

INDONESIA MANGO DEVELOPMENT: A RESEARCH AND DEVELOPMENT PERSPECTIVE TO CAPTURE THE OPPORTUNITIES AND FACE THE CHALLENGES IN GLOBAL TRADE ERA

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ABSTRACT

Indonesia is ranked fifth in the world as a mango producing country. Trade balance of Indonesian mangoes have always been at a surplus, although only less than 1% of mangoes are exported. Global as well as local markets for mangoes have remained robust, thus it is important to produce quality mangoes to be accepted into those markets. This paper will discuss the development of mangoes in Indonesia in order to capture the opportunities and face the challenges in the global market era, especially from the research and development perspectives. Currently, mangoes produced that meet the standards of the global market are still limited. Most mango farming is carried out on an extensive small home garden scale. Farmers' awareness of good production practices as well as the application of technology, are still low although many research results have been disseminated. Due to these problems, the trend of mango production has declined owing to the decreasing productivity of mango trees. In 2017, national mango productivity was 10.96 mton/ha, a decrease of 2.32% from the previous year (11.22 mton/ha). To increase the performance of national mango competitiveness, the Indonesian government has massively facilitated the development of mango regions in several regencies. The program becomes an opportunity in disseminating research results because it includes the free distribution of improved and certified seeds, assistance in mango farming technology packages, and also post-harvest technology. Under this program, Indonesia's mango competitiveness is expected to increase especially in productivity, quality, and the capacity to enter the global market.

Keywords: mango, Indonesia, research and development

1. INTRODUCTION

Mango is one of the important tropical fruits in the world. More than 80 countries cultivate mango with a global planting area of more than 2.7 million hectares (Jahurul *et al.*, 2015). The five biggest mango producers in the world are India, China, Thailand, Indonesia, Pakistan, and the Philippines (Trivedi, 2012; Saave, 2013; Wandschneider *et al.*, 2013; Evans *et al.*, 2017). Mango is not only consumed domestically but also exported by these countries. The top five largest importers of mango together with mangosteen and guava in the world are the USA, the Netherlands, the Kingdom of Saudi Arabia, the UK, and Germany with a total export of 1189.10 mton in 2013, an increase of 91.23% from 2010 (Evans *et al.*, 2017). The increase in mango commercialization and also the importance of the commodity reinforces its position as one of the most popular tropical fruits in the world.

In Indonesia, mango is an important tropical fruit that contributes to the national horticulture

development and with the most significant production number after bananas (Indonesian Statistics, 2017). In 2017, production reached 2,203,789 mton. The Indonesian Ministry of Agriculture also states the importance of mango in its 2014–2019 strategic plan, by developing mango production areas under the concept of agro-industry (Indonesian Ministry of Agriculture, 2014). Mango has also been identified as a potential commodity for increasing farmers' income and can support the development of industry and export (Supriatna, 2005). In some regions in Indonesia, mango has been identified by the local and central governments as a competitive commodity (Supriatna, 2005; Anugrah, 2009; Setyawati, 2012; Yuniastuti & Purbiati, 2016; Kusumo *et al.*, 2018; Mukti *et al.*, 2018).

Despite its growing prominence domestically, Indonesia is still left behind from other mango producing countries in the international market. Based on the statistical data from FAO, Indonesia is not in the top 10 mango exporters in the world. Indonesia is also not a significant exporter in Asia (Arifin, 2013). From the perspective of competitiveness, Indonesian mango has a smaller comparative advantage compared to other mango producers in the ASEAN region (Hanani *et al.*, 2009; Pradipta & Firdaus, 2014); with only less than 1% of the Indonesian mango being exported (Wandschneider *et al.*, 2013; Qanti, 2014).

Many factors contribute to the low export and competitiveness of Indonesian mango (Purnama *et al.*, 2014). Problems such as disparity in maturity (Ropai *et al.*, 2013), fruit fly infestation (Hasbullah *et al.*, 2009), the high level of damage due to rapid ripening (Sari *et al.*, 2004; Ropai *et al.*, 2013), seasonal production patterns (Anugrah, 2009; Arifin, 2013), and use of calcium carbide for ripening (Per *et al.*, 2007) are some of the common causes affecting competitiveness of Indonesian mango. Furthermore, mango cultivation in Indonesia is predominantly undertaken by smallholders (Wandschneider *et al.*, 2013), who lack awareness of good production practices, as well as the application of technology. Good maintenance and management practices to produce quality fruits are still lacking, especially in the home gardens of Indonesian mango farmers (Purnama *et al.*, 2014; Qanti *et al.*, 2017; Mukti *et al.*, 2018). Due to these problems, mango production has declined because of the decreasing productivity of mango trees. In 2017, national mango productivity was 10.96 mton/ha, a decrease of 2.32% from the previous year (11.22 mton/ha).

The development of mangoes in Indonesia has several opportunities for improving its competitiveness in the global market. From the market perspective, the value of world mango export showed an annual 26% average growth rate, with a total value of about USD1.69 billion in 2013, rising more than 200% compared with the year 2000 (Evans *et al.*, 2017). There is still a great opportunity to increase mango exports as so far there has not been limitations by importing countries (Saptana *et al.*, 2018). Preferred characteristics in the global market are orange to red, with a slight sour taste and fresh aroma, hence, indicating that the future trend of Indonesian mango exports could be for red mangoes (Rebin *et al.*, 2014).

In addition, most markets now require a certification of Good Agricultural Practices or the GLOBALGAP (Galán Saúco, 2015). It is very important to identify opportunities for the application of innovation and technology in mango development policies to improve the competitiveness of Indonesian mangoes in the global market. Therefore, this paper will discuss the development of mango in Indonesia in order to capture the opportunities and face the challenges in the global market era, especially from the research and development perspective and how to formulate it into developmental policies.

2. METHODS

The method of study was carried out by reviewing various literature studies, especially primary scientific journals and other data and information from the Ministry of Agriculture's Data Statistics and FAOStats.

3. RESULTS

3.1. Mango cultivation technology that has been generated

3.1.1. Variety

Indonesia has more than 30 species and numerous varieties of mango, which makes it a centre of diversity for mangoes (Kostermans & Bompard, 1993). There are some common commercial mango varieties in Indonesia such as the 'Arumanis', 'Manalagi', 'Golek', 'Lalijiwo', 'Gedong', and 'Indramayu' (Yuniarti & Santoso, 2000), and also some varieties that grow wild in the community forest (Kiloes *et al.*, 2016) which are not maintained but harvested when there are fruits (Kiloes *et al.*, 2015).

Cukurgondang Experimental Garden, an experimental garden under the supervision of the Indonesian Centre for Horticultural Research and Development (ICHORD), Indonesian Ministry of Agriculture in Pasuruan, East Java has a collection of more than 200 commercial and local mango cultivars (Yuniarti & Santoso, 2000; Tasliah *et al.*, 2016) with market potential. 'Arumanis' and 'Gedong' are two primary varieties of mango in Indonesia. 'Arumanis', or the "sweet green mango" (Natawidjaja *et al.*, 2014) is the variety that is commonly produced and consumed more in the local market rather than the export market (Wandschneider *et al.*, 2013). 'Arumanis' and 'Gedong' are also the varieties that are usually exported (Yuniarti & Santoso, 2000).

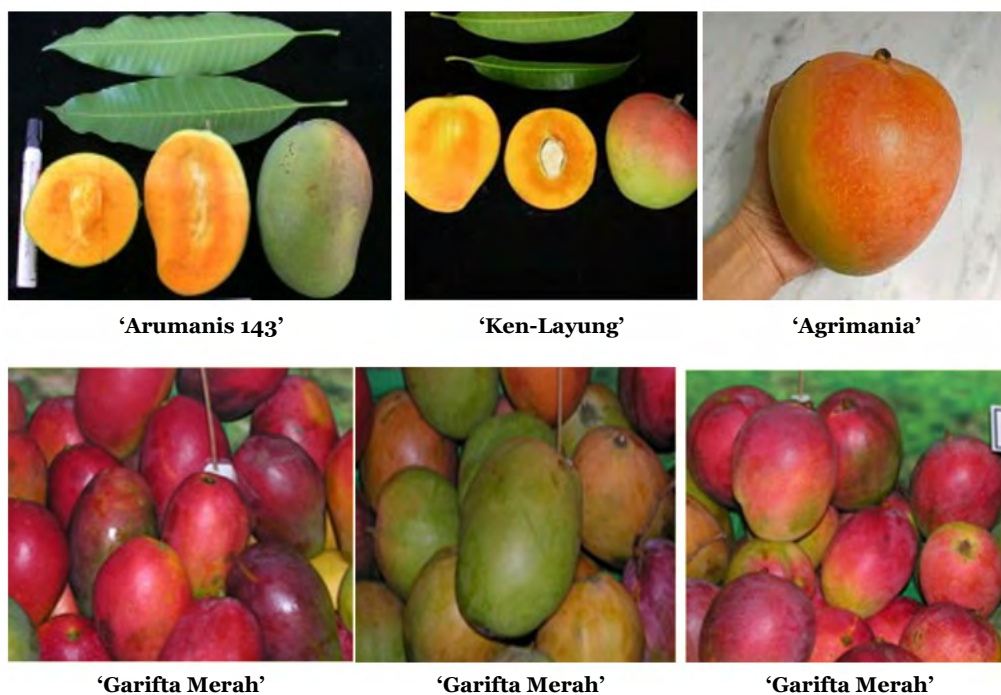


Figure 1. New improved Indonesian mango varieties from ICHORD

Some new improved varieties of mango developed from research and breeding programs possess favorable characteristics with good market potential. Varieties such as 'Garifta', 'Ken-Layung' (Rebin *et al.*, 2016) and 'Agrimania' (Karsinah & Rebin, 2018) have a red skin color that is different from the 'Arumanis', which is a green variety. Other varieties such as 'Gadung 21' can be eaten like an avocado (Karsinah *et al.*, 2017). Hybrid mango varieties like the 'Agri-Gardina 45' have a unique characteristic, in that it can be peeled like a banana (Karsinah *et al.*, 2014).



Figure 2. 'Gadung 21' variety (Avocado mango)



Figure 3. 'Agri Gardina' variety (Banana mango)

3.1.2. Off-season technology

During the off-season, mango trees can be induced to flower by physical or chemical manipulation (Yuniastuti & Purbiati, 2016). By using off-season technology, fruits can be harvested outside the usual season, decreasing risk of post-harvest loss when there is an excessive supply during the mango season (Maloba *et al.*, 2017). However, less than 20% mango farmers are currently applying this technology (Natawidjaja *et al.*, 2014).

3.1.3. Pest and disease management

The other factors that can affect the productivity of mango in Indonesia are pests and diseases. Some pests and diseases have a different preference for each variety of mango. The hairy caterpillar is one of the pests that can cause loss of leaves in mango trees up to 100% (Baliadi *et al.*, 2012). Fruit flies also cause a decrease in quality and quantity in mango (Soemargono *et al.*, 2011; Ruswandi, 2017). Stem borers are one of the crucial pests especially in wet lowland production centres and have an average attack rate of up to 10.36% (Muryati *et al.*, 2010).

3.1.4. Post-harvest technology

There also some post-harvest technology that can support the development of Indonesian mangoes, such as controlled atmosphere storage, modified atmosphere packaging, waxing, irradiation, and packaging (Broto, 2011).

3.2. Mango development policies related to research and development

3.2.1. Development of mango agribusiness area

Based on the Indonesian agricultural land suitability mapping, there are potential areas for the expansion of mango cultivation such as in South Sulawesi, East Nusa Tenggara, and East Kalimantan (Yuniarti & Santoso, 2000). The Republic of Indonesia's Ministry of Agriculture has issued a decree to establish a national mango development area in 22 provinces in Indonesia, within 110 regencies divided by priority areas in the National Agriculture Zone. The total potential land area that can be used for mango cultivation including existing areas is 25,734,199 ha (INAgrimap, 2018).

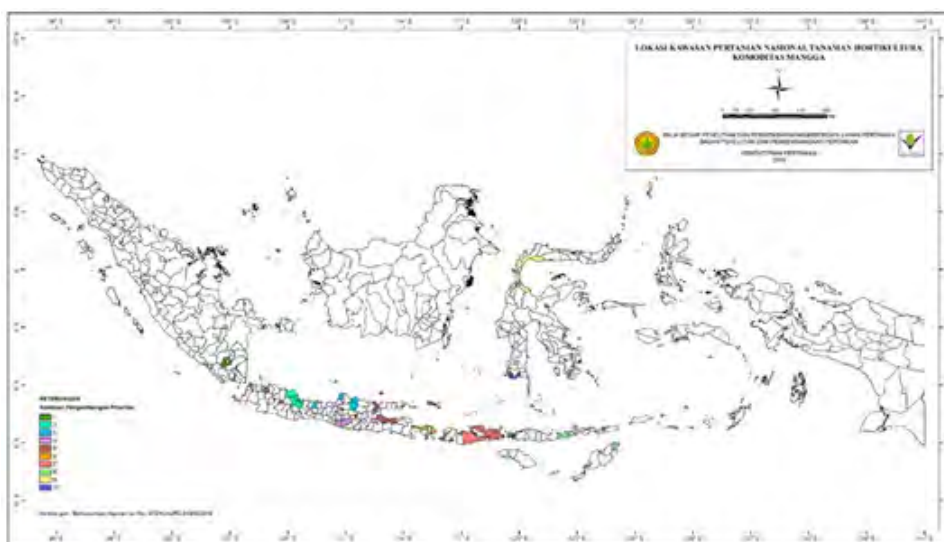


Figure 4. Potential mango cultivation areas.

3.2.2. Distribution of free certified mango seedlings

To increase the competitiveness of exported mangoes, the government needs to intensify mango production intended for export. One of the varieties that has been prioritized for export is the 'Garifta' variety. Since 2009, ICHORD through the Indonesian Tropical Fruit Research Institute has produced large quantities of 'Garifta' seedlings and distributed to communities and farmers for free in various regions in Indonesia. From 2018–2019, about 55,000 seedlings has been distributed in several districts, especially in the mango production centers in East Java, which are 'Probolinggo', 'Pasuruan', and 'Situbondo'. The spread of 'Garifta' varieties can be seen in Figure 5.

Other than to increase the area of mango cultivation, this distribution program was also an effort to regenerate old mango trees and was an endorsement to establish mango tourism areas.

Farmers are interested in developing 'Garifta' varieties, especially 'Garifta Merah' and 'Garifta

Orange' varieties, because some mango growers already knew the superior characteristics of both varieties. Based on information from farmers in Pasuruan and Situbondo who have produced Garifta mangoes, the varieties are: (1) favored by urban consumers; (2) fetches a higher price compared to other varieties; (3) have a good shelf life, which is 7–10 days after harvesting; and (4) high potential to be exported.

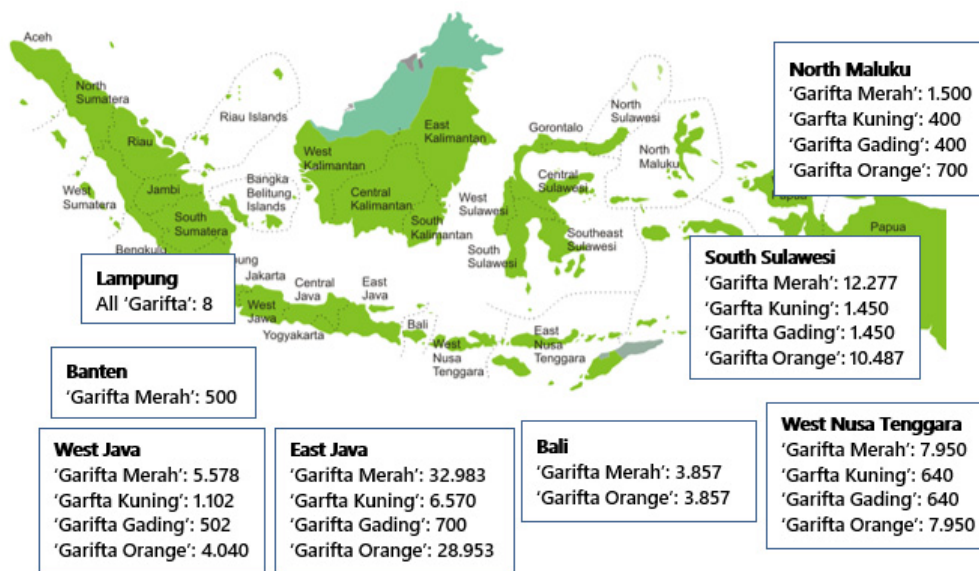


Figure 5. Distribution of Garifta varieties in Indonesia since 2009

3.2. Further development agenda

In order to increase exports, achieve competitive ability in the global market, and to provide sustainable benefits for farmers or community, the government must provide support programs, such as: (1) the assistance of export mango cultivation technology, up to post-harvest handling technology including the support of packing houses for sorting, grading, and packing; (2) the development of the agribusiness system from upstream to improve the performance of mango production, increasing the efficiency of distribution and marketing of fresh mangoes (domestic and export markets) while enriching the industry through the development of processed products and product promotion to support sustainability; (3) a program from local government agencies to support marketing of mangoes, especially for exports. A Standard Operational Procedure based on the planting region and farm registration must be prepared; and (4) establishment of marketing institutions by inviting exporters in the partnership scheme.

4. CONCLUSION

From a research and development perspective, Indonesia has a great opportunity to become a leading producer of mangoes in the world to meet global market demands due to the various innovations and technologies produced. These innovations and technologies need to be applied to support export-oriented mango development policies.

Aside from supporting the export-oriented mango development program, policies to support the adoption of new technologies by farmers also need to be formulated. Researchers and policy makers need to work together to ensure that these new innovations can be applied to further improve Indonesian mango's global competitiveness.

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