

Original Research Article

NUTMEG: Uniqueness of Flowering and Fruiting Origin of Spices Islands

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Abstract	Keywords
<p>The research aims to study the flowering and fruiting of nutmeg from Moluccas. The three islands were chosen for nutmeg observation, namely Banda island, Seram island and Ambon island. Flowering, fruiting and harvest of nutmeg were observed. Growth variables of flower, fruit and fruit set percentage were observed in Ambon island by selecting 5 nutmeg trees randomly. The results showed that the flowering time of nutmeg in Moluccas occurred on March to May, August to September, and November to December. Harvest season occurred on March to April, June to July/August, and November to December/January. Fruit developing followed the pattern of sigmoid growth curve. The average of fruit set was between 22.63 to 47.53 percent. The required time of flower bud initiation until fruit set was 1.8 months, and fruit set until harvest took 8 to 10 months.</p>	<p>Flowering Fruiting <i>Myristica fragrans</i> Houtt. Nutmeg Moluccas Spices island</p>

Introduction

Nutmeg (*Myristica fragrans* Houtt.) is native to Indonesia, which is derived from Moluccas islands (Heyne, 1987; Hadad, 1990; de Guzman and Siemonsma, 1999; Anandaraj et al., 2005; Bustaman, 2007; Marzuki, 2007), known as the spice island. results which took from nutmeg were seed, mace and essential oils and fruit meat which traded at the world market for food industry. Seeds and mace are used for fish preservation industry, manufactured sausages, canned food and a cake batter, because the essential oils and fats are contains of provide a sense of stimulating the appetite. The distillation of Nutmeg oils is used as industrial medicine, soap and perfume makers (Hadad et al., 2006). Moluccas nutmeg

produced essential oil with the content ranged from 9.99 to 11.92% and *Myristicin* is the highest aromatic component. Banda nutmeg is contains of 13.76% myristicin (Marzuki at al., 2014). The nutmeg in Kerala-India contains of 12.5% myristicin (Abdurrasheed and Janardanan, 2009).

There are nine species of *Myristica* genus in Indonesia (Heyne, 1987; Hadad, 1990; Wahyuny et al., 2008). In Moluccas, there are six species (Bustaman, 2007). There are three main species that have been cultivated. *M. fragrans* Houtt and *M. succedanea* Warb. species are often found in Moluccas and North Moluccas, while *M. argentea* Reinw is found in Papua (Marzuki,

2007). *Myristica fragrans* Houtt. is the main type of species. It dominates other types in terms of both quality and productivity, and high myristicin content of best seeds and mace (Hadad, 1990; Bustaman, 2007; Nurdjanah, 2007).

The nutmeg is *dioecious* plant, where male and female flowers are not in one flower. There is a male, female and bisexual tree. Generally, the first flower appears when the plant reaches in 5-7 years of age. The male nutmeg has male flowers in the form of series which consists of 3-15 flowers per circuit (Hadad, 1990). The numbers of female flowers are among 1-3 per circuits with the diameters about 4-6 mm (Hadad et al., 2009). Bell-shaped flowers are yellow (Hadad, 1990; Hadad et al., 2007). Generally, flowers appear from the axillary leaves laterally. The third to the eighth axillary leaves from the top branch are very productive to produce its flowers (Hadad et al., 2009). The forms of Nutmeg fruit are round and slightly oval with 1-10 cm long and thin flesh which rather thick. Seeds with hard skin which is covered by mace (arillus) are the main aromatic compounds of myristicin (de Guzman and Siemonsma, 1999; Arrijani, 2005; Wahyuni, 2008). Hadad et al. (2007). The ripe fruit of Banda nutmeg is characterized by ivory colored, brownish black colored of old seeds and blood red mace.

Materials and methods

The study was conducted in 2013-2014, in three regions of Moluccas, namely Ambon island, Seram island and Banda islands. The locations were selected purposively as a nutmeg production nowadays. Banda islands are the origin of nutmeg. The time of flowering, fruiting and harvest were observed in each region. Nutmeg trees which selected for the observation were based on stem loop > 30 cm, aged over 15 years, not deformed canopy and not attacked by pests and diseases. The time of flowering, fruiting

and harvest were observed when most of the trees were visible on dominant of flower buds, flowers, and fruit. Harvests time might be held when the nutmeg was characterized by a whole red of mace (red blood), brownish till blackness of seeds or some cracked fruits. In Banda and Seram, Aid agencies of observations were used for ordinary observation by giving brief training.

Growth variables of flower, fruit and fruit set percentage were observed in Ambon island by selecting 5 nutmeg trees randomly. The variables percentage of fruit set with 30-50 flowers per trees were marked by plastic ropes. The percentage of fruit set was obtained by dividing the number of fruit set and flower. The development and growth of fruit were determined by measuring the diameter size of fruit in one week intervals. Ten fruits of each tree were measured from the beginning until maximum growth. The development of fruits and seeds were observed after maximum growth. Every two weeks, three fruits of each nutmeg tree were selected at random to observe the seeds and maces in establishing the harvest time.

Results and discussion

The results showed that flowering nutmeg in Moluccas was occurred on March-May, August-September and November-December/ January. Specifically in Banda islands, flowering nutmeg was on March, August and November. In Seram island was on April, August/September and December. While in Ambon island was on April / May, August / September and December / January. In Banda islands, fruit sets of nutmeg were on May, September and December. In Seram islands was on June, October and January. While in Ambon was on July, October/ November and February.

Table 1. Flowering, fruiting and harvest of nutmeg in Moluccas.

No.	Islands	Seasons	Flowering	Fruiting	Harvest
1	Ambon	I	April / May	July	April
		II	August/ September	October/November	July / August
		III	December / January	February	December / January
2	Ceram	I	April	June	March / April
		II	August/ September	October	June / July
		III	December	January	December
3	Banda	I	March	May	March
		II	August	September	June / July
		III	November	December	November/December

Description: I, II, and III=first, second and third seasons.

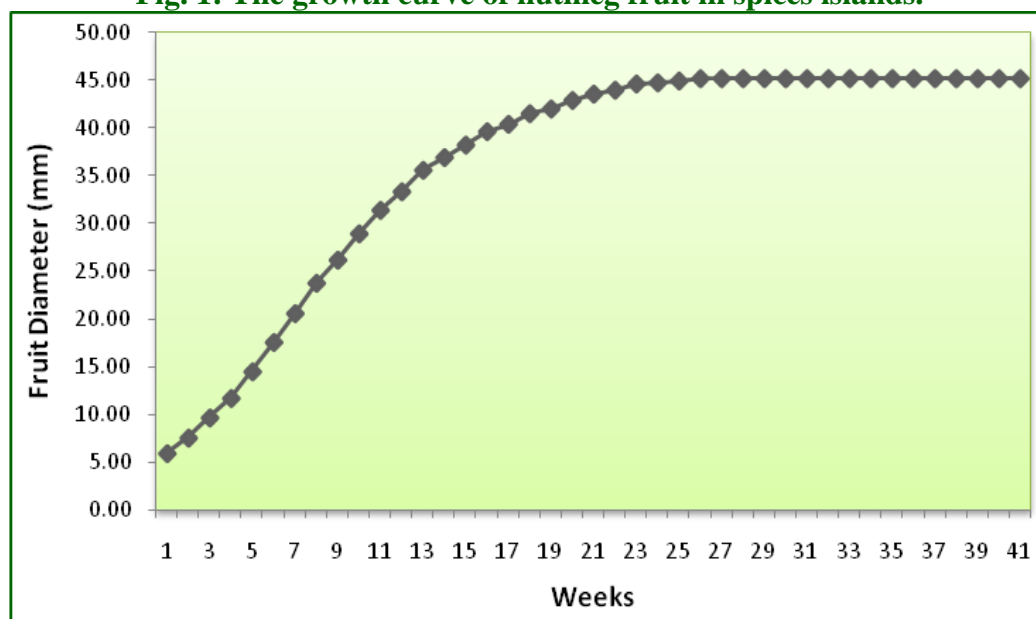
The harvest times of nutmeg in Moluccas were on March-April, June August, and November-January. Specifically, In Banda islands were on March, June / July and October / November. In Seram island was on March/April, June /July and December. While in Ambon island was on April, July/August and December/January (Table 1). The results above are rather different on report of Hadad et al. (2007) that the main fruiting season of nutmeg in Banda/Ambon, Ternate and Tidore were occurred on February and June. Nurjannah (2007) in Bogor, most of flowering nutmeg occurs during on November-December, and harvest is on May or June. Joseph (1980) reported that the harvest period was on June-August in India.

The flower of nutmeg occurred after 1-2 weeks appearing of buds flower. First diameter of flower size

was 1.1 - 1.3 mm. The diameter of flowers were 3.5 - 4.5 mm when anthesis. The period of floral appearance to anthesis was between 28-38 days. Haldankar et al. (2004) reported that the duration period of floral bud appearance to anthesis ranged between 34.3 - 52.0 days and average 40.8 days.

The results showed that the growth of nutmeg fruit began after a week of fruit set, with drying sepals, expend and greenness stalks of flower. The sepals were fall in two weeks. The growth of fruit was fast in the second until eight weeks (2 months). The growth was slow in 27 to 30 weeks in entering maximum growth. The ripping process to harvest was in 35 to 43 weeks. The diameter growth of fruit followed a sigmoid curve (Fig. 1).

Fig. 1: The growth curve of nutmeg fruit in spices islands.



The relative growth of fruit diameter to maximum was 28-30 week (Fig. 2). From maximum to harvest needed 4-12 weeks. The fruit might be harvested after 8-10 months. These results are parallel with Flach (1966) that the development of fruit to harvest took 9 months, Purseglove (1981) 6-9 months after flowering. Hadad et al. (2007), Development of the flower into fruit and ready to be harvested were after 7-9 months.

The average of increasing fruit diameter per week in the first until seventh months were 1.6; 2.9; 2.2; 1.2; 0.7; 0.3 and 0.05 mm per week (Fig. 3).

The exchange color of fruit skin from light green to yellowish-green was in 2 to 20 weeks, yellowish-green to greenness-yellow was in 21 to 28 weeks, and yellow to ivory or dark yellow were in 29 to 43 weeks. The percentage of fruit set ranged between 22.63 - 47.53%, average 36.66%. The percentage was better than Haldankar et al. (2004) in India, which reported average fruit set was 15%, 41% maximum and 2% minimum.

The Characteristics of biological nutmeg showed that continuously there were some different sizes of fruit all year. Especially in Moluccas, flowering, fruiting

and harvesting occurred three times a year. In other areas were only two times a year, as revealed by Joseph (1980) in India, and Nurdjanah (2007) in Bogor-Indonesia.

Fig. 2: The increase of diameter of nutmeg fruits per week in spices islands.

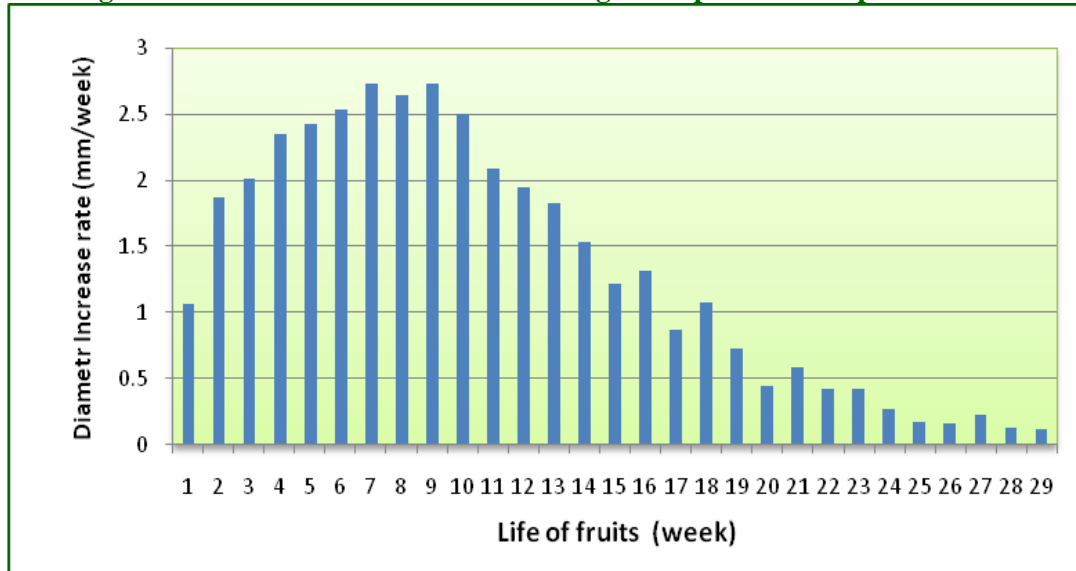
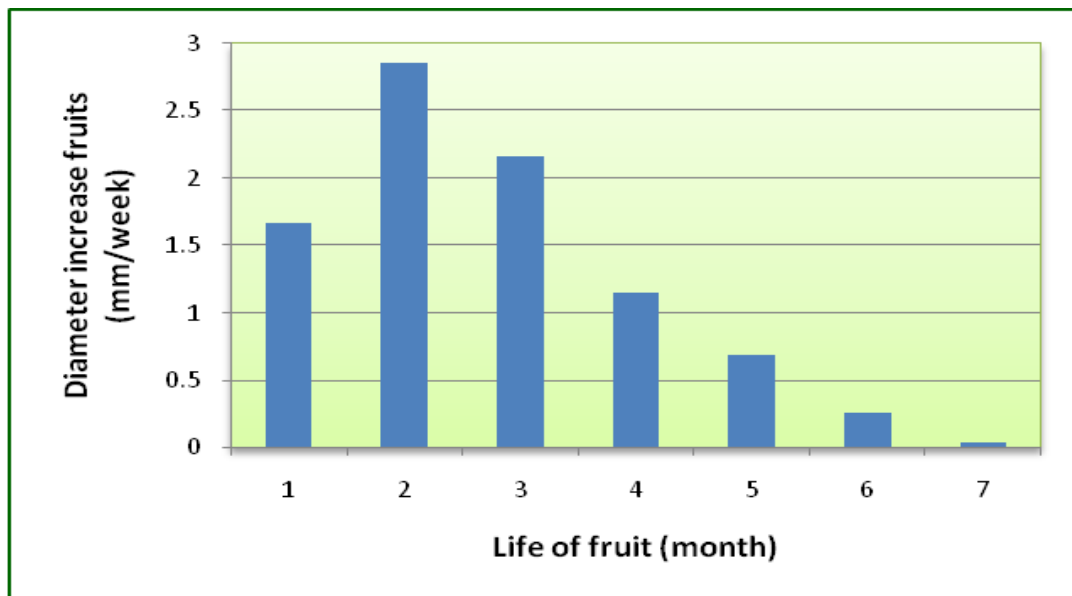


Fig. 3: The increase of diameter of nutmeg fruits per month in spices islands.



Conclusion

In the Moluccas, flowering seasons of nutmeg were on March-May, August-September, and November-December/January. Harvest seasons were on March-April, June-July/August, and November - December/January. The development of fruit follows the pattern of the sigmoid curve. The

Percentage of fruit set was 22.63-47.53%. Fruit growth to maximum size took 7 months. Fruit set until harvest took 8-10 months.

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