Bull. Fac. Bioresources, Mie Univ.
No. 3: 105-119
February 28, 1990

Evolution of Farming Systems in Peninsular Malaysia —Technology Transfer and Affecting Factors—

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Summary

In Malaysia, the issue of farm mechanizations has become very important and the development of agricultural mechanization has grown rapidly. In this paper, based on the field research conducted in 1986 under the title of "The Conventional Farm Tools and the Evolution of Farming Systems in Southeast Asia", general background of Malaysian agriculture was firstly introduced, then information of the present situation of rice production mechanization and other agricultural mechanization was provided. In Mechanaization of rice production, the technology transition of agronomic practices (land preparation, transplanting, direct seeding, harvesting, transporting, and post-harvesting technology in rice production) was introduced. The present situation of oil palm, rubber, and cocoa cultivation in Malaysia was briefly explained and some research subjects were proposed in order that Malaysian agriculture may advance in future.

Key words: Malaysia, mechanization, conventional farm tools, technology transter, southeast asia

I. Introduction

Agriculture in malaysia contributes to the national Gross Domestic Product (GDP) but its ratio has been dropping over the years. Various efforts are being made by Government and private agencies to medernize agriculture. One of the most important components in modernizing Malaysian agriculture is the introduction of mechanization.

Malaysia produced 1,713,500 tons of rice in 1985. Currently, however, productions of rubber and palm oil, which are primary commodities, are higher than that of rice and are most concentrated on in Malaysia as well. Due to a critical labor shortage, each production process requires mechanization to increase productivity per agricultural worker. Under these circumstances, a successful mechanization program is closely related to the discovery or development of suitable machinery and the introduction of this machinery through an effective system. It should also take the relationship between the natural enviroment and appropriate technology into consideration.

This paper deals with the general background of Malaysian agriculture and the technology transfer of agricultural mechanization with the emphasis being on agricultural mechanization. This work was based on the field research conducted in 1986 under the title of "The conventional Farm Tools and the Evolution of Farming Systems in Southeast Asia". The farm tools and field poerations employed in the traditional farming in malaysia

Received August 31, 1989

are described in the other sections of this report.

The purpose of this paper is:

(1) To provide information on the present situation of agricultural mechanization in Malaysia.

(2) To make some comments on the technology transfer and the agricultural mechanization in Malaysia.

II. Mechanization of Rice Production

The rice growing areas in peninsula Malaysia are shown in Fig. 1. The distribution of rice growing areas and production of paddy is given in Table 1. Prior to the introduction of double cropping of rice in 1970, most of

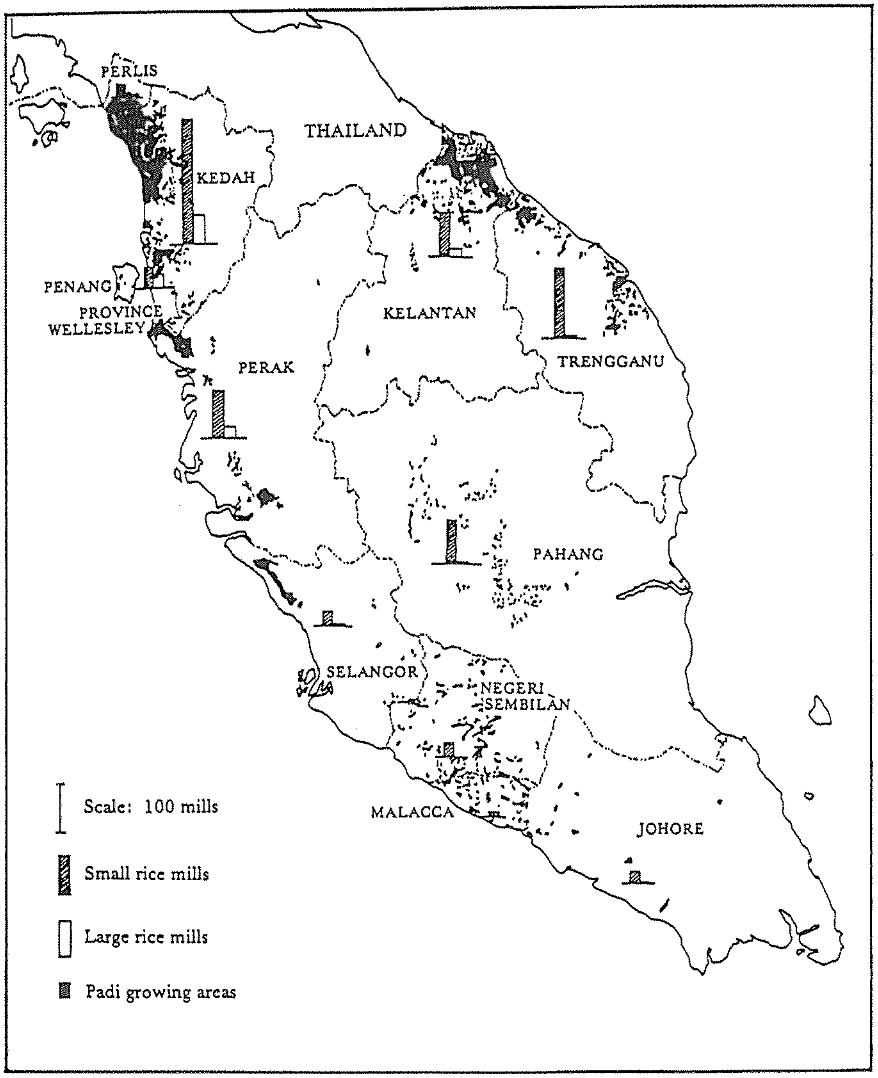

Fig. 1. Paddy growing areas and distribution of rice mills (peninsular Malaysia)
(Source: Rice processing in peninsular Malaysia, Oxford University Press, 1983)

Table 1. Paddy planted areas and production levels (1981/1982) in peninsular Malaysia

State	Area Planted (ha)	Production Paddy (tons)	Total %
Jour	3,150	6,833	0.4
Kedah*	49,890	116,105	7.2
Kelantan	65,340	172,729	10.8
Melaka	7,570	21,847	1.4
N. Sembilan	4,220	15,974	1.0
Pahang	3,480	5,304	0.3
Penang/ S. Perai	15,190	41,127	2.6
Perak	73,850	194,442	12.2
Perlis*	18,530	45,795	2.9
Selangor	35,900	140,832	8.8
Terengganu	31,540	81,859	5.2
MADA(Kedah/ Perlis)	184,430	752,526	47.2
Total	493,090	1,595,463	100.0

* Outside MADA
(Source: Paddy STATistics, Ministry of Agriculture, Malaysia 1982)

the agronomic practices (land preparation, transplanting, harvesting etc.) was done manually or with the help of draft animals. But animal power for rice cultivation is insignificant now. Unfortunately, there is no reliable data to determine the population of animal power used in the rice areas. The main source of farm power today is manual labor or hired machine. The power availability ranges from 1.92 to 0.06 HP per hectare and its average value is about 0.7 HP. Labors entering the agricultural sector have been on the decline when compared to the labor force employed in the manufacturing sector. Over the period from 1979 to 1984, the employment in agriculture declined from 41.7% of the total employed labors. The trend is thought to continue as national development progresses. Now due to the Government policy, production of rice will be concentrated in the granary areas.

Table 2 shows information which regards the present level of Mechanization in the granary areas. It can be seen that land preparation and harvesting operations in these areas are generally well mechanized. There is also a growing trend of direct seeding and the usage of motorized sprayers.

1. Land preparation

Many kind of problems such as land size, soil type, water management, land level and machinery are deeply related to each other in land preparation. In this paper, however, the present situation and some problems of machinery are introduced.

In Malaysia, power tiller or 4-wheel tractor mounted with a rotary cultivator is commonly used in the land preparation stage of the production process. In a study carried out at one of the rice growing areas (MADA, 1970), it was found that the use of power tiller tractors are still prevalent in spite of their lowest productivity, highest cultivation cost per hectare, and as the least efficient users of labor and capital. Also, conventional tractors, even when equipped with special devices attached to the wheels to aid traction, frequently bog down if

Table 2. Power availability estimation in rice growing area

State	Planted Area (ha)	Numbers in Paddy Areas				Horsepower Per Planted Area
		4 Wheel T	2 Wheel T	Large C	Small C	
Johor	3150	112	39	—	1	1.92
Kedah	205130	1349	6399	339	—	0.87
KElantan	65340	674	598	3	16	0.63
Melaka	7570	75	80	—	—	0.62
N. Sembilan	4220	76	37	1	3	0.12
Pahang	3480	122	20	1	1	1.86
Penang/ S. Perai	15190	78	563	7	—	0.75
Perak	73850	235	294	7	5	0.22
Perlis	47720	52	35	2	—	0.06
Selangor	35900	170	15	44	16	0.42
Trengganu	31540	170	40	2	1	0.29
JUMLAH	493090	3129	8180	406	43	(AV. 0.70)

(4 Wheel T: 4 Wheel Tractors (50 Hp))
(2 Wheel T: 2 Wheel Tractors (12 Hp))
(Large C: Large Paddy Combine (100 Hp))
(Small C: Small Paddy Combine (30 Hp))
(Source: Sumber Khidmat Jentera PErtaniandan Pengangkutan Di kawasan, Pembangunan Pertanian, Department of Agriculture, Malaysia 1986)

the land condition is soft. Four wheel drives have improved this situation a little. However, front axles are frequently damaged as most fields in Malaysia have high bunds. Thus, there are considerable areas in the rice growing areas of Malaysia, where conventional tractors cannot be utilized at all because of extremely soft soil conditions. In these areas, power tillers tractors have to be used due to necessity, despite their lower efficiency.

In order to remedy this situation, land condition must be improved to a certain level before introduction of modern machinery. Then careful selection of machines to suit the land size and farming system should follow.

2. Transplanting

Transplanting is a intensive operation accounting for at least 50 man-hours per acre. It is equated to 20% of the labor hours required for the whole process of rice cultivation. In Malaysia, however, the mechanized transplanting operation is still in the experimental stage and transplanting is usually done by hands.

On farms with reasonable irrigation and drainage facilities, the rice transplanter can be used without any problem. Machines need not be modified for effective use in the above conditions. The imported version of the machine will not require any adaptation to work in average field in the local condition. Therefore, there is a great possibility of the machine usage in a number of acres in Malaysia.

The use of the rice transplanter, however, demands a more rigid adherence to working procedures. Supportion such as land preparation must be complementary to the mechanized transplanting operation. The use of a new kind of puddling implement will greatly help prepare an essential implement. Fields equipped with proper irrigation and drainage facilities will certainly be an advantage to mechanized transplanting.

3. Direct seeding

Table 2 shows a growing trend of direct seeding in some granary areas. There are some efforts being made to introduce the direct seeding practice for rice production in Malaysia. This practice will eliminate the transplanting operation which thus reduce the labor requirement associated with it. However, in order for direct-seeding to be effective, farm water control and weed control will have to be impoved. As the other weed control method, rotation of direct seeding for a year and transplanting operation for two or three years are also carried out in Malaysia.

In areas where direct seeding is practiced, different methods have developed in various areas due to the difference in nature of the particular locality, especially with respect to soil type, plot size, drainage/irrigation facility capabilities, accessibility infrastructure and socio-economic factors. In relation to these, appropriate mechanization systems have also been developed, and in turn have opened up avenues for innovative mechanical methods for direct seeding.

4. Harvesting

Harvesting is the most intensive labor operation in rice production and usually constitutes the biggest cost for farmers in Malaysia. Mechanization of harvesting thus provide opportunity not only to facilitate the successful implementation of double cropping, but also to lower production costs and thus increase farm incomes. Large scale combine harvesting started in the mid-1970's in response to the labor shortages in the area which continues to be experienced today. At present, in the major rice growing areas where double-cropping is practiced, the harvesting operations are fully mechanized with the use of combine harvesters (Fig. 2). For example, in the Muda project area, 99.2% of paddy was harvested by large combine harvesters with the remaining 7.8% harvested manually in the off season in 1985. In most of the rice production areas, both the mid-sized (30 hp) and the large-sized combine (100 hp) are used. These combines are operated through the custom operation system which farmers are charged on per area basis by the combine operator.

Fig. 2. Combine harvesting of rice.

5. Transporting

Bulk handling of grain has become a very important topic lately in order to ease the congestion at the the National Paddy and Rice Board (LRN) complexes. Grain handling in the field is done alongside the harvesting process. Once the grain tank of the harvester is full, the grain is discharged onto large plastic sheets or tarpaulins and spread out on the ground. Once the field is fully harvested and the paddy heaped onto the sheet, the grains are bagged manually into gunny sacks for ease of transportation onto lorries. This bagging is mormally done by teams of 5–10 persons made up of local people. The bagged paddy is then transported to the farm road by bicycle or motorbike along the bunds and from there it is collected by a lorry (normally small lorries of 1–2 tons capacity) and sent to the processing centers (Fig. 3).

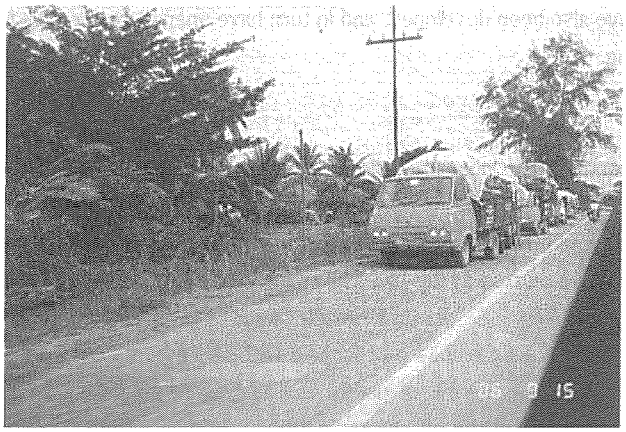

Fig. 3. Small lorries for transporting rice to the processing center.

This paddy is sometimes transported out to the roadside and stacked to await the lorry which transports it to the mill/processing center. It is here that damage occurs in the field should delays in transport. The paddy is sometimes kept waiting overnight and often becomes wet if it rains. However, the most serious damage as far as paddy deterioration is concerned, occurs in the long delays at the purchasing points. These delays are caused by the long queues of lorries waiting for their turn to sell their paddy up to 1–2 days resulting in losses due to deterioration of the paddy and consequently lower milling recoveries, especially at the LPN complexes. These problems are compounded by the rainy season coinciding with the off season harvest and the large volume of paddy harvested in such a short time span.

Recently, some bulk handling techniques have been adopted by some paddy purchasers. In such instances, the harversted paddy is discharged directly from the grain tank of the combine straight onto a lorry waiting on the farm road. However, this practice is limited to only a small number of places where the fields lie adjacent to the farm road and the paddy is sold to private rice mills only.

Bulk handling of paddy would be a very attractive proposition if it could solve this problem of severe losses due to delays in processing wet paddy, in addition would reduce handling costs.

6. Post-harvesting technology

The farmers in Malaysia normally sell most of their paddy; only a small portion is being kept for their own use. However, most farmers do not have their own dryer or milling facility. Because of this situation, LPN was established in 1971 to deal with the drying and milling requirements of farmers through the setting up of large integrated complexes in Malaysia. Responsibilities of LPN are

1. to purchase paddy to implement price policy
2. to import rice for stockpile and to supplement rice shortage
3. to distribute rice arising from the above two activities.

With the introduction of the double cropping program, the off season crop has to be harvested in the rainy season. Since this freshly harvested paddy delicered from the field normally contains a moisture content in the range of 20 to 28% (w.b.), it must be promptly dried to at least 14% in order to avoid deterioration. The drying of freshly harvested paddy is also necessary for safe stoage as well as for successful milling. Direct sun drying has normally been practiced by most farmers in Malaysia (Fig. 4, 5), but it has been replaced by mechanical drying performed by the public and private agencies involved directly with the rice industry. The Government through LPN has set up 29 integrated padddy drying and rice milling complexes mostly located in major rice growing areas. Each complex is fully equipped with 2 units of multiple pass with continuous flow dryers, and each dryer is capable of handling 15 ton per hour per pass with 2.5% moisture extraction for each pass. In addition, some flat dryers as well as moisture extraction units are also available for uses during peak periods.

Fig. 4. Direct sun drying on concrete floor.

Fig. 5. Direct sun drying by rice field.

The mechanical drying facilities available in some larger private mills are mormally moisture extraction dryers with capacities of between 10–50 tons (Fig. 6, 7). Whereas, the small private mills are still solely dependent upon sun-drying which is less expensive but more labor intensive. Out of the 329 commercial mills, only 112 mills (34%) have installed mechanical dryers. However all the government owned commercial mills

Fig. 6. Moisture extraction drying system.

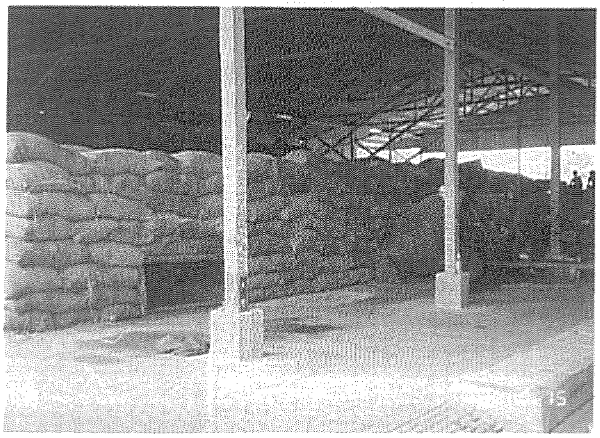

Fig. 7. Rice bags piled for pre-drying by moisture extraction unit.

are integrated with drying facilities and they possess a total drying capacity of about 617,210 tones/year available in all the commercial mills. Thus the public sector owns a bigger share of the mechanical drying capacity (53%).

In recent years, necessity of drying has been intensified with the widespread use of combine-harvester for harvesting operations in the major paddy growing areas in Peninsula Malaysia. The harvesting time is very much shorten while the daily production of wet paddy is increased. This has imposed a greater burden on the existing drying facilities, both in the private as well as in the public sectors, since the various existing drying facilities have to handle the peak harvest within a short period. Talbe 3 shows the sales of paddy to LPN. This table reflects the changes in the 1980's which coincided with the introduction of the paddy price coupon subsidy in 1979. This drastic change in marketing patterns meant that LPN had to buy and the bulk of the paddy produced and it is obvious that the complexes were not designed to handle such large quantities of paddy.

Table 3. Sales paddy to the National Paddy and Rice Board (LPN) (% of farmers)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Off season	21.6	—	21.6	47.6	62.0	69.2	67.4	70.4	79.9
Main season	4.1	7.8	44.4	57.7	47.6	74.8	74.9	74.3	

III. Other Agricultural Mechanization

Harvesting of oil palm, rubber, cocoa and pepper, the major plantation crops in Malaysia, is still done manually. For the mechanization of harvesting, various machines have been tried and assessed but were found to be unsuitable, due to various reasons. At present, no single machine has proved to be effective for harvesting these plantation crops.

1. Oil palm

The implements recently used for harvesting are chisels and knives fixed to Aluminum poles (Fig. 8). The choice of implement depends on the accessibility of bunches, which depends upon the height of the palm. Generally, chisels are used until ripe bunches are produced at approximately 9–10 ft. above ground level. From this stage onwards, cutting is done using knives on bamboo poles. The poles must be of a type of bamboo that is both strong and light, the knives are curved and must be kept sharp.

Fig. 8. Harvesting knife for oil palm.

The present practice of manual harvesting is quite satisfactory except for tall palms where harvesters have problems in erecting the pole and aiming it at the right place for the bunch and frond (Fig. 9). An extension pole made of Aluminum Alloy has been studied for this purpose. Another alternative is to study any possible mechanical cutter; example is a light motorized chainsaw that can be operated at the ground level. Harvest oil palms are usually loaded on a small lorry for transporting to the oil processing factory (Fig. 10).

2. Rubber

The hevea tree is the chief source of natural rubber. The milky sap, or latex, as it is called, comes from the inner layer of bark, and the tree is gashed just deep enough to reach this layer. The tool used resembles a hatchet. First a vertical gash, or channel, is made. Then slanting gashes connecting with this are made on one or both sides. The latex flows down these cuts to the main channel and then into a cup placed at its bottom (Fig. 11). The tapping is done early in the morning, and the latex is gathered a few hours later. At present, the

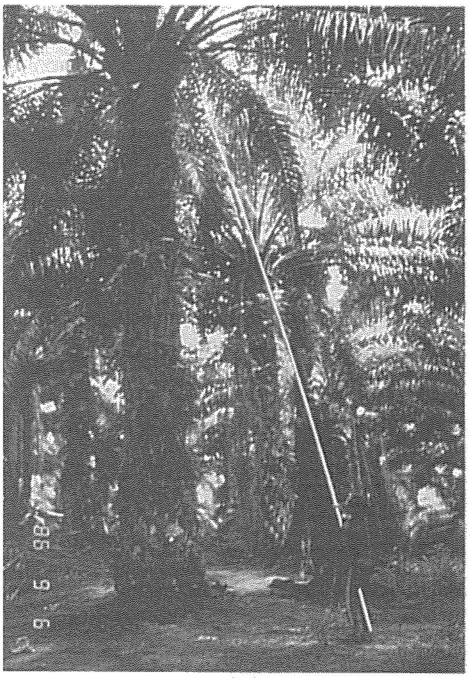

Fig. 9. harvesting oil palm.

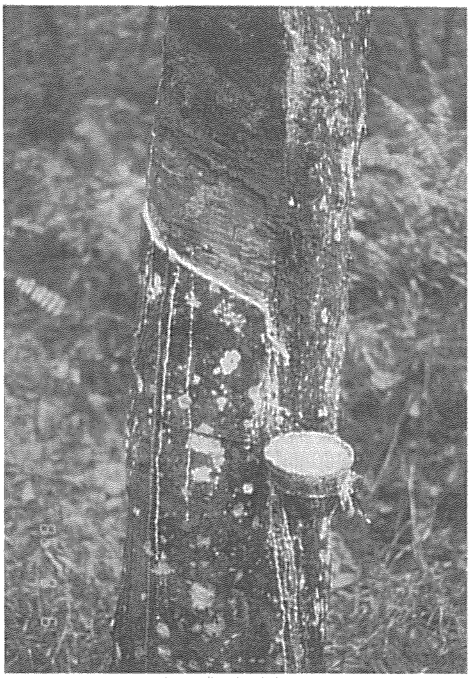

Fig. 11. Rubber tree cut for obtaining latex.

Fig. 10. Oil palms loaded on a small lorry.

gathering of latex is still done manually.

3. Cocoa

Cocoa in Malaysia is grown as a sole crop, main crop or intercropped with coconuts. In Peninsula Malaysia about 65% of the crop comes from mixid cropping. The adoption of cocoa intercropped with coconuts has led to a substantial smallholders' participation in cocoa cultivation. Harvesting of cocoa is done manually.

IV. Conclusion

IN Malaysia, the issue of farm mechanization has become very important and the development of agricultural mechanization has grown rapidly with the declining farm labor supply and the need to maintain timeliness of farm operations. This situation, the most important thing to consider is what level of mechanization is best for Malaysian farmers. At present in Malaysia, technological evolution in agricultural mechanization can be seen mainly in two ways. Namely

1. appropriate technology transfer from developed conuries.
2. appropriate locally-developed technology.

The classical approach is the former one. It is to introduce imported machines and trying to modify the machine for local conditions. For example, in the area of paddy production, most of the mechanization has been hased on technology transfer from the introduction of foreign-developed machinery, such as the power tillers and the 4-wheeled tractors. It is important to note that even the most modern technology in rice harvesting, using the large self-propelled combine has been successfully introduced in certain areas of Malaysia. Three reasons for this success are:

1. Strong government supporting program and implementation.
2. Labor shortage resulting from industrialization.
3. Uniform land and other environment improvement schemes designed for intensive rice production.

Therefore, agricultural planners must suit the field and crop conditions as far as possible to the imported machine.

Some aspects of the agricultural mechanization program in Malysia do require the latter approach, that is, appropriate locally-developed technology. In the area of perennial crops, namely rubber and oil palm, the modernization will have to be based on this technology. Since the problem of plantation mechanization is unique to malaysia, it is very difficult to adapt implements developed in other parts of the world. For building up this kind of technology, fundamental and continuous research program for each crop are needed.

When considering how malaysian agriculture is to advance in the future, its abundance of biological resources and how to utilize them should be reconsidered. At the same time, rationalization of production, processing and distribution systems is required in conventional agriculture. Research subjects that can be proposed to attain these objectives are as follows:

1. How to increase the added value of agricultural products.
2. To find the various properties of agricultural products unique to Malaysia.
3. How to reduce the labor requirements.
4. How to increase the farmer's income.

Co-operative research projects between Malaysia and Japan can be carried out for the realization of (1) and (2). A research proposal on physical properties related to harvesting and processing of tropical rice is attached in the appendix.

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Appendix

Research Proposal

on

PHYSICAL PROPERTIES RELATED TO HARVESTING AND PROCESSING OF TROPICAL PRODUCTS

1. Introduction

One of the serious problems facing tropical agriculture today, is the urgent need to ascertain requirements and develop reliable techniques for the harvesting and processing of rice. The agricultural program in developing countries designed to increase production several folds over the next decade, can succeed only if efficient relicable methods of harvesting and processing of agricultural products are developed.

It needs to be emphasized that contemporary knowledge concerning modern harvesting and processing techniques of various agricultural products is derived almost entirely from the industrialized countries. This knowledge has only limited application under conditions of tropics or tropical products. The extremes of rain, heat and humidity induce environmental differences which require substantial modifications where techniques are transferable. Quite often only new and specialized techniques can meet the need.

In view of these facts, it is necessary that a unified and systematic research program be initiated to:

1. ascertain requirements
2. develop techniques

for the harvesting and processing of agricultural products in the tropocs.

II. General

A long range program of systematic research is envisaged. This will be attacked in three complementary stages.

1. Basic data collection
2. Experimental system design
3. Working systems development and design

1. Basic data collection

The keeping quality of products or its response to a given treatment in harvesting and processing, is dependent on its physical, bilogical and chemical properties and upon certain environmental factors. These properties and environmental factors constitute the fundamental which must be studied if a successful attack is to be made on the harvesting and processing problem.

The chemical and biological properties are only of indirect interest in this particular work since they are receiving adequate attention in agronomy and related fields. However the physical properties of agricultural products together with the problem of product engineering concerns. These factors are often expressible in quantitative teams and constitute the initial parameters of design and process systems design.

The objectives of this study at this stage can be outlined as follows:

1. To extensively investigate those physical properties of tropical products relevant to harvesting and processing and to develop quantitative data necessary for harvesting.
2. Processing systems design
3. To ascertain requirements which must be in rice quality, and operations of systems for the optimum harvesting and processing of tropical products.

2. Experimental systems design

Based on the data furnished from stage one, experimental harvesting and processing systems shall be developed. These systems shall be tested extensively for efficiency and effectiveness, for varying conditions of operation.

Efficient and inexpensive methods of harvesting and processing shall be investigated. Such methods shall be incorporated into experimental design.

III. Working Systems Development and Design

Such methods as have proven offective experimentally, shall be developed into working designs. Such designs must be

1. economical
2. functional
3. technically tenable

IV. Specific Research Proposal

An attack on one aspect of the harvesting and processing of agricultural products in the tropics is proposed in this paper. This research falls within the domain of stage I was specified above. It is designed to furnish the most essential parameters of design for the harvesting or processing of selected agricultural products. The emphasis is on the development and perfecting techniques. These techniques shall be tested and proved on a few selected agricultural products.

PHYSICAL PROPERTIES RELATED TO HARVESTING AND PROCESSING

1. Mechanical properities

Harvesting, handling, and processing are almost invariably mechanical processes. These processes lend themselves to engineering an analysis in terms of force or pressure response principles. The utilization of these properties in design presupposes a knowledge of the mechanical properties of the products.

The Elastic modulus, Shear modulus, Ultimate strength and poisson's ratio of a product must be known before the analysis of mechanical strength and damage reduction during particular harvesting or processing operations can be made. Mechanical strength considerations are pertinent not only to harvesting and processing problems, but also have extensive applications in the analysis of further handling and storage and also working life of the machines.

2. Frictional and abrasive properties

Among agricultural products, cereal grains, both husked and unhusked, are frictional and abrasive since they contact each other or with the working parts of the machine systems during harvesting and processing. The frictional force and abrasive effect depend upon the physical and environmental conditions of grain surfaces including shape, roughness, hardness and moisture. The angle of repose and internal friction which are important in handling and storage are also in the domain of the frictional properties.

It has been recognized that excessive wear machine parts including screw conveyer of harvesting machine and rubber roller of husking machine is caused by tropical rice varieties. The high frictional and abrasive properties of the tropical rice combined with the prevailing rough environmental and operational conditions make the life of machine parts unexpectedly short, which must be overcome in rice harvesting and processing in the tropics.

3. Thermo-physical properties

Per-cooling, drying, storage and processing are almost always thermal process. These processes lend themselves to engineering analysis in terms of simultaneous heat and mass transfer principles. The utilization of these principles in design depends upon the knowledge of thermophysical properties of the product.

The Specific Heat, Heat of Respiration, Heat of Vaporization, Thermal Diffusivity, Thermal Conductivity, Diffusivity of Components, and Densities of a product must be known before the equation of heat and mass transfer can be used. Heat and mass transfer considerations are pertinent not only to product storing and drying problems, but also have application in the analysis of refrigeration or the phenomena of aeration and other processing operations.

4. Hygroscopic equilibria and moisture dependence of preservative properties.

Farm products, both natural and processed, are hygroscopic, since they will lose or gain moisture from a surrounding atmosphere depending on the relative vapor pressure exerted by the absorbed moisture in the product. The moisture content of a product in equilibrium with the surrounding atmosphere is called the equilibrium moisture content or its hygroscopic equilibrium. The relative humidity of the surrounding atmosphere is called the equilibrium relative humidity at the particular temperature. A plot of the equilibrium relative humidity and moisture content yields an isotherm called equilibrium moisture curve. The moisture content may be given on either wet or dry basis, depending on the intended use of the curves. The curves are dependent on temperature and vary from material to material.

The equilibrium moisture properties of agrivultural materials are important in storage, drying and preservation.

The relative humidity of the drying air in contact with a product must lower than the equilibrium relative humidity of the product at its current moisture content in order to induce moisture loss from the product.

It has long been recognized that mold growth and its subsequent rate of fruitification on stored products are dependent on both moisture content and humidity. The presence of high moisture and high humidities encourage insect infestation, and promote deterioration by micro-organisms, of which damage by molds is the most important. The high relative humidities of the tropics, combined with the prevailing high temperatures make micro-organic damage the greatest single problem which must be overcome in food storage and processing in the tropics.

It needs to be stressed that even though a large body of information is currently available on hygroscopic equilibria of food products in Japan, the United States and Western Europe, their utilization in solving tropical storage and processing problems is limited by product, varietal and environmental differences. A tremendous need exists to

1. develop data on the hygroscopic behavior of tropical products
2. develop economical systems for humidity and temperature control in the tropics.

マレーシア半島における農法展開
——技術移転と影響要因

亀岡孝治・法貴　誠

マレーシアにおいては，農業の機械化は非常に重要であるとともに，急速な機械化がおこなわれつつある。ここでは,「東南アジアにおける在来農具と農法展開」という課題のもとで1986年におこなわれたフィールド調査に基づいて，まずマレーシアの農業の一般的な背景を紹介し，稲作の機械化と他の農業の機械化の現在の状況について情報を提供した。稲作の機械化に関しては，本田準備，田植，直播，収穫，運搬，および乾燥・脱穀などの収穫後の技術について個別に機械化にいたる技術的変遷を紹介した。また，油やし，ゴムとカカオの栽培の現状について簡単に説明をおこない，マレーシアの農業が将来発展するために必要と考えられるいくつかの研究課題を提起した。