FAO

In all cases, subject to the special provisions for each demand the violaneros allowed, the guavas must be:

- o Whole
- o Sound, produce affected by rotting or deterioration, such as to make it unfit for consumption (excluded)
- o Clean, practically free of any visible foreign matter
- o Practically free of blemishes and the general appearance of the produce
- o Practically free of damage caused by pests.
- o Free of abnormal external moisture, excluding condensation following removal from cold storage
- o Free of any foreign smell and/or taste
- o Firm
- o Practically free of bruising.

63

Export of fresh/processed guava from India

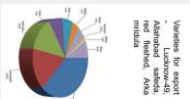
- ❖ India is the largest **producer and exporter of guava pulp**
- ❖ The tropical **pink guava puree** shares a market share of **55.3%**
- ❖ The **white guava puree** shares a market share of **40%**
- ❖ The food processing industry enhances the worldwide guava puree market
- ❖ In 2021-22, India exported guava worth more than **Rs. 5000 crores**
- ❖ According to the Ministry of Commerce and Industry, the export of guava from India has registered a growth of **280%** since 2013
- ❖ It increased from **US\$ 0.58 million** in April-January 2013-14 to **US\$ 2.09 million** in April-January, 2021-22 i.e. more than **Rs. 150 million**

64

Export of Guavas (Fresh/Dried) from India

Value in MT
Value in Rs. Lacs

Countires	2015-16	2016-17	2017-18
	Qty Value	Qty Value	Qty Value
United States	0.00 0.00	2227 14.85	1830 97.02
United Arab	21584 97.51	10637 59.82	7883 84.55
Emirates	2797 18.7	3181 28.53	36.4 70.8
Nepal	53737 158.00	40388 112.00	38248 58.61
Oman	57.24 33.41	27.27 17.25	6253 327
Saudi Arabia	88938 306.1	15657 91.98	7318 3872
Uganda	300 17.5	404 1.93	4823 2833
Kuwait	514 4.04	4382 25.19	43.35 23.98
Netherlands	0.20 0.13	54.4 32.91	51.1 20.95
Malaysia	4.36 23.48	5262 21.77	59.40 20.63
Bahrain	43.80 23.48	3767 20.57	77.67 17.08
Others	1198 59.68	47871 225.08	10383 62.55
Total	19372 7823	148818 80.81	12873 55.38

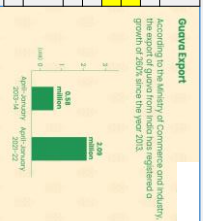


65

Export of fresh/processed guava from India

Country	Quantity (MT)	Value (Rs. Lacs)
Nepal	352.49	55.61
USA	153.06	97.02
UAE	11835	84.55
Qatar	98.19	70.81
Bahrain	77.67	17.08
Saudi	73.16	36.27
Arabia	62.99	37.21
Oman		

➤ The Guava Market size is estimated to reach \$1250 million by 2027. Furthermore, it is poised to grow at a CAGR of 4.5% over the forecast period of 2022-2027. (Source: OAGR & AEC Report)



66

Export performance of Guava in the last four years: All India

HS Code	Description	2018-19	2019-20	2020-21	2021-22
08045010	Guavas Fresh/Dried	0.67	0.75	1.27	2.7
20079920	Guava	7.38	7.4	7.28	8.07
20089994	Guava prepared and preserved	0.08	0.11	0.04	0.07



Source: Eim analysis, DGCS

67

Export Analysis of Guava and its products: 2021-22*

No.	State	Value USD Mn	Destination
0	All India	2.71	Nepal, UK, Tanzania (+30)
1	Madhya Pradesh	1.07	Nepal, Sweden, UAE (+3)
2	Uttar Pradesh	0.75	Tanzania, Netherlands, Mexico (+2)
3	Tamil Nadu	0.55	Catar, Bahrain, Oman (+3)
11	Karnataka	0.01	

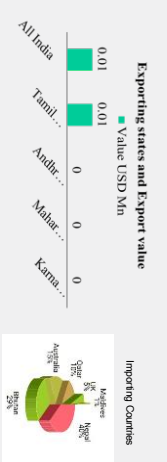


Source: Eim analysis, DGCS

68

20089994: Guava prepared or preserved

No.	State	Value USD Mn	Destination
0	All India	0.01	Nepal, Bhutan, Australia (+3)
1	Tamil Nadu	0.01	Nepal
2	Andhra Pradesh	0.00	Bhutan
3	Madhya Pradesh	0.00	Australia, Qatar, Maldives
11	Karnataka	Nil	NA



Source: Eim analysis, DGCS

70

Exporting states and Export value



Source: Eim analysis, DGCS

68

Regulators and Service providers

KdI Organization	Service	Contact
Agricultural and Processed Food Products Export Development Authority (APEDA)	FCIMC Market survey and assistance.	1st Floor, Bheja Bhanu, Bellary Rd, Hebbal, Bengaluru - 560024. E: apeda@apeda.gov.in
2 Karnataka State Agricultural Produce Processing and Export Corporation Limited (KAPPEC)	PURFME Scheme	17, Richmond Rd, Shivamala Nagar, Richmond Town, Bengaluru - 560025. E: ksdppcc1988@gmail.com
3 Directorate General of Foreign Trade (DGFT)	IEC, Customs and DEECATE	6th floor, Kondriva Sadan, C & E Wing, 17th main, Koramangala 2nd Block, Bengaluru - 560004. E: bangalore
4 Plant Quarantine	Phyto Sanitary certification (SPS)	Head Office, Bengaluru Road 11A, Farm Post, Bengaluru - 560024. E: dfr@qis.kvafv.in
5 BIAL, Coal Port	Freight and Right	KALU Road, Davanahalli, Bengaluru - 560030. E: mfr@www.bial.in

71

20079920: Guava

No.	State	Value USD Mn	Destination
0	All India	8.07	Netherlands, Indonesia, Saudi Arabia (+4)
1	Tamil Nadu	2.66	Indonesia, USA, Netherlands (+2)
2	Madhya Pradesh	1.89	Saudi Arabia, Netherlands UK (+14)
3	Andhra Pradesh	1.89	Yemen, Tanzania, Netherlands (+20)
11	Karnataka	1.17	Indonesia, USA, Netherlands (+9)



Source: Eim analysis, DGCS

69

Challenges in production and marketing of guava

- Attack of biotic (viral, nematode, canker, and insect pests like fruit fly, tea mosquito bug etc) and abiotic stress (drought)
 - Physiological disorders, viz., boron deficiency, zinc deficiency and bronzing.
 - Dependence of monsoon
 - Poor orchard management
 - Inadequate availability of agricultural inputs
 - Small and fragmented land holding
 - Market gluts & Price instability
 - Improper harvesting and handling practices
 - Poor infrastructure facilities refrigerated transportation of goods, market infrastructure
 - Less number of processing industries of guava
 - High transportation cost
- Recent Developments
- Oregon Fruit Products: Pink guava puree
 - Celalis Holdings On-The-Go Powdered Slices with a Kiwi-Guava-Lime flavor.
 - Daily Day launched 'Chilli Guava', a delicious scribe like fresh guava fruit.

72

Conclusion

- ❖ The bearing habit of guava makes it amenable for pruning which bears flowers in leaf axils of **current season growth**, thus by adopting good agricultural practices like improved varieties, canopy management, crop regulation, integrated nutrient and water management, integrated pest and disease management, post harvest management practices it is possible to achieve the **desired levels of productivity** coupled with **quality**.
- ❖ India can emerge as a far bigger producer and exporter if sufficient emphasis is given to resource allocation, infrastructure development, more R&D technological up-gradation and better policy framework for this crop

73

Future plan

- ❖ Introduction of new high yielding varieties with multiple traits like resistant to biotic and abiotic stresses coupled with yield and quality
- ❖ Precision farming
- ❖ Research and Developmental Institutions Collaboration
- ❖ Developing proper marketing strategies
- ❖ Strengthening technology development for value addition of guava
- ❖ HRD & training to farmers needed including large scale awareness programs on quality standards
- ❖ Developing proper marketing strategies (Cold-chains with pre-cooling and transportation, terminal market complexes and wholesale bazars, Support for retail markets/outlets, vending carts)
- Farm Mechanization & adoption of innovative methodologies (CT)

74

Thank you!




75

4. SLIDES - RECENT DEVELOPMENTS IN GUAVA PRODUCTION AND MARKET IN CHINA – DR. XUEHUA SHAO FTRI-GDAAS, CHINA,





TF Net 2023
Recent developments in guava production and markets in China
 Institute of Fruit Tree Research
 Guangdong Academy of Agricultural Sciences
 Presented by: Xuehua Shao
 11/2023


Content summary
 I. Development course
 II. Industry status
 III. Variety introduction
 IV. Cultivation technique



Development course




Development course
 1990s Traditional guava
 1979 Introduction of big fruit guava from Thailand
 1980s Introduction of Xin shi guava from Taiwan
 1980s Introduction of Zhuanhu guava from Taiwan
 2021 Guavaing area reached 13,333 hm²



Industry status
 ◆ China produces 4,366,300 tons of guava per year, the main producing area is in southern regions.
 ◆ Planting production in China's main producing areas:

Origin (production)	Guangdong	Fujian	Guizhou	Hainan	Taiwan
Origin (city)	Chaozhou, western Guangxi	Zhangzhou	Yulin	Qionghai	Yilan, Nantou, Zhonglun, Yulin and Pingtung
Variety	Zhenzhu, Yan zhang	Zhenzhu	Yan zhang	Zhenzhu	Zhenzhu
Production (ton)	488,400	114,300	19,900	44,000	205,900


Industry status
Import and export trade

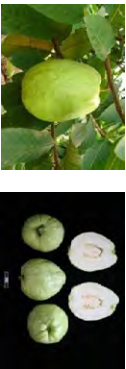
Time	Import volume (ten thousand tons)	Export volume (ten thousand tons)
2015	1599	6799
2020	370	7629
2021	132	

◆ In 2021, export amount was 7.6 million dollars, export price was 1.32 dollars/kg, the import amount was 0.2 million dollars, import price was 1.44 dollars/kg, all imported from Taiwan.
 ◆ Hainan is the largest export market for guava from China. In 2021 year, the export amount was 2,118,700 dollars, accounting for 95.7 percent of 20.02%.

III. Variety introduction

1. 'Zhen zhu' guava (main variety)

The fruit type is large, thick meat, crisp and sweet, high yield, excellent quality and durable fruit. The planting area accounts for 80%.



7

2. 'Di wang' Guava

Proportional variety

Compared with Zhenzhu Guava, larger fruit type, thicker flesh, more crisp and sweet, higher yield, better quality, more durable fruit.

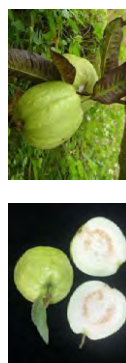


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3. 'Fei cui' Guava

a variety selected from Zhenzhu Guava

The fruit type is large, the meat is thick and crisp, the flavor is sweet and clear, and it is easy to flower, set early and high yield.



9

4. 'Shui mi' guava

No or few seeds

The fruit type is oblate and the surface is irregularly raised. The fruit is crisp and has a high sugar content.

The natural fruit setting rate is low.



10

5. 'Mu gua' guava

No seeds

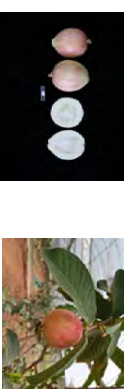
The fruit is large and seedless, irregular fruit type. The fruit surface has a warty budge. The fruit is crisp and has a high sugar content.



11

6. 'Si jihong' guava

The skin is red and the flesh is soft and smooth. The fruit has a rich aroma, high yield and good quality.



12



7. 'Jin douxiang' guava

The skin is yellow and the flesh is soft and smooth.
The fruit has rich aroma and unique flavor, high yield, good quality



13



8. 'Hong baoshi' guava

Red flesh! Taste sweet. High sugar content, but low fruit setting rate.
Nansha District of Guangzhou City recommended planting variety.

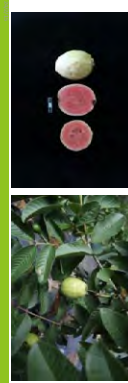


14



9. 'Chao hong' guava

The flesh is bright red and fragrant.
The taste is smooth and soft, but it does not withstand storage.



15



10. 'Yan zhihong' guava

The guava is a famous local good variety in Guangzhou, dense, easy to manage, strong growth, good quality.

It has a large cultivation area in Guangzhou and Guangxi, and its most important feature is that the fruits show a variety of beautiful red colors when ripe, which is lovable.



16



四. Cultivation technique

1. Soil management

Soil loosening: Soil loosening 1-2 times a year, the depth of about 15 cm.
Increase organic fertilizer: Organic fertilizer improves the physical and chemical properties of soil, improves product quality, and also improves disease resistance. Apply twice a year.



17



2. Fertilizer and water management

Growth promotion: A large number of elements N, P, K fertilizer
Improve quality: medium and trace elements Ca, Mg, B, so on
Change soil, promote growth, improve quality: organic fertilizer



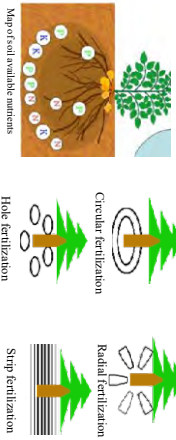
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2. Fertilizer and water management

◆ Fertilization method: Fertilize around the tree crown, commonly used methods are as follows:



19



3. Plastic pruning technique

- ◆ **Control the height:** About 1.5-1.8 meters (opened crown, easy to bag, easy to operate)
- ◆ **Control the diameter:** Branch diameter (cut off cross branches, weak branches, dead branches, disjunct branches, internal branches)
- ◆ **Control branch length:** Result: Main branch 60-80cm (Remove the tender ends above 6-7 leaves, commonly known as core picking)



20

Acknowledgement

International Tropical Fruits Network 2023



Excellent and rare fruit tree laboratory,
Institute of Fruit Tree Research,
Guangdong Academy of Agricultural Sciences
Email: 802131317@163.com
Phone number: 0757-2622838

21



22

4. SLIDES - THE STATUS OF GUAVA PRODUCTION IN MALAYSIA AND THE BREEDING PROGRAM IN MARDI - MR. AHMAD HAFIZ BAHAROM, MARDI, MALAYSIA

1

WEBINAR SERIES ON TROPICAL FRUITS
GUAVA
 8 November 2022 | 1.00pm - 2.00pm (GMT+8) | 1st Floor
 Program of expanding export production and trade

The Status Of Guava Production In Malaysia And The Breeding Program In MARDI

Ahmad Hafiz b Baharom
 Malaysian Agricultural Research and Development Institute

2

GUAVA (*Psidium guajava*)

- Super fruits: high in antioxidant content (lycopene and anthocyanin)
- The highest vitamin C content for tropical fruits

TYPE OF GUAVA

- Fresh eating: Large size, thick flesh, few or no seeds, sweet or crunchy texture
- Process: Seed/peel-less, colored flesh, aromatic and high in acid and vitamin C content

HEALTH BENEFIT

- Lower cholesterol and blood sugar levels
- Blood pressure control
- Improve the body's immune system

3

CURRENT STATUS OF GUAVA PRODUCTION IN MALAYSIA

PLANTED AREA & PRODUCTION OF MALAYSIAN FRUITS, 2022

Fruit	Planted Area (ha)	Production (t)
Apple	1,000	10,000
Avocado	1,000	10,000
Banana	1,000	10,000
Cherry	1,000	10,000
Citrus	1,000	10,000
Coconut	1,000	10,000
Guava	1,000	10,000
Jackfruit	1,000	10,000
Lychee	1,000	10,000
Mango	1,000	10,000
Pineapple	1,000	10,000
Rambutan	1,000	10,000
Watermelon	1,000	10,000

- Planted area declined (59.2%) - 4,180 ha (2017) - 1,749 ha (2022)
- Total production declined (65.7%) - 84,288 tM (2017) - 27,362 tM (2022)
- Per capita consumption: 1 kg/year

Source: Department of Statistics Malaysia (2022)

4

GUAVA MARKET IN MALAYSIA

FRUIT SHOP

HYPERMARKET

Wet market/Night market

Hotels

5

GUAVA PRODUCTS

Guava Candy

Susu dried guava

Guava drink

Muskmelon

Guava tea

Pickle

6

MALAYSIA SELF SUFFICIENCY RATIO (SSR) 2022

Fruit	SSR
Apple	42%
Banana	99%
Cherry	23%
Citrus	11%
Coconut	120%
Guava	38%
Jackfruit	100%
Lychee	101%
Mango	80%
Pineapple	2%

Source: Department of Statistics Malaysia (2022)

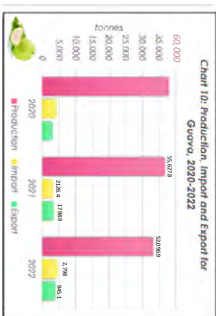
I DR AND PCC

IMPACT DIMENSION: FARM LEVEL		IMPACT DIMENSION: PCC LEVEL	
Year	Value	Year	Value
2018	RM2,051	2018	RM2,051
2019	RM2,051	2019	RM2,051
2020	RM2,051	2020	RM2,051
2021	RM2,051	2021	RM2,051
2022	RM2,051	2022	RM2,051

Source: Department of Statistics, Malaysia, 2021

7

GUAVA PRODUCTION, IMPORT AND EXPORT 2020-2022



Source: Department of Statistics, Malaysia, 2021

8

- Export mainly to Singapore, Maldives, Germany, UK, Brunei
- Export value: RM7.82M/Year

9

MARKET PRICE

Year	FARM	WHOLESALE	RETAIL
2018	RM2,051	RM3,107	RM4,797
2019	RM2,051	RM3,107	RM4,797
2020	RM2,051	RM3,107	RM4,797
2021	RM2,051	RM3,107	RM4,797
2022	RM2,051	RM3,107	RM4,797

• Selling prices at the farm, wholesale and retail levels are increasing every year, showing that sales potential and demand are also increasing.

• Estimated profit margin: Farm - Wholesale: 28%; Wholesale - Retail: 30%.

9

GUAVA REGISTERED CLONE IN MALAYSIA

Clone Name	Registration Year	Origin	Characteristics
Registered Clone (G023): 2018one	2018	Malaysia	...
Recommended clones by DoK:			
1) G04 (Guava)			
2) G04 (Guava)			
3) G04 (Guava)			
4) G04 (Guava)			
5) G04 (Guava)			

10

GU8: KAMPUCHEA



- Registered in 1984
- First fruiting (6-8 months) after planting
- Yield (45-50/ha) (4-5 year)
- Large fruit (150-500g/fruit)
- The shape of the fruit is round and oval
- The flesh is white, thick and very crunchy than 10/ha
- The fruit matures 14-16 weeks after fruit set
- It tastes sweet and sour
- The number of seeds is large.

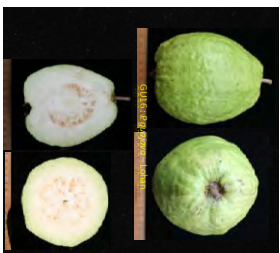
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GU9: Kiom Toon Kiao



- Registered in 1985
- Fruiting period is 10 months after planting
- Yield (45-50/ha) (4-5 year)
- Medium fruit weight (180-300g/fruit)
- The shape of the fruit is round and oval
- The flesh is white, thick and very crunchy than 10/ha
- The fruit matures 14-16 weeks after fruit set
- It tastes sweet and sour
- The number of seeds is large.

12



GUI16: LO HAN

- Registered in 2013
- After opening
- Yield 45-50 T/ha (4-5 years)
- Large fruit size (10kg - 30kg)
- Highly resistant to diseases and pests
- Highly resistant to cold and frost
- Crunchy

Parameters	Value
Fruit weight (kg)	300-350
Fruit length (cm)	9-10
Fruit diameter (cm)	9-10
Fruit thickness (cm)	2-4
Sectorem (cm)	4-6
Leaf area (cm ²)	850

13

ACCREDITATION

Malaysia Standard (SRM) has produced standard operating procedures (SOP) and specifications on both guava and guava products.

The Department of Agriculture has also come out farming practices with Good Agriculture Practices through MY GAP or SNAK.

14

EXPORT REQUIREMENT

Country	Exporting Requirements
Malaysia and Type III (all zones)	1. Phytosecurity Certificate 2. Phytosanitary Certificate 3. Phytosanitary Certificate 4. Phytosanitary Certificate
European Union (EU) Countries	1. Phytosecurity Certificate 2. Phytosanitary Certificate 3. Phytosanitary Certificate 4. Phytosanitary Certificate

Number: Phytosanitary Requirement for Exportation of Horticulture Product from Malaysia, D005/2020

15



16

Nematode infestation on Guava

- 1. A nematode has been associated with guava cultivation. Malaya root-knot nematode (MN) and Guava root-knot nematode (GN) are the most common species. They are found in the soil and on the roots of guava plants.
- 2. MN and GN are both sedentary and non-reproductive. They feed on the roots of guava plants, causing them to become stunted and distorted. The roots become thickened and necrotic, and the plants become yellowed and wilted.
- 3. Above ground symptoms include stunted growth, yellowing, and wilting. CRP yield can be greatly reduced.

Gall formation infected roots

17

HORTICULTURE RESEARCH CENTRE

Instituted in 1986 with combination of the Fruit Research Division and the Horticultural Research Division.

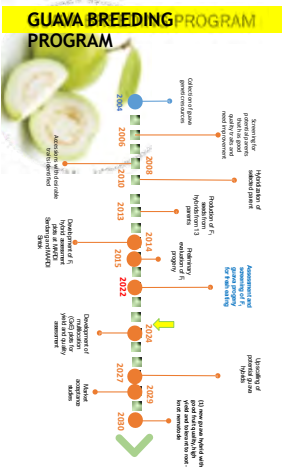
The Horticultural Research Centre is mandated to carry out research for export crops: vegetables, fruits, and ornamentals and commercial tree crops for the export market.

GOALS AND STRATEGIES

- Developing technologies that are appropriate and relevant to the horticulture industry.
- Providing a suitable and viable science to the horticulture industry.
- Enhancing the horticulture industry's productivity and competitiveness.
- Enhancing the horticulture industry's sustainability and resilience.

HORTICULTURE RESEARCH CENTRE
A branch of agriculture research on horticulture, ornamentals, and tree crops.

18



19

Genetic Resources

Origin	No of Accessions
Outside Malaysia	23
Dept of Agriculture	17
Unregistered	34
TOTAL	74



20



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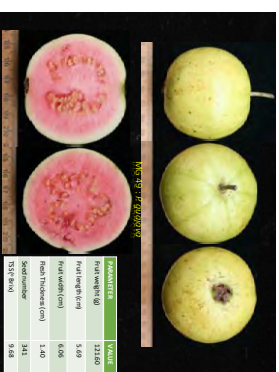
MG01 – Malaysian Red



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25

HYBRID EVALUATION PLOT

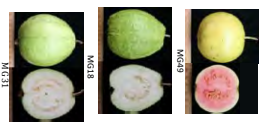


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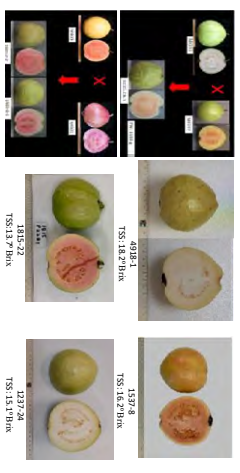
HYBRIDIZATION OF SELECTED PARENTS

Parent 1	Parent 2	Parent 3	Parent 4
MS01	MS02	MS03	MS04
MS05	MS06	MS07	MS08
MS09	MS10	MS11	MS12
MS13	MS14	MS15	MS16
MS17	MS18	MS19	MS20
MS21	MS22	MS23	MS24
MS25	MS26	MS27	MS28
MS29	MS30	MS31	MS32
MS33	MS34	MS35	MS36
MS37	MS38	MS39	MS40
MS41	MS42	MS43	MS44
MS45	MS46	MS47	MS48
MS49	MS50	MS51	MS52
MS53	MS54	MS55	MS56
MS57	MS58	MS59	MS60
MS61	MS62	MS63	MS64
MS65	MS66	MS67	MS68
MS69	MS70	MS71	MS72
MS73	MS74	MS75	MS76
MS77	MS78	MS79	MS80
MS81	MS82	MS83	MS84
MS85	MS86	MS87	MS88
MS89	MS90	MS91	MS92
MS93	MS94	MS95	MS96
MS97	MS98	MS99	MS100

26



EVALUATION AND SELECTION



29

27



WAY FORWARD

- > Guava in Malaysia has potential to expand its production because of consistent demand and market in domestic and export esp. to East Asia countries (Singapore, Bunnai) and Europe
- > Implementation of GAP on guava cultivation procedure
- > R&D support-Agromony/R&D/Breeding/Post harvest
- > Government policy support in National Agricultural Policy 2.0 (2021-2030)

30



ACKNOWLEDGEMENT



31

32





INTERNATIONAL TROPICAL FRUITS NETWORK

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