INVENTORY OF *Musa paradisiaca* L. (BANANA) KEPOK IN LUMAJANG REGENCY, MALANG REGENCY AND MAGELANG REGENCY

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ABSTRACT

Banana is fruit containing fairly high nutrition and provides quick reserve enegy. The crop grows in tropical area with average rainfall all the year and banana produces at any season. One of the bananas which has high value sale and high competable potency is subvariety of kepok banana. Kepok banana has various subvarieties, these subvarieties have the same morphologies but have different texture appearances thus uneasy to differenciate among them. The texture appearance determines the quality and price of the banana. Often the buyer makes a mistake in choosing subvariety of kepok he wants to, whereas the seller gives him the cheapiest subvariety of kepok. Methods we used was method of exploration using free exploration technique step by step without any certain path. There were two phases in the research namely the first phase was carried out in field and the second phase was done in the laboratory. Subvarieties of kepok found in Lumajang Regency are 4 subcultivars, Malang Regency there are 3 and Magelang Regency are subcultivars subcultivars, The sequence of the qulity of kapok subcultivars are as follows, red kepok, yellow kepok, big (gede, gilo, gembrot) kepok, and white kepok. Sugestion, organic ferlitilizer should be used in the fertilization of banana cultivation, and conservation of red kepok is highly required.

Key words: *inventory, kepok banana*

INTRODUCTION

Banana is fruit containing sufficient nutrition and provides quick energy supply. The plant grows in groups in the tropical area with a yearly everage rains, and produces at any sesons. Indonesia is known as a banana exporter. Banana is national superior fruit commodities (Anonymous, 2005; Wahyunindyawati *et al.*, 1997; Kasijadi *et al.*, 2000; Wahyunindyawati *et al.*, 2007).

Banana which is cultivated in Indonesia is of 14 cultivars. Cultivation of bananas is profitable at relative short time (1–2 years) and the production of banana is independent to seasons. Banana cultivation productivity is better and better, in 1999: 39,1 ton/hectare, it reaches 48,75 ton/hectare in 2003. The world level of banana production is 28 ton/hectare/years for home scale plantation. For a small scale plantation (the area 10–30 hectares) and large scale plantation (the area is more than 30 hectares) should reach at least 46 ton/hectare. The target of banana export in 2005 is 1,000,000 tons. The destination of export are Japan, Korea, China, Singapore and Malaysia. The cultivars of bananas which are exported are cavendish, barangan, mas and kepok will be introduced to be a banana excellent cultivars of Indonesia. In order to reach the target of 1,000,000 tons in 2025 30,000 tons will be exported in 2010 and 150,000 tons which is expected to be supplied from commercially managed first production centra will be exported in 2015. One of the banana cultivars which has high value scale and has high competable potency is kepok cutivar banana (Department of Agriculture, 2004). Kepok banana has various subcultivars and has a similar morphology but has a different texture appearances so that it is uneasy to differenciate among the kepok subcultivars. The appearances of textures determine the quality and price of the banana. The buyer often makes a mistake in choosing the right kepok subcultivars he wants to and the seller gives him the cheapest subcultivars of kepok.

Banana is crop which has many advantages. Several kinds of bananas are found in Indonesia. They serve as fruit, fiber materials, decorative plants and produce leaves which are used as food cover. As fruit, it has value nutrition because it contains carbohydrate, protein, lipid, vitamins A, B1, B2 and C. Banana is also very popular because it can be used to prevent constipation and used as dessert. In Africa, banana is used as alternative food (Pulseglove, 1985). In general, banana which can be consumed belongs to two groups, namely which can be directly consumed and which has to be cooked (boiled or fried). In traditional markets, banana cultivars which can be directly consumed are among others ambon bananas, susu, mas, raja etc. Bananas also produce fiber, the tree trunks of bananas produce fiber for textile, for example abaca (*Musa textiles*). Kepok bananas

can also be used as antitoxin for snake bites (Uji *et al.*, 1992). The liquid produced of banana trunks can be used blacken hair, and banana leaves serve as food covers.

Musa family can be grouped into 5 different series,

1. Emusa, consisting of 13–15 series, has morphological characteristics: quasi trunk reaches as long as 3 meters, inflorescentia hangs or partly hangs, the protective color leaves are not bright. Bananas which belongs to this group are *Musa acuminate* Colla and *Musa balbisiana* Colla.
2. Rhodochlamys, consisting of 5–7 series, have morphological characteristics: the quasi trunk is less than 3 meters, inflorescentia is straight, and protective leaf has few flowers. Bananas which belongs to this group is *Musa flaviflora*.
3. Callimuysa, consisting of 5–6 series, have morphological characteristics: a small habitus, has a straight inflorescentia and violet protective leaf.
4. Australimusa consists of 5–7 series.
5. Incertae sedis which have morphological characteristics: the height of the plant is 10 meters (Purseglove, 1975; Saptasari, *et al.*, 1990).

Based on the way how bananas are consumed, bananas can be devided in to 2 different groups:

1. Bananas which are directly consumed (edible). Subcultivars belongs to this type are *Musa paradisiaca* L var. sapientum Kuntze, *Musa saplentum* var. paradisiaca Backer, *Musa nana* Lour., *Musa chinensis, Musa cavendishii,* L.
2. Bananas which are consumed after being cooked (plantain). Subcultivars belongs to this type are *Musa paradisiaca* L.

Rhodochlamys, consisting of 5–7 series, have morphological characteristics: quasi trunk are less than 3 meters, have straight inflorescentia, and each protective leaf has few flowers. Subcultivars belongs to this type are *Musa flaviflora* (Saptasari *et al.*, 1990).

Banana is fruit which grows in group in tropics area. Banana is rich of calium, magnesium, phosphor, iron (2 mg/100 g), Zn (0,8 mg/100 g), calsium, vitamin A 45 mg/100 g), C, B complex, B6 (0,5 mg/100 g), B6 (0,5 mg/100 g), and serotonin which acts as neurotransmitter for brain function. The energy value is about 136 calory for every 100 g which per capita/year and the banana consumption of Indonesia society according to Susenas data has just reached 7,80 kg/capita/year which is far lower compared to the banana consumption of American which reaches 22,05 kg/capita/year. Thus the potency of fruit demands including bananas is great enough in line with the population increase and the society awarness of the importance of consuming fruits. Imdonesia is one of the tropical fruit supplier, but the role is relatively little namely less than 1%. Although the tropical fruits from Indonesia go into world markets the quantity is very small because of low and discontinued supply capacities whereas in fact the world demands of fresh tropical fruits especially European countries, America, and Asia increase 10,7% per year (Anonymous, 2008).

East Java is will known as a province of exotic fruit producer, one of the fruits which has economic value and grows rapidly is banana, either in the forms of fresh fruits or manufactured products. Lumajang Regency which is called City of Bananas, comprising 21 subdistrict most of which are the centra of bananas, has the area of 2644 hectares and the production of bananas reaches 29,546 tons/year. The cultivars of bananas cultivated in Lumajang Regency among others, are agung semeru, mas kirana, raja lumut, ambon, susu, embug, kepok bananas. All this time, banana price has fluctuated, expect mas kirana bananas which is in cooperation with PT. Sewu Segar Nusantara Jakarta. Marketing is an important activity in agricultural business because marketing is an economic activity which influences high and low income of the farmers. The cultivation on bananas is carried out by the farmers themselves in sporadic locations in many villages, therefore intermediary institutions from village collectors, district collectors up to regency collectors have been involved in the distribution of bananas to the customers. The involvement of such institutions play an important role in accelerating the distribution of bananas from the farmers to the customers. The determining banana price, there is a different motives among market doers, namely the farmers as a producers who demands for high price, intermediary institutions which are eager to earn big profit and consumers who want low price. In an efficient marketing, satisfactory of producers, intermediary institution and consumers will be created (Anonymous, 2008). The Indonesia prime kepok banana cultivars is kepok gablok banana (The Decision of the Minister of Agriculture, 2003) and kepok bangun sari banana (The Decision of the Minister of Agriculture, 2005). Kepok banana have a high productivity in wet rainfall in the oxisol soil. The locations of cultivation influence the height of the plants, diameter of the trunks the quantity of buds and harvest time (Purnomo, *et al.*, 1997).

In agricultural business, the cultivation of banana is very profitable in relatively short time (1–2 years) with break even point of 1,76. The productivity of bananas in Indonesia has increased rapidly for 4 years, from 39,1 ton/

hectare in 1999 up to 48,75 ton/hectare in 2003. Futhermore, the foreign country's market demands for bananas such as Hongkong, China, Arab Saudi, Singapore, United States of America, Australia, dan France is also increasing. Based on this facts, deep concern on the product management, both on cultivation quality and quantity of bananas is required (Department of Agriculture, 2004).

MATERIALS AND METHODS

The methods that we used was exploration methods using free exploration technique step by step without any certain path. The research was done in two phases, namely the first phase is carried out in the fields (The Regencies of Magelang, Malang, and Lumajang) and the second phase is made in the laboratory. The choice is Magelang Regency, it is the banana centra of central Java Province which enables us to find the variety of kepok subcultivars. Malang Regency, it has a high enough distributions of cultivars and 17 banana cultivars are found in this regency. Lumajang Regency, it is a banana product centra of the East Java Province which enable us to find more variety of cultivars. Among the three regencies, Malang Regency has the highest variety of cultivars, followed by Lumajang Regency and Magelang Regency in the third place. The indicators are: the dimension the fruit, the weight of the fruit, the height of the crops, the color of the flesh fruit. The dimension of the fruits comprises the length of the fruit, the maximal and minimal width of the fruit. Kepok bananas have 4 sides, some 5 sides in the middle, and 3 at the edge. The dimension of fruit and the weight of the fruit are weighed with 4 desimal electric pair of scales with 4 replications. The selection of the fruits is done when all fruits has changed their color from green into yellow or brownish yellow. Measuring the height of the crops is conducted when the crops have produced maximal fruit (no more fruit sprung up). The testing of C vitamin is carried out in the Laboratory of Quality Control and Food Safety of the Faculty of Agricultural Technology, Brawijaya University Malang.

RESULT

Table 1. Stocktaking of morphological characters of kepok banana subcultivar in Regency of Lumajang

Assessment indicators		Red Kepok	Yellow Kepok	White Kepok	Big Kepok
The origin of the plant	:	Pasirian District	Pasirian District	Senduro District	Pasirian District
Height of the plant	:	4,5 m	5,1 m	6,3 m	7,2 m
Color of trunk	:	brown	brown	brown	blacky brown
Diameter of trunk (measured 0,5 meter above hump)	:	69 cm	73 cm	73 cm	81 cm
Color of leaf	:	green	green	green	green
Color of leaf stem	:	green	green	green	green
Dimension of the third leaf 30 cm from bottom:					
Length	:	1,8 m	2,4 m	2,4 m	2,7 m
Width of base	:	40 cm	47 cm	47 cm	51 cm
Width of midst	:	53 cm	58 cm	58 cm	64 cm
Width of top	:	23 cm	26 cm	26 cm	34 cm
Color of flower	:	yellow	yellow	yellow	yellow
Color of banana blossom	:	bluish red	bluish red	bluish red	bluish red
Lengt of banana stem	:	121 cm	129 cm	127 cm	127 cm
Number of bunch per stem of banana	:	15–18	16–18	11–14	16–18
Number of fruit per bunch	:	5	4–10	8–10	4–10
Shape of fruit	:	box shapped	box shapped	box shapped	box shapped
Dimension of fruit:					
length	:	9,61 cm	9,09 cm	10,27 cm	15,43 cm
width	:	2,60–2,70 cm	2,14–3,58 cm	2,61–3,18 cm	3,04–3,76 cm
Gross weight per fruit	:	61,80 g	61,92 g	70,28 g	190,97 g
Weight of flash per fruit	:	37,75 g	33,77 g	39,86 g	85,12 g
Weight of skin per fruit	:	24,05 g	28,15 g	30,42 g	105,84 g
Thickness of skin	:	0,41 cm	0,28 cm	0,33 cm	0,53 cm
Color of ripe fruit	:	brownish yellow with black spots on the tip	smooth yellow	whitish yellow	white
Taste	:	sweet	sweet	less weet	rather sour
Color of flesh (diagonal cut)	:	middle of yellow flash	middle of whitish yellow flesh	white in the middle of whitish flesh	white in the middle of whitish flesh
C Vitamin	:	21,78 mg/100 g	36,64 mg/100 g	23,77 mg/100 g	22,13 mg/100 g
Water content in ripe fruit	:	62,18%	63,52%	70,79%	71,76%

Table 2. Stocktaking of morphological characters of kepok banana subcultivar in Regency of Malang

Assessment indicators		Red Kepok	Yellow Kepok	White Kepok
The origin of the plant	:	Tumpang District	Tajinan District	Tumpang District
Height of the plant	:	4,7 m	5,4 m	6,2 m
Color of trunk	:	Brown	brown	brown
Diameter of trunk (measured 0,5 meter above hump)	:	69,5 cm	60 cm	71 cm
Color of leaf	:	Green	green	green
Color of leaf stem	:	Green	green	green
Dimension of the third leaf 30 cm from bottom:				
Length				
Width of base	:	1,9 m	2,5 m	2,2 m
Width of midst	:	43 cm	48 cm	48 cm
Width of top	:	54 cm	59 cm	56 cm
	:	25 cm	26 cm	25 cm
Color of flower	:	Yellow	yellow	yellow
Color of banana blossom	:	bluish red	bluish red	bluish red
Lengt of banana stem	:	130 cm	125 cm	132 cm
Number of bunch per stem of banana	:	11–19	18–20	10–15
Number of fruit per bunch	:	7–9	4–5	7–10
Shape of fruit	:	box shapped	box shapped	box shapped
Dimension of fruit:				
length	:	9,38 cm	9,05 cm	8,54 cm
width	:	2,39–3,34 cm	2,42–3,38 cm	1,95–2,28 cm
Gross weight per fruit	:	79,18 g	68,76 g	40,19 g
Weight of flash per fruit	:	37,58 g	41,31 g	24,12 g
Weight of skin per fruit	:	41,60 g	27,45 g	16,07 g
Thickness of skin	:	0,47 cm	0,31 cm	0,35 cm
Color of ripe fruit	:	brownish yellow with black spots on the tip	smooth yellow	whitish yellow
Taste	:	Sweet	sweet	less sweet
Color of flesh (diagonal cut)	:	yellow and red in the middle	whitish yellow and yellow in the middle part	whitish and white in the middle part
C Vitamin	:	11,41 mg/100 g	21,49 mg/100 g	17,09 mg/100 g
Water content in ripe fruit	:	58,56%	64,24%	68,75%

Table 3. Stocktaking of morphological characters of kepok banana subcultivar in Regency of Magelang

Assessment indicators	Red Kepok	Yellow Kepok	White Kepok	Gilo/gembrot Kepok
The origin of the plant	: Borobudur District	Muntilan District	Salaman District	Salaman District
Height of the plant	: 4,57 m	5,1 m	5,9 m	7,4 m
Color of trunk	: Brown	brown	brown	blackish brown
Diameter of trunk (measured 0,5 meter above hump)	: 65 cm	75 cm	68 cm	83 cm
Color of leaf	: Green	green	green	green
Color of leaf stem	: Green	green	green	green
Dimension of the third leaf 30 cm from bottom:				
Length	: 1,8 m	2,4 m	2,3 m	2,5 m
Width of base	: 42 cm	45 cm	45 cm	50 cm
Width of midst	: 52 cm	57 cm	59 cm	60 cm
Width of top	: 23 cm	24 cm	23 cm	32 cm
Color of flower	: Yellow	yellow	yellow	yellow
Color of banana blossom	: bluish red	bluish red	bluish red	bluish red
Lengt of banana stem	: 137 cm	128 cm	128 cm	120 cm
Number of bunch per stem of banana	: 12–22	7–22	14–22	8–15
Number of fruit per bunch	: 5–12	5–8	4–6	4–5
Shape of fruit	: box shapped	box shapped	box shapped	box shapped
Dimension of fruit:				
length	: 8,83 cm	11,50 cm	6,61 cm	15,43 cm
width	: 2,58–3,04 cm	2,27–3,10 cm	1,78–2,54 cm	3,04–3,76 cm

Lanjutan Table 3.

Assessment indicators		Red Kepok	Yellow Kepok	White Kepok	Gilo/gembrot Kepok
Gross weight per fruit	:	63,05 g	118,12 g	21,23 g	157,85 g
Weight of flash per fruit	:	44,31 g	62,56 g	14,98 g	91,52 g
Weight of skin per fruit	:	18,74 g	55,55 g	16,25 g	66,32 g
Thickness of skin	:	0,37 cm	0,22 cm	0,34 cm	0,37 cm
Color of ripe fruit	:	brownish yellow with black spots on the tip	smooth yellow	whitish yellow	white
Taste	:	Sweet	sweet	less weet	rather sour
Color of flesh (diagonal cut)	:	yellow in the middle part	whitish yellow and yellow in the middle part	whitish and white in the middle part	whitish and white in the middle part
C Vitamin	:	17,27 mg/100 g	30,26 mg/100 g	27,55 mg/100 g	25,15 mg/100 g
Water content in ripe fruit	:	69,41%	66,89%	70,75%	64,70%

Table 4. Assessment banana quality of subcultivar kepok in of Lumajang Regency

Assessment indicators	Red kepok	Yellow kepok	White Kepok	Big kepok
Color of fruit flesh	red	yellow	white	whitish yellow
Taste	sweet	rather sweet	taste less	rather sour
Density	80	70	40	70
Density after blanching	80	60	20	60

Table 5. Assessment banana quality of subcultivar kepok in Malang Regency

Assessment indicators	Red kepok	Yellow kepok	White Kepok
Color of fruit flesh	red	yellow	white
Taste	sweet	rather sweet	taste less
Density	80	70	40
Density after blanching	80	60	20

Table 6. Assessment banana quality of subcultivar kepok in of Magelang Regency

Assessment indicators	Red kepok	Yellow kepok	White Kepok	Gilo kepok
Color of fruit flesh	red	reddish yellow	white	whitish yellow
Taste	sweet	rather sweet	taste less	rather sour
Density	80	75	40	60
Density after blanching	90	80	30	60

DISCUSSION

In Lumajang Regency, 4 subcultivars are found, namely red kepok, yellow kepok or manurun kepok, big kepok, and white kepok bananas. The way to differentiate among these subcultivars is by cutting the middle part of the fruit which will show different colors of the flesh, the middle part of red kepok is red, yellow kepok is yellow, white kepok is white and big kepok is white but the dimensions is bigger. Morphologically, the skin of red kepok is brownish yellow with black spots on the tips of the fruit and the spots will extend to middle of the fruit when the fruit is riper and riper. The blacks spots are rarely found in trhe skin of kepok, very few if any. The surface of yellow kepok skin is pure yellow. The surface of white kepok skin is white or yellowish white, so is the big kepok. The skin of big kepok is yellowish white. The wiight of red kepok is 61,80 g, yellow kepok is 61,92 g, white kepok is 70,28 g, and big kepok is 190,97 g. Big kepok fruit is the heaviest of all, white kepok is heavier than red kepok and yellow kepok. The amount of water in red kepok is the lowest of all. The taste of red kepok is sweet, yellow kepok is less sweet, white kepok is tasteless and big kepok is rather sour. When red kepok is boiled the flesh of the fruit will be rubbery and hard.. Yellow kepok is fairly hard, white kepok will be flabby and big kepok will also flabby. Based on research result, the quality of fresh banana depends on the fruit morphology, the taste of the flesh, the color of the fruit, plasticity, the thickness of the fruit skin, and the density of fiber. The height of big kepok crop is the highest compared to red kepok, yellow kepok and white kepok. The spread (distribution) of big kepok is

very small is rarely found. The growth of bananas requires a monthly rainfalls as of 75–85 inch (Simmonds, 1959). The shape of big kepok which is gigantic consumers more nutrition and more water than that of rather small ones. Cutivation of bananas is not properly managed, meaning the locations are very depend able to nature, both nutrition and water are not supplied to the soil.

In Malang Regency, 5 subcultivars are found, namely red kepok, yellow kepok, white kepok and Australia kepok. The morphological characteristics of red kepok, yellow kepok, white kepok is similar to those of Lumajang. In Pakis district, Malang Regency, Australia kepok is found but after 3–4 months the flesh of the fruit becomes black and gets dry, possibly because of bacteria (further research is needed). The productivity of Australia kepok is very high, big fruit, numbers of fruits per bunch, number of bunches per stem are more than red kepok, yellow kepok and white kepok. The quality of red kepok and white kepok fruit is good but susceptible to illness. Productivity of red kepok in Malang Regency is better than Lumajang. The gross weight of fruit is 79,18 g/each in Malang which is higher than in Lumajang of which the gross weight is 61,80 g but the gross weight of the skin in Malang which 41,60 g is higher than the gross weight of banana skin in Lumajang namely 24,05 g/each. The quality of fruit is influenced by kalium nutrition supply and calcium is easily leached by water (White, 1987). The areas of Lumajang are more wavy than the area of Malang thus more calsium is leached by run off. The distribution of cultivars in Lumajang Regency is very high because ecological distribution varies (Gubbuk, 2004).

In Magelang Regency 4 subcultivars are found, namely red kepok, yellow kepok or manurun kepok, white kepok and gilo (gembrot) kepok. The morphological characters of red kepok, yellow kepok, white kepok are the same as Lumajang Regency. The quality of the fruit from Magelang is better than Lumajang and Malang Regencies because the organic fertilizers is used where as organic fertilizer is rarely used in both regencies of Malang and Lumajang. Bananas are cultivated in social forest in Malang and ferlitization is rarely done. Gilo kepok is rarely found in Magelang Regency and the quality of gilo kepok is not as good as big (gede) kepok from Lumajang.

Lumajang Regency has the most subcultivar of kepok namely red kepok, yellow kepok or manurun kepok, white kepok and big (gede) kepok. Malang Regency has 3 subcultivars of kepok, namely red kepok, yellow kepok and white kepok. Magelang Regency has 4 subcultivars of kepok namely red kepok, yellow kepok, white kepok, and gilo (gembrot) kepok.The sequence of quality of kepok subcultivars are as follows, red kepok, yellow kepok, gede (gilo, gembrot) kepok and white kepok. Subcultivar of red kepok and yellow kepok can be used as fresh fruit and banana manufactured product. Boiling can not be applied to subcultivars of gede/gilo/gembrot kepok and white kepok. Subcultivar of big (gede, gilo, gembrot) kepok can serve as fresh fruit but cannot is used as bird food.

Organic fertilizer should be used in cultivation of banana. Conservation of red kepok should be done because red kepok is susceptible to illness and similar to Australia kepok which has been contagious (the kinships is close red kepok and yellow kepok).

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