

Utilization of the Major Crops in East Java, Indonesia*

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Introduction

From June to July in 1981, the author stayed in East Java, Madura, and Bali, Indonesia. This paper reports on the utilization of four kinds of major crops (palms, cereals, tuber crops, and legumes) in this area, and the analysis of several kinds of starch which are used commercially in this country. Separate papers will deal with other crops and include a more detailed description³⁻⁵⁾.

Indonesia is an archipelago in South Asia inhabited by many races of people each having their own language and culture. From ancient times, Indonesia has been under the strong influence of the two great but different cultures, Chinese and Indian. European culture was later introduced by the Dutch, and these cultures integrated to form the present culture peculiar to Indonesia. The peculiarity of her culture is well reflected in the way the crops are used, and gives many ideas as to the spread and acceptance of crops.

In Indonesia, the same foods have many names and different methods of preparation. The names used in the literatures listed under "Reference" are used herein^{1,2,6-10)}.

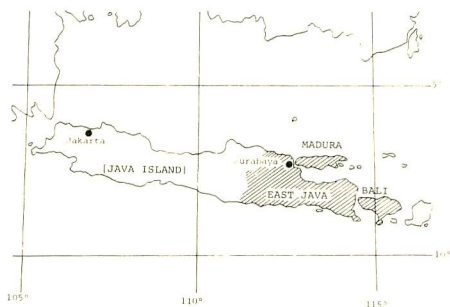


Fig. 1. Map of Java and the neighboring islands.

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Descriptions of Major Crops

1. The palms

The palms are invaluable to the people living in tropics. The most popular of the palms is coconut palm, *Cocos nucifera* Linn. The yearly production of coconut fruit reaches about 14 million tons in Indonesia. As can be said for other coconut palm growing areas of the world, coconut is one of the most important foods in Indonesia. *PARUTAN KELAPA* (grated coconut albumen, oil content 30–40%) is consumed in large quantities for cooking, as well as being sprinkled over various dishes and cakes for additional flavor (Fig.6). *SANTAN KELAPA* (coconut milk), made by adding water to the grated albumen and squeezing it, is used to cook rice, vegetables, fishes and others. Thick *SANTAN KELAPA* (coconut cream) is seasoned to make various sauces and syrups. The most demanding oil in Indonesia is *MINYAK KELAPA* (coconut oil) and many dishes and cakes are made using this oil. *GULA MERAH* (palm sugar) is obtained by condensing the juice flowing out from slashes made on the stem of the coconut palm. It is also made from sugar palm, *Arenga pinnata* Merr., and palmyra palm, *Borassus flabellifer* Linn. These sugars are sold after being solidified into various forms, and are known by various names such as *GULA AREN*, *GULA JAVA*, *GULA BALI*, etc. (Fig.7). They are an indispensable ingredient for the Indonesian dishes and cakes.

The sago palm, *Metroxylon sagus* Rottb., from the stems of which starch is obtained, grows wild in such areas as Melanesia, Malaysia, New Guinea and others. And many races use it as their staple food. Its value as a starch producing plant has attracted the attention of many countries lately. But, the number of sago plants growing in Java is very small, and it is said that low cost *SAGU* (sago starch) has long been imported from Moluccas Is. to make noodles and sago pearl in Java. The so-called "sago flour" sold in Jakarta, however, was found not to be sago starch but cassava starch (Sample G).

There are several other species of palms from the stems of which starch can be obtained. But, the most common starch is *ARENGA* obtained from a kind of sugar palm, *Arenga microcarpa* Becc. As shown in the results of analysis, some of the *TEPUNG HUNKWEE* in the market is *ARENGA* (Sample B). Since the properties of mung bean starch and arenga starch are similar, both starches may be marketed as *TEPUNG HUNKWEE*, just as potato starch is sold as starch of dogtooth violet "katakuri" in Japan.

2. The cereals

The staple food in Indonesia is rice. About 26 million tons of rice are produced annually in Indonesia, which is twice the amount produced in Japan. However, rice production in Indonesia does not meet the demand of her people hence more than 2 million tons of rice is imported each year.

The basic way of rice consumption is to mix a small amount of a "sidedish" with *NASI PUTIH* (white rice). *NASI PUTIH* is cooked by steaming, and also by boiling as in Japan. In either case, non-sticky rice with non-scorched part is preferred. There are also several other rice dishes made by adding various ingredients with *NASI PUTIH*. For example, *NASI GORENG* is made by mixing *NASI PUTIH* with chopped meat and shrimp, and frizzled in *MINYAK KELAPA* after seasoning it with spice consisting mainly of chilli. This is a typical dish in Indonesia. *NASI GURIH*, boiled rice in coconut milk instead of water, is preferred to *NASI PUTIH*. *NASI KUNING* (yellow rice) is made by adding turmeric to rice, and *NASI KEBLI* is made by adding various vegetables and meat to rice, and both of them are a popular dish during a festivals or celebrations. This is a custom common to Malaysia also.

LONTONG, which is made by cooking rice molded into a cylinder of banana leaves, and *KETUPAT* is cooked in a small basket made of palm leaves, are eaten as a staple food. It is also cut up and used in cooking such as *GADO-GADO*. *LEMPEL*, identical to "zontsu" popular in China is also a common dish in Indonesia.

There are a lot of cakes made from rice and waxy rice in Indonesia (Figs.8 and 9). For example, *KUE-KU* is made by steaming kneaded waxy rice flour, *DODOL* made by kneading rice flour with various ingredients such as palm sugar, eggs, milk and some fruits etc., *ONDE-ONDE* a deep-fried sweet cake filled with sweet bean jam, and *LAPIS* a kind of pudding, can be found throughout Java and the neighboring islands.

About 4 million tons of maize is produced annually to supplement rice. Two thirds of the maize is grown in the paddy fields during the dry season.

Apart from these cereals, Indonesia imports about 1 million tons of wheat per year.

3. The tuber crops

The most popular of the tuber crops in Indonesia is cassava. About 13 million tons of cassava is produced annually. Sweet cassava contains less CN-compound and is good to eat without any pretreatment. For example, *KETELA KRAWU* is steamed tuber, *BUBUR TENUTUAN* is made by cooking with various ingredients in coconut milk, and *KERIPIK*

is made by frying after slicing tubers.

About half of the total cassava produced is dried immediately after it is dug up. It is called *GAPLEK*. *GAPLEK HITAM* is made moldy by wetting in rain during the drying process. These are eaten after steaming, or cooked with rice, after soaking in water overnight. *GATOT* is made by drying after tubers have been steamed.

The method of removing the juice by pressing cassava mash is used around the world. The main purpose of using this procedure is to eliminate poisonous CN-compound, but also commonly practised because it adjusts the moisture of cassava mash. By this procedure, *ROTI*, a kind of bread, and *PROL SINGKONG*, a kind of pancake, etc. are made. *TAPIOKA* (cassava starch) is used in various cooking, and also hardened into small kernels to make *BIJI DELIMA* (Fig.10). *KERUPUK UDANG* (Fig.11), a kind of crackers, is made by adding shrimp with *TAPIOKA*.

The food made from pounded steamed cassava is called *GETUK*. Various kinds of *GETUK* are made by adding different ingredients, such as palm sugar, grated coconut and coconut milk. Large amounts of *TAPE* is produced by fermenting steamed cassava, and is eaten in this form, or after processing in different ways.

Another important product is sweet potato, and about 2 million tons of it is produced annually. Taro, yam, edible canna, potato, arrowroot, elephant's foot, Indian arrowroot, etc. are also cultivated. These are cooked as vegetables, or sometimes their starches are extracted.

4. The legumes

Various kinds of legumes are cultivated in Indonesia. The most popular of the legumes is the soybean and nearly 0.7 million tons are produced annually. Soybean is an important protein source for the people of this nation, and methods of processing soybean are well developed. One of the most popular products is *TEMPE* (Fig.12). It is made from molded soybean, and is added to cooked foods as a "seasoning" or is fried to make *TEMPE GORENG*. *TAHU*, another product of soybean (Fig.12) is similar to the Japanese "tōfu", but is slightly firmer. It is produced in nearly same quantity as *TEMPE* and is cooked into *TAHU GORENG*, *TAHU TELUR* etc.. Fermented seasonings similar to "shōyu" and "miso" of Japan are also made from soybean. *KECAP* is comparable to "shōyu". It is made by forming steamed soybean moldy, which is dried and then pickled in brine. After these processes, sugar is added. The contents are boiled to make a thick sauce. There are two kinds of *KECAP*, i.e., *KECAP MANIS* (sweet taste) and *KECAP ASIN* (salty taste). *TAUGE* (germinated soybean) is also popular in Indonesia.

The next most abundant crop after soybean is peanut. Close to 0.4 million tons of peanut is harvested annually in Indonesia. It is widely used as an ingredient of candy and various sauces for *GADO-GADO* and *SATE*. *GADO-GADO* and *SATE* are very popular dishes in Indonesia. *ONCOM* is another product, made from steamed peanuts moldy, which is added to various cakes or cooked food as a "seasoning".

Mung beans are used in various Indonesian dishes such as sweet bean jam, sweet bean meal soup, *TAUGE* (germinated), noodle, and a kind of pudding cakes called *HUNKWEE* (Samples A and C).

The young pods (or beans) of pigeon pea, lima bean, kidney bean, goa bean and cuba bean etc. are used as vegetables, while another crop tamarind is used as a staple vinegar (Fig.13).

Discussion

Although both Japan and Indonesia consume rice as a staple food, the dishes of the two countries taste very different. The characteristic features of Indonesian foods seem to consist in a conventional use of coconut and its oil, together with the abundant use of various kinds of spices in almost all the dishes. Coconut is certainly one of the most important cooking media in Indonesia. Coconut oil is composed of a relatively high proportion of saturated fatty acids and is stable in its quality¹¹⁾, this is the reason why coconut makes itself an excellent cooking medium for the tropical dishes (Table 1). However, it is considered to be quite probable that the use of spices may be reduced in accordance with the improvement of the nutritional and hygienic conditions in future.

It is quite interesting that many soybean products similar in kinds have been developed in both countries though there is a big difference in taste. Not only is the

Table 1. Property of coconut oil¹¹⁾

Melting point	20 - 28°C	
Specific gravity	0.912 - 0.922	
Saponification value	246 - 264	
Iodine value	7 - 11	
Composition of fatty acids	10 : 0	10 - 19.5%
	12 : 0	40 - 45
	14 : 0	20 - 24
	16 : 0	7 - 10.5
	18 : 0	5
	18 : 1	6.3

combination of rice and soybean nutritionally beneficial, but soybean is very important protein source in Indonesian diet because pork is not eaten for religious reasons.

The fact that cassava is used in various ways is also a point of interest. Cassava has the disadvantage that it deteriorates rapidly after harvest and contains poisonous CN-compound. However, cassava has at least the following favourable qualities that a) the peel and cortex are removed smoothly by hand, b) the inner part is full of starch and less content of others, and therefore, c) the tissue is not sticky and easy to process or dry.

But, judging from the quality of the *GAPLEK* produced for commercial use it seems that many processing techniques need improvement. Development of a technique to extract starch from *GAPLEK* is most anticipated. Since the potential demand for both *GAPLEK* and *TAPIOKA* are high in many parts of the world, the utility value of cassava as a crop will increase. The development of cassava production is thought to be very favorable from the aspect of effective use of land, especially in Java.

The analytical data of the starch samples showed that A and C =mung bean starch, B =arenga starch, D=arrowroot starch, and E, F, G, H=cassava starch⁵.

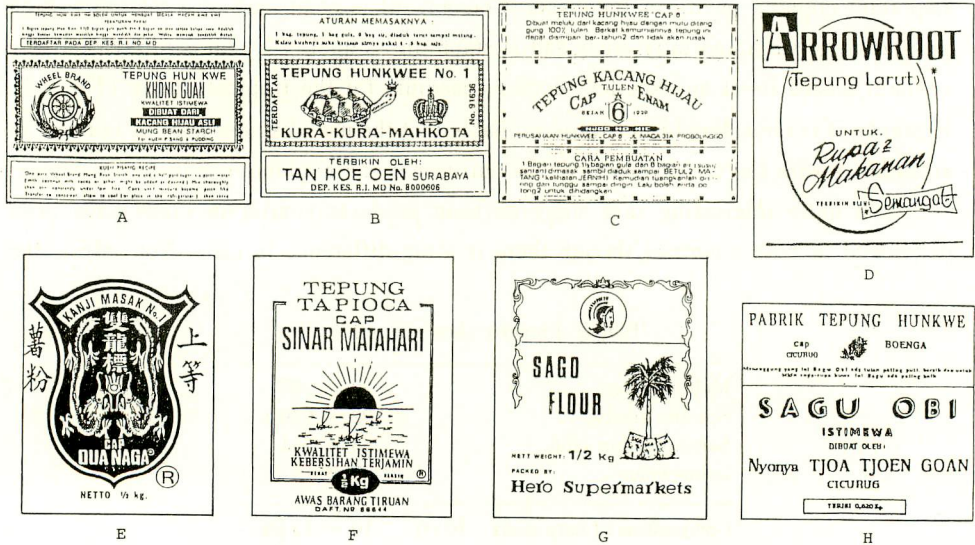


Fig. 2. Labels of the starch samples.

Table 2. Chemical analysis of the starch samples

Symbol	Indication	Origin	Purchase	Moisture %	Purity %	Whiteness %	Total P. %	Blue value O.D.
A	<i>TEPUNG HUN KWE</i> (Mung bean starch)	Mung bean	Jun.6 Jakarta	13.3	98.3	84.0	0.017	0.602
B	<i>TEPUNG HUNKWEE</i>	Mung bean (?)	Jul.1 Sumenep	15.6	99.8	70.5	0.009	0.461
C	<i>TEPUNG KACANG HIJAU</i>	Mung bean	Jul.19 Jakarta	13.8	99.0	71.0	0.027	0.564
D	<i>ARROWROOT</i> (Tepung Larut)	Arrowroot	Jul.16 Surabaya	13.1	96.3	81.4	0.017	0.398
E	薯粉	Cassava(?)	Jul.16 Surabaya	14.6	98.5	85.3	0.009	0.400
F	<i>TEPUNG TAPIOCA</i>	Cassava	Jul.19 Jakarta	13.3	97.9	90.3	0.011	0.390
G	<i>SAGO FLOUR</i>	Sago palm	Jul.19 Jakarta	13.1	98.2	94.4	0.009	0.369
H	<i>SAGU OBI</i>	Cassava(?)	Jul.19 Jakarta	15.3	98.9	92.0	0.012	0.369

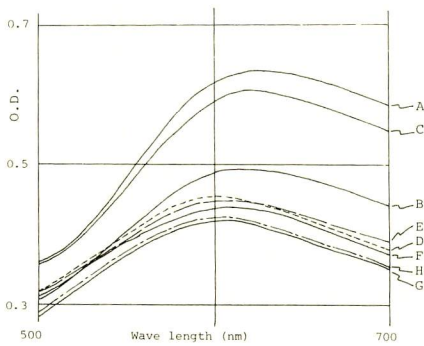


Fig. 3. Iodine coloration spectra.
Starch 2 mg-I₂ 4 mg/50 ml
Hitachi EPS-3T, 1 cm cell

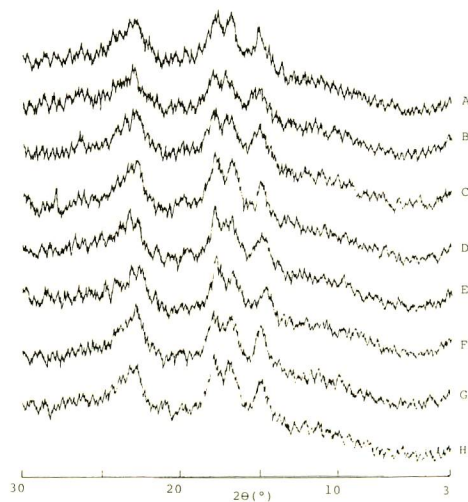


Fig. 4. X-ray diffractograms.
30 KV-15 mA, 1°(2θ)/min
Rigakudenki D-3F

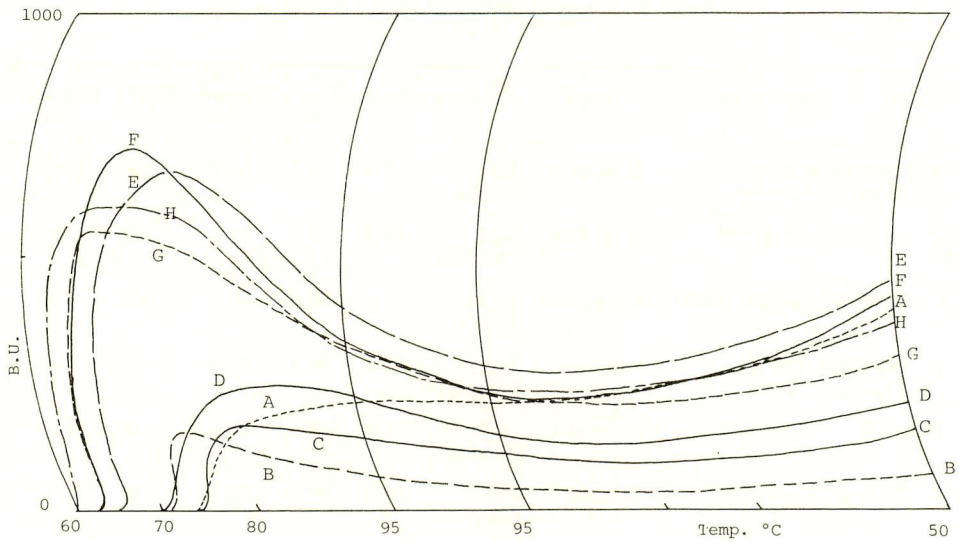


Fig. 5. Brabender amylograms.
6 % starch, 75 rpm, 1.5°C/min Brabender DC-3

Summary

This paper reports on the utilization of four kinds of crops : palms, cereals, tuber crops, and legumes, in Indonesia, and the analysis of several kinds of starch which are used commercially in this country.

Coconuts was found to be one of the most important foods in Indonesia. The characteristic features of Indonesian foods seemed to be attributable to the conventional use of coconut and its oil.

The staple food in Indonesia is rice, which is widely used as an ingredient for cakes also. One of the most popular cakes is "undried sweet cakes" made from rice assorted coconut and palm sugar.

Cassava is the most popular of the tuber crops in Indonesia and is used in various ways for cooking, drying, squeezing, starch extracting, pounding and fermenting. These products are used as staple and also snack foods, with replacing rice.

It is quite interesting that many similar soybean products are found in Indonesia and Japan, although the two countries have very different backgrounds as far as people and their diets are concerned.

Results of analysis of the starch samples indicate that starch sold as "sago starch" is not from sago palm but from cassava. On the other hand both types of starch (from mung bean and from arenga) were sold as *TEPUNG HUNKWEE*.

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References

- 1) DARJANTO and MURJATI : *Khasiat, racum dan masakan ketela pohon*. p. 59 - 84, Yayasanam Dewi Sri, Bogor (1980)
- 2) ELEONORA : *Masakan masakan Indonesia*. p. 1-103, Loka Tjipta, Semarang (1974)
- 3) FUJIMOTO, S. : On the general foods of Java and Neighboring islands. *Bull. Fac. Agr. Kagoshima Univ.*, **33** (in press)
- 4) —. : The utilization of cassava in Indonesia. *Mem. Kagoshima Univ. Res. Center S. Pac.*, **3** (in press)
- 5) —. and NAGAHAMA, T. : The properties of the several starches on the market in Indonesia. *Kaseigaku Zasshi*, **34** (in press)
- 6) Lembaga Biologi Nasional-LIPI : *Ubi-ubian*. p. 1-113, Balai Pustaka, Jakarta (1980)
- 7) “ Nyonya Rumah ” : *Pandai masak I*. p. 1-164, Bagian Penerbitan, Jakarta (1980)
- 8) STEENIS, C. G. : *Flora, untuk selolah di Indonesia*. p. 1-495, Pradnya Parameta, Jakarta (1978)
- 9) SURATIN, N. Y. : *Resep kue-kue dan podeng*. p. 1-58, Mekar, Surabaya (—)
- 10) TJOKRONEGORO, A. A. : *Aneka masakan singkong dan ubi*. p. 1-69, Gramedia, Jakarta (1980)
- 11) SAKURAI, Y. (ed.) : *Sogoshokuhinjiten*. p. 923, Dōbun Shoin, Tokyo (1975)

Explanation of figures

- Fig. 6. Grinding of coconut albumen in a market.
- Fig. 7. *GULA MERAH*, palm sugar.
- Figs. 8–9. *KUE-KUE*, various “undried sweet cakes”.
- Fig. 10. *BIJI DELIMA*, made from tapioka or sago starch.
- Fig. 11. *KERUPUK UDANG* and other crackers.
- Fig. 12. *TAHU* and *TEMPE*, the major products of soybean.
- Fig. 13. *ASAM*, drying of tamarind pods.
- Figs. 14–21. Photomicrographs of starch granules.
14 : A : Mung bean starch, 15 : B : Arenga starch, 16 : C : Mung bean starch, 17 : D : Arrowroot starch, 18 : E : Cassava starch, 19 : F : Cassava starch, 20 : G : Cassava starch, 21 : H : Cassava starch.

