PHYSICAL CHARACTERISTICS OF BANANA *Musa paradisiaca* cv. Saba DURING RIPENING AND SENENSCENCE.

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I certify that this thesis, **'Physical characteristic of banana *Musa paradisiaca* cv. Saba during ripening and senescence'** does not incorporate without acknowledgement any material previously submitted for a bachelor degree in any university; and that to the best of my knowledge and it does not contain any material previously published or written by another person where due references has not made in the text.

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ABSTRAK

Kajian ini dijalankan adalah untuk melihat perubahan ciri-ciri fizikal pisang *Musa paradisiaca cv. Saba* semasa peranuman dan penuaan yang disimpan pada suhu bilik. Hasil daripada pemerhatian yang telah dijalankan, ciri-ciri fizikal pisang berubah mengikut pertambahan indeks kematangan. Pada keseluruhannya, pisang yang berada pada fasa peranuman mempunyai ciri-ciri fizikal yang baik berbanding dengan pisang yang berada pada fasa penuaan. Kajian ini menunjukan bahawa kehilangan berat adalah rendah pada fasa peranuman berbanding dengan fasa penuaan. Bagi pemerhatian kepada keteguhan isi pula, didapati bahawa pada peringkat peranuman keteguhan isi adalah tinggi berbanding dengan fasa penuaan. Nisbah isi kepada kulit pula didapati bertambah bersama dengan pertambahan indeks kematangan. Bagi berat kulit pula, didapati bahawa berat kulit adalah tinggi pada peringkat peranuman dan rendah pada peringkat penuaan. Keadaan ini adalah bertentangan dengan berat isi dimana berat isi pada fasa peranuman adalah rendah pada keseluruhanya dan tinggi pada fasa penuaan. Dari kajian ini juga didapati bahawa semakin tinggi tahap keranuman maka semakin panjanglah masa yang diperlukan untuk mencapai indeks keranuman tersebut.

ABSTRACT

This research was carried out to observe the changes in physical characteristics of *Musa paradisiaca cv. Saba* during ripening and senescence stored at ambient temperature. From the observation that been done, the physical characteristics of banana had changed along with increment of maturity index. Overall, banana at ripening stages has better physical characteristics compare to banana at senescence stages. This study showed that the weight loss at ripening stages were lower than the weight loss at senescence stages. As for observation of pulp firmness, it recorded that pulp firmness were higher at ripening stages than senescence stages. Pulp to peel ratio shows an increment along with increment of maturity indexes. As for peel weight, it recorded that peel weight at ripening stages were higher compare to senescence stages. These situations are opposite to pulp weight where by pulp weight at ripening stages is lower than senescence stages. Based on this research, number of days of fruit taken too ripe increased along with the increment of ripening indexes.

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%	percent
g	gram
kg	kilogram
mm	millimetre
cm	centimetre
m	metre
°C	degree of celcius
N	Newton

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Bananas are native fruit to Southeast Asia and later on introduced to all tropical countries. Since then, it has become one of the most important crops in the world. As the centre origin of bananas, Southeast Asia is also play as important role for its centre of diversity. In areas where subsistence farming predominates, a great diversity of its varieties exists. Exotic cultivars vary from area to area and from country to country (Valmayor *et al.*, 1990).

Table 1.1 Commercial banana cultivar names and synonyms in ASEAN.

Filipino	**Indonesian**	**Malaysian**	**Thailand**
"Lakatan"	"Pisang Barangan"	"Pisang Berangan"	-
"Latundan"	"Pisang Raja Sereh"	"Pisang Rastali"	-
"Bungulan"	"Pisang Ambon Lumut	"Pisang Masak hijau"	"Kluai Hom Khieo"
"Saba"	"Pisang Kepok"	"Pisang Nipah"	"Kluai Hin"
"Ambon"	"Pisang Ambon Putih"	"Pisang Embun"	"Kluai Hom Dok Mai"
"Amas"	"Pisang Mas"	"Pisang Mas"	"Kluai Khai"
"Tindok"	"Pisang Tanduk"	"Pisang Tanduk"	"Kluai Nga Chang"
"Katali"	"Pisang Awak"	"Pisang Awak"	"Kluai Namwa"

Source: Valmayor *et al.*, (1990).

The commercial banana cultivar names and synonyms in ASEAN are shown in Table 1.1. In 2004, the world total export of banana accounted for 15.9 million tones. Bananas are also a very important staple commodity for many developing countries, together with wheat, rice or corn, hence the relevance of bananas for food security. Some of the main bananas producing countries, such as India or Brazil, are hardly involved in international trade. In fact, only about one fifth of total banana production is internationally traded. Nevertheless, the share of banana trade in world banana

production increased slightly in the last decades (from around 18% in the sixties and seventies to over 22% in the nineties). The international banana market shows a highly regional character (Food and Agriculture Organization of the United Nations, 2004).

Due to the special climatic condition to grow bananas, they are usually grown in tropical countries where most of them are developing countries. About 98% of world production of banana is grown in developing countries. Commonly, developed countries is the main target or destination for exports banana (Food and Agriculture Organization of the United Nations, 2004).

Banana is one of the important fruits in Malaysia and is widely grown all states especially in Peninsular Malaysia. In 1982, about 15,384 hectares area is cultivated with banana where Johor, Pahang and Perak are major producing states. Raub, Parit, Kuala Kangsar, Kluang, Pontian, Batu Pahat, Lipis and Larut-Matang are the important banana growing areas (Abdullah *et al.*, 1990).

Traditionally, banana cultivation is confined to small holdings as a cash crop, or intercrop with other tree crops such as cacao, coffee or oil palm (Abdullah *et al.*, 1990).

Visual quality plays an important role in marketing of banana fruit. It was powerful attraction that can easily attract customers. So, banana cultivars such as 'saba' cultivar that exhibit some unpleasant visual on its peel especially at higher ripening index usually are not in list of the first choice of customers. This is also true for sellers. If the

sellers found out that the peel is look like to deteriorate, he or she might not sell it to the customers. Therefore, the justification of this study is to tell people that even though the banana pulp is look like to deteriorate, but the flesh is still good and can be consumed especially for making fried banana.

1.2 Objective

The objective of this study is to observe the physical changes of banana *Musa paradisiaca* cv. Saba during ripening and senescence.

CHAPTER 2

LITERATURE REVIEW

2.1 Banana

Banana or *Musa* spp. is one of the most popular tropical fruit around the world. In Malaysia and Indonesia, banana is called "Pisang", in Philippines, the local people called it "Saging" while local people in Thailand and Vietnam called banana "Kluai" and "Chuoi" respectively.

The exact origin of edible bananas is unknown (Espino *et al.*, 1991). But this statement conflict with Abdullah *et al*, (1990). According to Food and Agriculture Organization of the United Nations (2004), and Abdullah *et al.* (1990), banana are originated from Southeast Asia where it grows wildly in the jungles of Malaysia, Indonesia and Philippines.

The first Europeans to know about banana were the armies of Alexander the Great in 327 B.C. During the middle ages, Moslems and Christians believed that banana is a forbidden fruit of paradise (Food and Agriculture Organization of the United Nations, 2004). According to Espino *et al.* (1991) in his books, Indo-Malesian region is considered as the main centre of banana diversity. It is believed that *Musa accuminata Colla* is a major parent for most edible bananas.

Banana is member of the genus *Musa*; part of family Musaceae and derived from wild species *Musa acuminata* (AA) and *Musa balbisiana*. About 1000 varieties exist around the world in 50 groups. The most valuable banana is Cavendish varieties which been exported in many countries (Food and Agriculture Organization of the United Nations, 2004).

Banana plant is often referred to as a tree-like perennial herb. It can reach 2 to 9 m in height with short underground stem or corm. The short rhizomes will grow from the underground stem to produce a clump of aerial suckers close to the parent plant.

As for roots, banana roots are adventitious and spreading 4 to 5 m laterally and generally forming a dense mat in the top 15 cm. New leaves that grow from the corm will grow up continuously through the centre of the pseudostem with their laminas tightly rolled. The emerging leaf unfolds a large oblong blade (150 to 400 cm x 70 to 100 cm) with well-marked, pronounced supporting midrib and arrange pinnately.

Terminal inflorescence grows from each corm and its peduncle extending through the centre of the pseudostem. Terminal inflorescence is a compound spike of flowers and arranged by groups, compact and conical when still young.

Generally about 12 to 15 flowers are produced for each node and 5 to 15 nodes produce female flowers. Bracts are open in sequence from base to top while the peduncles elongates. Banana fruit is berry-like, seedless, 6 to 25 cm x 2.5 to 5 cm in size, green, yellow or reddish and curved. Each cluster of fruit is known as 'hands' while individual fruit are called 'fingers'.

Banana is suitable planted in warm and humid tropical climates. The optimum temperature for optimum growth of banana is 27°C and the maximum temperature is 38°C. Injuries such as chilling injuries will develop when banana is placed in area with temperature reaches 13°C. It requires full sun in order to grow but excessive exposure to sun light causes sunburn. Other than that, banana is sensitive to strong wind which can blows over banana plant and causes distortion (Espino *et al.*, 1991). To avoid wind destruction, use bamboos as a shield. This can be done by planting bamboo trees on edge of the plantation (Espino *et al.*, 1991).

2.2 Saba Cultivar

Saba banana is one of the important cultivar in Philippines. Nevertheless, the awareness of Saba banana economic value has spread through out Malaysia especially in Sabah (Photo 2.1). Saba banana usually consume after cooking and one of the famous cooking purpose banana cultivar. Bunch weight is about 14 kg to 22 kg with 10 to 16 hands and 12 to 20 fingers per hand (Valmayor *et al.*, 1990).

Photo 2.1 Saba cultivar

The fruit is angular and skin thick while the pulp is creamy white with fine texture and well develop core. Commonly, flesh will become sweet upon ripening (Valmayor *et al.*, 1990).

2.3 Banana Quality

Quality is a mixture of parameter or characteristics that defines the value of certain vegetables and fruits. Basically, characteristics that been used to determine quality are physical quality (size, appearances, shape and also free from any diseases), color (skin and flesh), taste (sugar and acid contain, aroma), changes in texture either hardening or softening and also fiber contain while quality that related to nutritional value is vitamin and minerals (Kader, 2002).

2.4 Changes That Occur During Growth, Maturation, Ripening and Senescence

Banana fruit usually undergo 4 phases of development namely: growth, maturation, ripening and senescence. Growth stage can be characterized by rapid cell division and elongation while maturation phase can be marked by physical and chemical changes that have bearings on fruit quality and postharvest behavior. As for ripening stage, it can be characterized by increased of respiration rate and ethylene production and followed by a decline which will trigger the senescence stage.

The growth of banana fruit usually follows a simple sigmoid curve. In the early stage of growth, banana fruit usually experienced slow changes in physical characteristic but later on rapid increase in size, volume, weight, pulp firmness, pulp and peel weight. All of these changes occur simultaneously with visual changes such as skin color, nature

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