PROCEEDINGS OF THE IPB-JICA INTERNATIONAL SYMPOSIUM ON AGRICULTURAL PRODUCT PROCESSING AND TECHNOLOGY

JULY 31 — AUGUST 2, 1984
BOGOR, INDONESIA

Edited by

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INSTITUT PERTANIAN BOGOR
and
JAPAN INTERNATIONAL COOPERATION AGENCY

FOREWORD

The Agricultural Product Processing Pilot Plant (AP4) Project (Project code: JTA 9(a)8) was initiated in October 1977 as a technical assistance extended by the Government of Japan through the Japan International Co-operation Agency (JICA) to the Faculty of Agricultural Engineering and Technology (FATETA), Institut Pertanian Bogor (IPB). Upon completion in 1984, the project has fulfilled its aims of upgrading FATETA-IPB staffs and staffs from other relevant institutions in Indonesia in the pilot plant as well as related training in Japan and provision of the pilot plant with adequate facilities for food quality control and processing lines.

The International Symposium and Exposition on Agricultural Products Processing and Technology (ISEAPPT) was held to commemorate the successful completion of the AP4 Project in which scientists from ASEAN, Japan and the United States were gathered in Bogor from July 31 through August 2, 1984 to exchange views and share updated information in the field of agricultural products processing and technology.

Major items discussed in the meeting as can be seen in this proceeding included research achievements and experiences from the respective participating countries, the state of the arts of traditional foods and its future improvements and the possibility to develop other food resources available in ASEAN countries. It is our sincere hopes that this proceeding could be utilized effectively as a source of information not only for references in future research programs but also for the practitioners and field engineers as well as for curriculum development in the field of agricultural products processing and technology.

Finally, we appreciate the asistances extended by the Japan International Cooperation Agency, the Directorate General of Higher Education, Ministry of Education and Culture, Bogor Agricultural University, as well as other institutions which had provided support from the preparation stage until the completion of the symposium, exposition and publication of the proceeding.

Bogor, April 1985

The Steering Committee

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INTERNATIONAL SYMPOSIUM AND EXPOSITION ON AGRICULTURAL PRODUCT PROCESSING AND TECHNOLOGY

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REPORT BY THE STEERING COMMITTEE

The honorable Japanese Ambassador representated by Mr. Yamamoto

The honorable Prof. Doddy Tisnaamidjaja, Director of The Indonesian Institute of Sciences

The honorable Rector of IPB, Prof. Andi Hakim Nasoetion

The honorable JICA representatives

Distinguished Guests

Ladies and Gentlemen

It is a deep and great pleasure for us to have you with us today in the Opening Ceremony of The International Symposium and Exposition on Agricultural Product Processing and Technology. The symposium was organized by The Faculty of Agricultural Engineering and Technology, Bogor Agricultural University, jointly sponsored by The Indonesian Ministry of Education and Culture, and Japan International Cooperation Agency (JICA). The symposium is a part of the activities of the Agricultural Product Processing Pilot Plant (AP4) Project which is a cooperative program between IPB and JICA. As you know the AP4 project was officially opened by his excellency President Soeharto in September 1981. The AP4 has since then been utilized for education, research and extension, public services, and the project will officially terminate in October 1984, this year. This symposium serves as a proof that this cooperation has been satisfactorily carried out. It is our hope that the cooperation might be further developed in the future.

The symposium will last for three days and is divided in three sessions: Papers in the first session will be on Traditional Food Processing in Tropical Asia, the second session will be on Recent Development on Agricultural Product Processing and Technology in Asia, and the third session will be on General Presentations on Agricultural Product Processing and Technology.

The total participants are about 100 persons, from various universities, research institutions, private industries, governmental agencies, and IPB staffs and students. I am very happy to inform you that the participants from outside of Indonesia are about 15 persons from ASEAN countries, Japan and USA.

On the last part of the symposium a general discussion will be held on the following two subjects: First, Processing Engineering, and second, Research and Development. It is hoped that the results of the symposium may be used for the development of science and technology in the area of agricultural product processing.

To complete the symposium, an exposition will be held at the AP4 Project in Darmaga on Wednesday afternoon. The exposition will include demonstrations of various processing lines such as tofu, starch, cassava, noodle, rice, jar

fermentor and sugar, as well as an exhibition of supporting facilities such as the quality control laboratory, microbiology laboratory and workshop.

In order to give the basic idea and direction for the symposium we are honor to have Prof. Doddy Tisnaamidjaja, the Director of the Indonesian Institute of Sciences, to give his keynote address. Prof. Doddy has given a great deal of attention and assistance to the conduction of the AP4 project when he was the Director General for Higher Education. I believe that his keynote address will be very useful for the symposium participants. For this I would like to thank him.

To all those who have assisted in the conducting of the symposium especially to Prof. Matsuyama, JICA Expert Team Leader, and his staffs, and the Organizing Committee of the symposium, I would like to say thank you and extend our great appreciation. And last but not least I would like to cordially ask the Rector of IPB, Prof. Andi Hakim Nasoetion to officially open the International Symposium and Exposition on Agricultural Products Processing and Technology.

Thank you.

Chairman of The Steering Committee,

Soedodo Hardjoamidjojo

ADDRESS AND OPENING OF THE SYMPOSIUM AND EXPOSITION

The Ambassador of Japan, representated by First Secretary Mr. Yamamoto

Prof. Doddy Tisnaamidjaja, Director of The Indonesian Institute of Sciences

The Dean of Faculty of Agricultural Engineering and Technology, IPB

Distinguished Guests and Participants

Ladies and Gentlemen

First of all I would like to welcome you to this campus. I hope that you will have a fruitful discussion here. I will try to give my remarks by telling you some experience I have been encountered a few days ago. One week ago I was visiting Air Sugihan, a transmigration area, three and a half hours away by speedboat trip from Palembang. On that trip along the Musi river, I was passing a riverboat loaded with bunches of halfripe bananas. Arriving at Air Sugihan I found out that from one bunch a farmer will only benefit between 200 to 400 rupiahs, while in Palembang it will cost you 75 rupiahs to get hold of a banana. The other way around, if a farmer needs a sack of fertilizer, it has to be brought from Palembang by boatride to Air Sugihan and from there transferred to small raft that could enter the shallow drain into the transmigration villages. This could result in the doubling or tripling of the retail price of fertilizer and that implies that the banana sold of 200 rupiahs is really less in value than 200 because the price of fertilizer in Air Sugihan is very expensive.

Ladies and Gentlemen,

This is a simple example of the importance of agricultural products processing and technology to the successful expansion of farming areas to places remote from urban centers of population concentration. It is therefore a great pleasure for Institut Pertanian Bogor to cooperate with the Japan International Cooperation Agency (JICA) to conduct this Symposium and Exposition on Agricultural Product Processing and Technology. In this symposium there will hopefully be an opportunity to exchange scientific information gained from research developed in the ASEAN region, including those resulted from research conducted at the Agricultural Product Processing Pilot Plant (AP4) which by itself again was established through the assistance of JICA.

Through this continued cooperation between ASEAN and Japanese scientists I hope beneficial effect will be developed in the form of useful ideas to both agro technology and may be also biotechnology in Indonesia and the ASEAN region. In conclusion of this remarks I would like to declare this International Symposium and Exposition on Agricultural Products Processing and Technology officially open.

Thank you for your attention.

Rector of IPB,

Andi Hakim Nasoetion

CONCLUSIONS AND RECOMMENDATIONS OF THE SYMPOSIUM

PROCESSING ENGINEERING

1. The symposium had provided information of two major problems:
   (i) The need to develop basic as well as applied research.
   (ii) To determine the appropriate equipments and processes for certain products.
2. Basic and applied research should cover:
   (i) Inventory of potential sources of food, feed and calories (protein, sugar, etc.).
   (ii) Determination of the physico-chemical properties to obtain standardized quality and food safety standard.
   (iii) Modeling on process mechanisms: distillation, thermal processing, drying, cooling, size reduction, extraction, energy requirements, packaging, etc.
3. The development in process equipments should be provided by inventory of available unit operations (traditional and modern), equipment models and other related information. In the future, emphasize should be given to consider the diversified nature of products available at the farm level, users friendliness, and the need to provide labor intensive equipments.
4. Some of the above issues should be continued as future topics for research.
5. It is recommended the research results should be disseminated not only for improving the rural society but also to encourage the development of agro-based industry.

RESEARCH AND DEVELOPMENT

For the development of agricultural products processing and technology the research activities should be directed toward the following groups:

1. Basic Research
   - (i) Inventory of natural and genetic resources.
   - (ii) Determination of chemical changes including safety aspects, quality control and standard, and process technology.
   - (iii) Food habit.
2. Applied Research
   - (i) Development of appropriate processes and equipments which include:
     - a. Inventory of traditional agricultural product processes..
     - b. Development of new agricultural product processes.
   - (ii) Development of research management which include clearing house, coordination, and extension services.

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KEYNOTE PAPER

RESEARCH AND DEVELOPMENT ON AGRICULTURAL PRODUCT PROCESSING AND TECHNOLOGY

DODDY TISNAAMIDJAJA
Director General of Higher Education
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The Rector of Bogor Agricultural University (IPB)
The representatives of Japan Embassy and JICA
The Chairman and Members of the Steering Committee
Distinguished guests, participants of the Symposium,
Ladies and Gentlemen.

Allow me to begin this address by extending a word of sincere appreciation to the Chairman of the Steering Committee of this Symposium for giving me the honour to address this distinguished gathering of eminent senior scientists and many promising young scientists and students, on a topic which is of key importance of the national development of Indonesia.

However, at the same time I would also like to apologize for the incompleteness of my presentation, especially concerning up to date information and the most current development that may have taken place in the different scientific institutions that I am not aware of. Nevertheless hopefully my address will still provide you with some inputs that will be of use for your deliberations.

Ladies and Gentlemen

In the fourth five year development plan (PELITA IV), the agricultural sector is still a key of importance and is given top priority in the national development, especially in the efforts to acquire self-sufficiency in food and supporting the industrial sector. It is intended to obtain a balanced economic structure between the agricultural and industrial sectors.

To refresh our memory and to give us better perspective of the importance of agricultural in the total national development, I will put some salient figures concerning the agrosector in Indonesia, during the post Pelita's. The agrosector absorbs most of the employment and other economic engagements of the population, comprising 54.8 percent working in the agricultural fields by 1980.

Agriculture contributes approximately one third of the gros domestic product of Indonesia. From the GDP 9,936.2 billion rupiahs in 1979, 3,203.7 billion rupiahs or 29.8 percent came from agriculture. Although the absolute contribution of the agricultural sector to GDP increases from 2,354.1 billion rupiahs in 1970 to become 3,203.7 billion rupiahs in 1979, the selective

contribution of the agricultural sector to GDP tends to decrease from 45 percent in 1970 to become 32.3 percent in 1979. Agricultural commodities which contribute most to GDP are mostly food crops, followed by non-food farm crops, estate crops, livestock and livestock products, forestry, land and marine fisheries. From the total export of Indonesia in the amount of US 12.70 billion in 1982, the agricultural sector contributed 1.86 billion or 14.6 percent. The agricultural commodities contributed 69.9 percent of the non-oil export of Indonesia. It contributes more than the other non-oil export commodities, e.g. non-agricultural crude materials, manufactured goods, machinery and transport equipments, chemicals etc.

The production of rice has doubled in 14 years, i.e. from 10.44 million tons in 1968, becoming 23.837 million tons in 1982. At the same period the cultivated rice-land only increased 17 percent. This creates a fundamental problem in development. The active population working in agriculture constantly increases in number and percentage. The increase of agricultural manpower is higher than the increase of agricultural land, which leads to the decrease of productive land per capita. The other problems in agricultural development are the marketing of agricultural commodity and post-harvest losses of agricultural products. Those will influence the productivity, and hence the income and welfare of the active farmers.

Ladies and Gentlemen

As a continuation of the previous effects during the post Pelita's, agricultural development in Repelita IV, sets the following multiple objectives:

1. To increase agricultural production to meet domestic requirements for food and industry.
2. To promote export of certain agro-commodities.
3. To increase farmer's income.
4. To create new employment.
5. To promote more balanced distribution of business opportunities.
6. To support regional development, and to promote transmigration activities.

It is expected as I have mentioned before, that the agricultural sector will have an increasingly biggers role in supporting the development of industries to achieve a more balanced economy.

In our efforts to formulate research programs that are relevant to the needs in the agro and related sectors, it is also very important to be aware of the main objectives the food and nutrition programs in Repelita IV, i.e.:

1. To achieve an adequate and equitable distributed supply of food at prices that are reasonable for both the consumers and producers, so or to improve the nutritional value of the people's diet.
2. To reduce the degree of dependence of the people's diet on rice by diversifying both the population's food-consumption pattern and the available food supplies.

3. To support the effort to promote the acceptance of the norm of "a small, happy, and prosperous family", through the reduction in infant and child mortality rate.
4. To improve the nutritional status of the people through reduction in the prevalence on nutritional diseases, primarily protein-calorie malnutrition, vitamin A deficiency, nutritional anaemia and goitre.

To support the food diversification program, food processing industries will be encouraged and more efforts will be directed towards the improvements of post-harvest technology. On the consumption side, nutrition education program will be intensified to promote diversification in the peoples diet.

Ladies and Gentlemen

Taking those very important objectives in the agro sector and related food and nutrition programs into consideration, it stands to reason that those objectives could only be met if the research function of the concerning institutions in obtaining the science and technology to be implemented in the programs, could be well-fulfilled.

The capabilities to open up scientific frontiers in agricultural research and development in Indonesia, still have narrow boundaries, due to the many constraints that still have to be overcome. However, while still engage in manpower development and institution building, agricultural research in Indonesia, does show encouraging strend. Substantial result for the application and improvement of certain aspects in the agricultural proses and phase, is well commensurated with the current available limited resources in the R & D in agriculture.

It is well understood that to achieve the objectives in the agro-sector as mentioned before, manpower and institute building to cater for the development of new agro science, agro technology and even further to biotechnology and genetical engineering, is a prerequisite and should be finely implemented. Scientific frontiers as base for agriculture that still need to be determined in Indonesia, to mention only a few key areas, are:

- Genetical, physical and chemical approaches towards achieving greater photosynthetic efficiency and inhibition of photo respiration.
- Enhancement of biological nitrogen fixation and the basic requirements and mechanisms of symbiosis; catalysts in abiotic chemical fixation.
- Enhancement of crop productivity and reduction of resources-input by improved water and fertilizer management: trickle or drip irrigation, foliar application, timely application of nutrients, etc.
- New strategies for pest control.
- Building of new crops, breeding for specific yield components, etc.

While in the post harvest period, the treatment and processing of agro products, e.g. for storage, preservation of food products, feed and certain industrial chemicals, the success depends very much on the mastering of biotechnology and genetical engineering. Biotechnology, simply explained as "the use of living organisms or their components in industrial process", is possible because microorganisms naturally produce countless substances during their lives, some of the substances have proved commercially valuable. A number of different industries have learned to use micro-organisms as natural factories, cultivating populations of the best producers under conditions to enhance their abilities.

By special techniques, i.e. genetical engineering, the genetic material of the microorganisms could be manipulated to produce the desired characteristics, e.g. in improving the efficiency and productivity of these biological systems. The major commercial effects of the application of genetic engineering will be in the pharmaceutical, chemical and food processing industries.

It is very fortunate that the Indonesians are well familiar with indigenous, simple biotechnology processes, e.g. fermentation, in their food and nutrition habits. However, the improvement of their techniques and technologies and its enculturization, especially if new food products are to be introduced, certain social and cultural understanding need to be developed to facilitate the acceptance.

Ladies and Gentlemen

It should be noted that already since the late sixties or early seventies, several laboratories in the universities and research institutions have already made efforts to develop competensis in certain aspects of biotechnology, and even disseminated socially certain improvements in techniques, e.g. in the production of tempe, by providing improved strains of microorganisms, fermentation process, packaging, etc. Also efforts have been made in the isolation of certain chemicals, toxin and other industrially promising substances. The production of vaccines, have been successfully performed by institution in the pharmacy, medical and veterinary sectors. Also, study programs have been set-up in several universities. Thus, from the national point of view, there are potentials available for biotechnology development, however the efforts are not yet well-coordinated and their development followed a random pattern.

Biotechnology in the modern use should be developed as soon as possible in Indonesia, especially because of the processing problem confronting the agro-sector as mentioned above. Furthermore, the Indonesian people have been familiar with the product produced by biotechnology. Therefore, the marketing aspects and acceptability of the products by the consumers will poise no problem. Moreover, the national resources which can be used as raw

material for development through the agency of biotechnological approaches are available in abundance in Indonesia. So that new products could be developed to be marketed in the country and exported. The introduction of biotechnology and genetic engineering is expected to induce the improvement of science teaching, both in the high school and university. Basic sciences such as microbiology, biochemistry, genetics and molecular biology, which so far have been neglected, are expected to receive new attention in line with the demand of the overall development of Indonesia.

Since 1982, the Indonesian Institute of Sciences (LIPI) has undertaken a study to investigate the possibility of setting of a national biotechnology program. Based on the findings of this preliminary activity, the State Ministry for Research and Technology, set up a feasibility study team (1983/1984),to prepare a plan for establishing such a project, and to evaluate such a program for technological, managerial, marketing and other economic aspects. The feasibility study team was also changed with the formulation of the goals of the project and the preparation of short and long term plans of activities.

The establishment of a biotechnology and genetic engineering project will need a focal point. This focal point, in the beginning, may be constituted as a Coordinating Board, however, in the ultimate objective it would be a National Center for the development of science and technology in Biotechnology and Genetical Engineering. The presence of such a focal point will make possible the establishment of a national network of biotechnology projects and concentrating the effort by all available capable manpower who are now scattered all over Indonesia, among different Government Institutions.

The availability of qualified and property trained manpower represent a major handicap for the implementation of this program. Therefore, manpower development is given the higher priority in this program.

The scope of research and development activities that will be given attention are within the field of:

1. Contraceptive and corticosteroid drugs based on sifosterol and diorgenin which could be extracted from selected agricultural wastes and converted into the desired products with the assistance of microbes.
2. Production of vaccine for medical purposes.
3. Food, feed and chemicals.

Ladies and Gentlemen

Research and development in agriculture has become multidisciplinary in nature. It is based not only on the traditional disciplines of biology, chemistry, physics, mathematics, engineering, but also sociology, psychology, anthropology, etc.

It is of course still possible for an individual researcher to specialize in some small area, but to understand and solve the complex agricultural prob-

lems, he has to be one of a team which together give the multidisciplinary research needed.

R & D agricultural Institution in Indonesia can be clonified into four groups, i.e. Universities, non-ministeral and ministeral Institutions, and industries. In principle, functionally, all R & D activities in Indonesia are conducted by the Ministry of State for Research and Technology.

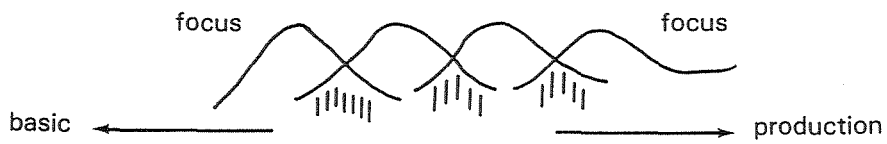
There are four main programs formulated by the minister as main streams for research activities, where agricultural R & D activities may be linked up, i.e.:

1. The basic human needs.
2. Natural resources and energy.
3. Industrialization.
4. Social, economy, culture and economy.

As has been mentioned above the biotechnology program is expected to be a focal point of a national biotechnological network in Indonesia. As such, the program center will have an advisory board drawn from various R & D agencies, universities, as well as the production sector (industries). In their way the network will become an active form for exchanging experiences, solving common problems and drawing a general plan of development. It is envisaged that the scope of network can be visualized as follows:

Institutions	University	Biotech.	BPPT	Industry
Results	Basic data, Information, Theories	Data and model for appli-cations	Design Field pilot project	Line pro-duction

However, this division of type of research and development activity, in actuality it is not clear-cut, it depends only in the main focus of activities. In the actual extention, overlapping may occur in executing basic research, application and pilot projecting. However, unnecessary duplications should be avoided.



Ladies and Gentlemen

I have taken already too long of your invaluable time, my allocated time has also been used up. Hopefully this information may still be relevant to your needs in this Symposium. I wish you all a fruitful discussion.

Thank you very much for your attention.

Bogor, July 31, 1984.

SESSION I :

TRADITIONAL FOOD PROCESSING IN TROPICAL ASIA

SESSION II :

RECENT DEVELOPMENT ON AGRICULTURAL PRODUCT PROCESSING AND TECHNOLOGY IN ASIA

SESSION III :

RESEARCH PAPERS ON AGRICULTURAL PRODUCT PROCESSING AND TECHNOLOGY

APPENDIX

Appendix

Traditional food processing for some agricultural and forestry products in South-East Asian countries.

Products from estate crops are excluded. Local names are indicated in parentheses (I: Indonesia; M: Malaysia; P: Philippines; T: Thailand). Stroke "/" and two parentheses "( )( )" mean "or" and "two different products", respectively.

Raw material	Processing	Product (Local name)	Remarks
Cereals			
Rice grain	Threshing and polishing	Rice I (Beras), M (Beras), P (Bigas), T (Kao san)	Staple food
	Fermentation (saccharification)	Fermented glutinous rice product I (Tape ketan), M (Tapai pulut), P (Binubudan/binuburan), T (Kao mark)	
	Fermentation (solubilization and saccharification), pressing, kneading and sun-drying after cutting into disks	Glutinous-rice sweet solid cake I (Brem/brem lempeng), M (none), P (Bubud), T (none)	
	Alcohol fermentation	Rice wine I (Brem Bali) (Anggur tape ketan), M (Samsu), P (Tapoi), T (Sato) (Ou)	
	Acetic acid fermentation	Vinegar T (Nam som sai shoo)	
	Frying	Fried glutinous rice I (Ketan uli), M (none), P (Ampaw), T (Kao pong)	Snack
	Soaking, draining, grinding, added with water and sugar, shaping and frying (rough rice)	Crispy fried product M (Karas)	
	Roasting and flake making (glutinous rice)	Flaked rice product M (Emping)	
	Roasting (frying without oil) till grains "pop". (rough rice)	Roasted rice product M (Bertih)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Rice powder/ grain	Dough making together with aromatic plant materials, microbial inoculation, incubation and sun-drying	Starter for food fermentation I (Ragi), M (Ragi), P (Bubud) (Angkak), T (Look pang)/luek pang)	
	Noodle making	Rice vermicelli product I (Bihun), M (Meehoon) (Laksa), P (Bihon), T (Sen mee) (Lod chong)[1]	1, Big-and-long-rod rice noodle as a sweet food
	Frying	Fried snack I (Risol) (Rampeyek), M (Rempeyek), P (Kropek), T (Mee tod)	Some other ingredients of vegetables and spices are incorporated.
	Bread making	Rice powder bread T (Kanom tal)	Cooked by steaming
	Roasting, mixing with grated coconut, frying	Fried rice-powder cake M (Sagun)	Added with sugar before eating
Wheat flour	Noodle making	Wheat vermicelli product I (Mie), M (Mee), P (Mike), T (Ba mee)	
	Bread making	Bread I (Roti), M (Roti), P (Tinapay) T (Kanom bang)[2] (Kanom saly)[3]	2. Cooked by baking 3. Cooked by steaming, added with some flavor and coloring materials
Corn	Salting and toasting	Toasted whole young corn T (Kao pod ping)	
	Cooked with coconut milk and sugar	Corn dessert M (Bubur jagong)	
Corn flour	Cake making	Cake I (Kue talam jagung)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Beans			
Soybean	Soaking, grinding with water, filtration, sweetening and boiling	Soybean milk I (Susu kacang kedele), M (Susu kacang soya), P (Utaw gatas), T (Nam tao hoo)	
	Milk preparation and protein coagulation	Soybean curd I (Tahu), M (Tauhu/tau fu) (Taukwa) (Tau fu fah), P (Tokwa), T (Tao hoo)	Coloring of soybean curd by plant materials (e.g. kunyit) is sometimes desired
	Milk preparation, protein-lipid film making and drying	Yuba I (Kembang tahu), M (Fuchok), T (Tao hoo pan)	
	Thick-film making by heating at the end of "fuchok" making	Sweet soymilk film I (Kembang tahu), M (Tim chok), P (none), T (none)	
	Frying of soybean curd	Fried soybean curd I (Tahu goreng), M (Tau fu pok), P (Pritong tokwa), T (Tao hoo tod)	
	Fermentation of soybean curd	Fermented soybean curd I (Tao koan), M (Sufu/tau ju), P (Tahuri), T (Tao hoo mak)	
	Mold fermentation of soybean-curd presscake	Unique local food I (Oncom)	By *Neurospora sitophila* for the pink-colored product and *Rhizopus oligosporus* for black oncom.
	Processing of "fuchok"	Vegetarian food I (Cap cai), M (Chai air) (Kiam hu)	

Appendix (continued).

Raw materials	Processing	Product (Local name)	Remarks
	Mold fermentation of cooked soybean without use of salt	Digestible fermented soybean product I (Tempe/tempe kedele)[4], M (Tempe)[4], P (Tao si), T (Thua nao)[5]	4. By *Rhizopus* sp. 5. Fermented whole soybean with natural fermentation is ground and roasted before serve.
	Fermentation of cooked soybean, filtration of "moromi" and boiling with/without palm-sugar	Soysauce I (Kecap)[6,7], M (Kicap)[6,7], P (Toyo), T (See eew)	6. Different types of products e.g. thin, thick, sweet and salty types 7. By *Aspergillus* sp. and *Rhizopus* sp. (some yeasts and bacteria)
	Fermentation of cooked soybean similar to soysauce making	Soybean paste as a seasoning I (Tauco)[8,9], M (Tauchu)[8], P (Miso), T (Tao jeow)	8. Different types of products, e.g. wet or dry paste and semi-liquid types 9. By *Aspergillus* sp. and *Rhizopus* sp.
Peanut	Expression	Peanut oil I (Minyak kacang tanah), M (Minyak kacang tanah), P (Langis mani), T (Nam mon tou)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
	Mold fermentation of peanut presscake	Unique local food I (Oncom)	Oncom is made from peanut presscake added with some soybean- or cassava-presscake by using *Neurospora sitophila* (for red oncom) or *Rhizopus oligosporus* (for black oncom).
	Formulation of seasoning	Peanut sauce I (Saos kacang tanah), M (Kuah satay) (Kuah kacang) (Kuah pecat) (Kuah rojak)	
Fruits, vegetables and root crops			
Banana	Peeling, sun-drying or smoking (no pressing)	Dried banana M (Pisang salai)	
	Peeling, sundrying and pressing	Dried whole/sliced banana I (Pisang sale), P (Dinatuyong saging), T (Klow tak)	
	Peeling, cutting/toasting/ pressing/sweetening/paste making/boiling/concentration	Candied banana I (Dodol pisang), P (Pastillas nasaging), T (Klow ping)	
	Peeling, slicing, frying and sweetening or salting	Candied banana or snack M (Kerepek pisang) M (Kerepek pisang)	
Mango	Peeling, curing and sweetening	Sweet-sour mango preserves I (Manisan mangga), M (Jeruk mangga), P (Atsara), T (Ma mong dong)	
	Concentration	Mango paste T (Ma mon pan)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Durian	Fermentation	Fermented durian I (Asam durian), M (Tempoyak), P (Burong durian), T (none)	
	Concentration	Durian concentrate T (Tu rian kuan)	
Some fruits, vegetables, and root crops	Pickle making using vinegar, salt, spices, etc., with/ without fermentation	Pickles I (Acar), M (Acar) (Jeruk) (Kiam chye), P (Atsara), T (Pak dong) (Nam mai dong)[10] (Pak gard dong)[11] (Hom dong)[12] (Ton puak dong)[13]	Pickles by lactic acid fermentation: 10. Bamboo shoot; 11. black mustard cabbage; 12. red onion (small); 13. taro stem
Cassava	Chipping and frying	Fried cassava chips I (Keripik singkong), M (Kerepek ubi/keropok ubi), P (Pritong kamoteng kahoy), T (Mon tod)	
	Boiling, smashing and mixing with sugar and some aroma materials	Sweet cassava root product I (Getuklindri)	
	Fermentation (saccharification) of roots	Sweet snack/dessert I (Tape singkong), M (Tapai ubi), P (none), T (none)	
	Starch making from roots	Cassava starch flour/Tapioca I (Tapioka/pati singkong), M (Tepung ubi), P (Arinang kamoteng kahoy), T (Pang mon)	Staple food
	Plating and frying of cassava presscake	Fried cake I (Enyek-enyek)[14]	14. Larger in size than kerepek ubi

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Tapioca	Doughpreparation added with shrimp, steaming and drying	Shrimp/fish flavoured crispy I (Kerupuk udang/ikan), M (Keropok udang/ikan), P (Kropek), T (Kao kriap)	
	Slicing, soaking in water and sun-drying	Dried cassava I (Gaplek), M (none), P (Pinatuyong)	
	Cake making	Cassava snack I (Cakar-cakar) (Getuk lindri/jenang gaplek), M (Cakar ayam), P (Budin)	
	Dough making	Tapioca ball T (Med saku)[15]	15. Like pearl
Sweet potato	Dried chips/starch/cake making similarly to cassava		
Taro	Storage of root crops		Staple food in lowland area of West Irian Three groups, i.e., *Colocasia esculenta* I (Talas), *Xanthosoma* sp. I (Keladi) and *Crypto-spermae* I (Kiha)
	Chipping/slicing and frying	Fried taro chips/home-made cake I (Keripik talas), T (Puak tod)	
Yam	Storage without processing		Staple food in some districts of West Irian
	Cake making	Home-made cake P (Halayang ubi)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Spices	Harvesting fruits/seeds/roots and no processing/sun-drying/ grinding	Red pepper I (Cabe merah), M (Cili merah), P (Siling pula), T (Pik pon)	
		Bird pepper I (Cabe rawit), M (Cili api/ cabe burong), T (Pik pon)	
		Black pepper I (Lada hitam), M (Lada hitam), P (Pamintang itim), T (Pik tai dom bon)	
		White pepper I (Lada putih), M (Lada sulah), P (Pamintang puti), T (Pik tai kaw bon)	
		Ginger I (Jahe), M (Halia), P (Luya), T (Khing)	
		Clove I (Cengkeh), M (Cengkeh), P (Pako), T (Kan poo)	
		Shallot (small) I (Bawang merah), M (Bawang merah), P (Sibuyas tagalog), T (Hom Daeng) (Hom Baeng)	
		Garlic I (Bawang putih), M (Bawang putih), P (Bawang), T (Katiam)	
		Nutmeg I (Pala), M (Buah pala), P (none), T (Look joon)	
		Mace I (Fuli), M (Tampok biji pala), P (none)	
	Peeling, slicing, sweetening and drying	Glinger pickle M (Halwa halia)	
	Peeling, slicing, brine fermentation and sweetening	Ginger pickle M (Jeruk halia)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
	Peeling, slicing, soaking in brine and curing together with fish sauce and sugar of young ginger	Ginger pickle P (Atsarang luya), T (Khing dong)	
	Sauce making	Chili sauce I (Saos cabe merah), M (Sos cili), P (Siling labuyo salsa), T (Sauce pik)	Seasoning for fried chicken, fish and others
	Cake/snack making	Candied nutmeg-fruit flesh I (Manisan pala), M (Halwa pala), P (none), T (none)	
	Pickle making	Nutmeg-fruit flesh pickle I (Asinan pala), M (Jeruk pala), P (none), T (none)	
Palms			
Coconut palm *Cocos nucifera*	Collection from fruits	Coconut water I (Air kelapa), M (Air kelapa), P (Niyog tubig), T (Nam ma pow)	Local drink
I (Kelapa) M (Kelapa) P (Niyog) T (Ma pow)	Collection of fresh coconut meat corresponding to kernel	Coconut fresh meat I (Daging kelapa), M (Isi kelapa), P (Niyog laman), T (Nau ma pow)	Used for cooking and dessert
	Pressing of coconut meat	Coconut milk I (Susu kelapa/santan), M (Santan), P (Gata), T (Ka ti)	Used for cooking
	Sun-drying of coconut meat	Dried coconut meat, copra I (Kopra), M (Kopra), P (Kopra), T (Ma pow hang)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
	Husking, removing shell and brownish skin, grating white meat and drying/roasting	Desiccated coconut I (Daging kelapa kering), M (Kelapa parut kering) (Kerisek), P (Pinatuyong niyog), T (Ma pow chin hang)	Used for cake and biscuit making and for cooking
	Heating coconut milk/expression of copra	Coconut oil I (Minyak kelapa), M (Minyak kelapa), P (Niyog langis), T (Nam mon ma pow)	
	Mold fermentation of coconut presscake	Unique local fermented food I (Tempe bongkrek), M,P,T (none)	By *Rhizopus* sp. (usually *R. oligosporus* or *R. nodosus*)
	Collection of sugar juice from stalk of inflorescence	Fresh palm sugar juice I (Nira/legen), M (Nira), P (Tuba), T (Nam tal sod)	Non- or less fermented drink
	Spontaneous alcohol fermentation of palm sugar juice	Palm wine I (Tuak/lahang/saguer/sageru), M (Toddy/tuak), P (Tuba), T (Nam tal mou)	
	Distillation of palm wine	Distilled palm liquor I (Arak/anggur) kelapa), M (none), P (Lambanog), T (none)	
	Further acetic acid fermentation of palm wine	Local vinegar I (Cuka), M (Cuka), P (Suka), T (Nam som sai shoo)	
	Condensation of palm sugar juice	Red solid palm sugar I (Gula merah/gula kelapa/gula Jawa), M (Gula melaka), P (Pakaskas), T (Nam tal pip) (Nam tal pik)	

Appendix (continued).

Raw material	Processing	Product (Local name)	Remarks
Sugar palm *Arenga pinnata* (Wurmb) Merr.	Collection of sugar juice from stalk of inflorescence	Palm sugar juice (Local name: see coconut (palm)	Mainly from male flower
I (Enau/aren) M (Enau), P (Kaong/ sasa), T (Ton tal)	Spontaneous alcohol fermentation of palm sugar juice	Palm wine (Local name: see coconut palm)	
	Distillation of palm wine	Distilled palm liquor I (Arak/cap tikus/ sopi), M (none), P (Basi), T (none)	Produced in Menado district
	Blending with distilled liquor	Local liquor I (Anggur), M (none), P (Basi), T (none)	From cap tikus
	Further acetic acid fermentation of palm wine	Local vinegar (Local name: see coconut palm)	
	Condensation of palm sugar juice	Red solid palm sugar I (Gula merah/ gula enau/gula aren), M (Gula enau), P ( ), T (Nam tal pik)	
	Treatment of young fruits with/without $CaCO_3$ and removal seed shell	Kernel I (Kolang kaling), M (Buah kabong), P (Balat/ipa), T (Look tal)	Used as fruit cup together with soft drink
	Starch gathering from old trunk	Palm starch I (Sagu enau/aren), M (none), P (Sago), T (none)	Less important
Lontal/ palmyra palm *Borassus flabellifer* L.	Collection of sugar juice from stalk of inflorescence	Palm sugar juice (Local name: see coconut palm)	From both male and female trees Fruits are edible.
I (Lontal/rontal/ siwalan/tala)	Condensation of sugar juice	Red solid palm sugar I (Gula merah)	