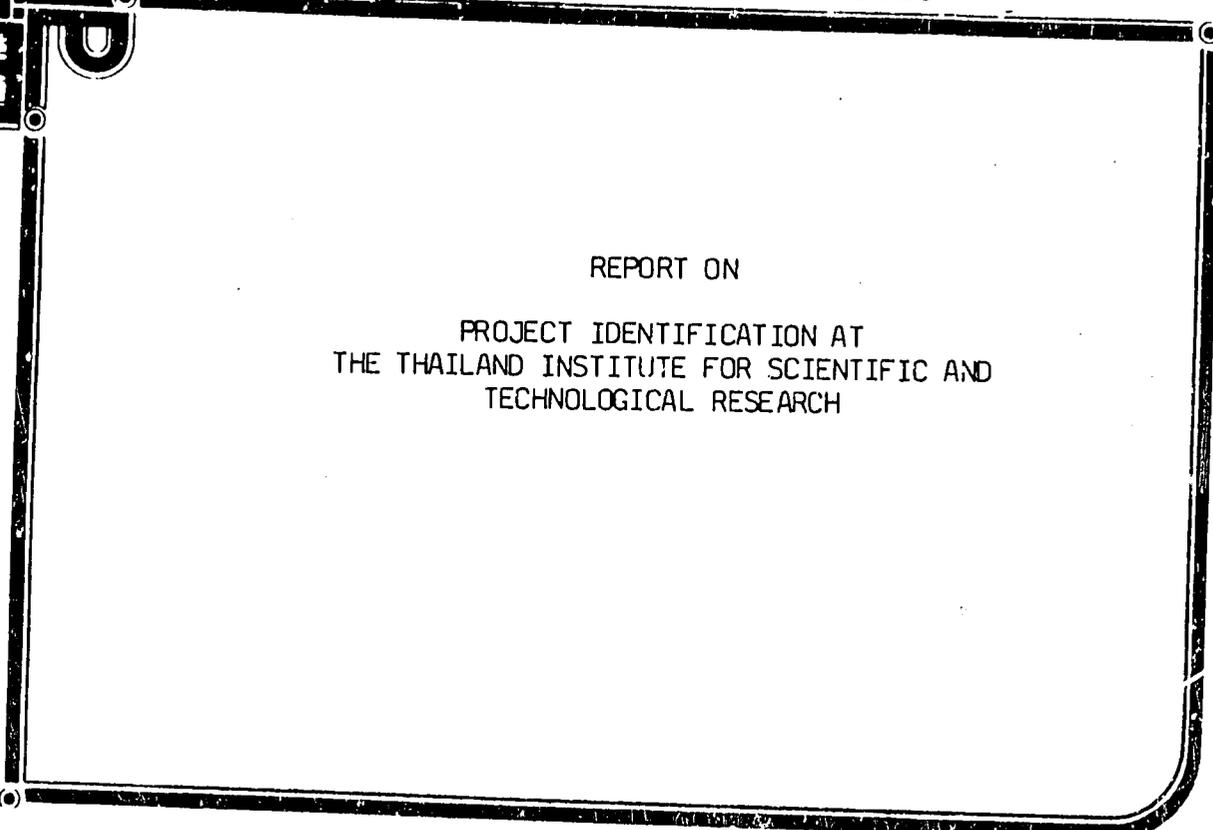


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Postharvest Institute for Perishables



REPORT ON
PROJECT IDENTIFICATION AT
THE THAILAND INSTITUTE FOR SCIENTIFIC AND
TECHNOLOGICAL RESEARCH

by

Harvey C. Neese
Postharvest Institute for Perishables
University of Idaho
Moscow, Idaho

April, 1982

GTS Report No. 81-02



in cooperation with
**United States Agency for
International Development**

Project Title: Storage and Processing of Fruits and Vegetables
Project No. AID/DSAN-CA-0265
Washington, D.C., U.S.A. 20523

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and

The United States Agency for International Development

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ERRATA

Page 8. Add to first list:

9. Assisting the Royal Northern Project in technical design of packaging for fresh vegetables.

Page 8. Add to In-House Project:

6. Development of package containers for fresh fruit and vegetable exports.
7. Improving the handling storage of horticultural crops.

Page 17. First paragraph should read:

TISTR is coordinating a workshop on postharvest technology of fruit, vegetables and root crops some time in late 1982 in Thailand. The Tropical Products Institute will send two of its staff to the workshop: one on horticultural crop handling/transportation/standardization and one on packaging. TISTR has requested financial support from PIP or USAID of Baht 50,000 (\$US 2500) to help cover workshop administration costs.

Page 18. Paragraph 8:

Change U.S. \$10,000 to U.S. \$20,000.

I. EXECUTIVE SUMMARY & RECOMMENDATIONS

Background

The Thailand Institute for Scientific and Technological Research (TISTR) requested assistance through AID/Washington under AID/DSAN-CA-0265 for the Postharvest Institute for Perishables (PIP), to identify project needs that might be supported by USAID or PIP.

The scope of work was outlined in Cables - Bangkok 09416 and 07869:

- A. Formulation of a project proposal for subsequent AID funding in need areas of the food industry.
- B. Establishment of essential facilities for postharvest work in the food handling and distribution system, and laboratory and research designs.
- C. Feasibility, preparation and recommended assistance for organizing a postharvest workshop or seminar in Thailand on food losses.

TISTR is a non-profit, state enterprise that conducts research projects in food processing, packaging and postharvest losses of perishable food crops. At present, in Thailand, there are no private sector facilities able to fill the food research gap for improving domestic and expanded export marketing.

TISTR charges a fee for private sector research or testing requests and plans to increase substantially the sale of services to such firms in the next five years.

Fruit and Vegetable Distribution System in Thailand

Fruit and vegetable distribution in Thailand follows traditional ways that are common in a number of Asian countries. The produce is collected by middlemen for the retail or export market or by agents for processors if processing is involved. The produce (other than that processed) is then consigned to wholesalers in the provinces and in Bangkok; after which wholesalers sell the produce to local retailers, exporters or other middlemen in other parts of the country for distribution throughout Thailand.

Bamboo baskets are the normal packaging units for transportation of most perishable produce. A basketful is the standard size unit in which most produce is sold and distributed.

Grading and sorting on a limited scale is done by wholesalers and retailers at the lower end of the distribution chain.

Problem Areas and Constraints

In conversations with personnel in various government agencies and with private sector food distributors, some constraints surfaced which were within the normal activities of TISTR. Others were outside of TISTR's general scope of work, but these constraints nevertheless had an adverse impact on perishable food marketing.

Quality of perishable products

There are no particular incentives at the present time for producers of most crops to market higher quality produce. A basketful of fruit or vegetables is expected to be composed of both the higher and lower qualities, giving an "average" container of produce.

Along with the lack of incentives for marketing higher quality produce, the long and sometimes arduous transportation process, with an accompanying lack of refrigeration, causes undetermined but reportedly large losses of perishable crops.

Lack of proper storage facilities also is reported to cause considerable losses in crops such as potatoes, onions, garlic, and shallots. Three months is the maximum storage time that can be attained in Thailand for the above crops with present facilities.

Export marketing of perishable produce

In the export market, lack of quality has caused rejections of some produce according to the exporters themselves. In reference to perishable exports, various personnel concerned with food handling or research mentioned the following problem areas:

- Inadequate packaging containers to meet foreign import requirements

- Complex and misunderstood quarantine regulations in Western markets pertaining to pests and chemical residuals

- Excessive handling of produce by customs officials prior to air transport

- Lack of cold storage facilities at the Bangkok airport

- Lack of standards and proper inspections for major perishable crops for export

- Lack of proper equipment to strengthen TISTR laboratories doing experimental work on improving postharvest, processing, and packaging for the private sector

Recommendations

Small growers, middlemen and collectors of perishable produce are usually not in an economical position to finance needed interventions to improve the food distribution system. Wholesalers and exporters do not normally have the technical capabilities to conduct these interventions and they do not seem to be particularly aware of how they should attain them. The ones interviewed thought the government should develop the technical research capabilities needed and the private sector would then rely on government assistance. The private sector firms have not objected to paying for these services.

Recommendations given here represent an attempt to define appropriate ways to reduce domestic losses, upgrade the quality of perishable crops and initiate some basic steps which could assist the export market. Correlating and upgrading the capabilities of TISTR with the needs of the food industry, both the large and small elements, was a major endeavor of this study.

Specific Recommendations:

TISTR Sponsored Workshop - September 1982

An expert (or experts) well versed in quarantine regulations, including pests and chemical residuals, should attend the TISTR workshop in September. The expert(s) should be able to cover both the U.S. and European regulations pertaining to quarantine regulations.

An expert experienced in setting grade standards for tropical fruits and some vegetables should also participate in the TISTR workshop. This person should be able to discuss in detail the criteria and methods to be used in the standardization process.

The above consultants would be expected to give presentations to the workshop. In addition, they would remain an additional ten days to confer with government agencies and exporters on quarantine problems so that these areas can be explained in a more detailed and systematic manner.

Storage Research Project for Onions, Garlic, and Shallots

A short term consultant is required who is experienced in storage of onions, garlic, and shallots under tropical conditions. The consultant would be required to make recommendations on practical and economical storage facilities that would extend the storage life of these crops. Although potatoes are not as important a crop as the ones mentioned above, it would be helpful if the consultant were familiar with potato storage also.

A support fund, estimated at \$10,000 would be needed for TISTR to conduct relevant, applied research in recommended facilities to complete the project.

Equipment for TISTR Laboratories

The TISTR staff submitted a list of equipment - to be utilized in the three sections of packaging, postharvest losses and processing sections of the Agricultural Products Development Division of TISTR. The equipment list (Appendixes E, F and G) has been given priorities of 1, 2 and 3. Assisting TISTR in obtaining at least some of this equipment would greatly expand the capabilities of this organization to assist the private sector in improving the food handling and distribution process.

Advisory Board on Applied Research Projects for Perishable Crops

This recommendation entails the formation of an Advisory Board consisting of both private sector and government agencies concerned with postharvest work on perishable food crops. The Governor of TISTR, as well as the head of the Agricultural Products Development Division endorsed the recommendation for such a board.

Government Cold Storage Organization (CSO)

More detailed work should be conducted to determine how the 32 CSO refrigeration vehicles can expand their activities into the transportation of other perishable crops in Thailand. Transporting grapes to the Malaysian border might be a possibility. (Grapes are presently transferred to refrigerated trucks at the border area.)

The possibility of the CSO becoming involved in improving refrigeration facilities at the Bangkok airport for export of perishable crops should also be studied. This organization has or is setting up cold storage facilities in several of the provinces. There appears to be a need for similar facilities at the Bangkok airport.

II. INTRODUCTION

USAID/Thailand has a policy to assist the country in establishing a more prominent part of the international market in fresh and processed food products produced in Thailand. The procurement of quality and continuity of supply of produce by exporters and processors are major problems that require the help of technical institutions in a number of areas of the marketing system.

The Thailand Institute for Scientific and Technological Research (TISTR), through USAID/Thailand, requested assistance from the Postharvest Institute for Perishables (PIP) in identifying needs that might be supported by USAID or PIP. TISTR is a nonprofit state enterprise that conducts research projects in food processing, packaging and postharvest losses of perishable food crops.

PIP was established under terms of a long term AID grant to provide assistance in project identification, assessment of perishable postharvest loss causes and problems and to provide the expertise needed for the resolution of specific problems in many areas.

This is a report of a short term project identification mission provided by PIP through the assistance of USAID/Thailand.

III SCOPE OF WORK

The scope of work entailed in this project identification mission was as follows (cables - Bangkok 09416 and 07869):

- A. Formulation of a project proposal for subsequent AID funding in need areas of the food industry.
- B. Establishment of essential facilities for postharvest work in the food handling and distribution system, and laboratory and research designs.
- C. Feasibility, preparation and recommended assistance for organizing a postharvest workshop or seminar in Thailand on food losses.

The number of work days in country was set at no more than 20 according to a limitation established by PIP for each individual country per any one year.

Mr. Harvey Neese was sent to Thailand by PIP to assist TISTR in identifying appropriate projects that may fall within the scope of work designated above.

IV. TISTR ORGANIZATION

Description

TISTR is a nonprofit state enterprise, under the Ministry of Science, Technology and Energy (Figure 1). This organization is financed partially from the Budget Bureau and partially from other governmental agencies as well as the private sector. The latter is in the form of research grants and payment for services rendered.

TISTR is entrusted principally with the application of research results in a number of fields for the economic and social development of the country. Research is done in the fields of industry, energy, agricultural products, housing and construction, general agriculture, the environmental resources and ecology. TISTR is also responsible for testing industrial standards, repair and calibration of scientific apparatus and procurement of scientific and technological information and documents. It is staffed with 185 graduates in 32 different disciplines.

The project identification assignment covered by this report is concerned with the Agricultural Products Development Division, which consists of three laboratories:

Postharvest Technology
Food Technology
Packaging Technology

The Postharvest Technology Lab conducts research such as solving problems of storage and postharvest losses of agricultural products.

Food Technology focuses on promotion of agro-industry, surveys of suitable agricultural raw materials and development of high quality acceptable food products for commercial application. This includes economic marketing studies with the aim of consolidating economic and social stability.

Packaging Technology is responsible for studies, research and consultancy services for the development of packaging containers appropriate to the resources and requirements of Thailand. Some facilities are available for the testing of packaging material for efficiency and quality control.

TISTR has completed a number of projects for the private sector and is involved in other on-going research projects. These projects which are contracted by the private sector are listed below.

Postharvest and Food Technology Labs

1. To study conditions for drying rice noodles. The information is to be used for building a dryer in a noodle factory.
2. To study conditions for making Chinese medicinal beverage powder.
3. To develop a process for making instant swiftlet bird nest.
4. To develop precooked food flakes from soybeans, rice and bananas for children. The client is seeking a joint venture from a foreign company to produce the product commercially.
5. To develop a composite of wheat and tapioca flour for making precooked noodles to reduce the cost of production for a noodle factory.
6. To develop a snack food from peanuts, and soybeans for an airline.
7. To develop 3 types of tamarind products for a factory. (Installation of equipment for the factory is almost completed. The test run of the products will be made soon).
8. Storage of fresh longans for export.
9. Dessicated coconut testing.

Packing Technology Lab

1. The Siam Kraft Paper Co. Ltd.
Products: multiwall sack kraft, liner board, corrugating medium, corrugated cartons, and others.
Testing for: bursting strength, basic weight edge crush, compressive strength, flat crush of paper and corrugated cartons.

2. Esso Standard Thailand Ltd.
Products: petroleum products and specialities
Testing for: compressive strength, bursting strength,
basic weight of corrugated cartons.
3. Crown Seal Co. Ltd.
Products: crown caps, pilfer-proof caps
Testing for: Compressive strength of corrugated cartons.
4. C.P.C. (Thailand) Ltd.
Products: food products
Testing for: shelf life of food products, water vapor,
transmission rate of plastic film, bursting strength
and compressive strength of corrugated cartons.
5. Thai Packaging Industry Co. Ltd.
Products: corrugated cartons
Testing for: bursting strength, ring crush and compressive
strength of papers and corrugated cartons.
6. Merck Sharp & Dohme (Thailand) Ltd.
Products: pharmaceutical products
Testing for: bursting strength, cobb test, compressive strength
flat crush, moisture content of paper and corrugated cartons,
thickness and pinholes of aluminum foil, WVTR & GTR of PVC
sheets.
7. Seriwat Co. Ltd.
Products: food products
Testing for: identification and WVTR of plastic films.
8. V. Sang Thai Paper Factory Co. Ltd.
Products: corrugated medium, kraft
Testing for: combined basic weight, bursting strength
of papers.

In-House Project

1. Chocolate powder beverage from soybean (similar to Milo,
Ovaltine)
2. Coconut flour product research
3. Papaya product - candy, instant beverage as Tang, pickling
or other uses (Photo 1)
4. Mung bean cream soup
5. Fruit juice; preservation of fruit and vegetables (on-going
project).

V. FRUIT AND VEGETABLE DISTRIBUTION SYSTEM IN THAILAND

In order to complete the scope of work for this project, it was necessary to examine how the food distribution system works in Thailand. This overview was then used in conjunction with the capabilities of TISTR to identify problem areas and needed interventions to improve research efforts in the perishable handling and distribution system.

The time allocated for the project identification mission (20 person days) did not allow for more than a cross-section of the various sectors of the food delivery system. The time element coupled with the departure of two of the three key section heads at TISTR (one became ill; the other went on an official trip to Europe) soon after arrival was another unavoidable negative aspect of the investigating period.

Below is given a cursory view of the perishable distribution system in the country.

From Producers to Market

Thai production areas of fruits and vegetables, are on the whole, small in size, although some fruit growers may have 25-30 rai.* Therefore, marketed amounts of produce by individual farmers are similarly small and transporting vehicles are required to pick up produce from a number of farmers in order to finish a load. Farmers bring their produce in bamboo baskets from remote farms to drivable road sides where open-air, non-refrigerated trucks pick it up.

Bamboo baskets are the common packaging method and produce is usually sold by the basketfull. (Photos 2, 3, 4) In its simplest form, produce is collected by middlemen at assembly points, and the produce is consigned to wholesalers who then sell to retailers, or to exporters depending upon the crop. Figure 2 shows specifically how potatoes are marketed from the northern provinces to other parts of Thailand and exported. Onions, shallots, garlic and even cabbage may follow this same scheme in the marketing process. Grapes, for example, grown close to Bangkok where the wholesalers, exporters and the central market are situated, may have short cuts in the marketing system compared to other perishable crops some distance from these key elements of the system. Figure 3 shows the marketing process of longans that are produced in northern provinces.

Grading

There is no sorting or grading done by producers for most perishables. A basketful of produce is expected to have variations from the highest quality down to the lowest. The practical reasoning behind trading in this manner is that produce from growers is in small amounts and some time has to be used to pick it up and transport it to assembly points. Sorting into grades might slow down transactions at every level of the marketing chain. Since grading takes time - and perishable crops are transported with no refrigeration - delays could spoil or lower the quality of the most highly perishable crops.

*1 acre = 2.5 rai

Grading on a limited basis is done at the end of the marketing chain, or by the wholesalers (mostly for export markets) and by retailers in the domestic market. (Photo 5)

Domestic Consumption of Fresh Fruit and Vegetables

About 90 percent of all fresh tropical fruit produced in Thailand is used for domestic consumption. (See production figures, Appendix A.) Some fruit species that are available year round from various areas are: tangerines, pomelo, bananas, grapes,* jujube, papaya, guavas, coconuts and jackfruit.

Seasonal fruit include mango, lichi, durain, rambutan, mangosteen, longan and custard apple.

Except for juices, Thais prefer to eat fresh fruit rather than that which is processed.

There are no estimates available on the percent of vegetables that are consumed domestically in comparison to what is exported. Vegetables, however, do not have as high an export value as fruit. (See export figures, Appendix B.)

Thailand produces a large number of vegetables in several areas of the country, although the northern provinces are the most prolific producers. Vegetables include yardlong beans, sugar peas, carrots, tomatoes, potatoes, garlic, onions, shallots, chilis, ginger, sweet potatoes, turnips, sweet corn, cabbage, cauliflower, broccoli, collards and Chinese cabbage.

All of these vegetables are consumed in the fresh form in Thailand.

Export Market

Large exporters are said to purchase up to 70 percent of their produce from wholesalers, whereas small exporters are said to buy about the same percent directly from farmers. The advantages of buying from middlemen are volume and quality. However, the lack of exporter control between harvest and packing for export is said to be the principal reason for the high percentage of damage claims by foreign importers.

Fresh and Processed Fruit

Fresh fruits are mostly exported to Hong Kong and Singapore although Europe and Middle Eastern countries also purchase from Thailand. The principal nonprocessed fruit exports in 1980 were: bananas, mangoes, oranges, pomelos, grapes, longans, durains and papayas.

The major processed fruits exported were pineapple, rambutan, rambutan stuffed with pineapple, pineapple juice and longans.

* Through a unique pruning process, forcing dormancy, as many as three crops of grapes can be harvested in a year by grape growers. This compares with only one crop in temperate climates.

Total value of exported, processed fruit for 1980 was 393,710,392 Baht.* (See Appendix C.)

Value of nonprocessed vegetables exported in 1980, excluding cassava or tapioca pellets, was 1,742,691,231 Baht. With the above two products added to other vegetables total exports of vegetables amounted to 15,287,887,951 Baht in 1980.

Quality Production

The present system tends to hamper export trade in vegetables because it offers farmers no incentives to provide high quality produce. Vegetable exporters have had difficulties in obtaining sufficient amounts of good quality produce to fill orders. Most of the vegetables are grown for the domestic market, where quality demand is not near as high as the export market. This accounts partially for the lack of incentives for higher quality produce.

The system works well in the domestic market but exporters need some improvements in the quality of produce for the international market.

Refrigeration:

Government Cold Storage Organization

Refrigeration facilities are not used to transport vegetables and fruit to domestic or export markets with a couple of exceptions. Longans, which are a highly perishable commodity and a good export earner, are being shipped to Singapore from the north by refrigerated trucks operated by the Government Cold Storage Organization (CSO) in Thailand. This organization has 32 trucks with cold storage units of approximately 25 cubic meters each. (Appendix D) The trucks are used mostly to transport fish products from South Thailand to Bangkok.

The CSO began transporting longans to Singapore two years ago through Malaysia. It has approval by the Malaysian government to use 15 trucks to drive on Malaysian roads. Roads taxes by the Malaysian government are 125,000 Baht per truck per year.** A truckload of longans hauled from Chiang Mai to Singapore costs 7,000 Baht. Although longans have only been hauled to Singapore, the management states that other crops could be transported with requests and agreements between exporters and the CSO. The CSO is looking into the possible purchase of longer trucks with trailers, as these are more economical to operate per MT of freight.

Transshipping Grapes in Refrigerated Trucks

At least some grapes are transferred to Malaysian refrigerated trucks at the Thai border and then transported to Singapore. The Malaysian government, according to a CSO official, is somewhat protective of either Malaysian cold storage transport companies and/or its part of the Singapore market in competitive perishable crops. For these reasons, negotiating cold storage trucks for Thai firms driving through Malaysia to Singapore has met with some resistance.

* Exchange rate calculated is: 22 Baht = 1 U.S. Dollar

** (Figure given by an official of the CSO)

Bangkok Airport Cold Storage Facilities

The only cold storage facilities found at the airport that exporters of perishable crops would have access to are operated by Thai International Airlines. One source said the facility is about 116 cu meters in size. An official of Thai International stated that his firm does not plan to get into the cold storage business. One reason given was that handling and air freighting perishable crops had the smallest margin of profit of any of its freight.

The small cold storage facility was only provided as a service for small storage of perishables. Since the facility is of such small size, there have been problems with who gets to use the facility, according to one source. The exporters interviewed all stated that an airport cold storage facility that was available to all perishable exporters would be a big asset to them.

VI. PROBLEM AREAS AND CONSTRAINTS

TISTR is sponsoring a perishable food crop workshop in September of 1982, assisted by the Tropical Products Institute (TPI) of the U.K. Part of the scope of work of this project is to identify important problem areas and constraints that might be covered in the workshop which is to be attended by both the Thai private sector and government officials. The constraints that surfaced in interviews with various government agencies and the private sector were discussed with TISTR department heads to obtain their input and concurrence of the main problem areas. Other constraints surfaced which were somewhat outside of TISTR's jurisdiction or scope of work. These are covered in the following pages.

Quality of Perishable Products

Maintaining the quality of perishable products is, at best, difficult in hot, humid climatic zones with all the necessary support to the system such as; good transport and roads, adequate cold storage, appropriate packing and containers, sorting into grades, and knowledgeable producers and food handlers who know the importance of maintaining high quality produce. There must be adequate incentives to supply produce of high quality. (Photos 3, 4, 6, 7).

It appears that exporters - and wholesalers that supply these exporters - realize more the importance of providing high quality produce than domestic handlers. Exporters, according to reports, have experienced some costly rejections by foreign importers because of poor quality produce.

Below are listed and described briefly some of the more important elements that contribute to poor quality produce which is particularly detrimental to the export market.

1. Lack of knowledge or incentives to produce quality - Growers and food handlers, by tradition, provide to the market system basketsful of produce which is of average quality throughout the container. There are few, if any, incentives to upgrade the quality of produce that enters or travels through the system until it gets to wholesalers who supply exporters or retailers on the domestic scene.

2. Transportation of Produce - As produce moves through marketing channels, bad roads, the long collection process, lack of cooling facilities, inadequate packing containers and carelessness by transporters insure the produce will most likely be less than the best quality. The long distances to market may delay produce reaching its destination for up to 50 hours although 12-15 hours is more common. However, the lesser figure under the climatic conditions of Thailand can cause severe loss of quality and actual physical losses. TISTR has initiated experimental work on improving containers to withstand the adverse transportation conditions for some crops. Other research work is contemplated subject to adequate funding. Considerable work is being done with exporters to improve on containers for their market.

The Tropical Products Institute (TPI) of Slough, England, will send an expert on packaging to the workshop in September to assist in improving packaging. (Photo 8).

3. Storage - Inadequate storage in Thailand's climate with some crops such as potatoes, onions, garlic and shallots contribute to substantial losses. The government has recently put into effect curbs on importation of onions. Garlic, onion and shallot imports amounted to about 70 million Baht in 1980. With restrictions put on imports, better storage facilities become more important. (Photo 9).

TISTR is planning some applied research projects on storage of the above crops if funding is made available.

Upgrading Export Quality of Perishables

Wholesalers who sell to exporters - and the exporters themselves - are beginning to realize the importance of providing this market with high quality produce. Rejection of some exported produce by foreign importers as mentioned, and lack of adequate supplies of sufficient quality has caused loss of business and revenue.

In interviews with exporters and personnel at TISTR, as well as other government agencies, the following areas were pinpointed as major constraints to providing high quality produce for the export market:

1. Inadequate packing containers to meet foreign exporter requirements - work is on-going by TISTR to assist in improvement of better packaging and containers for exported food crops. Lack of proper testing equipment has hampered TISTR from providing adequate services to clients who have requested assistance. (Photos 9, 10).

2. Complex and misunderstood quarantine regulations in Western markets - Exporters, generally, are not aware of all the various restrictions placed on fresh food imports in Western markets. This includes regulations pertaining to both pests and diseases as well as residual amounts of various chemicals that might be used by producers. Exporters are many times not aware of the kind of pesticides used by the producers and shipments to Europe have been held up or rejected because of this problem.
3. Excessive handling of produce by Customs officials - Exporters, as well as other agricultural officials, stated that most containers of produce must be opened and inspected by Customs officials in their search for smuggled items. According to knowledgeable people interviewed, this inspection may be excessive and roughly handled. In addition, quarantine officials also make inspections for some prominent diseases.

The inspections take place in nonrefrigerated areas before the produce can be loaded onto departing aircraft.

4. Air transport and cold storage at the Bangkok airport - Perishable produce - as fruits and vegetables - are given the lowest priority for shipment by the airlines because of the low profit margins involved. Although space can be booked in advance on a plane, the shipment can also be cancelled, according to an airline official, if a higher priority cargo shows up. Since there is only one small cold storage facility at the airport, the produce remains on nonrefrigerated trucks and under adverse climatic conditions as it awaits transport to an aircraft. (Photo 6).

Several exporters stated the advantage of having a sufficiently large cold storage facility at the airport - with different temperature compartments - where produce could be placed while it underwent inspection and awaited transport air service to its destination. (Photo 11).

Important Pest Infestations in Thailand

The oriental fruit fly and the melon fly infest parts of Thailand. The melon fly uses mostly cucurbits for its egg deposits whereas the fruit fly lays its eggs in a number of softer fruits. Because of these pests, fresh produce is mostly banned from entering Japan. The U.S., of course, also has similar regulations on fresh produce from infested areas, such as Thailand. Europe, the Middle East and other parts of Asia do not generally restrict fresh produce shipments because of these pests.

Use of ethyl bromide fumigant has been an acceptable control measure for these two fly pests. However, eggs may still persist in fruit after being fumigated by ethyl bromide. This fumigant is reported to be banned from use in Japan and the U.S. beginning in 1983.

Different doses of irradiation are now under experimentation at the Entomology, Zoology and Treatments Branch of the Department of Agriculture in order to find an effective dose which will destroy both the flies and the eggs.

Legislation of Standards Development and Inspections for Major Perishable Crops for Export

There is a move by the government to legislate standards for various fruit and vegetables aimed at improving export quality. Standards for longans are reportedly established or close to it. There are several working committees attempting to develop standards for other exported crops as well.

In an interview with the chairman of one working subcommittee, the impression was given that he was not completely aware of steps to take in establishing standards. He requested information in the form of reports which the U.S. Department of Agriculture might have. He also said he would welcome any assistance that might be offered.

Setting standards for fruit and vegetables for export by government legislation may not be the most appropriate path to take. Some timely advice prior to standards being established by the government might alleviate problem areas before they occur.

Equipment to Strengthen TISTR Laboratories

The lack of needed equipment for the three sections of the Agricultural Products Development Division has hindered services to private sector clients by TISTR. With the mandate to charge a user's fee for services requested by the private sector, TISTR could increase substantially its fees and not have to depend entirely on an allocated government budget.

Research Services to Support the Food Industry by Different Institutions of the Government (Photos 1, 12).

The following organizations have been found to be doing some work on postharvest research projects in perishable crops in Thailand:

Kasetsart University
Horticulture and Plant Packaging Sections of the Department of
Agriculture
Asian Institute of Technology (AIT)
TISTR
Chiang Mai University

There is plenty of room for considerable research work in the postharvest field for perishables in Thailand. There is also the possibility of costly duplication if there is not some means to coordinate the major efforts in this field. Some means should be established, which would include both the private and public sectors, to coordinate and guide research efforts to the needs of the users. Otherwise, the full efforts of research organizations in Thailand may not be all working in the same direction which is urgently needed for a quicker impact on food industry development.

VII. RECOMMENDATIONS

Recommendations made in this section represent an attempt by the PIP representative to define appropriate ways to reduce losses, upgrade the quality of perishable crops and initiate some steps which might assist the export market. Correlating and upgrading the capabilities of TISTR units, the needs of the food industry, both the large and small elements, was a major endeavor of this study.

It is a difficult task at best to recommend "important" areas of assistance that might be needed in a total food system, thereby downgrading somewhat less important aspects. The scope of work in the project identification mission did not allow sufficient time for identifying problems within the whole system of the perishable marketing system in Thailand. Assistance recommended does generally fall within the research experimental guidelines covered by TISTR.

One question persistently asked exporters and wholesalers by the PIP representative was where they thought the responsibility of giving technical assistance should lie. They were asked whether the private sector should not be in a position to provide its own support services for the industry. The answers were not conclusive and generally were answered this way: That they would be willing to pay a fee for technical assistance, but the government was in a much better position technically to provide this assistance.

Small growers, middlemen, and collectors of perishable produce are usually not in a financial position to finance, for example, research on better containers although there might be a very real need for this work. The fact is, these sectors of the marketing system do not see a great need for improving quality of product within their spheres of the distribution system. The need to improve quality - as seen from the eyes of the exporters - has not filtered down the links of the food system chain to the collectors, transporters and growers. This will no doubt come about as Thais become more demanding in their quality of foods and exporters become more proficient in the international marketing areas. Meanwhile, initial steps will have to continue by government agencies that are in a position to "start the ball rolling."

TISTR is able to operate as a quasi-government organization, both charging for its service and initiating in-house projects in which the costs will be absorbed by TISTR. This mode of operation enables TISTR to work both with the large segments of the food industry to the smallest elements, including producers.

Recommendations are given in the following pages for assistance which would be of benefit to the perishable marketing process in Thailand.

TISTR Sponsored Workshop

TISTR, assisted by the Tropical Products Institute, will hold a two-week workshop in September, 1982. Various experts in the postharvest field will give talks at the workshop which will be attended by both public and private sector personnel.

There are several subject areas that will not be covered unless experts can be brought in from outside of Thailand. The fields of expertise recommended are given below:

- A. Quarantine regulations and restrictions. The person should have intricate knowledge of quarantine regulations in the U.S. and European countries as they pertain to the importation of fresh fruits and vegetables. The person should be able to explain in detail how to prepare nonprocessed fruits and vegetables for Western markets; what tests, treatments, etc. are needed for perishable foodstuffs to pass quarantine regulations.

- B. Residual effects of chemical on exported fruits and vegetables. This expert will be able to explain the kinds of pesticides that should be avoided on foodstuffs going to Western markets, including recommended withholding periods prior to crop harvest, methods, if any, to reduce the amounts of residuals showing up on perishable foods which are imported by Western countries; and maximum allowable residues.

The person should be able to describe the latest methods used to test for various chemical residues, which are considered too toxic for use in Western countries, but may be in use in Thailand.

In review, the person should be able to talk about the broad subject of chemical residue controls and specifically on any part of it.

- C. Grade standards for tropical fruits and vegetables. This person should be knowledgeable in the methodology of setting standards for tropical fruits and some vegetables to be exported from Thailand. He should be able to discuss in detail criteria to be used for setting standards and the appropriate inspection methods that might be used.

Experts in the above fields would spend only a few days at the workshop and up to 10 days conferring with government officials and private sector exporters on their problems in establishing export markets for Thai food products in Western markets. The U.S. Department of Agriculture might be the appropriate organization in the U.S. that could supply these experts. Or perhaps the U.S. Food and Drug Administration could provide the one in chemical residues.

The workshop is planned for September, 1982. TISTR officials should be informed as soon as possible whether these experts will be available for the workshop.

Equipment for TISTR Laboratories

The three TISTR Laboratories in the Agricultural Products Development Division are in need of various kinds of equipment to support applied research for the private sector food industry. Potential clients have requested assistance from TISTR which could not be given because of lack of the right kind of equipment. Also, in-house projects which are initiated by TISTR in response to various needs, but not to any one particular request, need the equipment to assist the smaller elements of the food distribution chain.

The TISTR staff has submitted a list of equipment - to be utilized in the three sections of packaging, postharvest losses and processing - that they feel is necessary in order to meet the increasing demands from the private sector food industry.

The equipment list shown in Appendices E, F, and G is given first, second and third priorities.

Priority I, Appendix E, is equipment to be used by the packaging section of TISTR; Priority II, Appendix F, is equipment for the postharvest section and Priority III, Appendix G, is for the processing part.

The Belgian Packaging Institute has offered to send an equipment expert to Thailand to assist in demonstrating the different uses for any equipment that might be obtained.

Storage Research Project for Onions, Garlic and Shallots

Since the government regulation which was recently issued to reduce importation of onions, the development of better storage methods for this crop has taken on a new importance. Using present facilities in Thailand, onions, garlic and shallots can be stored for only a maximum of three months.

In this proposed project on storage by TISTR, a short-term consultant is required who has expertise in storage of onions, shallots and garlic in warm tropical climates.

In addition to the short-term expert - of about three weeks duration - a support fund of U.S. \$10,000 would be needed to complete the project.

TISTR personnel will present a formal and more detailed proposal for this project upon request.

It is suggested that the onion storage expert be sent to Thailand prior to the use of any funds for research on different kinds of facilities. Short-cuts may be recommended by the expert which may be wasted if facilities and project development are too far along.

PIP may assist in locating such an expert upon request by the Thai and USAID mission.

Advisory Board on Applied Research Projects for Perishable Crops

Perishable food production, handling and marketing are done exclusively by the private sector in Thailand. Any assistance to elements of the food distribution system must necessarily be directed to the private sector. There are several government institutions involved in research projects on postharvest aspects of perishable crops. Some means to coordinate these efforts should be initiated in order to avoid duplication and competition for similar projects.

This recommendation is made for TISTR and other government institutions to consider setting up an advisory board, consisting of both the private sector and government organizations concerned with postharvest work on perishable food crops. The private sector might include representation from the three food industry associations (Food Processors, Fruit and Vegetable Exporters, and Packaging). Wholesalers should also be represented as well as food transporters. The Government Cold Storage Organization should have a representative on the board.

Other government institutions that should be represented on the Board are: TISTR, Kasetsart University, the Horticulture and Pathology Sections of the Department of Agriculture, Asian Institute of Technology and Chiang Mai University.

By conducting several annual meetings, government research organizations will be able to learn what each is doing or planning in postharvest research projects. At the same time, inputs by the private sector will tend to keep these projects in line with the real needs of the food industry.

Related Issues Beyond the Scope of This Identification Mission

During the course of investigation, the PIP representative identified several important issues related to postharvest losses which are outside the scope of work of this identification mission. It is believed that comments should be made on these issues, and perhaps follow-up work directed by USAID for future contract groups which will be involved with projects pertaining to perishable food marketing:

Bangkok Airport and Perishable Food Exports

Exporters interviewed, as well as some government officials concerned with food handling, stated that there were recurrent problems at the Bangkok airport in relation to lack of adequate cold storage facilities, excessive handling by customs officials of produce and low priority status attached to fresh produce air freighted to foreign markets.

Brief discussions are given below for each of the above problem areas. The PIP representative does not have any recommendation other than more basic investigative work to determine more precisely where the problem areas exist, and what action might be taken to assist in solving them.

A. Cold storage facilities

Exporters stated to the PIP representative that a cold storage facility of sufficient size at The Bangkok airport would be a highly desirable asset for increasing exports of perishable food crops. These same exporters stated they would be willing to pay a reasonable fee to help maintain the costs of such a facility to store their perishable goods while awaiting airfreight availability.

In a conversation with a Thai International Airline official, it was learned that there is, in fact, a small cold storage facility at Bangkok airport under the supervision of the airlines. However, the reported 116 cubic meters size is hardly large enough to handle sizable amounts of produce.

This problem area, the magnitude of which is not known, was discussed with the Deputy Director of the Government Cold Storage Organization. He seemed interested enough in the situation to attend a meeting with Thai International Personnel if such were arranged.

It would appear that the situation warrants a closer look to determine more specifics.

B. Customs Department handling of perishable foods prior to export

Some private sector and government officials mentioned that the handling of perishable foodstuffs by customs officials was excessive and caused some loss of quality and delays in shipping. The inspection process, according to those interviewed, involved physically inspecting each container and removing produce from their containers. Again, if this is a problem, it must be realized that Customs officials have a responsibility to inspect cargo for possible smuggling of illicit drugs and other contraband. How much of a problem exists in the inspection process is not known at this time, or what solutions might be possible if the problem is severe. One official mentioned that she thought that "sniffer" dogs were being trained to smell out illicit drugs at the airport. This was not confirmed. It is also not known if electronic devices are suitable and available to detect gold smuggling, thereby lessening the need to inspect food containers so closely.

It would be most productive to determine more about this problem area, so that ways could be devised to solve it.

C. Government Cold Storage Organization

The CSO already has, as stated earlier, 32 cold storage vehicles. Shipment of fish products from South Thailand to Bangkok is a regular function of this organization. It would be very useful to explore the possibility of the CSO transporting other perishable foods and expanding its services to other parts of the country where it is needed.

Since transportation of perishables is not traditionally done by refrigerated vehicles, it is not known how much interest there would be in utilizing this service or how economically feasible it would be for various perishable crops.

Transport of grapes to the Malaysian border by cold storage vehicles might be a possibility; depending on the charges. It would appear that exporters of grapes to Singapore would certainly consider the use of refrigerated trucks if shipping costs were reasonable.

A more indepth investigation of the potential of expanding use of CSO transportation services to other perishable crops might turn up some partial solutions to losses that occur because of the transport problem in Thailand's warm climate.

Future Project Proposals to be Submitted by TISTR to AID

TISTR is planning to submit other project proposals on research projects that fall within the funding of the Science and Technology Division of AID. The PIP representative obtained guidelines from USAID/Thailand for TISTR to use in the submission of these types of proposals.

Several of the proposed projects were discussed and reviewed for TISTR. Some assistance was given in recommendations on how they might be prepared to fit the guidelines set by AID/Science and Technology. However, two of the section heads were absent, and since the deadline is not until June 1, TISTR personnel were advised to submit pre-proposals, as specified in the guidelines, after the section heads have returned.

Table II: Fruit Production in Thailand by Regions, 1978/1979

Production	Central Region		Northern Region		Northeastern Region		Eastern Region		Western Region		Southern Region		WHOLE COUNTRY	
	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)	Total (000 kg) Production	Planted Area Rai (000)
1. Tangerine	443	1.5	7,113	22.9	138	.6	102	.5	1,178	1.0	3,511	5.5	12,466	32.0
2. Mango ✓	40,344	950.0	65,729	300.1	249,223	504.0	77,262	225.0	169,793	117.2	17,458	59.8	639,809	1,354.8
3. Rambutan	132	1.6	527	2.0	5	.02	69,109	110.2	321	1.4	1,051,726	1,073.4	121,820	1,188.5
4. Longan ✓	129	.6	99,356	177.6	13,935	19.2	169	.9	613	1.6	-	-	114,263	200.0
5. Lichee ✓	184	.6	7,071	25.5	92	.2	326	2.2	719	2.5	-	-	8,403	31.0
6. Pomelo	2,972	4.9	15,443	19.9	4,524	6.0	2,680	5.0	6,574	6.7	14,276	16.3	46,468	60.8
7. Durian	6,520	20.2	4,603	6.4	.1	.001	22,892	126.2	123	.4	221,427	236.0	265,624	389.0
8. Mangosteen	413	1.0	335	.5	6	.006	11,327	17.4	65	.1	20,134	58.3	32,290	77.2
9. Banana (Nam-Thong)	6,122	10.5	4,438	7.1	5,095	9.9	9,260	14.7	5,308	7.2	29,199	30.2	59,542	79.6
10. Banana (Nam-Wa) ✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11. Lime	2,438	9.3	5,330	16.8	2,441	11.6	4,158	18.4	31,158	28.0	26,696	22.0	75,221	105.8
12. Grape	-	-	6	.003	-	-	.3	.002	40,151	14.0	102	.07	40,261	14.2
13. Sapodilla	12,287	26.0	19,451	66.1	3,932	9.9	4,997	10.8	22,164	35.0	13,364	27.1	76,195	182.8
14. Custard-Apple ✓	3,289	5.1	19,934	10.2	63,117	28.4	1,800	2.3	6,981	2.2	2,014	1.4	97,033	49.6
15. Jack Fruit	932	11.8	17,126	99.3	12,962	92.7	20,914	39.5	2,567	28.1	6,153	51.4	60,713	221.0
16. Tamarind	13,603	26.5	76,669	162.7	135,132	337.4	17,052	22.2	19,443	30.5	10,107	28.7	272,027	608.0
17. Guava	21,366	23.5	26,528	27.1	42,645	54.9	7,010	8.1	6,493	7.4	10,189	10.8	114,231	131.7
18. Langsat	-	.02	7,167	14.6	-	-	2,625	6.3	15	.02	43,426	38.7	53,244	59.6
19. Sweet Orange	151,318	97.8	40,266	39.1	1,566	1.2	41,626	115.7	11,009	10.0	85,703	55.7	331,508	319.3
20. Coconut ✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21. Water-Melon	17,296	8.6	60,069	53.4	192,518	104.0	12,805	7.0	53,067	17.5	141,049	61.4	476,764	251.0
22. Pineapple	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 acre = 2.5 rai

Source: Technical Working Group on Food Products - Thailand; ASEAN Working Group

APPENDIX B. - Fresh Vegetables and Fruit Exports for 1980

070101	FRESH POTATOES (KG)						
	HONGKONG	109	03			9,500	45,720
	LAOS	121	03			7,758	78,730
	MALAYSIA	126	03			258,050	940,520
	VIETNAM	143	03	50	771	50	771
				50	771	275,358	1,071,747
070103	TOMATOES FRESH OR CHILLED (KG)						
	HONGKONG	109	03			2,550	10,745
	SINGAPORE	136	03			1,025	10,375
						3,355	21,150
070104	MUSHROOMS AND TRUFFLES FRESH OR CHILLED (KG)						
	BRUNEI	103	03	20	1,041	20	1,041
	FRANCE	210	03	220	56,024	720	155,909
	AUSTRALIA	701	03			54	4,814
				240	57,065	774	171,754
070105	BAMBOO SHOOTS FRESH CHILLED (KG)						
	BAHRAIN	102	03			50	1,000
	JAPAN	115	03			115,475	794,517
	FRANCE	210	03			3,340	14,372
	GERMANY FED REP	212	03			90	3,672

Note: Continued on following pages.

Source: Thailand Customs Department

				(BAHT)		(BAHT)	
070103	BAMBOO SHOOTS FRESH CHILLED (KG)						
	NORWAY	225	03			15	993
	UNITED KINGDOM	233	03			100	1,223
	UNITED STATES	402	03			2,340	24,776
						119,618	860,561
070106	ONIONS SHALLOTS GARLIC LEEKS AND OTHER ALLIACEOUS VEGETABLES FRESH OR CHILLED (KG)						
	LAOS	121	03			60	1,200
	MALAYSIA	124	03			1,200	11,217
						1,260	12,417
070109	OTHER VEGETABLES FRESH OR CHILLED (KG)						
	BAHRAIN	102	03	1,470	15,119	105,222	762,295
	BANGLADESH	103	03			1,155	4,520
	BRUNEI	105	03	1,863	42,071	4,209	77,457
	CHINA PEOPLES REP	107	03			3,150	15,750
	HONGKONG	109	03	6,980	1,768,941	7,990,543	32,002,143
	INDONESIA	111	03			108	1,546
	KUWAIT	120	03	720	4,443	20,200	94,643
	LAOS	121	03	600	2,000	5,600	34,500
	MALAYSIA	124	03	46,000	362,354	310,551	1,578,167
	SAUDI ARABIA	134	03	280	7,816	9,073	97,929
	SINGAPORE	136	03	42,592	498,014	130,816	6,966,634
	SRI LANKA	137	03			960	9,852
	TAIWAN	139	03	90	884	90	884
	U ARAB EMIRATES	142	03	1,323	15,084	153,791	1,016,056
	VIETNAM	143	03	400	3,293	6,634	57,792
	AUSTRIA	203	03			4,200	52,115
	BELGIUM	204	03			1,104	8,176
	DENMARK	207	03			450	10,710
	FRANCE	210	03	48,481	329,655	387,936	2,788,637
	GERMANY FED REP	212	03	3,176	32,100	44,234	381,191
	LUXEMBOURG	221	03			71	2,150
	NETHERLANDS	224	03	46,210	481,376	725,432	5,740,276
	NORWAY	225	03	1,250	5,142	2,200	8,942
	PORTUGAL	227	03			1,413	5,753
	SWEDEN	231	03			400	2,400
	SWITZERLAND	232	03	1,981	29,753	31,717	427,557
	UNITED KINGDOM	233	03	660	5,579	2,620	19,639
	UNITED STATES	402	03	2,270	20,652	7,198	246,002
	AUSTRALIA	701	03			140	7,055
				645,048	3,626,876	10,351,139	50,423,120
070200	VEGETABLES FROZEN (KG)						
	BRUNEI	105	03	100	1,964	100	1,964
	HONGKONG	109	03			7,500	37,500
	JAPAN	115	03			18,000	271,885
	NETHERLANDS	224	03			6,037	372,620
	UNITED STATES	402	03			145	3,534
	AUSTRALIA	701	03			4,848	61,175
				100	1,964	36,650	698,710
070410	SHALLOTS DRIED (KG)						
	HONGKONG	109	03	90,900	185,552	210,400	1,726,550
	MALAYSIA	124	03	279,400	1,296,490	6,774,678	30,715,953
	SINGAPORE	136	03			1,176,450	7,715,231
	VIETNAM	143	03			250	2,017
				900,300	1,482,042	8,161,808	40,160,613
070421	GARLIC DRIED (KG)						
	SINGAPORE	136	03			850	14,450
	TAIWAN	139	03			10,000	91,699
	FRANCE	210	03			90	2,965
	UNITED STATES	402	03		591	7	571
					591	10,947	109,706
070422	ONIONS DRIED (KG)						
	HONGKONG	109	03			21,150	139,070
	LAOS	121	03	400	4,800	1,120	12,640
	MALAYSIA	124	03			79,700	347,427
	SRI LANKA	137	03			92	1,890
	NETHERLANDS	224	03			215	8,752
				400	4,800	102,277	501,759
070423	MUSHROOMS AND TRUFFLES DRIED (KG)						
	BRUNEI	105	03	50	2,603	105	6,035
	HONGKONG	109	03			180	16,455
	SAUDI ARABIA	134	03	90	12,959	90	12,959
	SINGAPORE	136	03	750	66,301	750	66,301
	FRANCE	210	03	1,760	448,195	16,862	3,917,635
	GERMANY FED REP	212	03			5	511
	NORWAY	225	03			45	7,193
	SWEDEN	231	03			3	2,067
	UNITED KINGDOM	233	03			75	23,450
	CANADA	401	03			30	6,734
	UNITED STATES	402	03			61	12,227
				2,650	530,038	18,186	4,071,613
070424	BAMBOO SHOOTS DRIED (KG)						
	LAOS	121	03			800	4,000
	NORWAY	225	03			100	8,924
	UNITED STATES	402	03	3,439	26,960	4,332	44,507
				3,439	26,960	5,282	57,431
070429	OTHER VEGETABLES DRIED DEHYDRATED EVAPORATED (KG)						
	BAHRAIN	102	03			50	3,050

COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
070506	BLACK MATPE BEANS (KG)						
	GERMANY FED REP	212	03				
	NETHERLANDS	226	03			1,140	7,013
	UNITED KINGDOM	233	03			69,748	363,080
	CAMBODIA	401	03	47,820	608,896	348,653	4,892,423
	UNITED STATES	402	03	18,000	444,063	194,500	1,959,836
	OTH AFRICAN CTRY	699	03	328,690	3,765,380	403,467	4,614,211
	AUSTRALIA	701	03			5,000	61,710
	FIJI	705	03	10,000	86,394	33,000	289,986
						1,300	16,924
				13,248,526	103,901,173	119,526,587	836,300,853
070507	PEAS (KG)						
	LAOS	121	03			99	2,096
						99	2,096
070509	OTHER DRIED LEGUMINOUS VEGETABLES (KG)						
	BAHRAIN	102	03				
	CHINA PEOPLES REP	107	03			30	1,530
	HONGKONG	109	03			321,000	1,931,423
	JAPAN	113	03	18,700	288,464	428,360	2,297,379
	KOREA REPUBLIC OF	119	03	420,040	3,364,840	17,737,511	107,598,156
	LAOS	121	03	1,301,000	17,031,960	4,045,000	32,556,823
	MALAYSIA	124	03			1,200	9,600
	PHILIPPINES	124	03	42,551	315,551	396,725	2,140,092
	SATAR	131	03	16,000	249,925	216,000	1,277,799
	SINGAPORE	136	03			18,000	100,171
	TAIWAN	139	03	43,040	349,401	553,556	3,555,151
	FRANCE	210	03	132,000	881,588	636,000	3,596,656
	GERMANY FED REP	212	03			3,970	72,117
	ITALY	219	03			3,990	18,608
	SPAIN	230	03			98,900	611,925
	UNITED STATES	402	03			300,000	1,449,373
				2,013,331	22,481,729	24,780,317	157,244,589
070601	CASSAVA ROOTS (KG)						
	HONGKONG	109	03			400	5,459
						400	5,459
070602	CASSAVA SHREDED OR SLICED (KG)						
	HONGKONG	109	03				
	BELGIUM	204	03	4,750	10,347	8,380	26,570
	FRANCE	210	03			31,000,000	127,081,458
	GERMANY FED REP	212	03			3,000,000	7,581,105
	NETHERLANDS	226	03			14,662,600	46,974,175
				7,240,000	19,502,417	90,520,400	223,307,219
				7,244,750	19,512,764	159,191,380	404,970,528
070603	FARO AND YAMS (KG)						
	BRUNEI	105	03				
	HONGKONG	109	03			545	7,585
	MALAYSIA	124	03			97,460	499,337
	UNITED KINGDOM	233	03			35,400	367,263
						18,000	208,366
						151,405	1,060,851
070604	SWEET POTATOES (KG)						
	BRUNEI	105	03				
	VIETNAM	143	03	20,000	131,621	20,000	131,621
				200	3,085	200	3,085
				20,200	134,706	20,200	134,706
070605	CASSAVA OR TAPIOCA PELLETS (100 KG)						
	JAPAN	113	03				
	SINGAPORE	136	03			40	14,176
	BELGIUM	204	03	11,000	3,122,526	51,000	15,692,005
	FRANCE	210	03	797,456	221,873,501	6,677,831	2,004,308,020
	GERMANY FED REP	212	03	121,000	31,780,410	1,201,100	323,193,042
	ITALY	219	03	237,200	67,404,298	3,237,854	929,572,605
	LUXEMBOURG	221	03	314,860	92,635,996	739,940	197,243,106
	NETHERLANDS	226	03	27,000	7,608,863	27,000	7,608,863
	PORTUGAL	227	03	3,458,231	1,006,057,087	35,735,448	9,531,436,120
	SWITZERLAND	232	03			20,000	6,074,730
	HONDURAS	514	03	10,000	13,789,716	300,000	89,238,454
	PANAMA	518	03			20,000	6,181,155
	REUNION	634	03			100,000	28,911,900
	AUSTRALIA	701	03			2,025	694,193
						10	2,365
				3,006,507	1,444,080,377	48,112,248	13,140,220,733
070609	OTHER ROOTS AND TUBERS FRESH OR DRIED (KG)						
	BRUNEI	105	03				
	MALAYSIA	124	03			95	1,825
						600	1,713
						695	3,541
TOTAL BY CHAPTER					1,706,917,443		15,287,887,931
080111	CUCUMBERS SHELLED OR NOT (HUNDRED)						
	BAHRAIN	102	35			10	9,080
	HONGKONG	109	35				
	JAPAN	113	35	234	72,827	17,497	1,321,863
	KUWAIT	120	35			60	58,140
	LAOS	121	35	1	1,111	175	15,910
	SINGAPORE	136	35			52	42,800
	TAIWAN	139	35	12	4,936	63	41,373
	GERMANY FED REP	212	35			50	12,231
	SWITZERLAND	232	35			36	37,516
							720
				247	78,874	17,943	1,532,553
080112	CUCUMBERS DESICCATED (KG)						
	BAHRAIN	102	03				
						100	900

EXPORTS

P. 17

COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
080112	COCONUTS DRIED (KG)						
	BURMA	184	03	4,300	18,000	4,300	18,000
	HONGKONG	109	03			1,430	5,440
	LAOS	121	03			3,280	14,000
	SAUDI ARABIA	134	03			30	1,093
	SINGAPORE	136	03			420	3,427
	CANADA	401	03			167	26,172
	UNITED STATES	402	03			475	14,768
				4,500	18,000	10,422	53,775
080124	CASHEW NUTS NOT SHELLED (KG)						
	CHINA PEOPLES REP	107	01	8,940	105,380	408,960	5,566,930
	HONGKONG	109	03			1,210,210	14,725,484
	FRANCE	210	03	105	2,677	105	2,677
				9,045	108,057	1,619,275	20,294,711
080122	CASHEW NUTS SHELLED (KG)						
	CHINA PEOPLES REP	107	03			100,000	1,363,293
	HONGKONG	109	03			11,400	137,143
						111,400	1,502,436
080124	BANANAS FRESH (KG)						
	HONGKONG	109	03	1,657,950	3,819,020	12,702,684	28,714,095
	LAOS	121	03			80	800
	MALAYSIA	124	03			7,600	18,695
	SINGAPORE	136	03	2,760	28,381	2,940	101,022
	FRANCE	210	03	30	600	2,395	16,575
	GERMANY FED REP	212	03	3,590	33,996	3,480	54,858
	SWITZERLAND	232	03	83	781	1,559	13,909
	UNITED KINGDOM	233	03	105	1,080	105	1,080
				1,654,298	3,903,858	12,724,047	28,923,013
080125	MANGOES FRESH (KG)						
	BAHRAIN	102	03			201	6,874
	BRUNEI	105	03			26	530
	HONGKONG	109	03			303,011	2,420,823
	MALAYSIA	124	03			997,748	4,342,357
	SINGAPORE	136	03			1,950,634	12,312,116
	TAIWAN	139	03			20	1,000
	U ARAB EMIRATES	142	03			6,000	90,000
	BELGIUM	204	03			78	2,050
	DENMARK	207	03			200	7,344
	FRANCE	210	03			6,851	96,737
	GERMANY FED REP	212	03			6,057	75,870
	NETHERLANDS	224	03			600	5,047
	SWITZERLAND	232	03			336	3,413
	AUSTRALIA	701	03			3,067	27,668
						5,274,679	19,443,864
080126	PINEAPPLES FRESH (KG)						
	BAHRAIN	102	03			1,168	9,859
	JORDAN	116	03			1,000	7,072
	PAKISTAN	129	03			1,125	3,625
	SAUDI ARABIA	134	03			3,408	12,750
	U ARAB EMIRATES	142	03			29,400	137,651
						34,101	193,007
080129	AVOCADOS GUAVAS MANGOSTEENS FRESH (KG)						
	BAHRAIN	102	03	250	4,114	1,148	22,260
	BRUNEI	105	03			620	12,706
	HONGKONG	109	03			66,580	361,275
	KUWAIT	129	03			180	2,023
	LAOS	121	03			1,335	20,945
	SINGAPORE	136	03			5,253	44,601
	SRILANKA	137	03			100	2,026
	U ARAB EMIRATES	142	03	190	3,127	490	3,127
	BELGIUM	204	03			150	2,100
	DENMARK	207	03			175	6,419
	FRANCE	210	03	516	10,614	33,821	433,953
	GERMANY FED REP	212	03			8,149	110,136
	ITALY	219	03	1,000	16,456	1,000	16,456
	NETHERLANDS	224	03	1,118	11,469	19,618	217,415
	SWEDEN	231	03			1,660	10,250
	SWITZERLAND	232	03	75	771	7,074	86,436
	UNITED KINGDOM	233	03	127	2,330	2,727	23,520
	UNITED STATES	402	03			60	1,278
				3,276	49,081	149,860	1,456,914
080131	BANANAS DRIED (KG)						
	HONGKONG	109	03			1,370	8,545
	SINGAPORE	136	03			900	18,395
	FRANCE	210	03	30	900	92	2,140
	GERMANY FED REP	212	03			60	1,273
	SWITZERLAND	232	03			188	1,323
	UNITED KINGDOM	233	03			200	8,242
	CANADA	401	03			200	4,343
	UNITED STATES	402	03	1,854	119,418	12,464	710,306
	AUSTRALIA	701	03			1,163	24,191
				1,884	120,318	16,642	843,719
080132	PINEAPPLES DRIED (KG)						
	JAPAN	115	03			26,000	827,559
	CANADA	401	03			17,442	576,375
	UNITED STATES	402	03			61,000	1,807,723
	NEW ZEALAND	708	03			400	14,781
						104,842	3,226,437

COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
080139	AVOCADOS MANGOS GUAVAS MANGOSTEENS ORIED (KG)						
	BRUNEI	105	03			805	22,692
	HONGKONG	109	03	560	14,340	37,842	707,453
	SINGAPORE	136	03			2,200	39,349
	FRANCE	210	03	133	2,777	370	5,439
	UNITED STATES	402	03			356	21,304
				695	17,117	61,373	796,777
080201	ORANGES (KG)						
	BRUNEI	105	03	400	2,638	1,425	11,328
	HONGKONG	109	03	121,052	1,047,697	627,462	5,383,770
	LAOS	121	03			23,750	238,970
	MALAYSIA	124	03	1,100	14,300	16,850	167,060
	SINGAPORE	136	03	1,7350	1,032,423	736,003	6,120,267
	SRI LANKA	137	03			125	848
	VIETNAM	143	03			440	7,939
	FRANCE	210	03	102	2,600	934	21,740
	GERMANY FED REP	212	03	120	2,469	311	6,183
	NETHERLANDS	224	03			500	9,400
	UNITED KINGDOM	233	03			236	3,911
				210,124	2,102,127	1,408,042	11,971,436
080202	MANDARINES TANGERINES SATSUMAS CLEMENGINES (KG)						
	BRUNEI	105	03	700	4,833	900	6,348
	HONGKONG	109	03	42,822	370,065	143,277	1,238,552
	LAOS	121	03			18,876	219,695
	MALAYSIA	124	03	1,250	8,750	1,250	8,750
	SINGAPORE	136	03	44,070	337,930	121,256	1,283,317
	VIETNAM	143	03			140	1,653
	NETHERLANDS	224	03			520	3,303
				48,842	921,578	286,221	2,763,619
080203	LEMONS AND LIMES (KG)						
	BAHRAIN	102	03			20	1,754
	HONGKONG	109	03	1,465	21,844	39,969	430,445
	LAOS	121	03			1,170	13,050
	GERMANY FED REP	212	03			30	3,071
	SWITZERLAND	232	03			16	652
	CANADA	401	03			84	22,599
				1,465	21,844	41,289	491,591
080204	GRAPEFRUIT (KG)						
	HONGKONG	109	03			80	1,323
						80	1,323
080205	POMELOS (KG)						
	BAHRAIN	102	03			374	4,371
	BANGLADESH	103	03			50	750
	HONGKONG	109	03	79,230	436,515	1,670,275	10,869,794
	LAOS	121	03			100	1,000
	SAUDI ARABIA	134	03			47	1,147
	SINGAPORE	136	03	15,000	176,805	553,895	7,508,209
	FRANCE	210	03	382	9,738	1,090	18,695
	GERMANY FED REP	212	03			210	3,200
	NETHERLANDS	224	03			1,545	13,425
	UNITED KINGDOM	233	03			1,320	20,992
				882	14,747	1,320	20,992
				85,314	635,805	2,228,906	18,441,593
080209	OTHER CITRUS FRUIT FRESH OR ORIED (KG)						
	HONGKONG	109	03	680	23,395	2,530	29,353
	MALAYSIA	124	03			3,300	19,519
	FRANCE	210	03			30	611
	NETHERLANDS	224	03			100	600
				680	23,395	5,960	30,283
080301	FIGS FRESH (KG)						
	HONGKONG	109	03			1,800	28,672
						1,800	28,672
080410	GRAPES FRESH (KG)						
	BAHRAIN	102	03			1,650	17,009
	BRUNEI	105	03	1,910	25,891	6,979	144,895
	HONGKONG	109	03	11,528	118,567	1,339,559	13,694,639
	JAPAN	115	03			52,006	1,321,812
	KUWAIT	120	03			630	6,003
	LAOS	121	03			9,658	178,020
	MALAYSIA	124	03	300	6,000	6,850	108,800
	SINGAPORE	136	03			140,407	2,558,318
	SRI LANKA	137	03			405	4,930
	U ARAB EMIRATES	142	03			1,200	12,000
	FRANCE	210	03			507	7,279
	GERMANY FED REP	212	03	124	3,826	1,387	28,959
	NETHERLANDS	224	03			40	815
	SWITZERLAND	232	03			75	1,050
				14,062	134,284	1,561,554	18,078,532
080420	GRAPES ORIED (KG)						
	HONGKONG	109	03	680	23,394	2,360	38,133
	MALAYSIA	124	03	900	8,493	11,900	108,714
				1,580	31,887	14,260	144,852
080510	BETEL NUTS (KG)						
	HONGKONG	109	03			37,490	470,453
	JAPAN	115	03			10,000	136,995
	KOREA REPUBLIC OF	119	03			38,000	609,779
	KUWAIT	120	03			59,800	731,932

CODE	DESCRIPTION	CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (HAHT)	QUANTITY	F.O.B. VALUE (HAHT)
080510	BETEL NUTS (KG)						
	MALAYSIA	124	03			1,446,000	5,812,675
	PAKISTAN	127	03			1	977
	SAUDI ARABIA	129	03			986,043	11,676,772
	SINGAPORE	136	03			20,580	330,806
	TAIWAN	138	03			210,000	2,678,280
	FRANCE	139	03			4,100	125,317
	CANADA	210	03			2,213	180,932
	UNITED STATES	401	03	530	70,619	2,410	208,321
	AUSTRALIA	402	03	28	926	377	37,052
		701	03	130	23,094	998	109,017
				708	94,639	2,818,012	21,078,655
080520	OTHER NUTS NES (KG)						
	HONGKONG	107	03			31,320	671,356
	UNITED KINGDOM	233	03			200	2,047
	UNITED STATES	402	03			208	3,555
						31,728	676,958
080601	APPLES FRESH (KG)						
	LAOS	121	03			60	3,600
	VIETNAM	143	03			500	12,940
						550	14,440
080800	BERRIES FRESH (KG)						
	JAPAN	115	03			24,000	482,317
	SINGAPORE	136	03			500	7,500
						24,500	489,817
080901	LIMONS FRESH (KG)						
	BRUNEI	105	03			4,310	113,220
	HONGKONG	109	03			750	7,716
	LAOS	121	03			2,220,879	53,171,257
	MALAYSIA	124	03			132	4,470
	QATAR	131	03			59,047	1,476,993
	SAUDI ARABIA	134	03			40	720
	SINGAPORE	136	03			180	13,513
	FRANCE	139	03			1,385,435	37,127,445
	GERMANY FED REP	210	03			975	11,272
	NETHERLANDS	212	03			59	1,357
	NETHERLANDS	224	03			11,175	241,040
	SWITZERLAND	232	03			300	7,500
	UNITED KINGDOM	233	03			1,500	44,674
				750	7,716	3,684,052	92,196,283
080902	WATERMELONS FRESH (KG)						
	BAHRAIN	102	03			17	1,202
	HONGKONG	109	03			198,375	403,978
	LAOS	121	03			337	7,716
	FRANCE	139	03			342,155	1,041,510
	GERMANY FED REP	210	03			200	900
		212	03			102	2,600
						255	3,825
				198,494	407,680	343,059	1,076,169
080903	RAMBUTAN (KG)						
	BAHRAIN	102	03			4,115	46,124
	BRUNEI	105	03			2,459	51,532
	HONGKONG	109	03			24,010	131,930
	KUWAIT	120	03			650	7,716
	LAOS	121	03			5,854	45,630
	SINGAPORE	136	03			120	1,724
	TAIWAN	138	03			10,500	150,597
	BELGIUM	139	03			107	1,745
	DENMARK	204	03			175	6,240
	FRANCE	207	03			20,857	224,607
	GERMANY FED REP	210	03			6,134	78,758
	NETHERLANDS	212	03			27,558	315,814
	NETHERLANDS	224	03			1,700	10,200
	SWEDEN	231	03			7,935	24,771
	SWITZERLAND	232	03			4,225	35,011
	UNITED KINGDOM	233	03			116,249	1,249,007
080904	DURIAN (KG)						
	BAHRAIN	102	03			1,005	15,317
	BRUNEI	105	03			3,052	44,153
	HONGKONG	109	03			12,875	132,414
	INDONESIA	111	03			3,135,644	31,271,477
	JAPAN	115	03			65	2,712
	LAOS	121	03			15,008	271,210
	MALAYSIA	124	03			6,366	119,040
	SINGAPORE	136	03			41,516	227,617
	BELGIUM	204	03			227,199	3,743,100
	FRANCE	207	03			66	900
	GERMANY FED REP	210	03	160	2,470	64,409	1,417,441
	NETHERLANDS	212	03			721	21,107
	NETHERLANDS	224	03	273	3,856	15,927	248,033
	SWEDEN	231	03			200	1,200
	SWITZERLAND	232	03	90	1,388	1,547	21,751
	UNITED KINGDOM	233	03			230	5,205
	UNITED STATES	402	03			2,843	151,111
				13,400	140,128	3,519,925	37,605,714
080905	SUGAR APPLE						
	BAHRAIN	102	03			61	4,132
	HONGKONG	109	03			721,052	5,442,142
	INDONESIA	111	03			32	774
	JAPAN	115	03	165	5,210	155	5,210
	KUWAIT	120	03			90	720
	SAUDI ARABIA	134	03			50	1,750

COMMODITY CODE	DESCRIPTION	CODE	CODE	QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
080905	SUGAR APPLE					104	2,450
	SINGAPORE	136	03			3,448	27,895
	FRANCE	210	03			228	4,257
	GERMANY FED REP	212	03			1,436	20,893
	NETHERLANDS	224	03	165	5,210	726,698	5,516,965
080906	PAPAYA (KG)					298	19,271
	BAHRAIN	102	03	136	8,957	5,308,845	15,509,519
	HONGKONG	109	03	446,420	1,502,680	3,400	13,947
	MALAYSIA	124	03			2,125	9,625
	PAKISTAN	129	03			3,990	53,134
	SINGAPORE	136	03	150	14,734	3,831	50,275
	BELGIUM	204	03			500	18,835
	DEM MARK	207	03			2,349	24,997
	FRANCE	210	03	150	3,086	1,738	20,540
	GERMANY FED REP	212	03			4,565	35,056
	NETHERLANDS	224	03	600	11,904	40	4,517
	SWITZERLAND	232	03	455,456	1,541,361	5,332,101	15,761,653
	080909	OTHER FRUIT FRESH (KG)					
BAHRAIN		102	03	1,032	27,540	17,948	203,150
BANGLADESH		103	03			400	3,200
BRUNEI		105	03	575	4,504	3,670	40,505
HONGKONG		109	03	2,980	16,745	1,440,796	13,773,250
INDONESIA		111	03			10	500
JAPAN		115	03	420	11,533	4,275	68,293
KUWAIT		120	03	180	1,851	3,475	28,774
LAOS		121	03			2,106	27,120
MALAYSIA		124	03			5,560	56,441
PAKISTAN		129	03			1,000	5,000
PHILIPPINES		130	03			10	750
SAUDI ARABIA		134	03			3,580	67,975
SINGAPORE		136	03			199,554	2,594,145
U ARAB EMIRATES		142	03	1,060	16,703	5,337	60,167
BELGIUM		204	03			99	1,400
FRANCE		210	03	3,743	66,895	45,985	639,277
GERMANY FED REP		212	03	1,585	23,601	9,187	135,217
NETHERLANDS		224	03	5,725	80,111	58,440	748,278
SWEDEN		231	03			300	15,000
SWITZERLAND		232	03	1,150	15,802	8,207	129,021
UNITED KINGDOM	233	03	195	1,802	897	16,449	
UNITED STATES	402	03			4,596	219,352	
AUSTRALIA	701	03			1,250	73,950	
				18,645	267,087	1,816,736	18,945,370
081000	FRUIT FROZEN NOT ADDED SUGAR (KG)						
	JAPAN	115	03	433,084	3,874,142	6,295,767	62,497,469
	JORDAN	116	03			900	2,430
	AUSTRIA	203	03			1,200	27,660
	FRANCE	210	03			59,638	643,153
	ITALY	219	03			119,985	1,123,534
	NETHERLANDS	224	03	4,515	183,661	40,855	1,407,897
	UNITED STATES	402	03			4,641	538,465
	AUSTRALIA	701	03			8,142	79,967
					447,599	4,057,803	6,531,078
081100	FRUIT PROVISIONALLY PRESERVE FOR TRANSPORTATION (KG)						
	HONGKONG	109	03			6,000	12,335
	CANADA	401	03			5,000	149,560
					11,000	181,895	
081201	LUNGANS DRIED (KG)						
	UNITED STATES	402	03			75	22,451
	AUSTRALIA	701	03			200	31,950
					275	54,501	
081209	OTHER FRUIT DRIED NES (KG)						
	BAHRAIN	106	03			600	3,400
	HONGKONG	109	03			58,552	495,991
	MALAYSIA	124	03	8,700	60,862	35,475	251,613
	SAUDI ARABIA	134	03			6,676	236,210
	SINGAPORE	136	03	8,900	129,175	63,170	751,221
	UNITED KINGDOM	233	03			1,680	9,789
	UNITED STATES	402	03			24,028	727,402
					17,600	190,037	190,191
TOTAL BY CHAPTER					14,897,884		393,710,197

APPENDIX C. - Processed Fruit and Vegetable Export for 1980

200111	FRUIT PREPARED OR PRESERVED BY VINEGAR OR ACETIC ACID IN AIRTIGHT CONTAINERS (KG)						
	HONGKONG	109	03			142,275	198,331
	LAOS	121	03			86	2,880
	MALAYSIA	124	03			450	3,550
	SINGAPORE	136	03			24,650	126,079
	FRANCE	210	03			1,730	16,635
	GERMANY FED REP	212	03			37	3,129
	NETHERLANDS	224	03			40	1,224
	CANADA	401	03			1,423	45,497
	UNITED STATES	402	03			48	2,325
	AUSTRALIA	701	03			250	7,395
						170,989	441,049
200112	VEGETABLES PREPARED OR PRESERVED BY VINEGAR IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03				
	HONGKONG	109	03	650	4,719	124	2,624
	JAPAN	115	03			170,714	2,442,997
	LAOS	121	03			46,080	346,402
	MALAYSIA	124	03	1,750	17,929	2,348	32,472
						64,048	507,204

Note: Continued on following pages

Source: Thailand Department of Customs

E X P O R T S

COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	----- DEC, 1980 -----		----- JAN.-DEC, 1980 -----	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
200112	VEGETABLES PREPARED OR PRESERVED BY VINEGAR IN AIRTIGHT CONTAINERS (KG)						
	SAUDI ARABIA	134	03	3,782	123,625	32,638	810,965
	SINGAPORE	136	03	12,247	274,048	302,339	4,070,134
	AUSTRIA	203	03			469	13,853
	DENMARK	207	03	170	5,805	408	13,134
	FRANCE	210	03			11,308	295,930
	GERMANY FED REP	212	03			234	7,087
	NETHERLANDS	224	03			672	16,436
	NORWAY	225	03			99	1,690
	SWITZERLAND	232	03			1,043	12,009
	UNITED KINGDOM	233	03	90	2,865	90	2,665
	CANADA	401	03			180	7,172
	UNITED STATES	402	03	4,692	143,813	47,452	1,274,390
	AUSTRALIA	701	03			4,936	154,517
				23,181	572,404	685,427	10,627,612
200121	FRUIT PREPARED OR PRESERVED BY VINEGAR OR ACETIC ACID NOT IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03			78	2,540
	HONGKONG	109	03	12,930	107,312	375,383	3,244,369
	JAPAN	115	03			45	603
	LAOS	121	03			22	780
	MALAYSIA	174	03			4,260	66,867
	SAUDI ARABIA	134	03			644	15,425
	SINGAPORE	136	03	24,820	501,750	131,872	1,861,715
	FRANCE	210	03			10,135	325,807
	GERMANY FED REP	212	03			22	1,720
	NETHERLANDS	224	03			75	750
	UNITED KINGDOM	233	03			5,040	70,703
	CANADA	401	03	217	9,121	1,671	64,672
	UNITED STATES	402	03	951	25,147	16,265	348,857
	AUSTRALIA	701	03			492	39,429
				18,918	843,330	546,204	6,047,032
200122	VEGETABLES PREPARED OR PRESERVED BY VINEGAR NOT IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03			834	18,313
	CHINA PEOPLES REP	107	03			108	4,427
	HONGKONG	109	03	19,000	311,657	344,926	2,304,904
	INDIA	110	03			30	915
	JAPAN	115	03	126,030	638,677	737,805	4,745,894
	MALAYSIA	124	03	46,650	253,365	336,400	1,772,856
		127	03			30	917
	SAUDI ARABIA	134	03	4,247	117,558	13,815	507,353
	SINGAPORE	136	03	109,000	612,379	948,103	4,562,031
	SRI LANKA	137	03	4,210	114,302	4,210	114,302
	AUSTRIA	203	03			94	3,400
	BELGIUM	204	03			399	13,853
	FRANCE	210	03			6,152	256,777
	GERMANY FED REP	212	03	189	7,116	595	17,234
	ITALY	219	03			57	1,610
	NETHERLANDS	224	03			200	900
	NORWAY	225	03			43	1,474
	SWITZERLAND	232	03			24	1,305
	UNITED KINGDOM	233	03			327	19,243
	CANADA	401	03	444	24,003	3,093	123,148
	UNITED STATES	402	03	9,751	439,892	44,647	1,825,391
	AUSTRALIA	701	03	177	14,109	2,316	72,047
				338,106	2,545,090	2,444,208	16,399,117
200201	TOMATO IN AIRTIGHT CONTAINERS (KG)						
	SRI LANKA	137	03			180	7,451
						180	7,451
200202	MUSHROOMS TRUFFLES IN AIRTIGHT CONTAINERS (KG)						
	HONGKONG	109	03			70	852
	LAOS	121	03			43	2,590
	SAUDI ARABIA	134	03			640	31,355
	GERMANY FED REP	212	03			12,240	275,197
	UNITED STATES	402	03			1,555	31,127
						14,498	341,611
200203	BAMBOO-SHOOTS IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03	260	2,880	1,022	12,433
	HONGKONG	109	03	40,000	308,501	78,996	347,334
	JAPAN	115	03	9,900	174,136	1,023,104	8,692,866
	LAOS	121	03			181	4,095
	SAUDI ARABIA	134	03	3,696	38,052	24,031	333,651
	SINGAPORE	136	03	12,000	294,675	77,690	531,821
	AUSTRIA	203	03			251	7,055
	FRANCE	210	03	2,280	22,217	34,458	433,752
	GERMANY FED REP	212	03	456	9,117	703	13,453
	NORWAY	225	03			272	7,596
	SWEDEN	231	03			66	465
	SWITZERLAND	232	03			210	1,714
	UNITED KINGDOM	233	03			340	3,872
	CANADA	401	03	2,160	26,477	5,000	39,710
	UNITED STATES	402	03	19,593	218,858	145,047	1,826,913
	AUSTRALIA	701	03	280	4,277	42,314	875,276
				122,625	1,119,190	1,633,685	13,225,771
200204	ASPARAGUS IN AIRTIGHT CONTAINERS (KG)						
	SINGAPORE	136	03			90	1,842
						90	1,842
200205	GREEN PEAS IN AIRTIGHT CONTAINERS (KG)						
	LAOS	121	03			255	7,000
	SAUDI ARABIA	134	03			170	4,551
						423	11,551

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COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
200206	YOUNG CORNS IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03				
	HONGKONG	109	03	232	5,534	403	10,015
	JAPAN	115	03			7,692	123,787
	SAUDI ARABIA	134	03			225,874	7,329,672
	SINGAPORE	136	03			230	13,502
	SRI LANKA	137	03	4,068	86,310	4,068	86,310
	BELGIUM	204	03			340	2,741
	FRANCE	210	03			1,356	24,566
	GERMANY FED REP	212	03			58,303	1,351,760
	NORWAY	225	03	42,701	809,486	100,349	2,984,666
	CANADA	401	03			136	3,749
	UNITED STATES	402	03			678	16,352
	AUSTRALIA	701	03			144,663	3,473,033
				28,902	638,441	312,199	5,958,072
				75,903	1,537,791	916,491	21,378,203
200207	STRING BEANS IN AIRTIGHT CONTAINERS (KG)						
	AUSTRALIA	701	03			1,200	14,634
						1,200	14,634
200219	OTHER VEGETABLES PREPARED PRESERVED IN AIRTIGHT CONTAINERS (KG)						
	HONGKONG	109	03				
	IRAQ	113	03	13,500	36,304	45,564	717,643
	JAPAN	115	03			30	1,102
	MALAYSIA	124	03			275	2,815
	SAUDI ARABIA	134	03	900	15,098	37,500	164,412
	SINGAPORE	136	03			2,552	133,651
	FRANCE	210	03	32,500	115,808	164,958	1,401,536
	UNITED STATES	402	03	1,701	47,928	1,701	47,928
	AUSTRALIA	701	03	1,859	44,225	6,290	172,995
				40,360	259,363	1,342	37,204
						260,213	2,679,306
200221	SALT CABBAGE DRIED (KG)						
	HONGKONG	109	03				
	LAOS	121	03			6,850	96,660
	SAUDI ARABIA	134	03			252	3,350
	SINGAPORE	136	03			4,104	76,398
	VIETNAM	143	03			3,963	56,033
	GERMANY FED REP	212	03			102	1,585
	NORWAY	225	03	54	1,491	1,011	23,477
	SWITZERLAND	232	03			50	652
	UNITED STATES	402	03			24	816
	AUSTRALIA	701	03	1,574	33,787	13,209	303,759
				1,628	35,278	397	14,077
						29,996	578,767
200222	TURNIPS PRESERVED NOT IN AIRTIGHT CONTAINERS (KG)						
	LAOS	121	03				
	MALAYSIA	124	03			200	2,500
	SAUDI ARABIA	134	03			39,700	169,231
	GERMANY FED REP	212	03			3,633	99,410
	UNITED STATES	402	03			655	10,242
				260	9,520	6,557	210,004
				260	9,520	50,747	691,777
200229	OTHER VEGETABLES PRESERVED NOT IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03				
	HONGKONG	109	03				
	JAPAN	115	03	47,080	366,212	60	1,200
	MALAYSIA	124	03	213,460	1,364,058	711,844	3,453,087
	SAUDI ARABIA	134	03	4,008	123,354	458,856	3,064,277
	SINGAPORE	136	03	1,280	62,348	32,448	303,933
	FRANCE	210	03			9,144	311,435
	GERMANY FED REP	212	03			57,510	362,313
	NORWAY	225	03	90	1,851	1,452	55,003
	SWEDEN	231	03			158	4,758
	SWITZERLAND	232	03			250	2,560
	CANADA	401	03			27	1,516
	UNITED STATES	402	03	275	2,164	100	1,244
	AUSTRALIA	701	03	907	50,377	697	15,022
				249,100	2,150,366	21,056	589,050
						68	1,793
						1,294,050	8,167,211
200300	FRUIT FROZEN SUGAR ADDED (KG)						
	UNITED STATES	402	03			230	17,117
						230	17,117
200401	FRUIT PRESERVED BY SUGAR (KG)						
	BAHRAIN	102	03				
	HONGKONG	109	03	200	1,800	6,900	62,200
	JAPAN	115	03	4,736	17,240	64,940	279,919
	LAOS	121	03	14,000	490,800	146,050	4,757,557
	MALAYSIA	124	03			10,793	91,330
	SAUDI ARABIA	134	03			4,050	22,933
	SINGAPORE	136	03			11,717	356,248
	SRI LANKA	137	03	1,410	59,996	41,040	784,738
	AUSTRIA	203	03			272	7,173
	FRANCE	210	03			29	1,774
	GERMANY FED REP	212	03	1,702	54,510	40,931	1,100,333
	NETHERLANDS	224	03			254	8,996
	NORWAY	225	03	12,760	396,147	12,820	396,747
	SWITZERLAND	232	03			60	2,752
	CANADA	401	03			1,658	59,313
	UNITED STATES	402	03	14,000	370,383	68,308	2,305,513
	AUSTRALIA	701	03	23,462	778,171	227,707	6,862,904
	NEW ZEALAND	708	03	417	13,029	1,744	98,011
				72,687	2,162,076	3,730	148,032
						642,373	17,333,807
200402	FRUIT PEEL PARTS OF PLANTS PRESERVED BY SUGAR (KG)						
	HONGKONG	109	03				
						600	13,291

QUANTITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC. 1980		JAN.-DEC. 1980	
				QUANTITY	F.O.B. VALUE (BAMT)	QUANTITY	F.O.B. VALUE (BAMT)
200402	FRUIT PEEL PARTS OF PLANTS PRESERVED BY SUGAR (KG) SAUDI ARABIA	134	03			3,030	99,075
200510	FRUIT PUREE FRUIT PASTES FOR INDUSTRIAL USE (KG) UNITED STATES	602	03			3,600	112,166
200520	JAMS FRUIT JELLIES MARMALADE OTHER FRUIT PUREE AND PASTES (KG)						
	BRUNEI	105	03	100			
	BURMA	106	03	210	2,769	660	12,052
	HONGKONG	109	03		1,920	285	2,520
	JAPAN	115	03			1,169	13,401
	LAOS	121	03			13,798	190,772
	SAUDI ARABIA	134	03	122	3,600	1,626	40,400
	SINGAPORE	136	03			857	24,750
	SRI LANKA	137	03	13,750	184,813	110,063	1,308,879
	AUSTRIA	205	03			50	2,021
	FRANCE	210	03	20	600	40	3,465
	NETHERLANDS	224	03			2,231	139,692
	SWITZERLAND	252	03			1,104	36,953
	CANADA	401	03			533	50,319
	UNITED STATES	402	03	1,781	83,693	222	17,057
	AUSTRALIA	701	03	283	24,149	13,095	753,231
				16,266	301,544	977	79,537
200601	PINEAPPLE IN AIRTIGHT CONTAINERS (KG)					146,736	2,710,454
	CHINA PEOPLES REP	107	03				
	CYPRUS	108	03			95,023	1,530,676
	HONGKONG	109	03			35,250	427,755
	INDONESIA	111	03	11,298	313,199	157,523	1,816,673
	ISRAEL	114	03			18,700	353,724
	JAPAN	115	03			61,995	725,504
	JORDAN	116	03	5,642,205	9,287,152	3,266,526	52,568,241
	KOREA REPUBLIC OF	119	03			12,096	161,927
	KUWAIT	120	03	4,96,614	9,932,856	2,045,860	23,379,559
	LEBANON	122	03			175,068	1,993,776
	OMAN	128	03	54,540	671,123	297,912	3,652,195
	SAUDI ARABIA	134	03			13,695	166,615
	SINGAPORE	136	03	741,274	7,758,282	3,306,064	54,060,547
	SYRIA	138	03			105,022	1,419,543
	U ARAB EMIRATES	142	03			43,693	413,513
	YEMEN DEMOCRATIC	145	03			150,720	1,793,453
	BELGIUM	204	03	25,646	296,618	399,335	4,250,126
	CZECHOSLOVAKIA	206	03	41,752	618,899	698,547	7,121,349
	DENMARK	207	03			75,816	882,750
	FINLAND	209	03	201,552	2,533,185	885,130	10,723,108
	FRANCE	210	03	11,298	408,010	498,856	6,229,148
	GERMANY FED REP	212	03	15,594	174,721	2,394,146	26,138,024
	GREECE	214	03	2,935,343	32,671,401	30,954,582	317,928,647
	IRELAND	218	03			115,423	1,139,933
	ITALY	219	03			16,172	176,597
	MALTA	222	03	141,976	2,161,749	790,718	9,016,407
	NETHERLANDS	224	03			5,443	63,232
	NORWAY	225	03	314,105	3,414,232	2,625,689	27,198,521
	SPAIN	230	03	46,842	524,414	788,554	9,337,413
	SWEDEN	231	03	321,947	3,983,303	5,814,399	23,336,745
	SWITZERLAND	232	03			154,089	1,518,065
	UNITED KINGDOM	233	03	15,241	192,371	181,009	2,178,411
	USSR	234	03	53,040	597,500	627,268	7,168,874
	CHILE	304	03			250,387	2,601,245
	CANADA	401	03			428,525	7,045,071
	UNITED STATES	402	03	342,858	4,941,212	7,309,494	85,910,293
	DJIBOUTI	613	03	7,123,558	91,433,527	63,462,940	729,950,495
	EGYPT ARAB REP	614	03			68,362	734,610
	SIERRA LEONE	638	03			235,091	2,517,403
	SUDAN	644	03			1,821	10,197
	AUSTRALIA	701	03	90,123	753,730	31,893	346,181
	NEW ZEALAND	708	03			347,170	3,420,771
				13,859,006	170,667,504	62,110	698,763
200602	RAMBUJAN IN AIRTIGHT CONTAINERS (KG)					127,008,132	1,432,242,611
	HONGKONG	109	03				
	LAOS	121	03			96	2,150
	MALAYSIA	124	03	678	15,000	3,205	41,245
	SAUDI ARABIA	134	03			25,784	653,941
	SINGAPORE	136	03	1,356	66,606	14,914	523,170
	VIETNAM	143	03			53,223	1,139,227
	DENMARK	207	03	210		210	4,370
	FRANCE	210	03	136	4,320	408	15,665
	GERMANY FED REP	212	03	3,240	97,300	21,548	742,112
	NETHERLANDS	224	03			68	1,497
	SWEDEN	231	03			6,780	163,300
	SWITZERLAND	232	03			41	1,102
	UNITED KINGDOM	233	03			60	3,947
	CANADA	401	03			407	13,923
	UNITED STATES	402	03	678	25,480	7,324	242,441
	HAITI	513	03	9,636	297,423	272,024	6,076,300
	AUSTRALIA	701	03	1,221	138,848	4,068	138,443
				21,223	39,770	7,453	217,544
200603	LICHEE IN AIRTIGHT CONTAINERS (KG)					417,613	10,077,245
	LAOS	121	03				
	UNITED STATES	402	03			122	13,000
						340	12,454
200604	LONGAN IN AIRTIGHT CONTAINERS (KG)					462	14,454
	INDONESIA	111	03				
						13,560	411,625

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				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
200604	LONGAN IN AIRTIGHT CONTAINERS (KG)						
	LAOS	121	03			961	47,544
	SAUDI ARABIA	134	03			7,470	310,515
	SINGAPORE	136	03			13,560	367,200
	VIETNAM	143	03			811	30,567
	FRANCE	210	03			33,551	1,224,722
	NETHERLANDS	224	03			15,255	428,017
	NORWAY	223	03			41	1,365
	SWITZERLAND	232	03			48	4,489
	CANADA	401	03		271	1,084	46,937
	UNITED STATES	402	03	22,852	1,058,770	83,362	3,829,398
	AUSTRALIA	701	03	406	20,906	3,251	141,319
				23,259	1,093,025	172,954	6,843,698
200605	RAMBUTAN WITH PINEAPPLE IN SYRUPS (KG)						
	INDONESIA	111	03			208,417	2,755,898
	JAPAN	115	03			135	3,050
	SINGAPORE	136	03	25,628	749,854	240,581	6,556,574
	FRANCE	210	03			19,212	599,884
	GERMANY FED REP	212	03			19,073	584,489
	NETHERLANDS	224	03			13,554	340,712
	NORWAY	223	03			298	7,880
	UNITED KINGDOM	233	03			1,350	53,835
	CANADA	401	03	408	15,428	408	15,428
	UNITED STATES	402	03	1,333	44,388	25,151	870,065
	AUSTRALIA	701	03	406	15,860	1,491	53,484
	OTH OCEANIA CNTRY	799	03			16,272	498,970
	CNTRY FOR SINGAP	899	03			2,688	69,360
				27,777	825,731	548,636	12,389,639
200606	MANGO IN AIRTIGHT CONTAINERS (KG)						
	JAPAN	115	03			18,406	278,495
	BELGIUM	204	03			1,350	14,329
	FRANCE	210	03			15,978	312,018
	GERMANY FED REP	212	03			9,150	189,304
	NETHERLANDS	224	03			14,780	274,176
	CANADA	401	03			406	12,141
	UNITED STATES	402	03	18,407	299,864	19,844	331,549
	AUSTRALIA	701	03			28,052	483,255
				18,407	299,864	107,502	1,895,277
200609	BAHAMA IN AIRTIGHT CONTAINERS (KG)						
	FRANCE	210	03			6,780	106,942
	GERMANY FED REP	212	03			9,492	148,396
	NETHERLANDS	224	03			16,278	237,801
	UNITED STATES	402	03			2,712	42,850
	AUSTRALIA	701	03	165	5,500	165	5,500
				165	5,500	35,427	561,529
200610	OTHER FRUIT IN AIRTIGHT CONTAINERS (KG)						
	BAHRAIN	102	03			209	3,091
	HONGKONG	109	03			654	14,745
	IRAQ	113	03			87,800	1,275,050
	JAPAN	115	03			44,273	660,479
	LAOS	121	03			96	4,896
	SAUDI ARABIA	134	03			670	12,239
	AUSTRIA	203	03			746	23,641
	BELGIUM	204	03			1,356	17,953
	DENMARK	207	03	34	2,333	54	2,333
	FRANCE	210	03			109,862	2,719,567
	GERMANY FED REP	212	03			22	1,646
	ITALY	219	03			121	1,972
	NORWAY	223	03			4,189	67,513
	SWITZERLAND	232	03			2,712	46,225
	CANADA	401	03			1,043	33,794
	UNITED STATES	402	03	17,738	421,249	67,908	1,300,341
	AUSTRALIA	701	03			4,236	118,520
				17,792	423,582	305,951	6,396,046
200611	ALMONDS GROUNDNUTS AND OTHER NUTS ROASTED (KG)						
	HONGKONG	109	03	9,700	139,204	117,847	1,923,756
	SAUDI ARABIA	134	03			20	1,102
	FRANCE	210	03			2,220	78,766
	AUSTRALIA	701	03			1,400	64,547
				9,700	139,204	121,467	2,078,171
200619	OTHER FRUIT PREPARED OR PRESERVED NOT IN AIRTIGHT CONTAINERS (KG)						
	HONGKONG	109	03			52,780	631,705
	SINGAPORE	136	03	1,404	139,617	66,500	1,158,186
	SRILANKA	137	03			136	3,943
	FRANCE	210	03			417	11,723
	SWITZERLAND	232	03			1,007	58,087
	UNITED STATES	402	03	599	12,085	1,552	66,330
	AUSTRALIA	701	03	1,321	15,633	1,321	15,633
				3,324	167,335	123,713	1,945,612
200710	NATURAL FRUIT FLAVOURS (KG)						
	UNITED STATES	402	03				1,681
							1,681
200711	ORANGE JUICE (KG)						
	BANGLADESH	103	03			294	3,040
	BRUNEI	105	03			1,600	12,142
	LAOS	121	03			3,759	42,800
	PAKISTAN	129	03	360	6,240	350	6,240
				360	6,240	8,013	106,272

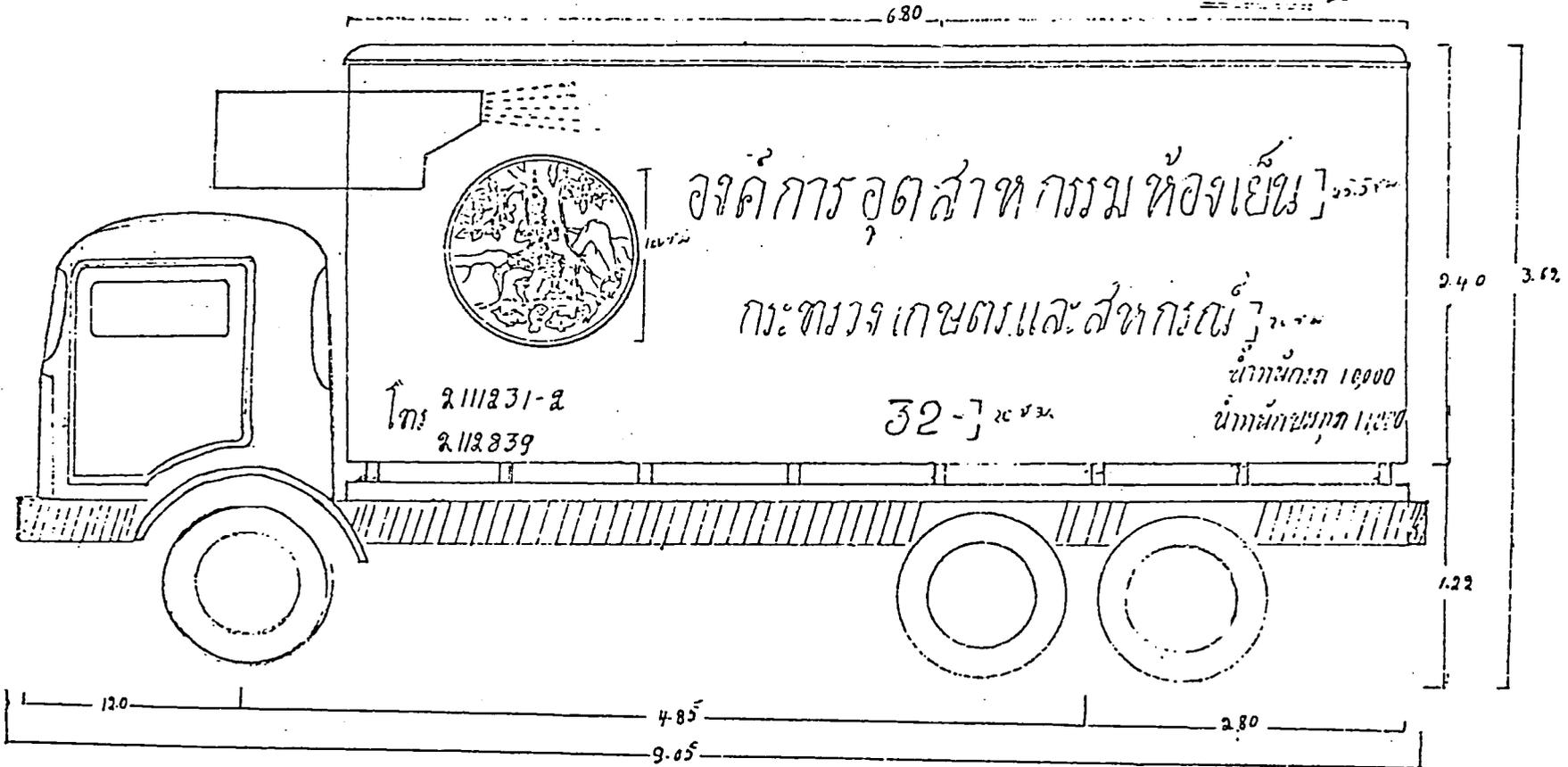
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COMMODITY CODE	DESCRIPTION	COUNTRY CODE	UNIT CODE	DEC, 1980		JAN.-DEC, 1980	
				QUANTITY	F.O.B. VALUE (BAHT)	QUANTITY	F.O.B. VALUE (BAHT)
200712	PINEAPPLE JUICE (KG)						
	BAHRAIN	102	03			23,310	218,903
	BANGLADESH	103	03			588	7,959
	BRUNEI	105	03			3,996	77,819
	HONGKONG	109	03			17,082	226,602
	JAPAN	115	03			13,608	210,172
	KOREA REPUBLIC OF	119	03			216,256	2,567,763
	KUWAIT	120	03			8,165	89,352
	LAOS	121	03			6,067	88,200
	LEBANON	122	03			369,094	5,941,182
	TAIWAN	128	03			45,823	518,798
	PAKISTAN	129	03	180	2,400	640	7,200
	SAUDI ARABIA	134	03			160,884	1,596,758
	SYRIA	138	03			1,356	5,207
	U. ARAB EMIRATES	142	03			10,886	143,716
	YEMEN DEMOCRATIC	145	03	10,088	100,691	10,086	100,691
	BELGIUM	204	03			31,243	306,931
	FINLAND	209	03			96,305	1,119,605
	GERMANY FED REP	212	03			356,811	3,361,042
	ITALY	219	03			46,728	490,633
	MALTA	222	03			5,443	57,078
	NETHERLANDS	224	03			520,620	4,749,281
	NORWAY	225	03			18,715	205,504
	SPAIN	230	03			1,656,288	18,655,745
	SWEDEN	231	03			78,080	929,815
	SWITZERLAND	232	03			28,948	318,435
	UNITED KINGDOM	233	03			150,372	1,601,733
	CANADA	401	03			540,994	6,334,674
	UNITED STATES	402	03	1,744,862	23,233,002	16,660,829	201,206,969
	NEW ZEALAND	708	03			45,680	318,715
				1,745,128	23,336,093	21,133,893	251,616,594
200716	JUICES OF ANY OTHER CITRUS FRUIT (KG)						
	SAUDI ARABIA	134	03	552	30,567	552	30,567
				552	30,567	552	30,567
200719	OTHER FRUIT JUICES (KG)						
	BRUNEI	105	03			932	12,451
	LAOS	121	03	263	3,600	27,761	359,150
	UNITED KINGDOM	233	03			446	4,545
	CANADA	401	03			163	3,495
	UNITED STATES	402	03			24,525	610,979
	AUSTRALIA	701	03			1,068	33,223
				263	3,600	54,895	1,023,944
200721	TOMATO JUICE (KG)						
	HONGKONG	109	03			129	2,425
	PAKISTAN	129	03			110	3,350
	SINGAPORE	136	03	46,234	1,322,722	66,234	1,322,722
				46,234	1,322,722	66,473	1,328,507
200729	OTHER VEGETABLE JUICES (KG)						
	UNITED STATES	402	03			508	31,195
						508	31,195
TOTAL BY CHAPTER					210,348,884		1,829,214,576

รถตู้ เลข 86

ภายใน	กว้าง 2.03 เมตร	ภายใน	กว้าง 2.50 เมตร
ยาว	6.50 "	ยาว	6.32 "
สูง	1.95 "	สูง	2.40 "
	26.35 ^{ลบ} 25.95		



Source: Government Cold Storage Organization

VIII. APPENDIX

APPENDIX E. - Needed Equipment for TISTR Packaging Laboratory

PRIORITY I.

No.	Equipment	No.	Price in baht	Reason for request
1.	Compression tester 5 T.	1.	850,000	To test compression and stacking strength of various packaging materials such as corrugated fibreboard container, bamboo basket, wooden crate, metal pail and pallet
2.	Concora medium tester	1	261,000	1. To measure crush resistance of corrugated fibreboard and box for the determination of flat crush strength. 2. These measurement is important in establishing standard of the corrugated fibreboard.
3.	Controlled environmental room, capacity 20 cubicmetre	1	1,800,000	Two Environmental chambers equipped with temperature and humidity controllers are used for the simulated effects such as weather or storage, or warehouse condition.
4.	Controlled environmental chamber, 1 cubicmeter	1	2,700,000	Controlled condition at 10°C, 90% RH; 25°C, 85% RH. These facilities are also utilized in aging test.
5.	Water permeation tester for film and foil, high sensitivity	1	405,000	To measure rate of vapor permeation through plastic film and foils.

No.	Equipment	No.	Price in baht	Reason for request
6.	Floor model universal testing instrument, 25 kN. max. capacity, includes graphic recorder and accessories.	1	4,861,800	<ol style="list-style-type: none"> 1. Basic instrumentation unit to be used in measuring physical properties of packaging material such as plastics, fibre, wire, strapping tape, cushioning material and corrugated fibreboard. 2. Examples of tested physical properties are: <ul style="list-style-type: none"> - tensile strength & elongation - adhesion traction of adhesive - compression of cushioning materials - compression of small containers - bending of board - etc.
7.	Gas permeation tester for film and foil, high sensitivity	1	660,000	To measure rate of gas permeation through plastic film and foils.
8.	Impact shock machine for cushioning a. instrument b. accelerometer & amplifier c. oscilloscope	1 1 1	100,000 54,000 279,000	<ol style="list-style-type: none"> 1. Losses fragile or brittle products due to uncorrected packing method, handling and distribution. 2. To test physical properties of cushioning material used in packing products.
9.	Falling dart tester (local)	1	111,000	To test the effect of impact on plastic film

No.	Equipment	No.	Price in baht	Reason for request
10.	Water permeation tester for package, high sensitivity	1	210,000	To measure vapor permeation rate through package.
11.	Oxygen analyzer, portable, for soft and hard packing including accessories	1	135,000	To measure the quantity of oxygen gas in the headspace of the packaging
12.	Revolving drum tester (local)			To test the rigidity of the container during rough handling
	a. material	1	47,000	
	b. 2H.P-motor	1	3,000	
13.	Temperature recorder	1	200,000	A multipoint datalogger for recording product temperature fluctuation in the container during transportation
14.	Humidity recorder	1	85,000	To measure and record relative humidity of the product in the container during transportation
15..	Anemometer	1	35,000	To measure air velocity in the storage room and through the stacking pattern of containers
16.	Programmable timer	1	60,000	To program sequence of time designed in simulation process. The timer is interfaced with other control equipment.
17.	Forklift - stacker	1	60,000	To handle stacks of container and pallets by lifting, carrying, moving and pushing the load.

No.	Equipment	No.	Price in baht	Reason for request
18.	Relative humidity indicator	1	4,500	To measure relative humidity with higher resolution.
19.	Impact-o-graph's 3-stylus bracket 6" x 15 x 6", 15" x 15" x 15"	3	8,700	To measure degree of impact affecting container during transportation
20.	Seam projector	1	55,000	To measure can seams such as double seam, body seam, overlapping, countersink waves, and defects
21.	Glass bottle pressure tester	1	45,000	To test resistance and strength of glass bottles against hydraulic pressure
22.	Blister pack machine	1	200,000	To make packing pattern and blister packing method
23.	Wall thickness gage	1	20,000	To measure the consistency of the plastic and glass bottle wall thickness
24.	Humidistat	2	4,000	A relative humidity controller
25.	Thermostat	2	7,000	A temperature controller
26.	Dynamic stiffness determination of packaging material	1	135,500	To measure stiffness, flexibility and bending properties of paper, cardboard, plastic, and other similar materials. The measured result will be used in the determination of dynamic modulus of elasticity.

No.	Equipment	No.	Price in baht	Reason for request
27.	PATRA crease stiffness tester 220 V, 50Hz, single phase complete with sample cutter	1	120,000	To test folding quality of the solid cardboard or kraft paper used in making container.
28.	Release and adhesion tester	1	90,000	To measure adhesive and releasing properties of the sealing tape.
29.	Package and product vibration test system and accessories	1	2,500,000	To measure the cohesive property of sealing tape on corrugated fibreboard container.
30.	Thermal conductivity measuring instrument	1	200,000	To measure thermal resistance of the packaging material used in making container and box.

Total: Baht 18,079,000

APPENDIX F. - Needed Equipment for TISTR Postharvest Laboratory

PRIORITY II.

I. Postharvest Technology Lab Equipment

I.1 Quality evaluation

1. Size and shape measurement

₪
Relative Cost

Sizing ring (sizing of various
fruits)

1,000

Banana dial reading caliper
(to measure diameter of
banana fingers, or other
fruits less than 2 inches

1,000

2. Color

Agtron M-500A & M300A Reflectance
Spectrophotometer (to measure
light reflectance in the blue,
green, red and yellow modes

150,000

3. Texture

Tension-Compression Force Gauges
capacity 0.5 kg x 5 g graduation

3,000

" 1.0 kg x 10 g "

3,000

" 10 kg x 100 g "

4,000

" 25 kg x 250 g "

5,000

(present available gauge at TISTR
with capacity 5 kg x 50 g is not
able to cover other ranges)

4. Light capacity Universal Test Stand
(motorized Model, to accommodate
above mentioned gauge)

50,000

5. Other quality factors	
Potato hydrometer (to determine specific gravity of potato related to starch content)	2,000
I.2 For measurement of temperature, relative humidity, air velocity and pressure	
1. Solid state "Digi-sense" digital thermometer (-30° to + 100°C)	30,000
2. Thermocouple sensor to accommodate existing multipoint temperature recorder	30,000
3. Portable digital temperature and humidity indicator	10,000
4. Hot wire anemometer (for measurement of air velocity during transportation)	30,000
5. Pyranometer (for measurement of solar radiation)	40,000
6. Temperature probe (for temperature range from -20 to + 80°C) 2	50,000
7. Humidity probe (coverage from 0-100% relative humidity) 2	50,000
8. Humidity and temperature transmitters to accommodation above temperature probe and humidity probe.	20,000
I.3 Instruments for gas sampling and analysis	
1. Gas sampling supplies (syringes, septa, pressure gauges)	10,000

2. Gas detector and detecting tubes for ethylent, carbon dioxide. Carbon monoxide, sulfide dioxide		20,000
3. Infrare CO ₂ analyser		250,000
4. Gas chromatograph (with thermal conductivity detector and porapak, molecular sieve and sililagel columns for O ₂ , N ₂ and CO ₂ analysis, and with flame ionization detector and alumina column for ethylene determination)		400,000
5. Precision flow meters	6	30,000
6. Gas cylinders (O ₂ , standard CO ₂ , standard ethylene, nitrogen, helium for the gas chromatograph)		100,000
		<hr/>
	Total:	1,289,000 =====

APPENDIX G. - Needed Equipment for TISTR Food Processing Laboratory

PRIORITY III.

No.	Equipment	Quantity	Price in baht	Reason for request
1.	Fluid bed dryer Lytzen, Type N 30 Capacity 30-35 Kg.	1	800,000	For preserved fruits and vegetables by drying.
2.	Freeze Dryer Lab type capacity approx 1 litre	1	1,200,000	For development of agricultural products
3.	Moisture tester balance	1	100,000	For testing moisture content of the products
4.	Commercial blender, 240 V waring, model 240 CB-6 (capacity 5 litre)	1	60,000	For mixing and grinding products
5.	Colorimeter (Nippon model NI 101D)	1	200,000	For testing the color of the products
6.	Pressure tester	1	50,000	For determine density of fruits.
Total			2,410,000	

APPENDIX H. - Partial Listing of People and Organizations
Consulted

Dr. Smith Kampenpool	- Governor, TISTR
Mr. Narong Chamlong	- Deputy Governor, TISTR
Mr. Robert W. Resseguie	- Asst. Agric. Officer, USAID
Dr. James Chamberlain	- President, Pragmatics, Int.
Mr. John A. Tennant	- Capital Develop. Loan Officer, USAID
Mrs. Pivan Varagoon	- Director, Agric. Products Div., TISTR
Mrs. Amornrat Swatditat	- Head, Packaging Lab., TISTR
Mr. Neungpanich Sinchaisri	- Insect Toxicologist, Kasetsart Univ.
Dr. Surapong Kosiyachinda	- Horticulture and Plant Physiologist, Kasetsart University
Mr. Chanoot Sriprab	- Chief of Office of Commodity Standards, Ministry of Commerce
Dr. Charles Yang	- Director/Resident Scientist, AVRDC, Kasetsart University
Mr. Ampol Senanarong	- Dep. Director-General of Research, Dept. of Agriculture
Mr. Chamlong Chettanachitara	- Chief, Entomology Zoology and Treat- ments Branch, Dept. of Agriculture
Mr. Riksh Syamananda	- Dep. Director-General, Dept. of Agr.
Mrs. Dara Buangsuwan	- Chief of Seed and Postharvest Pathology Branch, Dept. of Agri.
Mr. Anthony M. Zola	- Economist, Royal Irrigation Dept., Ministry of Agr. and Cooperatives
Mrs. Phichitra Thanajvanich	- Director, Pisitichai International Co. (Exporter) Bangkok
Mr. Chao Chotivanich	- Tang Han Kee Co. (Exporter) Bangkok
Mit Chaw Suan	- Exporter Firm, Bangkok
Mrs. Kessiri Sukkapinda	- Senior Trade Officer, Export Service Center

Appendix II. (Cont'd)

- Mr. Thet Zin - Regional Agriculture Services Officer,
FAO Regional Office, Bangkok
- Mr. Cameron Clark - Small Farmers Development Program,
FAO Regional Office, Bangkok
- Mr. Thamrong Gongmance - Grape Grower and Exporter,
Nakorn Pathom
- Mr. Sidh Chudsuwan - Dep. Director, Government Cold
Storage Organization, Bangkok
- Mr. J.P. Baker - Chief, Chemist/Consumer Products
Manager, SGS Far East Limited
- Miss Orajit Singkalavanich - Senior Trade Officer,
Export Service Center
- Miss Chantra Purnarisha - Senior Trade Officer,
Export Service Center
- Mr. Noravat Suwarn - Director, Export Service Center
Grape Grower - Nakorn Pathom
- Mr. Pairoj Polprasid - Director of Horticulture,
Department of Agriculture
- Miss Benjamas Ratanachainakorn - Scientist in Postharvest Branch,
Dept. of Agriculture
- Mr. John Nanagara - Thai International Airline,
Cargo Section
- Mrs. Sing Ching Tongdee - Acting Head, Postharvest
Technology Lab, TISTR
- Mr. Sampao Pataragetuit - Research Officer, Fermentation
Technology Lab, TISTR

(Sampao took time from his regular assignment to guide the PIP Consultant during most of the project time period. His assistance was greatly appreciated.)

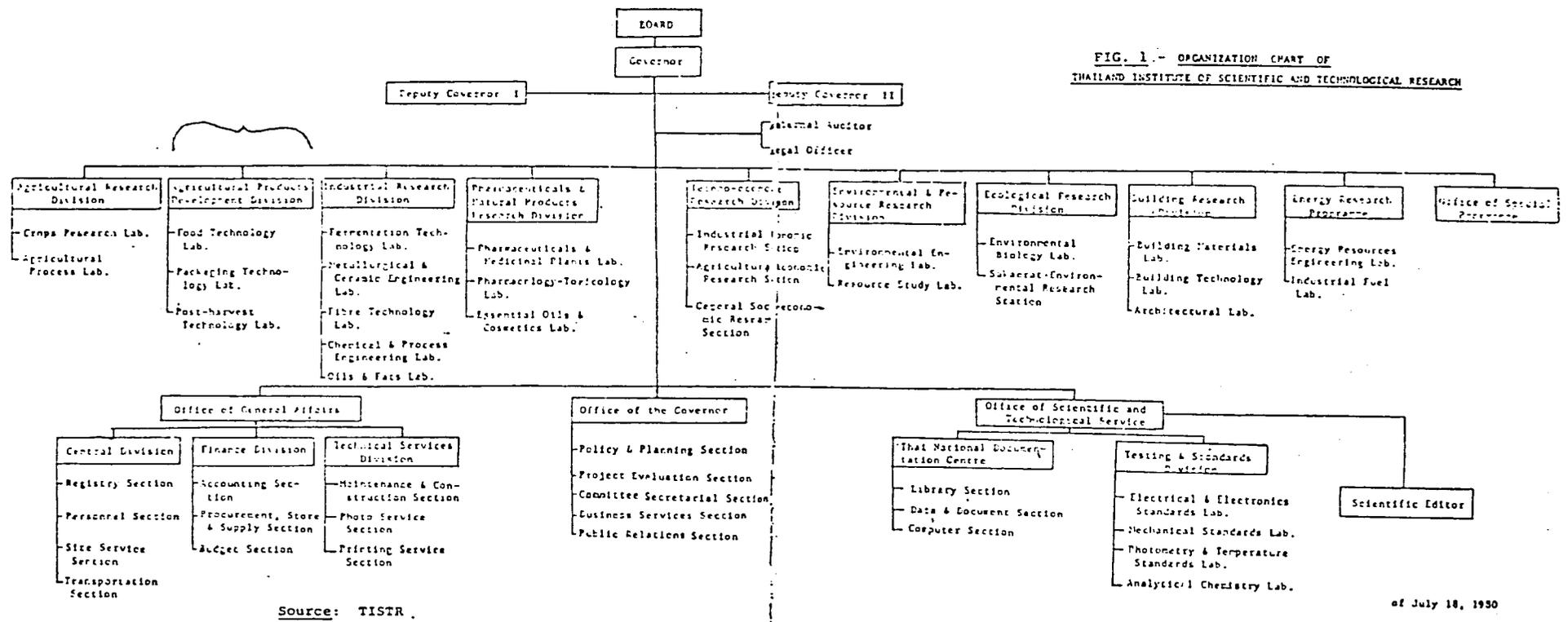
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2. Technical Working Group on Food Products - Thailand; Supply Survey: Fresh and Processed Fruits - Report II. ASEAN Working Group on Food Products, 1981.
3. Pre-and Postharvest Vegetable Technology in Asia. Workshop under Asian Vegetable Research and Development Center, Los Banos, Philippines, 1977.
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7. Crop Storage Structures in Potato Growing Regions in Thailand. TISTR, 1978.
8. Market Research Systems Report. Anthony M. Zola, 1982.
9. Food Processing Industry in Thailand. Supanee Artachinda, Research Report No. 4, May 1978.
10. Thailand FAO Small Farmers Development/Peoples Participation Program. FAO Regional Office, Bangkok. (undated).
11. Development of Packaging Technology Capability. TISTR, 1982.

IX. FIGURES

Best Available Document

FIG. 1.- ORGANIZATION CHART OF THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH



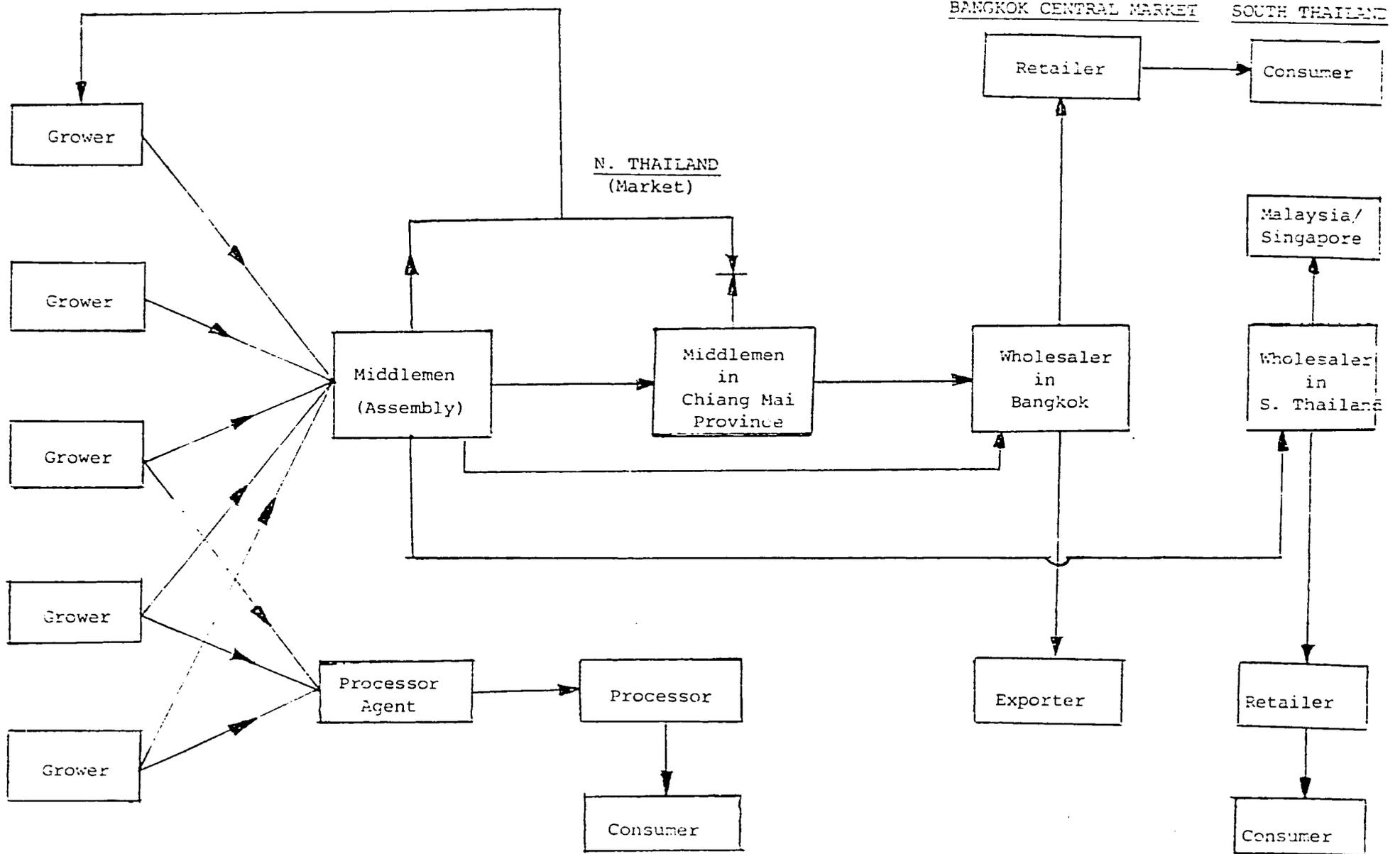
Source: TISTR.

of July 18, 1950

49

N. THAILAND
(Growers)

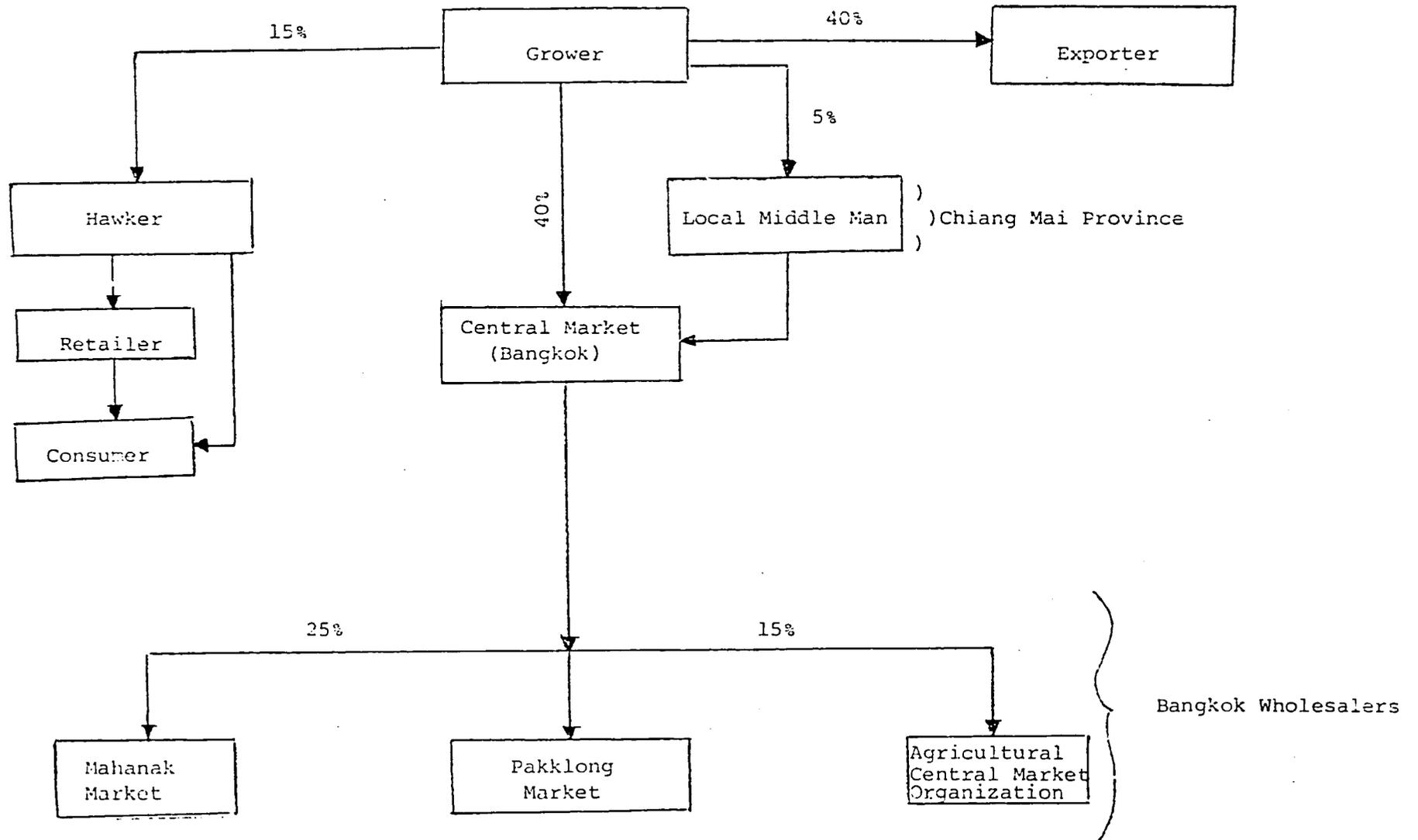
FIG. 2 - MARKETING PROCESS FOR POTATOES



50

Source: TISTR Economic Section

FIG. 3 - MARKETING PROCESS FOR LONGANS



X. PHOTOGRAPHS



Photo 1. Instant papaya beverage that is being developed as a TISTR research project.



Photo 2. Bamboo packing baskets commonly used in Northern Thailand.



Photo 3. A small truck carrying basketsful of fruit and vegetables. Note the wooden board spacers used to support the upper layers and to prevent compaction of the lower layers.



Photo 4. Growers carrying produce to market in bamboo baskets.

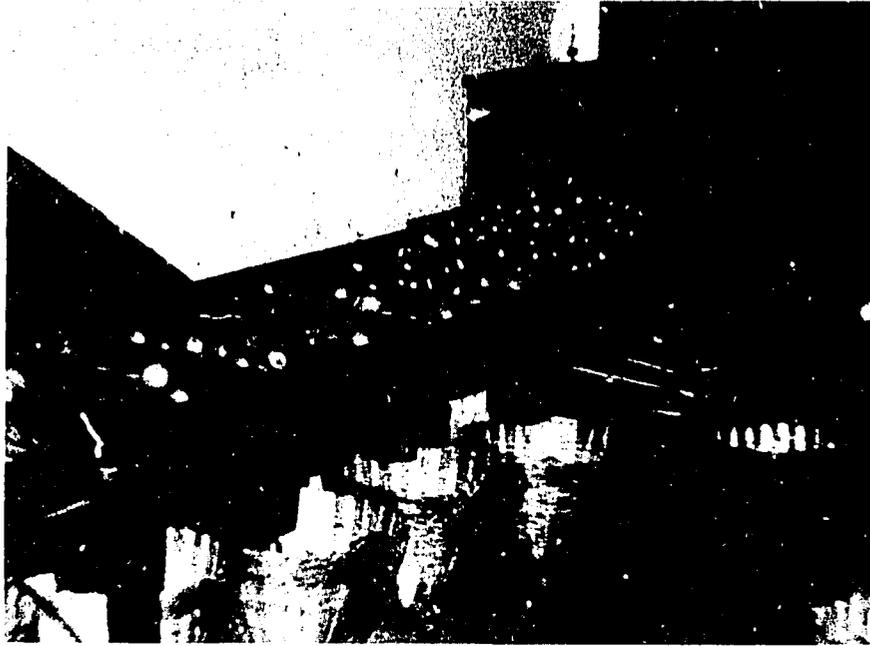


Photo 5. Grading machine being used for tangerines.



Photo 6. Longans awaiting air transportation at Bangkok Airport. This highly perishable crop is sitting in the hot, tropical sun awaiting Customs inspection.



Photo 7. Mangoes being packed in wooden boxes at a collection center for shipment to market.

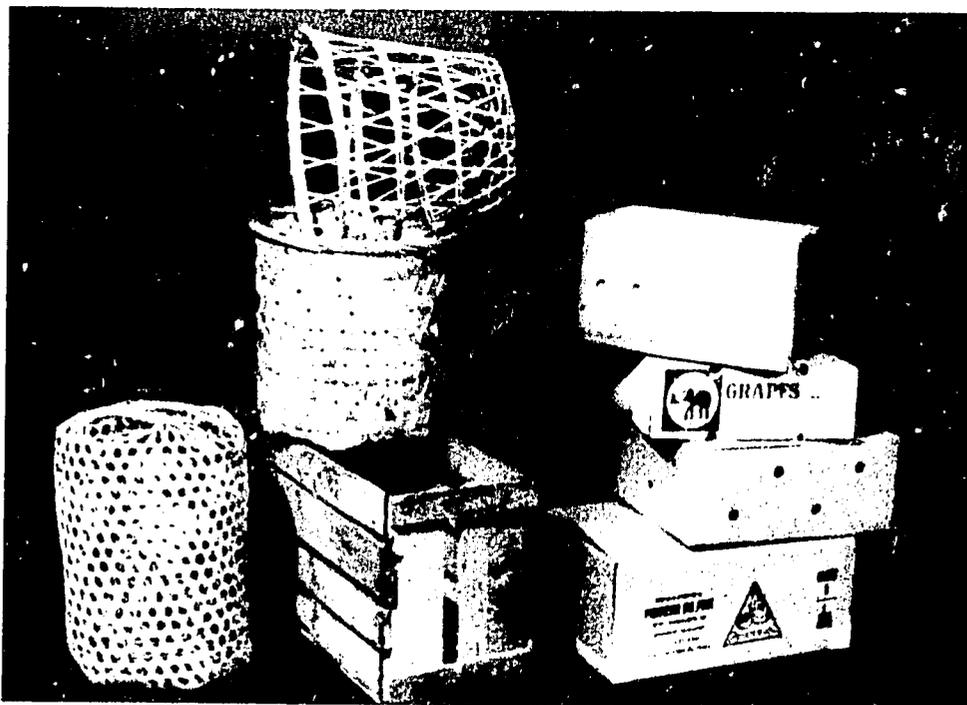


Photo 8. Different types of containers used to transport perishable produce in Thailand, and for export. TISTR is doing research and testing on improved packaging for perishable crops.

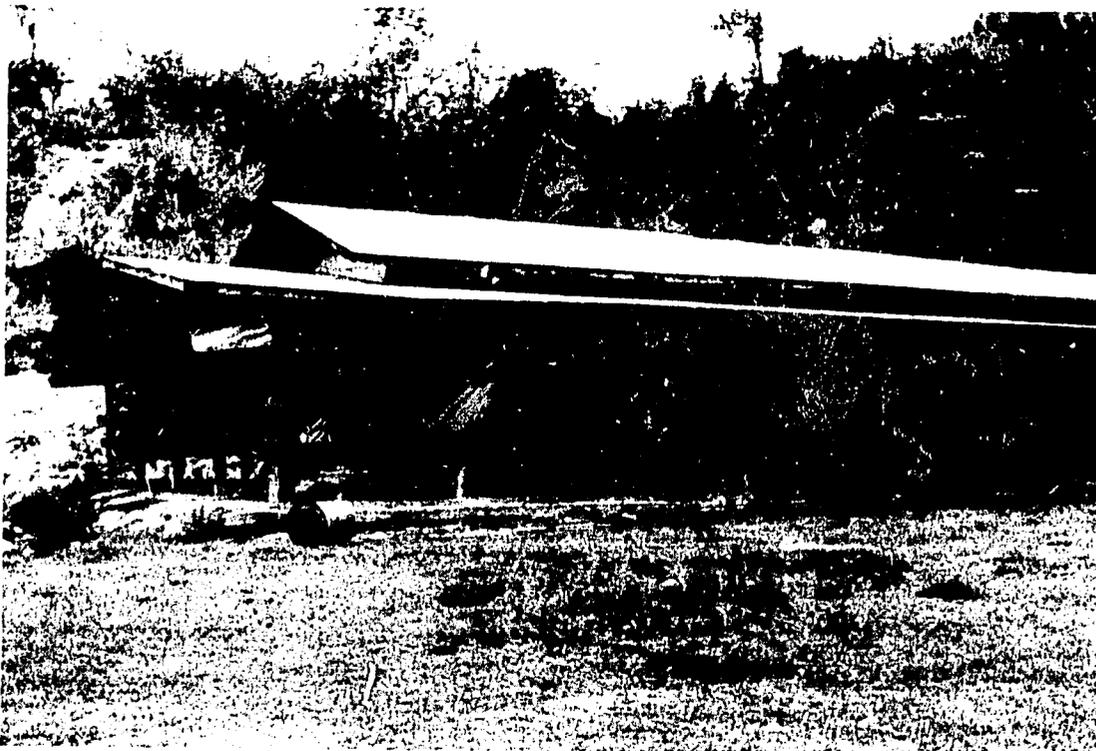


Photo 9. A multipurpose storage shed for garlic, onions and shallots.

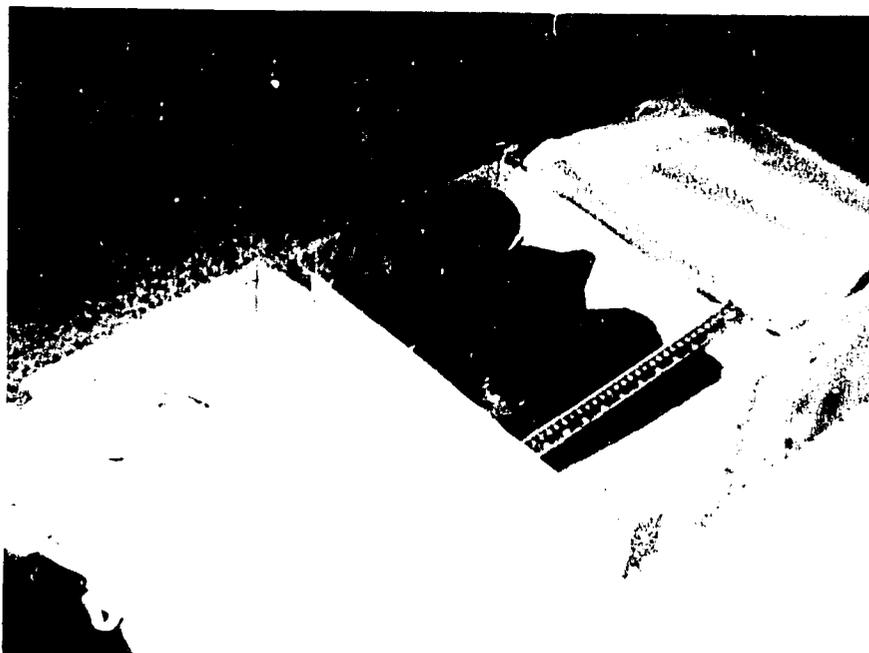


Photo 10. Papayas being packed in cardboard boxes for export.

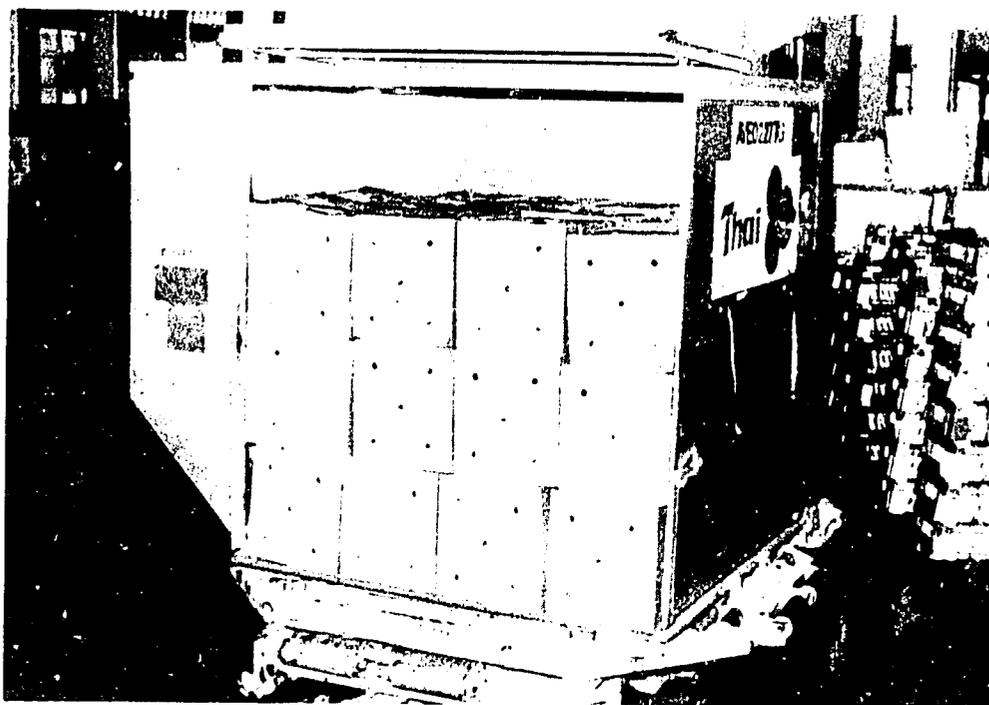


Photo 11. Longans packed in cardboard cartons awaiting air shipment to Singapore or Hong Kong.



Photo 12. Tamarind products, high protein cookies and snack food from soybeans are being developed by the IISTR Processing Laboratory.