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FEASIBILITY STUDY FOR THE GROWING, PROCESSING AND MARKETING OF TROPICAL FRUITS AND THE ESTABLISHMENT OF A CAN MANUFACTURING FACILITY IN THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

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I. INTRODUCTION

A. Background

In early 1981, the Trade and Development Program (TDP) of the United States Department of State agreed to assist the Burmese Government with funding a conceptual assessment of constructing two production and processing facilities in the townships of Thazi and Mudon along with an associated can manufacturing plant at an unspecified location.

The Trade and Development Program contracted with Experience, Incorporated, a private agribusiness consulting firm located in Minneapolis, Minnesota, for the services of a two-person team experienced in agricultural production, processing, and marketing for a two week assignment in Burma. The conceptual assessment was completed in June, 1981. It included a preliminary evaluation of the three proposed facilities plus a proposed comprehensive scope of work for a detailed study to determine the technical and economic feasibility of implementing the projects.

The conceptual assessment concluded that the Thazi site possessed good climate and soils that could, together with ample water availability and low labor and land costs, provide Burma with the competitive advantages necessary to establish and develop its fresh and processed markets for a wide range of agricultural products. 1/ The initial assessment also concluded that there is a need to develop more technology and technical competence among the Burmese population. There is, for example, only one small cannery currently operating in Burma. This plant, situated in Mandalay, produces slightly over 50,000

1/ The Mudon site could also provide many specialized fruits if the disadvantage of the monsoon rains can be overcome, especially with pineapple production.

cases of various fruits, vegetables, and meats. The handling operations are all hand-paced with little or no conveyor aids. Concentration of products is done in open steam jacketed kettles at atmospheric pressure. All other processing is done in three horizontal retorts. The quality of the end products is good, but not of the excellence necessary to supply most high quality export markets.

The Burmese view the development of the agricultural industry, particularly the three projects discussed above, as an effective means to promote regional development; to gain needed foreign exchange through export marketing of fresh and processed products; to increase domestic consumption of processed products; and to provide needed employment opportunities.

Since the initial assessment, the Burmese have assigned the Thazi project to the French Government for development, leaving only the Mudon facility and the can manufacturing plant for consideration by Experience, Incorporated personnel.

B. Scope of Study

The contract between the United States Trade and Development Program and Experience, Incorporated called for the services of a five person team experienced in the production, marketing, financial, and economic aspects of tropical agriculture. The team was supplied with support personnel and equipment as required. Specific tasks for the project will be detailed under separate analytical sections as the report progresses. The major objectives of the report will be subsumed under the following general headings:

1. Agricultural and component;
2. Factory component; and
3. Markets and marketing

The results of the above study components will be used to:

a. Provide the basis for developing component and total investment and operating costs in relation to foreign and domestic currency requirements;

b. Estimate fixed annual costs by project; and

c. Provide estimates of working capital requirements by the separate components.

The remaining sections include the findings of the study related to technical, financial, and economic feasibility, along with a final assessment and recommendations for overall project development.

II. EXECUTIVE SUMMARY

The objective of this study is to determine the feasibility of a possible fruit processing facilities near Mudon and evaluate the economies of locating a can manufacturing facility that could supply most of the needs of all other canning facilities in Burma.

In May of 1982, a team of five specialists, along with support staff, was assigned to the project. This team was to consider world market opportunities, horticultural aspects, the need for irrigation, plant design, and the overall economies and financial aspects of the project. The investigation in the Mudon area was limited to tropical fruits, mainly pineapple. Cashew nuts were considered even though they were not assigned to the project.

The implementation of the project was divided into three components; the agricultural component, the food processing component, and the marketing component, followed by a detailed economic and financial analysis and recommendations. To develop and analyze the alternative investments, the discounted cash flow and the internal rate of return methods were used. Both of these methods recognize the decreased future value or the present net value of money in the future. The effect of inflation was also analyzed. The cut-off rates established are included herein.

A. Agricultural Component

The agricultural component studied all aspects of growing pineapple for the fresh and canned markets. Other tropical fruits that will be purchased directly from local farmers were mango, rambutan, mangosteen, guava, papaya, passion fruit, durian, jackfruit, and the cashew nut.

To develop comparative pineapple costs and yields for the geographic area of Burma, cost studies from the Agriculture Ministry of Thailand were used for Prachuab Kirikhan and Petchaburi provinces. While there is a substantial difference in rainfall and spring temperatures, many other aspects are similar.

In many pineapple growing areas of the world, including Thailand and Burma, there are several agronomic improvements that will improve yield and cost. These are variety, irrigation, adequate fertilizer (especially nitrogen), increased population, improved weed/insect control, and the use of plastic mulch.

In the comparative analysis a reduction of 35 percent was designated to Burma compared to Thailand's labor rates. Yields were then increased for Burma to cover the cost of improvements as well as the cost of going into business with new equipment. Findings were that yields in Mudon would have to be increased to 40 metric tons 1/ (MT) per cycle from 25 MT in the Thailand provinces. In all cases, there is a "20 percent profit factor," about $8 per MT included. If costs and profits were reduced, a yield of much less than 40 MT could be tolerated. The cost per MT averaged about $48.60 with a 20 percent "profit factor."

In the analysis, the internal rate of return was adequate in all typical finances at $54 per MT. At $48.60 per MT it was found to be borderline, except where equity is reduced to 40 percent.

The challenge to the profitability of growing pineapple in Mudon is the heavy rainfall during half the year at 185 inches

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1/ All tonnages referred to are metric tons (MT) equal to 2,204 pounds.

compared to Thailand's 45 inches. This affects growing, harvesting, and insect/weed control as well as quality. The Burmese officials will have to determine whether they should move ahead at an accelerated pace, hoping that yields and cost will develop favorably, or wait until agronomic research provides statistical data to clarify the comparison.

All other tropical fruits are available in adequate volume to supply another small world market. Cashew nuts, however, are in increasing demand with prices rising in recent years. This is a labor intensive industry that could provide a real opportunity for Burma when supplies are made available.

Although there is substantial acreage of pineapple in Mudon, it is of the wrong variety (Kew) for economical processing. The Smooth Cayenne variety is more cylindrical and has a smoother surface which provides for better raw product recovery in the processing plant. Until the Smooth Cayenne or other improved varieties are grown in volume in the Mudon area, there is no necessity to build a large processing plant. Therefore, a seed plantation schedule that starts with 100,000 crowns of improved seed stalk from all pineapple areas of the world should be developed. These varieties will be compared, and only the most promising variety will be expanded until adequate pineapple seed is developed by the seventh year. At that time, a large pineapple plant can be built on the corporate farm east of Mudon.

In the meantime, the Kew variety and all other tropical fruits can be processed for the fresh and canned market at the small 1,900 ton multi-product plant to be built immediately at Mudon. In addition, the pineapple that is developed as a by-product of the seed stalk expansion program can also be processed at this plant.

Based on these assumptions, it is believed that with the above mentioned changes, the large pineapple plant at Mudon can be successful. If these new assumptions do not prove to be viable, as more knowledge is gained, there is enough time to stop this project. Nevertheless, the need to search for new scenarios indicates that processing and marketing pineapple profitably and internationally is extremely competitive. Many pineapple facilities are closing down in other areas of the world to accommodate those in the lower cost area. Thailand is said to be using only 40 percent of its pineapple factory capacity as they continue to expand acreage.

B. Food Processing Component

There are many tropical fruits and each fruit is variable in the wild. Pineapple, the major fruit by far, has been developed for both the canning business and the fresh fruit business. The market for other tropical fruit is limited, and widespread production cannot be very automated, because it is processed on a small scale.

1. Small Tropical Fruit Processing Plant

It is recommended that a small tropical fruit processing plant be built as soon as it is practical in the Mudon area. This plant would process the following tonnage of tropical fruit:

	Metric Tons
o Pineapple	1,900
o Mango	350
o Papaya	240
o Rambutan	548
o Passion Fruit	360
o Guava	83

o Tropical Fruit Cocktail

	Metric Tons
Pineapple	180
Papaya	140
Banana	15
Rambutan	21
Passion Fruit Pulp	22

These products will be purchased during the peak of the fresh market season or when the market cannot absorb the excess.

The total fixed cost of this plant will be K12,581,160 or without residences with annual sales of K27,507,715 for years two through seven with fresh at about 22 percent and processed products at 78 percent.

On an internal rate of return basis, the plant, under six different scenarios, is favorable. In addition to the favorable financial return needed, experience will also be gained.

2. Large Pineapple Processing Plant

The large pineapple plant is to be built on the corporate farm east of Mudon seven years after the beginning of the development of new improved seed stalk, if the Burmese choose that timetable. In the meantime, the present Kew variety can be processed at the smaller plant or for fresh market. If Burma is to compete in international trade with processed pineapple, it must grow a variety that is as good, if not better, than the Smooth Cayenne variety. High quality and improved recovery are characteristic of this variety.

The facility will produce three can sizes No. 300, No. 2, and No. 10. 1/ The pineapple products produced will be tidbits, chunks, cubes, crushed, and juice.

At Thailand's current prices, the sales volume would be K101,244,570. The capital fixed cost without residences is estimated to be K56,746,250.

An allowance of 25 percent has been made in can prices to give credit for self manufacturing or for volume discount. Can manufacturing companies give allowances of 25 to 30 percent for high volume customers, or they will lease the processing facility and manufacture the cans on site. The economics will be determined at the time whether the cans are obtained from the Pegu can manufacturing plant or on site. To realize the 25 percent savings, it is assumed that the demand for cans from other Burmese processing plants will increase substantially.

The larger pineapple factory will start out in the seventh year on a one shift basis and continue to expand to a three shift operation in the ninth year. It will require 660 tons of raw product each day for 75 days. At 28.6 cases per MT, this will result in 1,415,700 2-1/2 case equivalents.

At this point, it is assumed that much of the sales will go into the international market. The small tropical fruit plant would continue to supply fresh and canned pineapple to the local market, except for the amount necessary to cover the cost of imported material and interest (33 percent).

The initial profitability of the large plant showed a loss. Since this scenario was developed, several other scenarios were developed to look for an improved internal rate of return. The major changes were:

1/ Trade terminology used for Number.

a. Eliminate residential housing as directed by Foodstuffs Industries.

b. Lower the raw product cost to $48.60 per MT from $54 per MT, a price at which it is felt that the agricultural component can produce profitably.

c. Combine the cost of the large pineapple facilities with the small tropical fruit plant over a 27 year period to provide the full 20 years for the large plant.

With these changes, under six out of seven scenarios, the internal rate of return is positive. Only in one scenario where there is 100 percent equity and 12 percent interest for long-term capital and 18 percent for short-term capital, does the internal rate of return become negative. It must therefore be financed on the basis of 40 percent equity and 60 percent borrowed funds if it is to be profitable.

3. Can Manufacturing Plant

A can manufacturing plant is to be built in Pegu to supply six different processing plants in various stages of development. During the initial stage, the plant volume will be producing only 25,000,000 cans annually, which is small. Four different can sizes will be made with tops and bottoms being imported. Cans will be placed in cartons to be transferred to the individual plants to minimize damage in route. They will be used for meats, vegetables, tomatoes, nectars, jams, juices, and evaporated milk.

The total cost of this facility along with working capital will be K21,000,000 or US$3,000,000. The indicated rate of return on sales will be 0.033 percent. If the 30 percent tax

is eliminated, the internal rate of return will be acceptable in all scenarios except in the case where cost was raised by 10 percent.

If the cans, raw product, and the finished product were each taxed at 30 percent, there would be a total tax of 90 percent and the product would be competitive.

The ultimate high profitability of this can manufacturing facility is assured, if the demand for cans in Burma reaches the 100,000,000 can level which is four times its near-term volume requirements of 25,000,000 cans. Only one-half shift will be needed for the current volume with other shifts added as necessary. At these levels, the can cost should be lowered by 25 to 30 percent compared to purchased cans.

4. The Cashew Nut Processing Plant

The cashew nut market has advanced in price in recent years. The highly labor intensive job of removing the nut from the shell has limited the number of countries that are in the business. India has been very aggressive in processing the cashew nut and has historically imported much of its supply but is now increasing planting quite rapidly.

It is recommended that a small cashew nut plant be built near Mudon if adequate supplies of raw nuts are available. The plant could run continuously and could start out with a two shift operation handling 1,250 MT of raw nuts. The nuts would be placed in polybags rather than in square tins. Although early indications were that an adequate supply of cashew nuts was available, a survey by USAID personnel on September 25, 1982 revealed that there were approximately 1,500 trees. If 5,000 acres could be planted, this would provide enough nuts for a three shift operation in four years.

The fixed cost of the plant would be K16,079,300 with an initial annual sales volume of K8,834,900 (US$1,262,128).

Under all scenarios, the internal rate of return was positive even when costs were increased 18 percent using the average raw product nut cost for the past two years. In addition to the return from the processed nuts, there is a value from the oil that is inside the shell. This is used for plastic and petroleum additives. Some use is made of the flesh of the fruit for cocktail mixes.

C. Markets and Marketing

1. Purpose and Tasks

The purpose of the marketing component of the overall study was to investigate the export markets for 11 products considered as possible candidates for commercial production and marketing in the Mudon District of the Tenasserim Division in Southern Burma. The project focuses on pineapple production and marketing but includes also mango, rambutan, mangosteen, guava, papaya, passion fruit, durian, jackfruit, cashew nut, and tropical fruit salad/cocktail. The report also considers 15 major markets situated in the Orient, Middle East, Europe, and North America. The principal markets investigated include Hong Kong, Japan, Singapore, Kuwait, Saudi Arabia, United Arab Emirates, United Kingdom, France, Federal Republic of Germany, Netherlands, Belgium, Sweden, Switzerland, the United States, and Canada. Brief consideration is also given to the Austrian, Danish, and Norwegian markets and to domestic marketing in Burma.

Principal project tasks for the marketing component were as follows:

a. Review secondary data sources for general overview of world markets for the products considered.

b. Survey major import markets in Asia, Middle East, Europe, and North America by personal reconnaisance.

c. Determine quality standards demanded by importers.

d. Estimate promotion, brokerage, transport, and other costs and requirements.

e. Estimate market potential for each market.

2. Export Market Survey for Individual Products

a. Fresh Pineapple. Approximately 389,000 MT of fresh pineapple entered international trade channels in 1980. Leading importers were Japan, the United States and France. Significant quantities were imported also by Singapore, the United Kingdom, West Germany, and other European countries. The Middle Eastern countries have just recently begun to import significant quantities and are now taking most of the fresh pineapple exports originating in Thailand. The United States and Japan receive most of their fresh pineapple from the Philippines and appear likely to continue to do so in the future. The European market is supplied almost entirely by African countries, primarily from the Ivory Coast, Kenya, and South Africa.

Wholesale prices of fresh pineapples are given for selected European markets in the marketing section for October/April, 1979-80 and for July, 1982. For the earlier period, wholesale prices for sea-freighted pineapple originating from the Ivory Coast averaged US$0.93 per kilogram. Wholesale prices for air freighted pineapple from the Ivory Coast and Kenya averaged US$1.30 per kilogram in 1979-80 and US$1.47 in July, 1982. Wholesale prices have not increased in pace with inflation because of the worldwide recession during the past three years. Fresh pineapple sea freighted to the United States averaged only US$130 and $149 per MT CIF (West Coast), in 1980 and 1981, respectively. A better indication may be obtained from air shipments to Canada in 1980 for which FOB (Manila) unit value of US$348 per MT was recorded. The CIF unit values of these shipments came to US$2,713, implying an average air freight and insurance cost rate of US$1.09 per pound.

Ocean rates are approximately $30 more per MT for fresh as opposed to canned pineapples. Air freight rates originating from Bangkok were US$0.20 per pound to Hong Kong, $0.60 per pound to Tokyo, $1.19 per pound to Kuwait, and $0.73 per pound to Orly or Heathrow airports in Paris and London. Both sea and air freight rates change frequently and have been on an upward trend because of increasing fuel costs.

For prospective newcomers, the Middle East and Europe appear to offer the most promise. For price competitive fresh pineapples, markets in Asia such as Japan and Hong Kong offer limited possibilities. Fresh pineapple shipped to East Asian markets will generally go via air freight from the Mudon project site because Burma is farther removed in distance from Hong Kong, Japan, and Singapore than are Thailand, the Philippines, and Malaysia. West Asian and European markets are nearer to Burma than its Asian competitors, but closer to the heavy supply

areas in Africa. However, these markets are far removed and only high quality air freighted pineapples will be able to penetrate those markets. Burma will take advice from highly qualified expatriate specialist personnel to attain a high level of capability in post harvest handling techniques and to assure that only premier quality produce enters export trade. At destination markets, established and well recognized marketing agents should be sought out and used to develop trade acceptance for Burmese pineapples, monitor sales, and make collections.

b. Canned Pineapples. Major Asiatic processors with which Burma must compete are Thailand, Taiwan, the Philippines and Malaysia. Among these, nearby Thailand continues to expand acreage and is currently using only 40 percent of its rated processing capacity of 30 million cases. The Thai production and processing capability pose a formidable obstacle to the development of Burma's canned pineapple industry. These obstacles can be met and overcome only by efficient management of the lower cost labor and land resources now available in Burma along with comparable or higher product yields and recovery rates. These aspects have been investigated in the agronomic section of this study, but must be confirmed further by results of experimental test plots early in the development of the Mudon project.

c. Mangoes

(1) Fresh Mangoes. The United States is by far the largest importer of fresh mangoes, followed by Hong Kong, Singapore, and Japan. The European market, led by the United Kingdom, France, and the Netherlands is also a significant factor in fresh mango trade, having increased consumption markedly during the past decade.

The European markets are supplied primarily by Africa and West Indies, but have recently begun to import relatively large quantities of fresh mangoes from Mexico and India. The United States' primary supplier is Mexico. The Middle East countries are presently supplied by India, Thailand, and the Philippines.

Trade opinion is that Europe and the Middle East are the best targets for new or potential exporters of fresh mangoes. Singapore and Japan are well established with Philippine and Malaysian sources; and outsiders will find these low price, high quality supplies keenly competitive and difficult to displace in Asian markets. A possible exception is Hong Kong, the second largest importer in the world after the United States. Hong Kong is a receptive market in both the price related and gourmet or luxury markets. The Philippines currently supplies about 90 percent of Hong Kong's imports, however, and will be keenly competitive for additional volume as this market expands. Thailand has succeeded in penetrating the Hong Kong market recently, and there is no apparent reason that Burma's potentially high quality and low cost fresh mangoes could not compete effectively for a small share of this lucrative market.

Fresh mangoes command high prices in all the markets surveyed. Wholesale prices on the European markets averaged US$2.49 per kilogram in 1979-80 and have remained at about the same level. Fresh mangoes going to Japan and the United States must be treated for insect control, a procedure that adds greatly to post harvest costs. Wholesale prices in Hong Kong were also relatively high, ranging from US$1.10 to $2.50 per kilogram in May, 1982. Mangoes must be air freighted to most destinations because of their high perishability. As with all tropical fruits considered, fresh mangoes are normally sold on commission, the importer charging 8 to 10 percent of the selling price as payment for his service.

(2) Canned Mangoes. Few statistics on quantities of canned mangoes entering international trade are published. It is known that most of the countries involved in fresh mango trade, except African sources, also have a processing component. India, Brazil, Mexico, and the Philippines are using increasing quantities of mangoes as a component in the rapidly expanding production of canned tropical fruit salad/cocktail.

Canned mangoes command high prices on the world market. In 1980, the Philippines exported canned mangoes that brought an FOB average price per No. 2 case equivalent of $18.24. All trade specialists interviewed are optimistic about the canned mango market, particularly the growing use of mangoes in tropical fruit salad and cocktail mixes. New suppliers such as Burma should concentrate on nearby markets such as Hong Kong and later use sales agencies in the Mideast and/or Europe to develop markets there to supplement established fresh sales.

d. Rambutans and Mangosteens

(1) Rambutans. Import statistics on quantities traded are totally lacking. However, export statistics of supplier countries indicate that fresh rambutans are widely traded. Thailand, for example, shipped 116 MT of fresh rambutans to 15 countries in 1980 that commanded an average FOB (Bangkok) unit value of US$525 per ton. This value clearly implies that fresh rambutans are price competitive with air-shipped fresh mangoes and pineapples.

No information on quantities of canned rambutans is published. However, it is known that canned rambutans are available in retail markets throughout the world. Canned rambutans are very similar to canned lychees which are traded extensively in world markets.

(2) Mangosteens. Mangosteens are seldom seen outside points of production. Only France, Singapore, and Japan show small imports in recent years. Good quality mangosteens were said to wholesale at US$2.50 to $2.95 per kilogram on the Rungis market near Paris, but were rarely available. Europe has recently engaged in promoting the consumption of mangosteens with the objective of encouraging production in African countries.

As far as is known, mangosteens are seldom, if ever, processed because of their excellent eating qualities as a fresh dessert fruit. The possibilities of processing should be thoroughly investigated as the Mudon project proceeds.

Although mangosteens are allegedly difficult to propagate, the fruits are of high value and could offer an excellent item of commerce for the Mudon project. In line with this prospect, the Mudon project has programmed small acreages of Mango plantings in the initial stages of the project development to supplement existing stands.

e. Guavas. Practically all guavas entering commerce are processed. The United States and United Kingdom import fairly large quantities of processed guava products. The United Kingdom imported around 1,000 tons of canned guava slices in 1981-82 that competed pricewise with canned peaches and pineapple.

Canned guava products imported into the United States in 1980 brought relatively low prices. Unit CIF prices, converted to a No. 2 case equivalent basis, amounted to $6.40 per case for paste and pulp, $6.54 for jams and jellies, and $10.83 for canned slices. The prospects for increased trade in processed guava products are good because guava has high vitamin C

content and is being promoted in the United States and Europe as an excellent jam and jelly and as a tasteful additive in tropical fruit and fruit juice mixtures.

f. Papayas

(1) Fresh Papaya. Papayas are on an increasing trend in international trade. Production has increased 62 percent since 1969 with Brazil, Mexico, India, and Indonesia ranking as the leading producers among more than 30 countries for which estimates are given. The Asian markets surveyed are the leading importers with prices ranging from $85 for Malaysian papayas supplied to Singapore to over $2,300 per MT for air freighted and fumigated Hawaiian papayas shipped to Japan. Total shipments into major European markets are not known. It is known, however, that Thailand shipped 12.5 MT to European markets in 1980 with an FOB (Bangkok) value of US$450 per ton. Prospects for fresh papaya marketing are good, a conclusion that is borne out not only by trade data but from opinions solicited from tradesmen in Hong Kong and Tokyo, and from importers in the Rungis and Covent Garden markets in Paris and London. Papayas, like fresh mangoes, are subject to infestation by the Mediterranean fruit fly, the melon fly, and the mango fly and must be fumigated before entering the United States and Japan.

(2) Processed Papaya. The papaya is normally consumed fresh. Prospects for processed papaya are poor, and it is not included as a viable alternative for the Mudon project.

g. Passion Fruit

There is little, if any, passion fruit now grown in the Mudon area of Burma, but the yellow variety is known to be adaptable to the region. Australia and the United States have successfully developed a market for passion fruit juice as a

base in carbonated drinks. Passion fruit makes an excellent additive for fruit juice mixes, tropical fruit salad/cocktail, and as a component in mixes used in exotic drinks. Plans for the Mudon project call for growing and processing small quantities of passion fruit juice as a component in the recipe for tropical fruit salad and cocktail.

h. Durian and Jackfruit

(1) Durian. The durian, consumed raw or as a jam or jelly, has a small but wide distribution in international trade. In 1980, Thailand exported 3,516 MT to eight Asian countries, seven European countries, and the United States. The wide distribution of durians traded is largely due to ethnic population demands in the importing countries. France and the Netherlands, countries with large immigrant populations from Southeast Asia, were among the countries importing the greatest quantities of fresh durians. Unit values FOB Bangkok ranked high among the products investigated, averaging US$1,069 per MT in 1980. Despite difficulties in documenting trade quantities, enough is known to indicate that an export market for fresh durians does indeed exist. This, along with a large domestic demand, provides a persuasive argument for including durian in the product mix for the Mudon project.

(2) Jackfruit. The jackfruit is a staple in many countries, particularly those in the South Pacific Islands, and tropical Asia. The fruit is large, cumbersome, and difficult to transport. It does not enter international trade except in processed form.

The Philippines are known to have exported nearly 87 MT of canned jackfruit in syrup to eight European countries, the

Middle East, United States, and Canada. Canned jackfruit is a high value product that commanded an FOB (Manila) price of US$32.24 per case of No. 2 can-size equivalents in 1980.

The Mudon project is designed to process small quantities for the domestic market, with recommendations that test shipments of canned jackfruit be made to one or more potential export markets.

i. Cashew Nuts. Although world cashew nut production has remained fairly constant during the last decade, the large exporting countries of India, Brazil, Mozambique, Tanzania, and Kenya are increasing acreage and expanding processing facilities to take advantage of a continuing high demand for cashews on the world market.

The United States is by far the largest customer for processed cashew nuts, importing nearly 30,000 MT per year in 1980 and 1981. European countries also imported quantities ranging from 754 MT for France to 2,368 MT for the United Kingdom. In Asia, Hong Kong is the largest buyer with 4,671 MT imported in 1980, followed by Japan with total imports of 2,198 MT.

Once processed, cashew nuts are highly valued. Unit CIF values of United States imports in 1981, for example, averaged $5,118 per MT. In Europe, average CIF unit values were about the same. Producer prices in 1981-82 ranged from $0.61 to $0.68 per kilogram in Tanzania and Kenya, prices that are considered high in relation to farm prices of most agricultural products.

The market outlook for raw and processed nuts from the Mudon project looks very promising provided yields, production, processing, and marketing costs can be made comparable with those of its closest competitors -- India and Thailand.

j. Other Products. Other products considered for the Mudon project include tropical fruit salad or cocktail, ginger, and bamboo shoots. Among these, a tropical fruit salad/cocktail that could consist of a mixture of mango, pineapple, papaya, and bananas in a passion fruit juice base appears most promising.

Export sales of canned tropical fruit salad/cocktail have increased dramatically in recent years. The product, developed by Del Monte and Castle & Cooke, is among the most successful new canned products introduced in the last decade. Exports from the company's Philippine bases have expanded from 4,500 MT in 1971 to 10,125 MT in 1980, an increase of 125 percent. In 1980, the average FOB (Manila) unit value of Philippine shipments was US$668 per MT which converts to $10.91 per case of No. 2 can-size equivalents.

All the products contained in tropical fruit salad/cocktail are programmed for production in the Mudon project, except bananas which can be obtained from existing supplies. The processing and marketing of this product is highly recommended.

Ginger and bamboo shoots are among other high value crops that could be grown and marketed by the Mudon project. These products are not included for consideration at the present time, but could be investigated more fully as the Mudon project develops and grows.

3. Final Comments -- Markets and Marketing

The study of markets and marketing is comprehensive in covering the current status of potential import markets for products programmed for production in the Mudon area of southern Burma. The study assumes that the products can be cheaply and efficiently grown and processed in the project area and that

Burma will construct the necessary infrastructure to handle and move efficiently the products within the project itself and to temporary storage and loading points at the sea and air facilities in Moulmein.

These infrastructural requirements involve internal roads and communications within the project's area, power and telecommunications to the site from the national power and telephone networks, construction of additional sea and airport facilities including container handling facilities, and weather controlled warehousing. Other important considerations involve the availability of merchant ships and aircraft that are suitably equipped with cargo compartments capable of controlling temperature and humidity levels. At present, Burma does not permit foreign passenger or cargo carriers to service any city except Rangoon. Unless this restriction is modified to permit foreign carrier access to Moulmein, the Mudon project will be unable to move its fresh products into international commerce.

Also, the marketing component of this study has said very little about marketing strategy. In this context, it is important to realize that the Mudon project covers a maximum acreage of 6,000 to 8,000 acres and produces a number of products, none of which is large scale. Consequently, the marketing strategy must involve developing only one or two outside markets gradually and then attempt to supply these markets uniformly with high quality products even though the project contributes only a small fraction of the market's total requirements. The critical importance of selecting aggressive and responsible sales agents or brokers has been repeatedly stressed and is essential to success.

D. Economic and Financial Analyses

With each operation, we have found scenarios which would satisfy the investment goals. In many cases, several scenarios had to be developed to find a satisfactory internal rate of return. This was especially true of the growing, processing, and sale of processed pineapple because present worldwide prices for processed pineapple are very low. By the same analyses, fresh tropical fruits and cashew nuts could provide an excellent opportunity.

III. RECOMMENDATIONS

After a thorough analysis of the assumptions developed in this presentation has been made, those projects which are deemed feasible should be initiated after financing has been obtained. If there is some uncertainty with the large pineapple facility, a separate schedule covering the growing of pineapple and building of the plant should be established.

A. Small Tropical Fruit Plant

The small tropical fruit plant at Mudon should be built immediately. The raw product is available, and experience in processing canned and fresh produce in all tropical fruit is essential to the success of the overall project.

B. Can Manufacturing Plant

The can manufacturing plant to manufacture only can bodies should be built at Pegu as soon as practical if the future need for cans in Burma is as projected. The savings over importing cans is at least 25 percent at full production. At a later date when more volume is required, a line for tops and bottoms can be added.

C. Agricultural Production and Research

An international search should begin for pineapple crowns for as many promising varieties as are available. At least 100,000 crowns should be obtained for the seed nursery as indicated in the report schedule. If favorable prices for processed pineapple do not exist before the time of plant construction, consideration should then be given to selling on a fresh market basis.

D. Major Pineapple Plant - East of Mudon

Seven years from the start of the nursery expansion, a plant should be built east of Mudon on the large company farm with a capacity of 1,415,700 cases. By locating the plant in this area of Mudon, damage due to hauling will be minimized. Operation capacity should be developed for one shift in year seven, two shifts in year eight, and three shifts in year nine. If there is a delay in the schedule, the seed nursery should also be delayed.

E. Cashew Nut Plant

As soon as adequate supplies of raw cashew nuts are available, the plant should be constructed for a two shift operation and expand to three shifts as additional supplies are developed. It may be feasible to first import raw nuts and export the processed nuts as India does. Consideration must be given to the price of raw nuts at the time.

F. Infrastructure

Ultimately, the airport at Moulmein will need to provide air freight for fresh fruit. The roads betwen Mudon and Rangoon will need improvement. The utilities connecting the new factory from Moulmein must be extended to the factory site.

G. Technical Competence

As part of the University or Foodstuff Industries, training for persons in all the new food processing plants in Burma should be established. This is especially necessary for the microbiologist, chemist, and agronomist.

IV. OVERVIEW OF PRODUCTS CONSIDERED

A. Background

The preceding overview of products suitable for production and marketing for the Mudon area clearly demonstrates the versatility of this region's agricultural potential. Selection of a product mix for the Mudon project will be recommended on the basis of the production, marketing, and economic feasibility that form the substance of this study. In the initial phases, all of the tropical fruit should go through the small plant, and freezing capabilities should be added later if deemed feasible.

The success of this venture, given good management in the agronomic, handling, and processing stages, hinges on the exploitation and development of fresh and processed fruit markets. This will require several years of trial and experimentation, variety selection, and the development of processing techniques. Consequently, the marketing component of this study is given detailed and comprehensive treatment in the sections that follow.

B. Potential Products

The area in the vicinity of the Mudon site is currently producing a large number of tropical fruits and nuts at various volume levels. Although the crops considered will be discussed in detail in the agricultural, processing, and marketing sections of this report, a brief overview of the crops selected for the project is given at this point to provide additional background information. The crops considered are pineapple, mango, rambutan, mangosteen, guava, papaya, cashew nuts,

durian, and passion fruit, some of which are already grown in the Mudon area. Brief consideration is given to canned tropical fruit salad or cocktail.

1. Pineapple (Ananas cososus)

The pineapple consists of numerous fruitlets or eyes that develop from a single flower. The fruit was first discovered by Columbus in the West Indies in 1493, and since has developed into one of the principal commercial fruits of the world. It is grown in countries situated in a wide range between 30 degrees north and south latitudes. The Smooth Cayenne requires milder temperatures and cooler nights than more common native varieties, but its cultivation for fresh and processed markets has spread to all tropical countries. Other varieties include the Kew, Mauritius, Queen, Spanish Red, and Abacaxi, plus numerous others of less importance.

Pineapple plants bear fruit 16 to 18 months after planting. Yields vary widely depending on the variety, weather, soils, cultural practices and the like. Average yields for the Mudon site have not been conclusively determined. Pending the evaluation of the initial test plots during the first five to six years of the project, it is assumed that the first crop will yield 28 MT per acre followed by 12 MT per acre from the ratoon crop. 1/

The plants are removed and new stalks planted after harvesting the ratoon crop. After adequate seed stalk is developed and production is initiated on large acreage, the following three-year cycle yield will be used for evaluation.

1/ A ratoon crop is the sprout or shoot from the root of the plant after it has been harvested.

1. 25 MT per acre similar to Thailand

2. 40 MT per acre on acreage with all known agronomic improvements and special care

3. 54 MT per acre as the maximum practical level of production

These estimates will be revised as results from the initial variety and yield plots are evaluated. Based on information obtained from other production areas, the case yield per metric ton is initially estimated as 28.6 cases of 2-1/2 can size equivalent of the solid pack (slices, chunks, tips, spears) and juice pack. All known improved agricultural practices will be utilized in the early plot work. This will include but not be restricted to:

a. Optimum plant population

b. Optimum application of fertilizer

c. Effective weed and insect control

d. Variety trials of all known pineapple

e. Irrigated water to be applied as required for adequate plant development

In this project, two price levels have been assigned: $54 and at 10 percent less or $48.60 per MT delivered for processing and $63.21 per MT for delivery to fresh market. Other prices were also tested. The fresh market is higher because not all of the fruit will qualify. Processed pineapple makes use of all the product.

2. Mango (Mangifera indica L.)

The mango originated in the Indo-Burma region of Asia and has been known for over 4,000 years. It has been introduced in all tropical areas where the range in temperature is between 23.9 C 1/ and 26.7 C. Grafted trees take four to five years

1/ Degrees Centigrade

to fruit, seedlings somewhat longer. A major problem in growing mangos commercially is their tendency to become alternate year bearers, sometimes producing one good crop every four or five years. 1/

The mango is the most popular fruit in the Orient and other tropical regions of the world. The mango is very high in vitamin A and contains vitamin C roughly equivalent to that found in grapefruit (60 to 100 milligrams per 100 grams). It can be consumed fresh, frozen, canned, or in brine for chutneys. It is also canned or frozen as a single strength or concentrated juice. The mango is preferable in its fresh or frozen form, as it loses some of its flavor when thermally processed.

Estimates of yields are difficult to make because of the tendency of the mango to bear variable quantities of fruit in alternate years. Estimates of yields will also depend on the variety considered and the age of trees as well as agronomic, weather, and cultural factors. Average yields from plots and orchards in India, Hawaii, and tropical America indicate that yields of 5-8 MT can be expected from 10 year old groves 2/. When canned, the yield is approximately 35 cases of 2-1/2 can size equivalent per MT.

1/ This tendency can be offset to some degree by improved cultural practices. Also, alternate year bearing offers a good argument for processing in the "on" years.

2/ See, for example, Chandler, W.H. Evergreen Orchards, Lee and Febizer, Philadelphia, PA, 1958 and W. Popenoe, Manual of Tropical and Sub-Tropical Fruits, Univ. Microfilm, High Wycomb, England, 1934. Also Purseglove, J.W. Tropical Crops, John Wiley and Sons, New York, NY, 1968.

For this project, $214.43 per MT (K1,501) per No. 2-1/2 can size equivalents per MT of raw fruit has been assigned. Mango fruit production has been seriously hindered because of the Mediterranean fruit fly.

3. Rambutan (Nephelium lappacerim L.)

The rambutan is a native of the Malay archipelago (and, perhaps, Burma). It resembles the lychee in character and, like the lychee, is considered among the most prized of tropical fruits. The fruits are produced in clusters and each individual fruit is covered with soft fleshy spines one-half to three-fourths inches long. The fruit ranges from greenish-yellowish to crimson in color and the flesh is white, translucent, and juicy. It is similar to the lychee in texture and taste. Although customarily consumed fresh, the fruit is considered delicious when canned in a light syrup 1/. The rambutan can be frozen and stored up to two years without change in color or flavor. A mature stand (10 to 15 years) is alleged to yield an average of 4.5 MT per acre and to yield 40 cases of No. 2-1/2 can size equivalents per MT of raw fruit when canned. The rambutan will start to bear fruit three to five years after planting with yields continuously increasing for 20 to 25 years thereafter.

For this project, a price of $544 per MT (K3,808) has been assigned.

4. Mangosteen (Garcinia Mangostana L.)

This evergreen type of tree originated in the Malay Peninsula, and the Molucca and Sunda Islands. It is not known when it was introduced into Burma, but it is abundant in the

1/ Popenoe, W., Chandler, W.H. and Purseglove, J.W., op. cit.

markets of Rangoon and other southern Burma cities. It is strictly tropical and is well suited to the Mudon areas. However, the tree is said to be difficult to grow commercially and most of the fruit comes from scattered trees rather than from commercial orchards 1/. Nevertheless, the yields are reported to be substantial in good stands, ranging from 1,500 to 2,000 fruits per tree. Average yields for the Mudon area are estimated at 6.0 to 6.2 MT per acre. None is assumed to be canned. The tree will bear fruit within 7 to 10 years after planting.

The fruit is round, 3.75 to 5 centimeters in diameter, with a purple rind. The inner part of the fruit consists of between five and eight segments which Chandler describes as one of the world's most beautiful fruits. It has been proclaimed as having the best flavor among all tropical fruits, if not all fruits 2/. Popenoe ranks it above all other fruits of the Asiatic tropics.

The horticultural limitations of Mangosteen are:

a. Seeds reproduce characters only of the mother plant making development of superior fruit difficult

b. Delay in crop fruiting. Plants may take up to 15 years to produce sizeable crops

c. Plants bear only in alternate years

d. It is difficult to establish the plant in other than its natural environment

1/ Chandler, W.H. op. cit.

2/ Chandler, W.H. op. cit.

The mangosteen is generally consumed fresh, but it is sometimes used as a topping for ice cream or may be canned in syrup. Possibilities for freezing and/or canning mangosteen segments should be investigated as this project develops.

For this project, a price of $527.71 MT fresh, or K3,694 has been assigned.

5. Guava (Psidium guajava L.)

The guava is native to Central and South America, but has been introduced and widely grown in most tropical and sub-tropical countries. It is generally harvested in the wild state, which results in a lack of statistics on its production volume. The fruit is round and/or pear shaped, usually less than three inches in diameter. The flesh is white to salmon red and contains small hard seeds. The musky and pungent odor of the sweet flesh is not palatable to all people. The guava does, however, make excellent jams and jellies that have good markets in the United States and European Economic Community (EEC). It is often processed into juices and pulp as well as canned guava shells that are used as a dessert.

In this study, guava yields, based on University of Hawaii trials, are assumed to be 8 MT per acre 1/. Purees and nectars are all measured in terms of No. 2-1/2 can size equivalent cases.

For study purposes, a price of $48.43 per MT (K339) has been issued for fresh guava.

1/ Gerakis, A., and Calvin Lee, Profit Potentials in Hawaii's Guava: Feasibility of Expanded Fruit Juice and Fruit Drink Manufacturing in Hawaii, Department of Planning and Economic Development, State of Hawaii, February, 1974. Yields continue to increase up to approximately 15 MT per acre in the sixth year of cultivation, assuming a fairly intensive level of cultural inputs (fertilizers, pesticides, etc.).

6. Papaya (Carica papaya)

The papaya originated in tropical America and was first reported by Oviedo in 1513. The plant is now widely distributed in all tropical and semi-tropical areas of the world.

The plant is propagated by seedlings, will bear fruit about 12 months after planting, and will continue to bear for a period of three or four years after which the plants are removed and replanted with new stock. Fruit size varies in relation to variety, with commercial varieties such as the Solo that measure from 7.5 to 12.5 centimeters and weigh about 0.45 kilograms. Other varieties will grow to over 30 centimeters in length and weigh up to 9 kilograms. The fruits are yellow to salmon colored with a sweet musky flavor that might at first be objectionable to the novice. The fresh fruit is eaten at breakfast in much the same manner as is the cantaloupe in the United States. The fruit is used also in tropical fruit salads and cocktails and is highly digestible due to the presence of papain. The fruit can be made into a nectar where fruit acids are generally added to overcome its bland taste or the nectar can be used in combination with other fruit nectars or juices.

Because of its small size and uniformity, the Solo is a popular commercial variety. It is reported to yield an average of 20 MT per acre. Case yield for the solid pack will average about 37 cases of No. 2-1/2 can size equivalents per MT.

Virus and nematode are serious in most areas and spraying is necessary. High moisture and high nitrogen crop rotation are also recommended every few years.

For study purposes, $318 per MT (K2,226 per MT) has been assigned for papaya.

7. Passion Fruit (Passiflora edulis Sims, Passiflora edulis flavicarpa)

The passion fruit, of which there are around 400 different varieties, is native to tropical America. Like other tropical fruits described earlier, the passion fruit has been widely distributed throughout all tropical countries. It is also used in temperate zones as an ornamental.

The edible passion fruit (Passiflora edulis Sims) grows on a luxurious vine and has a short life of between five and six years. Although yields vary in relation to many variables, a good grove in Hawaii yields an average of about 10 MT per acre, although it may exceed 20 MT per acre in good years. For this report, it is assumed that passion fruit yields an average of 10 MT per acre and yields 13 cases of No. 2-1/2 can size equivalents per MT of raw fruit.

The fruit is oval, weighs about one ounce, and has a leathery skin (purple or yellow depending on variety). The flavor has been described as suggestive of citrus but with a floral accent. Because of its high acid content and uniquely penetrating flavor, passion fruit juice is usually combined with blander juices. The juice is normally processed by freezing, as heat processing causes flavor loss. The mixes or blends with passion fruit juice are becoming popular as mixes for exotic drinks of all types. No price schedule has been developed for this fruit.

8. Durian (Durio zibethinus)

The durian is found in Java, Sumatra, Celebes, Borneo and the Moluccas, and as far north as Mindanao in the Philippines. It is also common in the Malay Peninsula, southern Thailand, Burma, and other Southeastern Asian countries.

The tree reaches a height of around 2,400 centimeters and bears spherical shaped fruits that are 15 to 20 centimeters in diameter. The hard external shell is covered with hard pyramidal spines or tubercules that protect the fruit from insect and animal pestilence. The fruit has five oval compartments, each filled with a soft glutinous pulp that contains seeds about the size of chestnuts. The pulp and seeds are both edible, the latter of which are eaten in roasted form. The pulp has a sweet, mild, and unique flavor, accompanied by an odor that is offensive to outsiders who claim it is comparable to rotten onions or putrid animal tissue. There are some varieties, allegedly in Borneo, which have no objectionable odors 1/. Information regarding the adaptability of this fruit for processing has not been conclusively developed. The yield of durian fruit are assumed to be 10 MT per acre for purposes of this report. Because of its limited use, no price per metric ton was obtained.

9. Jackfruit (Artocarpus heterophyllus)

Jackfruit, a native of India, is a popular fruit in Southeast Asia, particularly in India, Sri Lanka, Burma, and the Malay peninsula. The trees grow to 2,010 to 2,100 centimeters tall and bear up to 250 fruits per tree that range in weight from 9 to 27 kilos each. Fruits up to 49.5 kilos have been recorded.

The jackfruit's fruit is usually disagreeable to non-natives, but is highly desirable to the indigenous population. The seeds are broiled or roasted and have a flavor like that of chestnuts. Like chestnuts, the seeds are also used as ingredients in many recipes. The jackfruit is not utilized to

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1/ Popenoe, W., op. cit.

any extent outside tropical Asia. The tree is a good source of lumber and also produces a valuable yellow dye. We did not include the fruit in our schedule because of its flavor. There is a limited market outside of Asia. The price per MT would be $47.13 (K330). No schedule has been developed for the production of this product as there is a limited market outside Asia.

10. Cashew (Anacardium occidentale)

The cashew is indigenous to the tropics of Central and South America. It was discovered in the 15th century by the Portuguese who took it to East Africa and India. The tree grows to a height of 1,200 centimeters in good soil and is important commercially for the nut it bears. The species is related to the American poison ivy and sumac and must be handled with great care during cultural, harvesting, and post harvesting activities. The nut has two walls, the outer of which is smooth, thin and somewhat elastic. The inner shell is harder and must be crushed like other nuts. Between the shells is a poisonous substance that will blister the skin. This substance finds valuable use as a lubricant and insecticide, and as an aid in the production of several types of plastics. With modern methods of processing, the nuts pass through revolving cylinders with perforated sides that revolve above well controlled roaster flames. The valuable oil between the shells drains through the perforated cylinders and is saved. The roasting process dispels all poisonous properties.

Although the cashew is common in the Mudon area, accurate measures of its yield are not available. The cashew is assumed to yield 5 MT of nuts per acre. The raw product is $882.00 per MT.

The cashew nut is shipped in hermetically sealed containers in which the air is replaced by carbon dioxide thus eliminating weevil infestation damage. Even though cashews were not specifically called for in the original study, this product should be considered if enough nuts can be grown or imported to be processed.

11. Other Products

Tropical fruit cocktail will be produced from various combinations of tropical fruits. Although not mentioned as products planned for the Mudon project, ginger and bamboo shoots offer excellent export possibilities and should be given attention as the project is implemented. Limes are consumed for drinks, seafood, fruits, and salad dressing. They grow well at low elevation near sea level. Due to low volume, limes were not included in the study.

V. AGRICULTURAL COMPONENT

A. Background

1. Historical

Some 50 million years ago, Burma was formed by the convergence of India and Asia. This huge plate of exposed earth slammed into Asia to form the Himalayas and adjoining mountain system evident today. This ancient mountain system, which runs in a general north-south direction in Burma and Thailand, drastically modifies the monsoon climate over the entire area. For example, the 5,000 to 6,000 foot Dauna and Bilauk Taung range, which forms the border between southern Burma and southern Thailand, is high enough to cause much of the monsoon downpours forming over the Adaman Sea to fall west of the range on southern Burma. This range makes the difference between lower Thailand's 38-48 inch annual rainfall compared to Moulmein's six month rainfall of 180-200 inches. The range, in blocking monsoon clouds from entering Thailand, provides various additional benefits for that area of that country. The main benefits for Thailand's successful pineapple industry have been the desirable annual rainfall and months of adequate sunlight and labor efficiency.

2. Geography

Limestone remnants observed en route to the site are among the last local pieces of a complete range of limestone sea deposit that once covered all of the region to a depth of possibly 1,000 to 3,000 feet. Lower Thailand has similar limestone remnants which cause problems for pineapple culture. Of course, all limestone formations visible today were formed beneath the sea during or prior to the Tertiary Period, then elevated to present location by plate movement sometime later.

The excessive alkaline soil composition pH, in the range of 6.0 to 7.7, results from the breakdown of limestone parent materials. The most virulent pineapple plant heart rot and root rot organisms (Phytophthora cinnamomi and P. parasitica) can be very destructive to pineapple in this pH range, especially during periods of excessive soil moisture.

3. Erosion

The 2,500 to 3,000 acre site selected by the Burmese officials is alongside a ridge of precipitous hills. Rapid runoff from this ridge must pass over the land selected for pineapple. Excessive rainfall from heavy downpours may cause severe erosion to destroy lower planted areas and the rapid runoff must be controlled as much as possible. Storm ditches should be built through plantings at frequent intervals to carry the huge volume of water. Maintaining the system will require many bridges infield. The attempt at runoff control, field roads, and sterile laterite out-croppings will occupy at least 30 percent of the site acreage.

B. Agronomic Considerations

1. Climate

Although Thailand is adjacent to Burma, the weather patterns are distinctly different. While western provinces in Thailand receive only 45 inches of rainfall, the Mudon/Moulmein area receives 194 inches of rain. There are 126 days of rainfall in Mudon compared to Thailand's 113-130 days.

Table 1 shows the average rainfall for six selected states in Burma and two adjacent provinces in Thailand. The climate variances are mainly caused by the monsoon rains that move into Mudon about May 15 each year and remain until October. Much of the rain falls as the clouds are forced up the mountain slope toward Thailand.

TABLE 1. FIVE-YEAR AVERAGE COMPARISON OF RAINFALL DATA, BURMA AND THAILAND, 1977-1981

Country/ Province	Annual Rainfall (inches)	Number of Days of Rainfall
Burma		
Mudon	183	125.8
Moulmein	201	
Thanbyzat	289	137
Rangoon	89	115.6
Akyab	150	115.6
Mandalay	33.9	50
Thailand		
Prachuab Kirikan	38.08	130
Chonburi	48.35	113

SOURCE: Foodstuff Industries, Rangoon, Burma.

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The heavy precipitation presents the most formidable challenge to producing high quality pineapple economically in the Mudon area. High nighttime temperatures in the spring and lack of sunshine are also factors in the development of ideal pineapple, i.e., quality, aroma, and sweetness. Additional climatic data can be found in Appendix A.

a. Rainfall. The amount of sunshine which falls on the growing plant is an important climatic factor in both plant growth and fruit quality. A very low percentage of sunshine, such as results from cloudy days, retards growth and results in small and poor quality fruit, particularly lacking in sugars and esters to an extent that this lowers the quality of pineapple in Thailand. 1/

1/ Collins, "Pineapple", pp. 134.

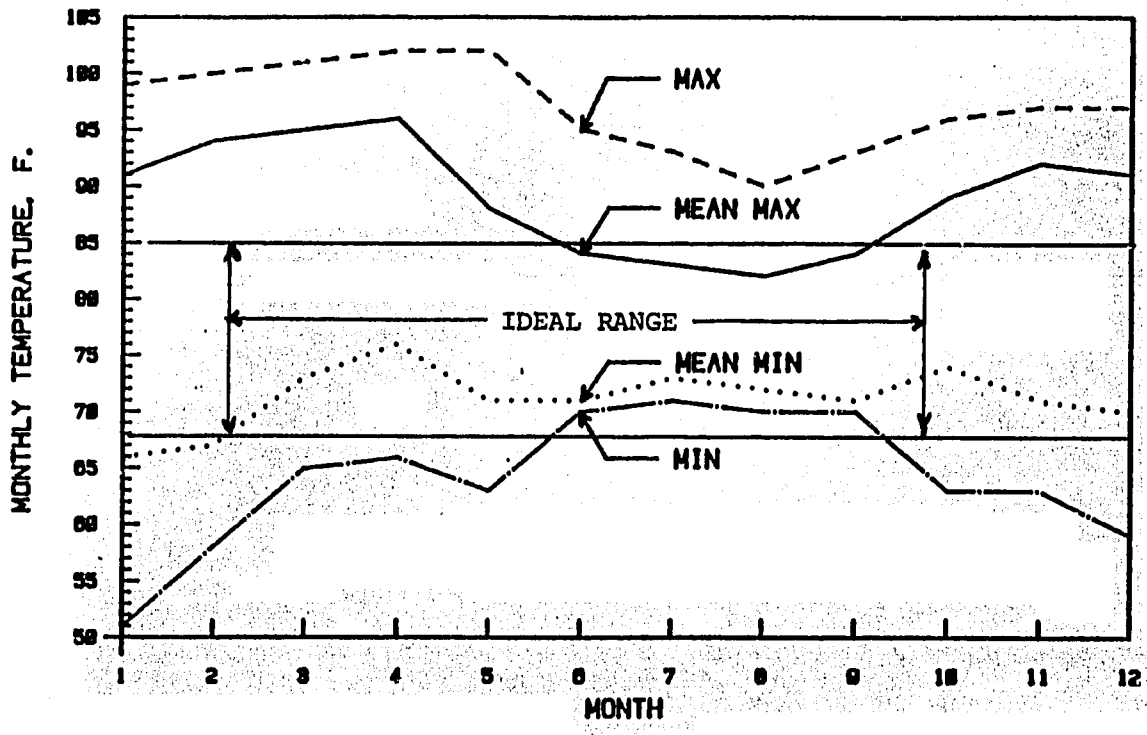
Rainfall over and above pineapple requirements disrupts or prevents all cultural efforts which must be performed on time. When continuity is broken due to excess weather of long duration, losses are great and irretrievable. All cultural operations commencing with land preparation cannot be performed during periods of rainfall. This rainfall, coupled with excessive night temperatures during the spring, prevents the production of pineapple plant slips and suckers. High humidity and night temperatures also produce the environment for numerous plant and fruit diseases as well as fruit physiological disorders which are formidable.

b. Temperatures. When the rate of respiration is such that the photosynthesis is being used faster than it is being made, the plant is in a state of metabolic imbalance. When temperatures are so high that respiration exceeds photosynthesis over a period of time, the plant is "operating in the red." Of course, a plant is normally in a state of some kind of imbalance most of the time. During a sunlit day when photosynthesis is proceeding, carbohydrates are manufactured faster than they are used. At night, carbohydrates are not made but are used in respiration and various growth processes. If a plant continues to use carbohydrates faster than they are manufactured over a long period of time, it will eventually deplete its reserves and die.

Nield and Boswell in 1976 stated that the ideal temperature for pineapple is 20 C to 30 C or 68 F to 86 F 1/. In Figure 1 it can be noted that during the harvest season the minimum mean temperatures average 72 F (22 C). The daily mean high temperature is 86 F or 30 C. During the harvest

1/ Degrees Fahrenheit.

FIGURE 1. MONTHLY TEMPERATURE IN MOULMEIN, BURMA 1976-1980



SOURCE: Burmese Government

season, the temperature is close to ideal; January temperatures drop to 52° F or (11° C), and April maximum mean temperatures are as high as 95° F (35° C). This off-season temperature is too high for pineapple and may result in a high rate of respiration which depletes carbohydrate reserves.

2. Production

Pineapple is grown in many areas of the tropics and subtropics, as seen in Appendix B. Although there is a steady growth in the production and consumption of pineapple products, currently there is excess production capacity. Areas such as Hawaii and Taiwan are phasing down their operations because of increasing land and labor costs. Thailand, which recently developed its pineapple industry, is utilizing only 40 percent of its processing capacity. Even so, more acreage is being planted (Table 2) and Thailand is becoming a major supplier to the

TABLE 2. PINEAPPLE--AREA PLANTED AND PRODUCTION IN THAILAND, 1967-1983

Year (October-September)	Area Planted	Yield Per Hectare	Production
	(hectares)	--------metric	tons------
1967-68	35,140	5.18	182,023
1968-69	42,252	4.37	184,753
1969-70	45,978	4.21	193,991
1970-71	63,062	3.84	242,489
1971-72	43,060	2.90	124,826
1972-73	87,251	3.65	318,789
1973-74	102,958	4.70	483,493
1974-75	148,837	5.40	803,720
1975-76	184,040	6.22	1,151,865
1976-77	220,000	5.89	1,295,850
1977-78	245,000	6.12	1,499,400
1978-79	275,000	5.60	1,540,000
1979-80	280,000	4.90	1,372,000
1980-81	298,750	5.60	1,673,000
1981-82 a/	302,000	6.04	1,824,080
1982-83 b/	325,000	6.15	2,000,000

a/ Estimated.
b/ Forecast.

SOURCE: Ministry of Agriculture & Cooperatives.
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United States. 1/ Cost and yield information was obtained from Prachuab Kirikhan Province in Thailand on 1980-81 results for comparative purposes to use in this report.

1/ The Office of Agriculture Industry Research, Agricultural Economic Division, Ministry of Agriculture and Cooperatives, and the Office of Agricultural Production Research provide data from the growers.

3. Variety

The Smooth Cayenne variety is considered the best for processing. This variety has a long cylindrical shape with a relatively thin skin so that the maximum recovery of sliced pineapple is possible. Others such as Red Spanish are common in the Caribbean area. Many other varieties are used for fresh market where size and shape are less critical. Major processors are constantly working on new varieties that will eventually replace present varieties.

In Burma, the major variety is the Kew. Although this variety of pineapple is inferior to Smooth Cayenne or selections in the industry, it can be used until other improved varieties can be introduced. Small replicated trials to study all possible selections should be initiated immediately to gain information as rapidly as possible. Trials need not be large or expensive to be effective and valuable.

4. Yields

Pineapple yields by growing areas vary from 7 MT per acre to 70 MT on a three-year crop cycle. The Philippine and Hawaiian yields of 60 to 65 MT are commonplace with irrigation, while the average yields in various provinces of Thailand are from 2.5 to 25 MT per acre without irrigation. Table 3 itemizes relative yields per hectare at several experimental stations. Thailand yields in Prachuab Kirikhan and Petchaburi Provinces used for each three-year cycle will be 25 or 40 MT, and 54 MT per acre respectively. Twenty-five MT per acre is higher than the average for Thailand where yield average is approximately 7 MT per acre (Table 2).

TABLE 3. LENGTH OF CROP CYCLE AND YIELD DATA FOR PINEAPPLE AT VARIOUS LOCATIONS IN THE TROPICS AND SUBTROPICS.

Location	Cultivar	Planting Material and wt.(g)	Date Planted	Months to Plant Crop: Forcing a/	Months to Plant Crop: Harvest	Months to Ratoon Crop: Forcing	Months to Ratoon Crop: Harvest	Density b/ (plants ha -1)	Yield, Plant Crop: Tons ha -1	Yield, Plant Crop: Tons Ha -1 Month -1	Yield: Plus Ratoon (tons ha -1)	Plant Crop Fruit wt(kg)	Reference
Nyombe, Cameroun	Cayenne	suckers 350	3/1966	6 (A)	11			61,500	98.4	8.94		1.60	Gaillard, 1970
Pekan Nenas, Malaysia	Singapore Spanish	slips	7/1964	10 (A)	15-17	Var.	Var.	71,729	59.4	3.71	89.9	0.95	Wee, 1969
Buenos Aires, Costa Rica	Montelira	suckers	7/1969	13 (NAA)	20			53,280	103.4	5.17		1.94	Romero et al., 1973
Rio Piedras, Puerto	Red Spanish	slips	11/9156	n.d.	n.d.	n.d.	n.d.	23,100	45.4		74.1	n.d.	Samuels and Gandia-Diaz, 1960
Rio Piedras, Puerto Rico	Cayenne	slips	11/1956	n.d.	n.d.	n.d.	n.d.	23,100	73.9		117.7	n.d.	
Yeppoon, Australia	Cayenne	slips	9/1967	8 (BOH)	16-17	21	28-29	36,000	59.4	3.60	108.2	1.65	Jorgensen, 1973
Wahiawa, Hawaii	Cayenne	slips	8/1958	14 (BOH)	23	28	36	43,000	101.5	4.41	188.2	2.36	Pineapple Research Institute unpublished data
Toulin Expt. Sta., Taiwan	Cayenne	slips	8/1958	16	23	n.d.	40	44,444	64.8	2.82	134.5	1.62	Su, 1949
Thika, Kenya	Cayenne	crowns	4/1959	n.d.	22-30	n.d.	51	24,829	30.8	1.18	61.8	1.97	Evans, 1957
E. London, S. Africa	n.d.	n.d.	n.d.	n.d.	24-36			33,839	24.4	0.18		n.d.	Strauss,
Malkerns,	Cayenne	crown	3/1959	22	32	32	n.d.	56,800	84.2	2.63	152.7	1.68	Dodson, 1968

a/ Forcing agent: NAA, napthaleneacetic acid; A, acetylene; BOH, -hydroxyethylhydrazine; n.d., no data given.
b/ Where more than one treatment was reported, only the highest densities and yields are given.

SOURCE:

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C. Plant Requirements

For purposes of this study, an assumption is made that a small tropical fruit plant to initially process available raw products for canned goods and fresh sales will be built at Mudon. The purpose of this plant would be to gain experience in production and marketing and to verify the assumptions that have been made.

If research results show pineapple production is feasible, the larger pineapple plant will be built in year seven east of Mudon on the large corporation farm (3,000 to 4,000 acres). It will require seven years to obtain adequate volume to start one shift at this plant. By year 10, it will be at full production.

Acreage requirements at three different, three-year cycle levels are:

Yield MT	Acres
25	5,909
40	3,700
54	2,750

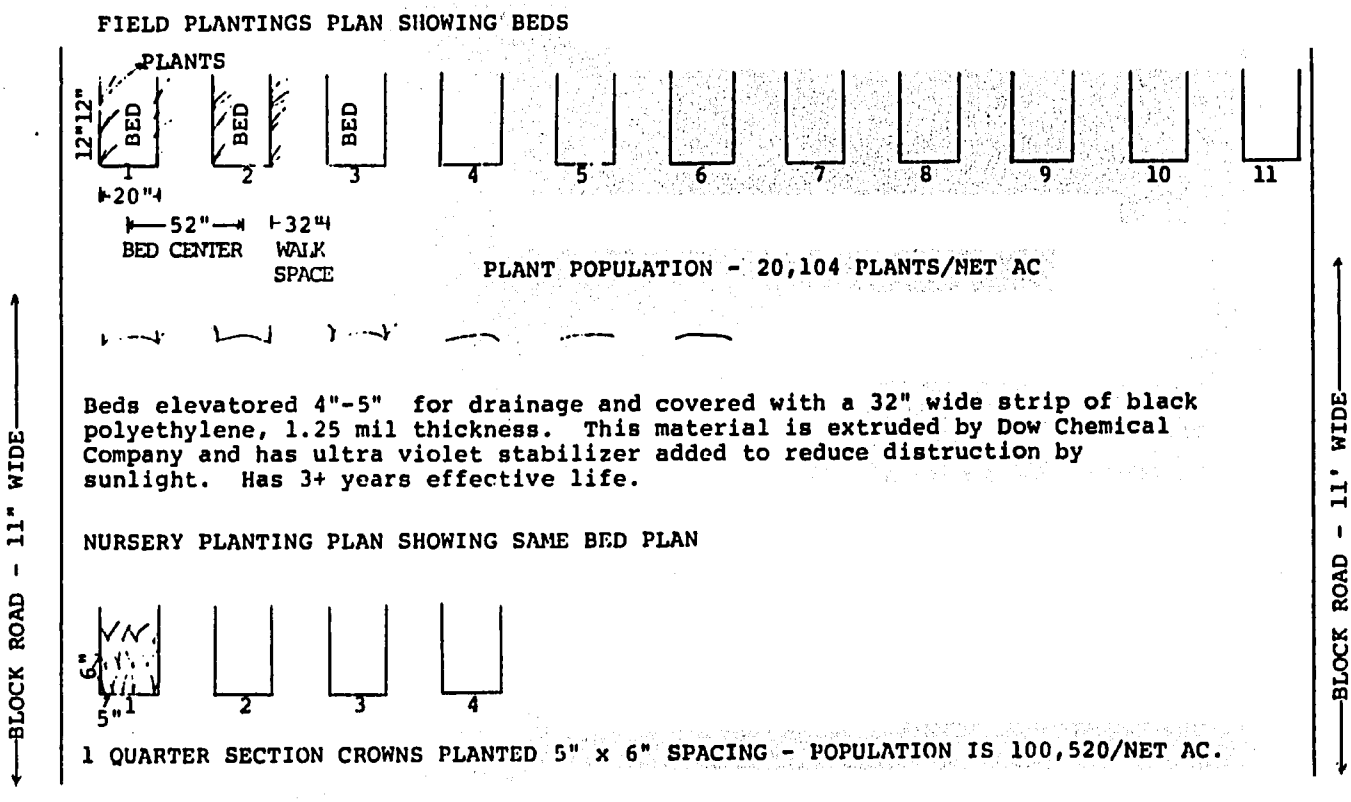
The can plant will be built in Pegu in the first year to supply cans to all Burmese processing units that can utilize available can sizes. Without reduced can costs, the pineapple project would not be feasible.

The cashew nut plant could be built separately in the Mudon area as soon as adequate supplies of cashew nuts can be developed in Mudon and other areas where hauling charges do not become excessive. The product will be placed in a polybag rather than a square can. Raw product cost must be evaluated at the time to see if the proper return in processing can be made.

D. Cultural and Planting Practices

After the fields have been thoroughly prepared, the stalks (seeds) are planted on a five-inch raised bed in two rows 32 inches apart on 55 inch centers (Figure 2). Recommended planting rates are 20,104 plants net per acre. For weed control, the use of a 32 inch wide strip of special polyethylene plastic will be used. The plants are then pierced through the plastic. This plastic has ultraviolet stabilizers to reduce the destruction by sunlight. The use of this material also prevents erosion and the loss of fertilizers when heavy rain occurs. The cost of this material from Dow Chemical is $75 per roll. Two rolls per acre are required or $150 per acre (1,050 Kyats per acre or 1,380 Bahts per Rai).

FIGURE 2. PROPOSED PLANT BLOCK FOR PINEAPPLE



SOURCE: Experience, Incorporated based on Industry Contacts

1. Fertilization

It is recommended that 850 pounds of fertilizer be applied as needed over the three-year cycle. The fertilizer formula should be nitrogen 16, phosphorous 4, potassium 16, and manganese 8 (16-4-16-8). The current cost to Rangoon is quoted at $947 per MT delivered with a 3 percent reduction for larger volume accounts. The total cost of fertilizer for the three-year cycle will then be US$358 per acre (2,457 Kyats per acre or 3,228 Bahts per Rai).

It is essential that early comparative plot work be vigorously pursued to develop the optimum fertilization requirement in each area.

2. Weed Control

Weed control is dependent upon local weather conditions. As mentioned earlier, the extremely wet weather conditions in the Mudon area for half of the year probably will entail excessively high weed control costs.

For purposes of this analysis, 32 inch polyethylene from Dow Chemical has been recommended which will moderate to some extent the effect of the wet condition. In addition, an aggressive spraying program as recommended by the DuPont Company of Wilmington, Delaware is shown in Table 4.

It is strongly recommended that detailed plot work be established immediately to determine the optimum weed control practices.

TABLE 4. PINEAPPLE SPRAYING PROGRAM

Treatment	Timing	Amount/ Material	Cost per pound	Total Material Cost
			--------US dollars--------	
First	After mulch	24 pounds hyvar at three pounds per acre	11.80	35.40
Second	Three months later	Two pounds Karmex per acre	5.30	10.60
Third	Twelve months later	Two pounds Karmex per acre	5.30	10.60
Fourth	After first harvest	Three pounds Karmex per acre	5.30	15.90
Total US$ Per Acre				72.50
Total Kyat Per Acre				508
Total Baht per Rai				667

SOURCE: DuPont Company.

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3. Insect Control

Mealy bugs and ants are the most common insect problems in the growing of pineapple. This may require overall treatment as well as spot treatment.

The DuPont Company recommends a budget of 1.8 pounds of Diazinon per acre spread over the three year period. At $5.00 per pound, this results in a cost of $27.00 per acre for the three-year cycle (189 Kyats per acre or 248 Bahts per Rai). Again, experimental work should be carried out to determine the optimum level.

4. Soil Tests

a. General. Eight soil samples were brought to the United States for analysis and the results are shown in Table 5 and Appendix C. Evaluation of soil samples on site found that although quite varied, they were generally deep, well drained, and of sandy loam-fine sandy loam to silt loam in classification. It is a characteristic trait of tropical soils to be highly leached and acidic, and the laboratory analyses bore out the field evaluations.

TABLE 5. PARTICLE SIZE ANALYSIS RESULTS

Sample ID	Sand	Coarse Silt	Fine Silt	Very Fine Silt	Clay	Textural Class Name
	----------percent----------					
1001	55.651	14.241	12.211	2.081	15.871	Sandy Loam
1002	79.761	3.521	4.541	0.500	11.681	Sandy Loam
1003	68.531	8.601	7.081	1.011	14.781	Sandy Loam
1004	67.541	6.0971	6.571	2.021	17.801	Sandy Loam
1005 a/	48.201	5.171	9.311	2.581	34.741	Sandy Clay Loam
1006	58.571	5.171	13.431	3.101	19.731	Sandy Loam
1007	58.711	5.661	12.871	3.611	19.151	Sandy Loam
1008	60.681	7.131	10.701	2.031	19.461	Sandy Loam

a/ 42.5 percent of this sample was composed of rock greater than 2 MM in diameter. The analysis was run on the material that passed a 2 MM sieve.

SOURCE: University of Nebraska.
4200A

b. Soil Analysis. Sample 1 is an example of a layer noted to be lighter in color and less permeable. The lab analysis showed it to be of the same general soil type (sandy loam) as the rest of the sample, but the sand percentage was 15 points

lower. These strata present potential problems in the form of relatively impervious layers and will require deep ripping operations to maintain a viable root zone.

Sample 5 was taken near the highest point proposed for tree crop production, and although the lab analysis indicates it is sandy clay loam, it would be considered gravelly clay which is the poorest of soils and should be developed last.

c. Soil pH Value. The soil pH values are quite low. Acidic soils are desirable for pineapple production, but these particular samples appear borderline. The organic matter content is good and on the nursery site very good. However, the fertility level in all these soils is very low, and any recommendations with regard to fertilizer applications should reflect this. Residual nitrogen was undetectable in all samples, which points to a potential problem. Because of heavy rainfall for six months and the relatively sandy nature of the soil, nitrogen will be leached out in large quantities every year. Recommendations for nitrogen application will have to be increased in order to reach production levels anywhere near maximum.

E. Irrigation Analysis

1. Background

It is very unusual to be so concerned over excessive rainfall over a six-month period of time and also to be confronted with a serious shortage of moisture during the remainder of the year.

The need for irrigation arises from the crop demanding more water than can be supplied from storage in the soil or rainfall.

Although Mudon has a very high total annual rainfall (Table 6), much of the rain is received during a six month period with dry conditions throughout the other six months.

The decision to irrigate is based upon production economics and appropriateness of technology, but other benefits exist. Not only will yields improve under irrigation, but so will reproduction rates (for new seed generation), quality, and disease resistance. It is anticipated that the latter three factors will be problematic in the early stages of fruit production. Other benefits are:

a. Improve plant vigor and reduce susceptibility to disease (especially mealy bug wilt)

b. Year around planting of material of all sizes

c. Reduce time from planting to harvest

d. Increase percentage of floral differentiation 1/

The ultimate decision of whether or not to irrigate is an economic one. In order to make that decision, the tradeoffs between the value of increased production, due to irrigation, and the increased cost of that production must be determined. The value of increased production is the product price of the crop produced and the additional production attributable to irrigation. With each type of irrigation system considered, it is necessary to consider not only the economics of the type of system, but the appropriateness of the technology involved in using the system. Whereas sophisticated irrigation systems such as drip may be both economically feasible and technologically appropriate in Hawaii, such may not be the case elsewhere.

1/ Py, et al. (1965).

TABLE 6. WEATHER DATA, MOULMEIN

Month	Max. Temp.	Mean Max. Temp.	Mean Min. Temp.	Min. Temp	RH 1830	ETP a/	Kc b/	ETA c/	Rain	Deficit d/
	--degrees fahrenheit--								---inches---	
Jan.	99	91	66	51	56	5.7	0.41	2.3	0.0	2.3
Feb.	100	94	67	58	57	5.9	0.35	2.1	0.0	2.1
Mar.	101	95	73	65	65	7.0	0.27	1.9	0.2	1.7
Apr.	102	96	76	66	67	7.5	0.27	2.0	2.4	(0.4)
May	102	88	71	63	82	6.8	0.29	2.0	24.6	(22.6)
June	95	84	71	70	91	5.5	0.30	1.6	31.7	(30.1)
July	93	93	73	71	92	5.3	0.31	1.6	41.5	(39.9)
Aug.	90	82	72	70	93	5.7	0.32	1.8	44.7	(42.9)
Sept.	93	84	71	70	91	4.9	0.32	1.6	17.2	(15.6)
Oct.	96	89	74	63	80	5.8	0.35	2.0	7.0	5.0
Nov.	97	92	71	63	64	5.8	0.38	2.2	0.3	1.9
Dec.	97	91	70	59	61	5.8	0.44	2.5	0.0	2.5

a/ Based on Radiation/Temperature Method.
b/ The Culture of Pineapples in Guinea, Pineapple Research Institute of Hawaii.
c/ ETA = Kc x ETP
d/ Deficit = Rain - ETA ( ) indicates excess.

SOURCE: Hargreaves, G. H., 1977. World Water for Agriculture, U.S. Agency for International Development, Utah State University Press. Py, C. et al, 1965.

2/4448A

The evaluation of pineapple as a major tropical fruit to be processed in Burma was taken into consideration in analysis of an irrigation system.

2. Pineapple Response to Irrigation

a. Background. Pineapple is a unique plant both in how it collects water and how it utilizes water. It can and does collect water from the air e.g., dew, precipitation, or sprinkling by water which runs down the leaves to the leaf axil into root hairs located in the axil. This phenomenon makes sprinkling methods more advantageous.

The stomatal response of pineapple is counter to normal plant stomatal behavior. It has been described as having xerophytic and sclerophyllous characteristics. For example, pineapple closes its stoma in intense light and heat and therefore uses less water during the day than at night. This response, while conserving water, has some undesirable results. One is high leaf and fruit temperatures which result from incident radiative energy heating and no evaporative cooling. 1/ Most plants protect themselves under such conditions by transpiring greater quantities of water and cooling themselves by the evaporation of water. Since pineapple does not do this, the temperature of the fruit can get near boiling. When walking in a pineapple field under these conditions the fragrance of cooking pineapple is quite noticeable.

Because of the unusual nature of pineapple, its water use is a fraction of most plants' use. The crop coefficient, K_c, shown in Table 5 varies from 0.27 to 0.44 and averages about 0.33. The standard rule in irrigation practices for pineapple

1/ Cooksey, 1982.

applies one inch per month in areas where rainfall averages 2.5 centimeters (one inch) per month. Total use is therefore about 5.1 centimeters (two inches) per month.

b. Yield Response to Irrigation. Crop response to irrigation is measured in terms of yield and depends upon the percentage of irrigation water to total water used by the plant and the timing of the application. Yields for Thailand are shown in Table 2. These yields are low and reflect average Thai conditions. 1/

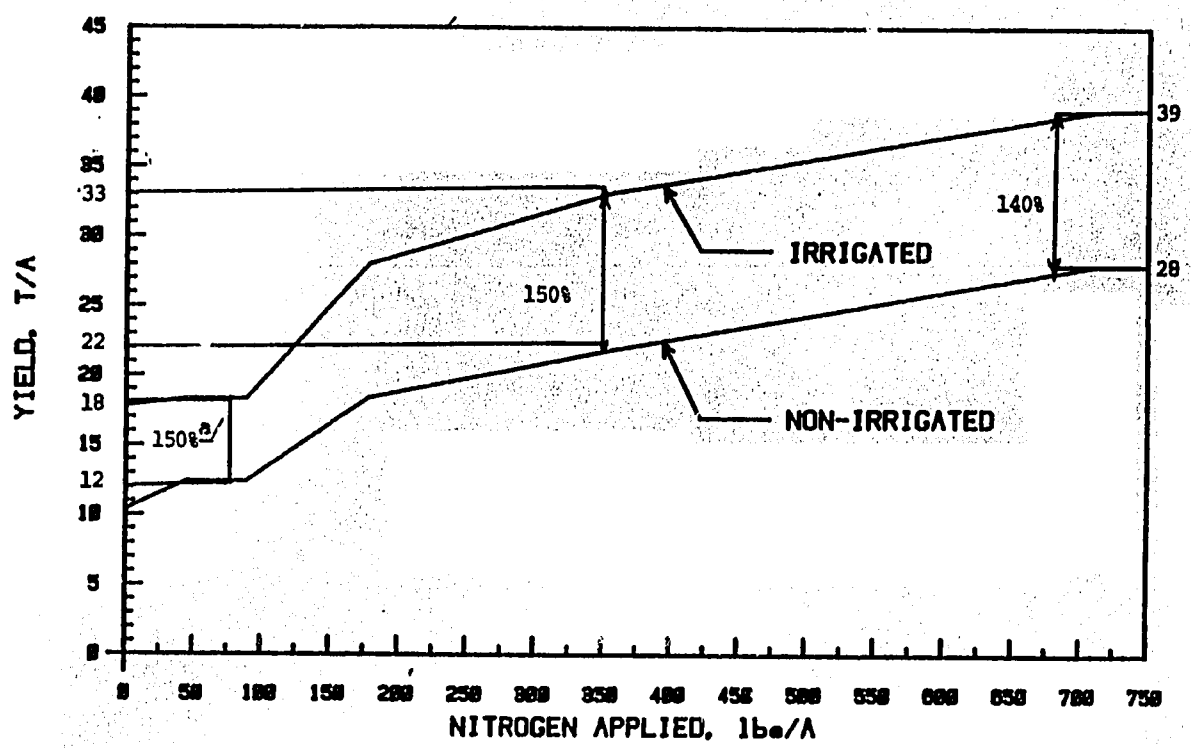
Pineapple yield response to water is not well documented, but the unirrigated conditions of Thailand can be taken as representative of the low end of non-irrigated yields. Hawaiian yields represent the high end of irrigated yields and reflect rather sophisticated agronomic practices. Singh, et al. in the process of performing nitrogen response tests as shown in Figure 3, showed a ratio of approximately 1.5 for irrigated versus non-irrigated pineapple yields.

3. Irrigation Systems Suitable for Pineapple

Pineapple is grown in field units of 100 to 120 feet in width with travel lanes between to allow for passage of spraying and handling equipment. The nursery area, where the first production of pineapple will be, is nearly flat and contains sandy soils. These two factors would make it necessary to apply two to three inches of water per irrigation while only one inch per month is needed on the balance of the plantings. Although the quantity of water is probably not limited, over-irrigation of sandy soils leads to nitrogen leaching and is incompatible with the very high level of nitrogen needed for good pineapple production.

1/ Doorenbos (1979) estimates commercial production yields at 75 to 90 MT per hectare (HA) (33 to 40 tons per acre), and Cooksey estimates that Hawaiian yields are 40 tons per acre for plant crop and 30 tons per acre for ratoon crop.

FIGURE 3. YIELD RESPONSE TO NITROGEN, INDIAN GIANT KEW PINEAPPLE



a/ percent increase in yield due to irrigation, Experience, Incorporated

SOURCE: Appendix D.

a. Unacceptable Systems. Several systems were found inappropriate for use in Burma based on prevalent agronomic conditions.

(1) Portable Set Systems. Portable set systems are inappropriate within the field units as the crop is densely planted in rows and is difficult to walk through (especially across rows).

(2) Surface Systems. Surface systems, other than furrow, are inappropriate because of the lower water requirement, necessity for drainage during the rainy season, and planting in rows.

(3) Automatic Mechanically Moved Systems. Automatic mechanically moved systems are not amenable due to the configuration of the land at the Mudon site and the low irrigation requirement.

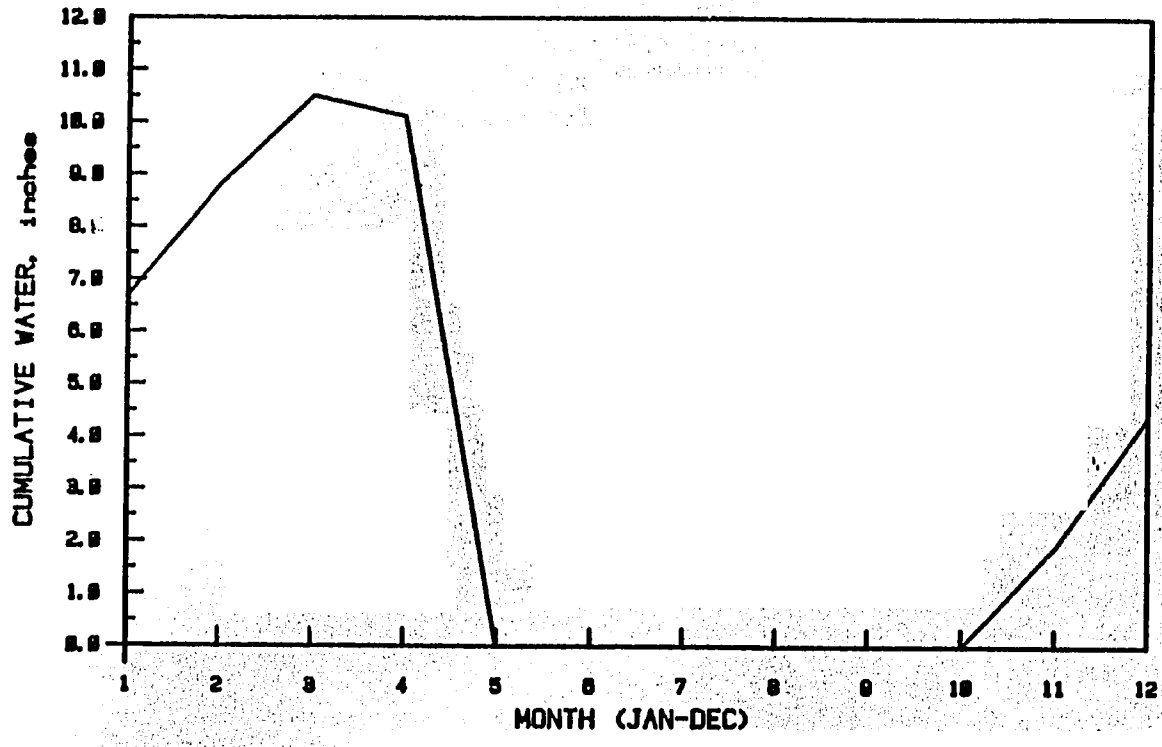
(4) Drip Irrigation. Drip irrigation requires very high technology. The water must be carefully filtered and would require chemical treatment to prevent clogging due to organic growth in this tropical location. Drip systems are expensive and require expert management and, for these reasons, are infeasible and inappropriate.

b. Traveling Gun. The hard hose traveling gun system was judged most feasible for irrigation over the cable tow machine where 40 percent of the cost is the hose which has a two-year life and cannot be field repaired. This system is based on the following analysis:

(1) Crop Needs and Soils. The irrigation system must be capable of supplying the crop water needs which [illegible] represented by the irrigation deficit shown in Table 6 and Figure 4. The greatest monthly deficit occurs in December when the deficiency is 2.5 inches with a total deficit over the five months of 10.5 inches. These soils typically hold available water of about 1.25 inches per foot in the three foot root zone so that when full, the zone holds 3.75 available inches of water. When the irrigation deficit period begins to occur, it is virtually certain that the root zone will be full. Therefore, the irrigation system must supply about 10.5 inches of water in five months.

A system capacity of 200 gallons per minute (gpm) on 200 acres (1 gpm per acre) will deliver an equivalent of 0.053 inches per day of water over the entire 200 acres. This amounts to 1.59 inches per month and 7.96 inches in the five-month period. Thus, the capacity of 1 gpm per acre will meet crop demand. The application rate under a traveling gun system at 200 gpm is compatible with the sandy loam soil.

FIGURE 4. SEASONAL IRRIGATION DEFICIT OF PINEAPPLE, MOULMEIN



SOURCE: Appendix A

(2) Water. No water treatment is necessary in use of the traveling gun system, and it can be from either surface storage or a groundwater well.

(3) Application and Frequency. The system capacity recommended is designed to apply approximately 1.5 inches per application and to be irrigated once per month.

(4) Water Source and Pumping Plant. The water for the irrigation system is assumed to be available at the field. No data are available on the costs of source development, and no design is presumed herein. If the capital costs of water development are not otherwise accounted for, they could well equal those of the irrigation system (for the remainder of the report, cost of dam, bridge, and well have been included in parenthesis). A factor of double the equipment cost has been used but may be less due to the lower Burmese labor costs.

(5) Capital Costs. Capital costs of hard hose travel sprinkler irrigators (an Ag Rain Model 3250 made in Havanna, Illinois was used-Appendix E) would be US$26,000 delivered to Mudon. This system would cover 200 acres for an annual depreciation and interest cost of about US$47.19 per acre per year, at 10-year life, and 15 percent interest. (Under Burmese conditions, the depreciation cost will be $25.74 per acre including dam, bridge, and well. The interest at 5 percent will be $7.15 per acre for a total of $32.89.)

(6) Operating Costs. Under United States conditions, operating costs are estimated to be US$25 per acre per year. ($1.50 per gallon diesel fuel). Labor is estimated at US$5 per acre per year. (Under Burmese conditions, state fuel at $0.34 per Imperial gallon fuel and with reduced labor cost, the operating cost would be $4 to $5 per acre. Labor is estimated at K2.38 or US$0.40.)

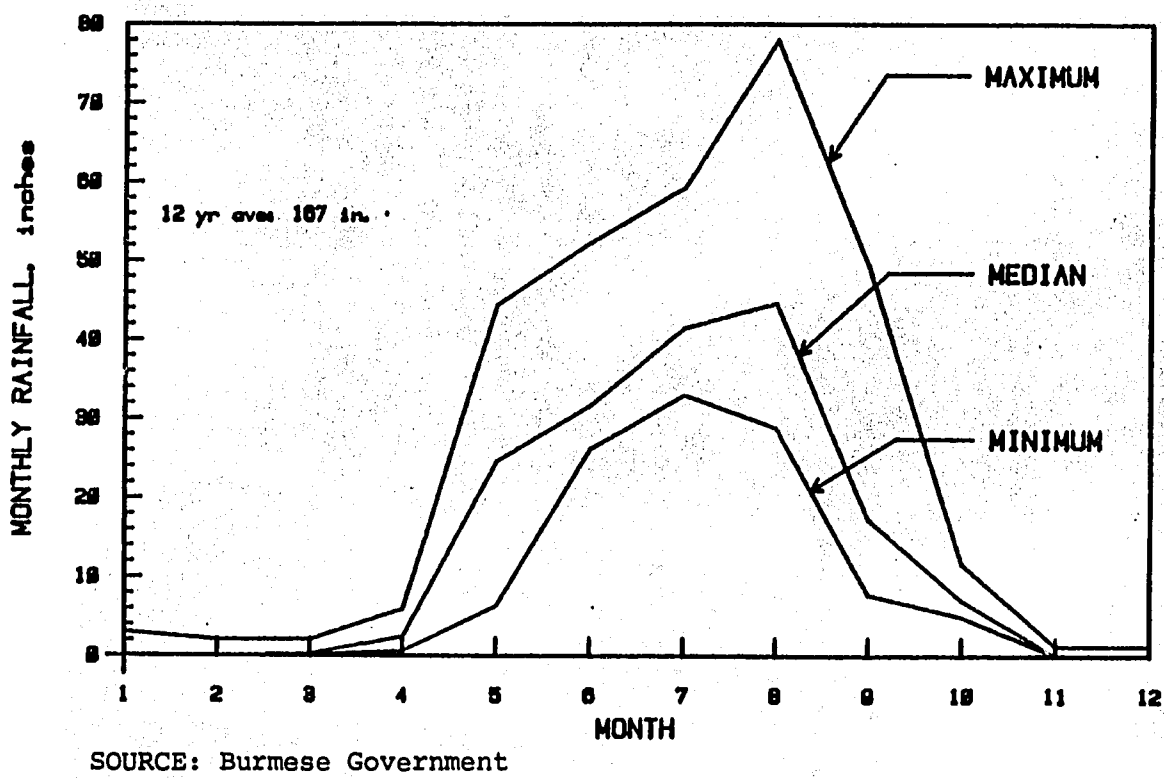
(7) Total Operating Costs. In the United States, total operating costs are the sum of annual depreciation and interest costs plus operating costs or about US$72 per acre per year. (Under Burmese conditions, the cost will drop to about $36 per acre or K252.)

(8) Break Even Yields. Based on United States costs, using current Thai prices of 4 cents per 2.2 pounds of fruit as in-field price levels before harvesting and hauling (US$36 per ton, US$41 per MT), the break even incremental yield is 1.4 tons per acre per year. Even at the lowest Thai yield of 3 tons per acre, the incremental yield (based on the 1.5 ratio of Singh) of 1.5 tons per acre per year is acceptable. This means under the worst conditions of yield, irrigation of pineapple is economically feasible. (Under Burmese conditions, the break even yield costs drop to one ton or less.)

(9) Fertilization. Because of the basic non-uniformity of application and the need for irrigation only five months of the year, it is not recommended that nutrients be applied with irrigation water.

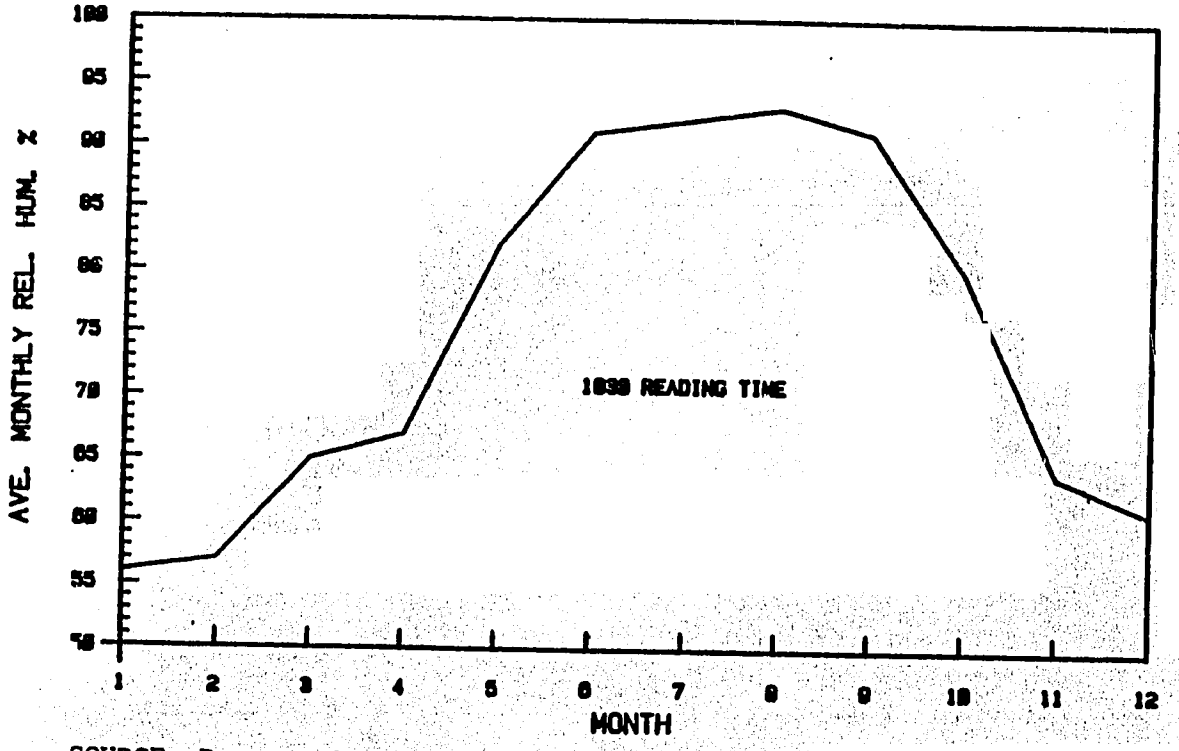
(10) Site Climatic Data. As shown in Table 6, temperatures do not reach extremes of over 100° F. Monthly rainfall (Figure 5) is very variable with five months of virtually no rainfall and five months of rainfall over an inch per day with relative high humidities (Figure 6). These data illustrate the probable need for irrigation in the dry months even though annual rainfall is high. As a comparison, the seasonal rainfall for Bangkok is shown in Figure 7.

FIGURE 5. MONTHLY RAINFALL IN MOULMEIN. 1968-1979 AVERAGE



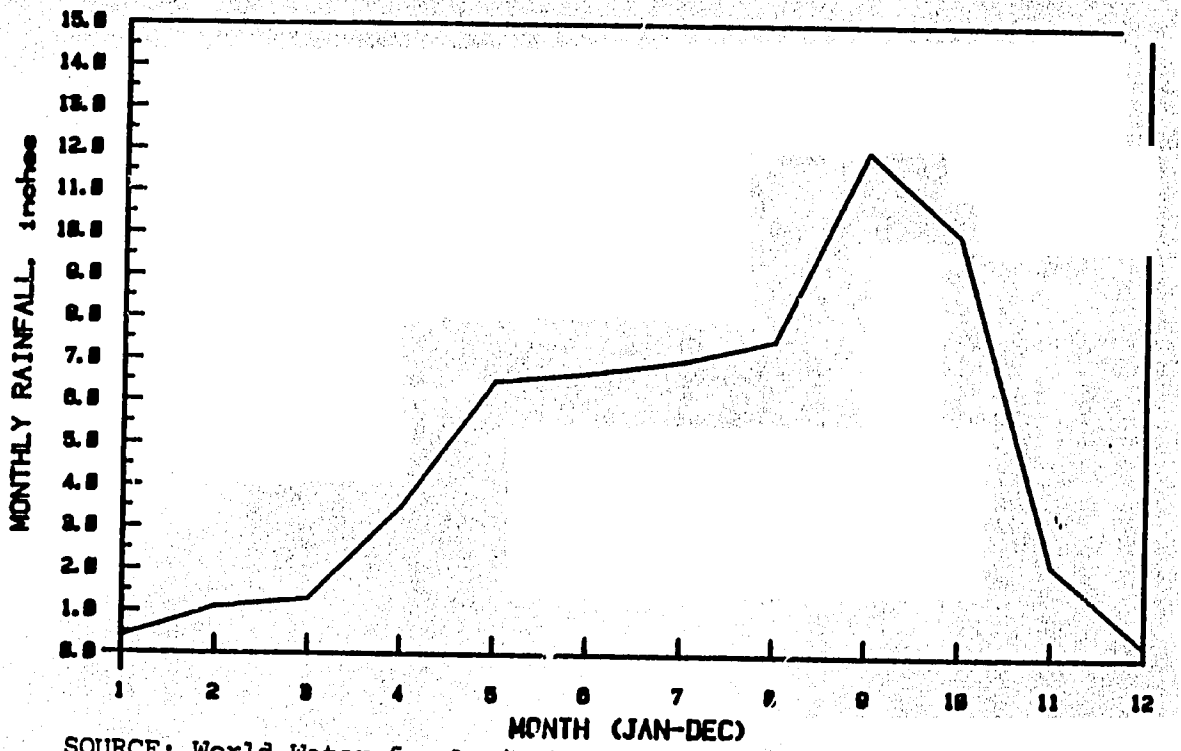
SOURCE: Burmese Government

FIGURE 6. MONTHLY RELATIVE HUMIDITY, MOULMEIN, 1976-1980



SOURCE: Burmese Government

FIGURE 7. MONTHLY RAINFALL IN BANGKOK



SOURCE: World Water for Agriculture

F. Harvesting

Harvesting begins 18 to 24 months after plant growth and the ratoon crop is harvested one year later, depending upon the temperature zone involved. Normally, the fruit is removed from the plant and transported to the truck bins by conveyors. The trucks or wagons are driven between each pineapple block to prevent damage (Figure 2).

Because of the heavy rains in the Mudon area, it is felt that the harvesting conveyor cannot be used. Therefore, small tractors and wagons equipped with large four-ton pallets will be used to collect the pineapple. The pallets will then be transferred to semi-trucks by a forklift tractor for final movement to the plant.

G. Equipment Requirements

1. Agricultural

In Table 7 the units and cost of the minimum equipment and parts requirements are itemized for 2,750 and 3,700 acres, respectively. The difference between 2,750 and 3,700 acres is the additional cost of irrigation equipment. Annual equipment costs are based on ten year depreciation and 10 percent salvage value at the end of the period. Irrigation costs for wells, dams, and bridges are included by doubling the cost of irrigation equipment.

To reduce the total amount of purchased capital equipment, every effort should be made to rent equipment that is not used during the 75-day period. This is especially true of wagons, small tractors, road graders, and bulldozers. In the analysis, it is assumed that local small tractors to pull wagons will gradually become more available each year, so that by year seven, there will be enough units available for rent or from other enterprises.

TABLE 7. TOTAL AGRICULTURAL EQUIPMENT REQUIRED FOR COMMERCIAL PINEAPPLE PRODUCTION, MUDON, BURMA (660 MT PER DAY FOR 75 DAYS)

		Unit Price	Percent	Parts	Total Required
		(US dollars)		---US dollars---	
2	65 HP tractor	24,000	50	12,000	72,000
3	30 to 40 HP tractor	15,000	20	3,500	54,000
1	36 inch disk plow	7,500	50	3,750	11,251
1	14 inch disk harrow	15,000	50	7,500	22,500
1	Bulldozer	195,000	50	97,500	292,500
1	Road grader	137,000	50	68,500	205,500
1	3 row bedder	10,400	50	5,200	15,600
38	4-wheel wagons	7,500	23	1,725	350,550
1	1,000 liter sprayer	8,600	50	4,300	12,900
3	Knapsack sprayer	190	20	38	683
1	Forklift tractor	50,000	50	25,000	75,000
150	Pallet/made in Burma	22,500	--	--	22,500
TOTAL (Prior to Irrigation)					1,134,984
	Irrigation equipment 3,700 acres	481,000	10	48,100	530,992
	Well, bridges and dams	--	--	--	530,992
GRAND TOTAL 3,700 ACRES					2,196,968
	Irrigation equipment 2,750 acres	357,500	10	35,750	393,250
	Well, dams and bridges	--	--	--	393,250
GRAND TOTAL 2,750 ACRES					1,921,484

Ten Year Depreciation Schedule with Ten Percent Salvage - Five Percent Interest

	2,750	3,300
Total Capital	US$1,921,484	US$2,196,968
Less 10 percent	192,148	219,697
Remaining value	1,729,336	1,977,271
Annual Depreciation	172,934	197,727
x 3 per cycle	518,802	593,181
÷ 2,750 $ per acre	188.66= ÷	64.13
x .4 = dollars per Rai	75.46	64.13
x 23 = Bahts per Rai	1,736 a/	1,475 a/
Kyats per acre	1,321	1,122

Continued . . .

TABLE 7. TOTAL AGRICULTURAL EQUIPMENT REQUIRED FOR COMMERCIAL PINEAPPLE PRODUCTION - Continued

	2,750 acres		3,700 acres
Equipment Interest Charge			
Average Value 10 year	$960,742		$1,098,484
Value x .05 percent interest	48,037		54,924
x 3 = interest per cycle	144,111		164,773
÷ 2,750 = dollars per acre	52.40	÷ 3,700	44.53
x .4 = dollars per Rai	20.96		17.81
x 23 = Bahts per Rai	482		410
Kyats per acre	366		312

SOURCE: Experience, Incorporated.
4200A

2. Other

In the central factory shop, all departments will have the use of the tools for repair and maintenance.

The cost of the tools is estimated to be $55,000 plus $15,000 for shipment, for a total of $70,000 or K490,000. The purchase of the tools could be spread over three years as follows: first year, $40,000; second year, $15,000; and the third year $15,000.

H. Comparative Labor Rates

It is difficult to compare labor rates between countries precisely because of minimum wages, medical care, housing, vacation, etc. Table 8 compares labor rates between Burma and Thailand. 1/ The nonskilled, semiskilled, and skilled

1/ Foodstuff Industries of Burma and Board of Investment, Bangkok, Thailand.

TABLE 8. COMPARATIVE LABOR RATES BETWEEN BURMA AND THAILAND

Job Classification	Burma a/		Thailand b/		Percent Over Burma
	Kyat Per Month c/	Dollars Per Hour	Baht Per Day d/	Dollars Per Hour	
Nonskilled	170-209	0.13-0.15	40-50	0.22-0.27	69-80 c/
Semiskilled	210-333	0.16-0.25	50-60	0.27-0.32	69-28 c/
Skilled	195-420	0.14-0.31	90-100	0.48-0.54	28-74
Skilled Mechanic	320-440	0.29-0.32	80-90	0.43-0.49	48-53
Foreman	320-440	0.23-0.42	80-96	0.43-0.49	81-17
Agriculture Supt d/	500-700	0.37-0.52	125-150	0.67-0.81	81-56
Manager	800-1,000	0.59-0.74	5,000/ month	1.13 --	91-52

a/ Burma provides medical and residence.
b/ Thailand has a minimum rate for Bangkok and Central Thailand at 54 Bahts per day (equal to 6.75 Bahts per hour).
c/ Foodstuff Industries Burma. Most of the agricultural workers will be nonskilled and semiskilled and a 35 percent lower labor rate in Burma would be conservative.
d/ Dr. Frankel, Bangkok, Thailand. Key Indicators of Thailand 1981. Estimated.

SOURCE: Foodstuff Industries and calculations based on industry figures.

4200A

classifications vary from 28 percent to 80 percent higher in Thailand. Semiskilled agricultural labor in Burma will be 69 percent to 80 percent lower. The higher minimum daily rates in Thailand are partially offset by the free medical and residence provisions in Burma. An arbitrary figure of 35 percent lower labor costs has been selected for Mudon, Burma.

Based on the proposed capacity of the large pineapple plant, the effect of this lower labor rate on the 1980-81 season on 49,500 tons of pineapple would generate a savings in Burma of 1,684,683 Kyats or US$240,669 annually.

I. Manpower Requirements

To provide the volume of 660 MT of pineapple daily, 31 harvest crews of 12.5 men each harvesting 1.70 MT of pineapple will be required. This includes the regular 10 man crew, supervisor, tractor operator, and a portion of the forklift truck operator, expatriates, and other area supervisors. All of these people are a part of the harvest operations. The agricultural plant superintendent will be listed as part of the general administration. Table 9 shows the breakdown of the manpower requirements to harvest and care for the crop when 32-inch plastic film is used.

During the 75-day harvesting season, 388 men will be required plus 5 men for the nursery. During the remaining 175 days of the year, 142 men will be required to complete the remainder of the work. The man days per acre for the total operation are outlined in Table 10.

Since this is a three-year cycle, the average acreage worked will be 917 acres for each operation of the total 2,750 acres. The total man days required will be 917 acres x 71 man days per year or 65,107 man days. The harvesting operation will use 56 percent of these man days or 36,460. The remaining 28,647 man days will be spread over 175 days.

TABLE 9. MANPOWER REQUIREMENTS FOR A CONTINUOUS ANNUAL 20-ACRE PLANT-HARVEST OPERATION USING 32-INCH POLYETHYLENE COVER FOR WEED AND EROSION CONTROL

Activities	Number of Item	Man Days (MD)
Harvest load and unload 20-acre seed	400,000 plants (5,000/MD)	80
Plant 20 acres of seed	400,000 plants (4,000/MD)	100
Harvest load and unload 20-acre fruit	400,000 fruit	800
		980
		X 2
Add 100 percent for other activity, e.g., equipment operator, weed/insect control, maintenance		1,960
545 man days less with use of polyethylene to control weeds		545
GRAND TOTAL MAN DAYS FOR 20 ACRES		1,415
MAN DAYS PER ACRE		71

Time Availability
52 weeks x 6 days = 312 working days less 20 percent a/ = 250 working days available

a/ Vacations, religious holidays, and illnesses. No weather delays are calculated, though there will be some.

SOURCE: Experience, Incorporated
4200A

TABLE 10. TOTAL MAN DAYS PER ACRE FOR PINEAPPLE OPERATION

Operation	Man Days (hours)	Total Days (percent)
Harvesting	40	56
Seed	4	6
Planting	5	7
Maintenance and weed control	22	31
TOTAL	71	100

SOURCE: Experience, Incorporated.
4200A

If a plan were designed for 40 MT per acre on 3,700 acres, the requirement would still be 388 men for harvest, but off-season cost would be increased. Since 3,700 acres is 35 percent higher than 2,750 acres, the number of men required in the offseason would increase from 162 to 217 plus five nursery men.

J. Comparative Cost Analysis

1. Availability of Cost Data

Because the major production and marketing of pineapple are controlled by three major companies, they are reluctant to give out historical information on costs and yields as well as information on specialized equipment which has also been developed by them. The cost of growing pineapple has therefore been estimated.

a. Cost of Pineapple in Thailand. To compare potential cost and prices, the accounting format established by the office of Agricultural Industry Research Division of Ministry of Agriculture and Cooperatives was used for the two major provinces of Prachuab Kirikhan and Petchaburi. This can be found in Table 11.

(1) Yield. While all of Thailand averages six tons per hectare per year, or 7.2 tons per acre, for a three-year cycle (Table 2), these provinces report 11,000 kilograms per Rai which converts to 27 MT per acre for three-year cycle in the production year of 1979-80.

(2) Cost. The cost in 1979-80 was $1.36 per kilogram which converts to $59.29 per MT or 415 Kyats per MT.

TABLE 11. COMPARATIVE PINEAPPLE GROWING COST, BURMA VS THAILAND; PINEAPPLE PLANTATION COST (BAHT) PRACHUAB KIRIKHAN AND PETCHABURI PROVINCE, THREE YEAR CYCLE, 1979 TO 1980

Description	Thailand Actual Labor Cost/Rate		Burma at Lower Labor Cost/Rate
	(Baht)		(Baht)
Land Preparation	300	-20%	240
Ploughing	150	-20%	120
Crown (Stalk seed)	1,800	--	1,800
Planting Labor	200	-35%	130
Fertilizer 15-15-15	1,480	--	1,480
Labor	130	-35%	85
Labor for Weeding	260	-35%	169
Weed Killer Material	1,403	--	1,403
Labor for Spraying	205	-35%	133
Labor for Cutting Leaves	115	-35%	74
Forcing Agent Material	505	--	505
Forcing labor	115	-35%	74
Labor Harvesting and Hauling	1,335	-35%	868
Land	750	750	750
Interest	2,344	-.042%	2,246
Total Cost (Baht)	11,092	--	10,077
Yield - Kilogram Per Rai	11,000	--	11,000
Cost Per Kilogram (Baht)	1.01	--	.92
Cost Plus 20 Percent Profit a/	1.21	--	1.10
Cost Plus 20 Percent Pla. 15 Baht Per Kilogram	1.36	--	1.25
Dollars Per Kilogram ÷ 23	.0591	--	.0543
Dollars Per Pound ÷ 2.2	.0269	--	.0247
Dollars Per MT x 2,224	59.29	--	54.43
Dollars Per 2-1/2 Case ÷ 28.6	2.07	--	1.90
Kyat Per MT x 7	415	--	381
Kyat Per 2-1/2 Case ÷ 28.6	14.51	--	13.32
Savings Per Case Due To Lower Labor Cost			Kl.19 or US$.17
GRAND TOTAL SAVINGS Per Cycle on 1,415,700 Cases			Kl,684,683 or US$240,669

a/ Includes overhead and return to management.

SOURCE: Office of Agricultural Industry Research, Division of Ministry of Agriculture and Cooperatives April 1, 1979 to March 31, 1980, Bangkok, Thailand and Foodstuff Industries Corporation, Rangoon, Burma.

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(3) Effect of Labor Cost Reduction. If a 35 percent labor savings cost factor were applied to the total labor cost in 1979-80, there would be an annual savings of $240,669 or 1,684,683 Kyats per three-year cycle.

b. Fresh Pineapple Production. In Table 12 the current estimated cost of fresh pineapple on Molokai is $105.3 per ton. If weeds are a problem, another $12 per ton could be added to this cost.

2. 1980-81 Actual Product Cost

In analyzing the comparisons, the use of the 1980-81 Thailand cost of pineapple production and yields are applied to a three-year pineapple cycle. In Table 13 the following comparisons have been developed:

a. Column 1. The Thailand cost and yields in Bahts per Rai have been duplicated (23 Bahts = US$1.00) (2.5 Rai = 1 acre). The cost in Prachuab Kirikhan Province was $52.68 per MT or K369. This includes a "20 percent profit" item which, for assumption purposes, is management, non-itemized overhead items, a reserve for profits if yields and costs are favorable, and hauling expense.

b. Column 2. The labor component was reduced by 35 percent where it applies to reflect the lower labor rate in Mudon, Burma.

c. Column 3. This column is the result of total cost of labor savings. On 49,500 tons of pineapple, the annual advantage in labor savings would be 1,684,683 Kyats.

TABLE 12. PRODUCTION COST OF FRESH PINEAPPLE ON MOLOKAI, HAWAII, AUGUST, 1974 UPDATED TO 1982, DOLLARS PER TON

Element Description	Dollars Acre/Cycle	Estimated 1982 Dollars Per Ton
Direct Costs		
1. Land preparation and road grading	102.00	3.26
2. Plastic Laying	51.58	1.65
Plastic Material - 32 inches wide	90.00	2.88
Fumigant 40 gallon DD+3RBC 80 +30 a/	110.00	--
Initial fertilizer 800# per acre	82.40	2.64
3. Plants	233.42	7.47
4. Planting $5.52/m x 23 m plus overhead	150.93	4.83
5. Irrigation (8 rounds of labor and equipment)	69.45	0.37
6. Spraying operation plus truck	48.52	1.55
Hand weeding	7.75	0.26
Fertilizer materials	169.94	5.44
Pesticides and forcing chemicals	69.22	2.21
Subtotal - Direct field costs	1,185.21	32.56
7. Harvesting and haul	1,233.18	39.46
Subtotal - Direct Costs at Parking Shed	2,418.39	72.02
Indirect Costs		
Land rent	99.00	3.00
Property taxes	14.85	0.45
Repairs and maintenance of equipment	132.04	4.22
Office and management vehicle	60.50	1.94
Miscellaneous Office supplies, legal, accounting, telephone, etc.	130.00	4.16
Interest on working capital for three months only	48.35	19.44
Subtotal	484.74	33.21
GRAND TOTAL	2,903.13	105.23

a/ Illegal to now use.
SOURCE: University of Hawaii Research Report #231 HAES 4200A

d. Column 4. Potential agronomic improvements have been added that should improve yields to optimum levels. These include a 20 percent increase in crowns per acre, 850 pounds of fertilizer (16-4-16-8) per acre, 32 inch plastic mulch, increased weed and insect control materials, irrigation, and all the new equipment required to enter the pineapple business. To carry the additional expense, it would require 40 MT per acre to reach the same cost of $47.82 per MT that Thailand would reach with 35 percent higher labor cost. In essence, Burma must increase Thailand's yield of 25.13 MT to 40 MT per acre over a three-year cycle to pay for all of the improvements and simultaneously go into the pineapple business with new equipment and still retain the same "profit level" as Thailand.

e. Column 5. The analysis of what costs might be accrued at 54 MT per acre have been calculated. The cost per MT would drop to $38.35 including a "20 percent profit factor." Again, the profit factors must include return to management, accounting, and small tractors rental on trucks for hauling in the field, if any. The labor and hauling costs have been budgeted. If the labor savings are realized, this would provide a US$708,235 or K4,963,235 advantage over Prachuab Kirikhan Province in Thailand. If 54 MT per acre is attained, 2,750 acres would be required to produce 49,500 MT of pineapple per year.

TABLE 13. THAILAND ACTUAL COST OF PINEAPPLE PRODUCTION CONVERTED TO BURMA PRO FORMA (BAHT PER RAI MULTIPLIED BY 3 FOR A THREE-YEAR CYCLE), 1980-81

Description	Actual Cost Thailand	Labor Savings in Burma a/	Burma Cost With Labor Savings	Costs Incurred To Make 20 Percent Profit b/	Cost At 54 MT Per Acre
	(baht/rai)	(percent)	----------baht----------		
Land Preparation					
First planting	467	-20	374	374	374
Second and third plantings	336	-20	269	269	269
Neck bells	112	--	112	134 c/	134
Crowns j/	1,307	--	1,307	1,568 c/	1,568
Transportation crowns	299	--	299	358 c/	358
Planting crowns	187	-35	121	145 c/	145
TOTAL BAHTS/RAI	2,708		2,482	2,848	2,848
Labor for Caring					
Fertilizer application	158	-35	102	102	102
Weeding	485	-35	315	--	--
Weed spraying	168	-35	110	110	110
Forcing agent lab	262	-35	171	171	171
Labor cutting leaves	57	-35	37	37	37
Ratoon collecting	144	-35	94	113 c/	135
Crown treating	57	-35	37	45 c/	45
Handling from planting area	614	-35	400	724	977
Laying plastic 32 inches	--	--	--	100	100
Labor for irrigation	--	--	--	11	11
TOTAL	1,945		1,266	1,413	1,688

Continued . . .

TABLE 13. THAILAND ACTUAL COST OF PINEAPPLE - Continued

Description	Actual Cost Thailand	Labor Savings in Burma a/	Burma Cost With Labor Savings	Costs Incurred To Make 20 Percent Profit b/	Cost At 54 MT Per Acre
	(baht/rai)	(percent)	----------baht----------		
Material Cost					
Fertilizer 13-13-21	840	--	840	--	--
Ammonia sulfate	525	--	525	--	--
Fertilizer 16-4-16-8 h/	--	--	--	3,228	3,228
Weed killer f/	852	--	852	667	667
32 inch plastic	--	--	--	1,380	1,380
Leaf treating material	42	--	42	42	42
Forcing agent	90	--	90	90	90
Insect control e/	--	--	--	248	248
Sundries	62	--	62	62	62
Equipment maintenance	79	--	79	160	160
Irrigation fuel	--	--	--	115	115
Tractor fuel	--	--	--	50	50
Forklift fuel	--	--	--	5	5
Land	738	--	738	4	4
Equipment depreciation	130	--	130	1,475 d/	1,736
Interest on equipment capital at 5 percent	1,000	--	1,000	410	482
Working capital 8 percent	--	--	--	412	423
TOTAL	4,358	--	4,358	8,348	8,692
GRAND TOTAL	9,011		8,106	12,609	13,228
Yield kilogram per rai	10,233	--	10,233	15,961 Kg	21,639
MT per acre per cycle	25.13	--	25.13	40	54
Acre required 49,500 MT	5,909	--	5,909	3,700 d/	2,750
Cost per kilogram	.88	--	.79	.79	.61
Cost plus 20 percent profit	1.06	--	.95	.95	.73

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Continued . . .

TABLE 13. THAILAND ACTUAL COST OF PINEAPPLE - Continued

Description	Actual Cost Thailand	Labor Savings in Burma a/	Burma Cost With Labor Savings	Costs Incurred To Make 20 Percent Profit b/	Cost At 54 MT Per Acre
	(baht/rai)	(percent)			
Plus .15B per kilogram hauling	1.21	--	1.10	1.10	.88
Dollars per kilogram ÷ 23	.0526	--	.0478	.0478	.0383
Dollars per pound ÷ 2.2	.0239	--	.0217	.0217	.0174
Dollars per MT x 2,240	52.68	--	47.82	47.82	38.35
Cost per 2-1/2 equivalent case ÷ 28.6	1.84	--	1.67	1.67	1.34
Kyats per MT 41.66 x 7	369	--	335	335	268
Kyats per 2-1/2 case equivalent	12.88	--	11.69	11.69	9.38
Savings					
Per 2-1/2 case equivalent dollars	--	--	.17	.17	.50
Per 2-1/2 case eqivalents Kyats	--	--	1.19	1.19	3.50
TOTAL SAVINGS OVER THAILAND					
1,415,700 - cases in Dollars	--	--	240,669	240,669	708,235
1,415,700 - cases in Kyats	--	--	1,684,683	1,684,683	4,963,238

a/ 35 percent lower labor cost in Burma compared to Thailand.
b/ "Profit" in Thailand includes return to management, central overhead charge not otherwise recognized plus a reserve for profit and if the market price is adequate.
c/ 20 percent more crowns.
d/ Based on 3,700 acres.
e/ DuPont recommendations.
f/ Little or no hand weeding.
g/ 40 tons.
h/ 850 pounds per acre.
i/ Cost of developing seed stalk and of the excesses on the initial seed stalk will be charged out with the crowns to products.

SOURCE: Experience, Incorporated.

K. Revenue

The Thailand prices per metric ton for 1976 to 1981 are itemized in Table 14. The average price for this period is approximately $50 per MT or 353 Kyats per MT. There is some question as to who pays the hauling charge. The budgeted cost for hauling is 15 Bahts per kilogram which converts to $6.64 per ton or 46.5 Kyats per ton. For this study, it is assumed the grower must pay the hauling cost.

It should also be noted that the price of pineapple is as low as $42 per ton (K294) in the summer (May-June-July) before the price increases to as high as $58.87 (K412) in October. For purposes of this study, a price of $54 (K378) is assumed to be the factory door price. For analysis purposes, a basis of $54 minus 10 percent ($48.60 or K346) is used to determine profit at the plant level and for the agricultural component. This should cover the normal price range under current cost conditions.

L. Initial Planting Schedule

There are two alternatives to consider, one of which must be chosen early in the implementation of the project.

1. Alternative Number 1

Delay all production planting until research data prove beyond a doubt that the projections made in this report, especially with regard to yield and quality of pineapples under the monsoon conditions of Mudon are adequate.

2. Alternative Number 2

Assume there is a high probability that adequate yield and quality data can be developed through plot work and through sale to the fresh market. This, along with minimal production

TABLE 14. FRESH FRUIT PINEAPPLE COST AT FARM PRICES, PRACHUAB KIRIKHAN PROVINCE THAILAND, 1976-1980

Month	1976	1977	1978	1979	1980	1981	Average	Per Metric Ton Dollar	Per Metric Ton Kyat
	----------baht per kilogram----------								
January	1.34	1.06	1.45	0.80	1.30	--	1.19	52.36	366.52
February	1.42	1.08	1.24	0.80	1.37	--	1.18	52.23	365.61
March	1.47	1.03	0.98	0.80	1.40	--	1.13	50.02	350.14
April	1.41	1.10	0.85	0.80	1.40	--	1.11	49.13	359.81
May	0.95	0.84	0.80	0.80	1.40	--	0.96	42.50	297.19
June	0.63	1.05	0.80	1.00	1.15	--	0.93	41.17	288.19
July	0.75	--	0.91	1.00	1.25	--	0.98	43.38	303.71
August	1.01	1.18	0.99	1.30	1.30	--	1.15	50.90	351.31
September	--	1.27	1.00	1.40	1.42	--	1.27	56.22	393.54
October	1.32	1.28	1.20	1.45	1.40	--	1.33	58.87	412.09
November	--	1.28	1.20	1.30	1.12	--	1.22	54.01	378.07
December	--	1.44	0.80	1.45	--	--	1.23	54.45	381.18
Average (Baht)	B1.14	1.15	1.03	1.07	1.32	--	1.14	50.46	353.22
Dollar Per MT	50.46	50.90	45.60	47.36	58.33	43.50	49.36	--	--
Kyat Per MT	K353.7	353.22	319.27	331.52	408.50	304.52	345.52	--	--

SOURCE: Office of Agricultural Industry Research, Agricultural Economic Division, Ministry of Agriculture & Cooperative, (April 1, 1975 to March 31, 1981)

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through a small plant, would be immediately scheduled until a larger plant is built when adequate seed stalk is available. The small factory would go into operation as soon as possible after the start of the project, and the large plant would begin production after the seventh year and be in full production by the tenth year.

An aggressive schedule has been outlined to accomplish alternative number 2. The main point is that during the first year, the purchase of 100,000 crowns from various areas of the world would be undertaken. These would be divided into four plants to begin the nursery project. The cost of these crowns will be approximately $100,000 or K700,000.

At first, the 62 acre farm available near Mudon would be utilized. The next step would be to expand into the larger farm at the higher elevation east of Mudon. While the nursery stalk is building, the fruit can be processed at the small processing plant or sold to the fresh market.

Either alternative 1 or alternative 2, or a variation in between, can be selected. This will depend on the latest information and the economic opportunities available as well as the intangible benefits Burma can realize.

3. <u>Assumptions for Pineapple Plantations</u>

a. Build toward 49,500 MT of annual production as quickly as possible.

b. Expand the most promising varieties first.

c. Any excess tonnage that is developed before the larger plant is built should be processed in the smaller plant as canned or fresh.

d. At any time, if it appears that the larger factory is not feasible due to new knowledge gained, then the planting schedule would have to be altered to fit the new circumstances.

4. Planting and Harvesting Pineapple Plantation Schedule

a. 1st Year. Propagate 400,000 plants in the nursery for six months. Plant 20 acres.

b. 2nd Year. Cultivate 20 acres of growing crop, unharvested.

c. 3rd Year. Harvest 20 acres. Propagate 1,600,000 plants in nursery for six months. Plant 80 acres.

d. 4th Year. Harvest 20 acre ratoon crop. Propagate 1,600,000 plants in nursery for six months. Plant 80 acres. Cultivate 80 acres growing crop, unharvested.

e. 5th Year. Harvest 80 acre ratoon crop. Propagate 6,400,000 plants in nursery for six months. Plant 320 acres. Cultivate 320 acres of growing crop, unharvested.

f. 6th Year. Harvest 80 acre ratoon crop. Harvest 80 acres. Propagate 128,000,000 plants in nursery for six months. Plant 640 acres. Cultivate 320 acres growing crop, unharvested.

At this point, if a larger factory seems more appropriate based on new knowledge gained, further expansion in seed stalk should be initiated.

g. 7th Year. Harvest 80 acre ratoon crop. Harvest 320 acres. Propagate 22,000,000 plants in nursery for six months. Plant 1,235 acres. Cultivate 640 acres growing crop, unharvested.

h. 8th Year. Harvest 320 acre ratoon crop. Harvest 640 acres plus propagate 22,000,000 plants in nursery for six months. Plant 1,235 acres. Cultivate unharvested growing crop acres.

i. 9th Year. Harvest 640 acre ratoon crop. Harvest 1,235 acres. Propagate 22,000,000 plants in nursery for six months. Plant 1,235 acres. Cultivate 1,235 acres in growing crop, unharvested.

j. 10th and Succeeding Years. Harvest 1,235 acre ratoon crop. Harvest 1,235 acres of regular pineapple. Propagate 22,000,000 plants in nursery for six months. Plant 1,235 acreage. Cultivate 1,235 acres in growing crop, unharvested.

M. Estimated Internal Rate of Return for Pineapple

The basic cost used in the analyses is the 1980-81 cost of growing pineapple in the Thailand province of Prachuab Kirikhan. From this, the labor cost was reduced by 35 percent, while crowns increased by 20 percent, and provisions were made for optimum levels of fertilizer and weed/insect control.

1. Internal Rate of Return

In Table 15, the internal rate of return (IRR) has been computed on the basis of 100 percent and 40 percent equity and at zero and 6 percent inflation.

TABLE 15. ESTIMATED INTERNAL RATE OF RETURN ON EQUITY

Price/ Metric Ton	Inflation Rate	Interest Rate Long	Interest Rate Short	IRR
(US$)	(percent)	----percent----		
100 Percent Equity	0			
54.00		12	18	18.6
54.00		5	8	19.8
48.60		5	8	16.2
100 Percent Equity	6			
54.00		12	18	25.7
48.60		12	18	21.7
40 Percent Equity 60 Percent Borrowed	6			
54.00		12	18	21.5
48.60		12	18	16.7
40 Percent Equity 60 Percent Borrowed	6			
54.00	6	12	18	29.4
48.60		12	18	24.3

SOURCE: Experience, Incorporated.

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2. Summary

Based on the assumptions used, the internal rate of return is very acceptable even at the higher interest rates of 12 percent on long-term capital and 18 percent on working capital.

To be conservative, a risk factor of 9 percent is added for the uncertainties involved. If these assumptions are right, it should be possible to reach these projected levels of return using all the improvements in agronomic practices outlined. There should be little doubt that pineapple can be supplied to the plant at $48.60 per MT.

N. Agricultural Research

If Burma is going into the growing and processing of pineapple, an outstanding team will be required to develop new varieties of pineapple and to pursue research into all agronomic aspects of this business.

1. Financing Costs

The estimated cost of this group will be $75,875 each year for three years including a highly qualified expatriate. During the following years, after the expatriate leaves, the cost is estimated at $50,000 per year. Normally, this type of expenditure would be paid by the government or one of its various subdivisions. If it cannot be financed by any other method, then the cost could be assigned to the agricultural production department. In Tables 16 and 17, it can be seen that after absorbing these yearly charges, the growing operation is still an attractive investment. By using low cost capital and 40 percent equity, all scenarios work. The same scenario with 6 percent inflation provides an internal rate of return seven percentage points higher.

2. Research Staff

An agricultural research group should be employed with responsibility for obtaining and/or testing all varieties of tropical fruit, fertilizer, weed control, insect control, and

TABLE 16. INTERNAL RATE OF RETURN (IRR) WITHOUT RESEARCH

	Price Per MT	Equity	Inflation Rate	Interest Short	Interest Long	Risk	IRR
	(US Dollars)	percent					
Scenario 1	54.00	100	0	12	18	9	18.6
Scenario 2	54.00	100	0	8	5	9	19.8
Scenario 3	54.00	100	6	12	18	9	25.7
Scenario 4	54.00	40	0	12	18	9	21.5
Scenario 5	54.00	40	6	12	18	9	29.4
Scenario 6	48.60	100	0	8	5	9	16.2
Scenario 7	48.60	100	6	12	18	9	21.7
Scenario 8	48.60	40	0	12	18	9	16.7
Scenario 9	48.60	40	6	12	18	9	24.3

SOURCE: Experience, Incorporated.

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TABLE 17. INTERNAL RATE OF RETURN WITH RESEARCH

	Price Per MT	Equity	Inflation Rate	Interest Short	Interest Long	Risk	IRR	Excess
	(US Dollars)	percent						
Scenario 10	54.00	40	0	8	5	9	19.9	+704
Scenario 11	48.60	40	0	8	5	9	15.7	+98
Scenario 12	54.00	40	6	8	5	9	27.5	+2,971
Scenario 13	48.60	40	6	8	5	9	23.2	+1,776

SOURCE: Experience, Incorporated.

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other agronomic practices. These should follow closely the activities of the seed developing aspect of the agricultural component. This will require no more than three acres of land.

a. Personnel. For the first three years, a well qualified expatriate fully knowledgeable in pineapple growing and other tropical fruits should be hired. There should be a group of six people during this three-year period. In addition to the expatriate, there should be one supervisor and four other semi-skilled to skilled individuals. After the first three years, this group will continue with only five individuals.

b. Research Salary Expense. Table 18 outlines the annual rates of pay for the research staff.

TABLE 18. ANNUAL SALARIES FOR SKILLED AND NONSKILLED WORKERS

Position	Number	Salary	Kyats
		(US Dollars)	
Expatriate	1	50,000 a/	350,000
Supervisor b/	1	875	6,125
Skilled and semiskilled c/	4	3,000	21,000
TOTAL		53,875	377,125

a/ Breakdown: salary, $36,000; hardship, $9,000; transportation, $2,000; and moving, $3,000.
b/ US$0.35 per hour assuming 2,500 hours per year.
c/ US$0.30 per hour assuming 2,500 hours per year.

SOURCE: Experience, Incorporated

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Budget for materials such as fertilizer and chemicals should be $3,000 (K21,000) per year. Miscellaneous equipment for specialized work could cost up to $5,000 per year.

c. Total Expenses

	US Dollars
Chemicals and other material	3,000
Miscellaneous equipment	2,000
Packaging material	2,000
Travel	5,000
Reserve	10,000
TOTAL	22,000
Salaries	53,875
GRAND TOTAL	75,875

In addition, if this group cannot work out of the present building at the Mudon experiment station, a separate building would have to be built. After the three years, when the expatriates leave, a total budget of $40,000 (K280,000) should suffice.

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VI. FACTORY COMPONENT

A. Tropical Fruit Processing Overview

1. Background

The tropical fruit cannery has been designed to provide an outlet for the excess tropical fruit production from small farms in the Mudon area. One of the major problems that will be encountered is a lack of standardization in the varieties of fruit produced in the region. The experimental station is assisting farmers through improved seed selection of higher yielding trees, insect/disease control, and fertilization. This long-range program takes 8 to 10 years for many trees to enter into full production and as such, small farmers cannot afford to lower their current income and replanting on an extensive scale. Table 19 shows average farm prices for fruits. After the plant is in operation and suitable varieties can be evaluated, purchasing policies must be established to insure that fruit for processing meets the specifications established.

Tropical fruit yields vary in each country, and it is difficult to arrive at an exact figure without previous experience with locally grown products. The amounts used in this report have been estimated based on an extensive review of production data in similar tropical areas and are shown in Table 20. The product formulations in the report are those commonly accepted by the industry, although modifications may have to be made to meet local tastes or individual foreign market demands.

The volume of fruit to be handled does not warrant the investment required for high speed automated equipment. Appendix F outlines the estimated can consumption for the first year of operation. The processing methods selected require manual

TABLE 19. AVERAGE FARM PRICES FOR FRESH MARKET TROPICAL FRUITS RECEIVED IN MUDON AREA

Product	Average Weight Per Fruit	Farm Prices: Low Season Production: Price Per Fruit	Low Season Production: Price per MT		High Season Production: Price Per Fruit	High Season Production: Price per MT	
	(kilograms)	(Kyats)	(Kyats)	(US$)	(Kyats)	(Kyats)	(US$)
Pineapple	2.26	3.00 a/	1,327.00	189.63	1.00 a/	378.00	54.00
Mango	0.283				40.00 b/	1,361.00	194.40
Mangosteen	0.113				40.00 b/	3,540.00	505.71
Rambutan	0.021	10.00 b/	4,762.00	680.00	8.00 b/	3,810.00	544.29
Jackfruit	9.07	4.00 a/	441.00	63.00	3.00 a/	330.00	47.14
Guava	0.177	15.00 b/	847.50	121.07	6.00 b/	339.00	48.43
Papaya	0.907				2.00 a/	2,205.00	315.00
Passion Fruit c/	0.03						

a/ Each.
b/ Per 100.
c/ Little commercial production at present.

SOURCE: Interviews with the Mudon Experimental Station and Foodstuff Industries Corporation Staffs. Data represents averages of estimates provided.

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TABLE 20. ESTIMATED CANNED AND FRESH FRUIT PRODUCTION a/

	Fruit Use		Edible Portion	Waste Material	Estimated Yield Raw Fruit	Average Weight Fruit	Farm Production	Estimated Tree Planting
	Canned	Fresh						
	----------	----------	percent	----------	(cases/M.T.)		(M.T./acre)	(acres)
Pineapple								
Small Plant	100	--	55-60	40-45	28.6	4 to 4-1/2 lbs.	18.0 b/	20
Large Plant	20	80			24.0			
Mango	30	70	60-70	40-30	35	8 - 20 oz.	6.5	36
Mangosteen	--	100	26	74	--	3.2 oz.	6.2	109
Papaya	40	60	49	51	25.7 to 36.7	1 to 12	15 - 30	302 - 435
Rambutan	60	40	60	40	40	21 Fruit/lb.	4.5	70
Passion Fruit	100	--	29 - 38	62 - 71	13	1.3 to 2.4 oz.	10.0	544
Guava	100	--	81	19	Depends on Product	2 to 4 oz.	7.7	129
Cashew Nut	100	--	22 - 25	--	Packed in 5 gal. Sq. Cans or Polybags		0.49	40 - 80
Cashew Nut Shell			20		Packed in Drums			

a/ Estimated case per MT yields from raw fruit depends on the type of product to be manufactured: sliced fruit, pulp or puree, juice, or nectar.

b/ Average - three years.

SOURCE: Tropical Crops, J.W. Purseglove, 1968
Fruits of Hawaii, C.D. Miller, K. Bozore, M. Barton
Technical Service Bulletins - American Can Company
Evergreen Orchards, W. E. Chandler
Tropical and Subtropical Fruits, S. Nagy and P.E. Shaw

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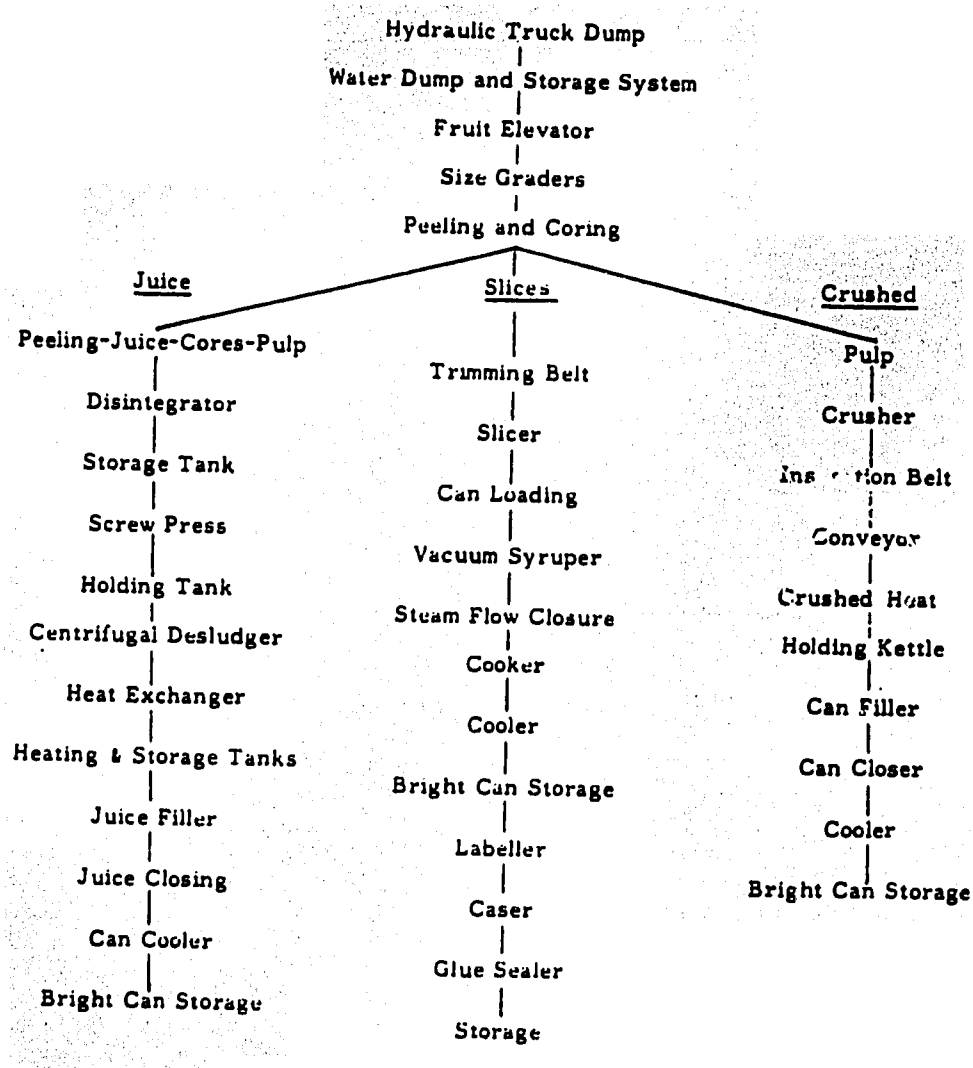
labor for many operations, with machinery being used in those instances where it will improve quality or facilitate the work to be accomplished. Figure 8 shows the detailed flow chart for the tropical fruit cannery. The plant will be capable of meeting international standards for all of the products that will be manufactured.

FIGURE 8. FLOW CHART TROPICAL FRUIT CANNERY



SOURCE: Appendix G

2. Pineapple Line

a. Harvesting. Pineapple to be used for canning should be picked when the fruit is fully mature, since green fruit which lacks flavor and overripe fruit that may start to ferment are unsuitable for canning. Large plantations use a harvesting machine with a long conveyor that carries the hand-picked pineapple to a dump truck or pallet bins for transportation to the cannery. Due to the heavy rainfall at harvest in the Mudon area, heavy equipment with conveyors cannot be used. Small tractors would instead be used to pull rubber tired wagons with wood pallet containers. The pallet containers will be forklifted to trucks for hauling to the factory.

Crowns can be removed in the field or trimmed at the canning plant. In order to avoid bruising the pineapple during transportation, fruit should not be stacked over 60 centimeters deep.

b. Purchasing. Pineapple will be purchased from small farms that lack mechanized equipment. Picking will be done manually and collected in bags slung over the worker's shoulder. The filled bags will be carried to the end of a row and transferred to lug pallets holding approximately 60 pounds of fruit. When a sufficient number of pineapple has been accumulated, the pallets are forklifted onto a truck and hauled to the canning plant. The crowns will normally be cut in the field as these can be used for replanting. Fruit that will be sold on the fresh market will be shipped with the crowns intact.

c. Receiving. All of the fruit except pineapple will be received in lug boxes and stored on the unloading platform until needed for processing. The fruit is dumped into a soak tank washer to loosen any dirt or objectionable material on the

fruit surface that can then be washed away by the high pressure sprays on the discharge conveyor. The cleaned fruit drops onto a roller inspection conveyor where any overripe or unsuitable raw material for processing is discarded.

d. Processing. When the trucks arrive at the cannery, the fruit is weighed and dumped into a water tank to cushion the drop and minimize damage. The pineapples are soaked in these tanks to loosen soil embedded in the eyes, which is washed away by high pressure sprays located over the conveyor elevator. Figure 9 details the processes involved for the various pineapple products.

FIGURE 9. FLOW CHART FOR PINEAPPLE PRODUCTS

	Equipment Number		Equipment Number		Equipment Number
		Receive Fruit in Bins			
		Soak Tank Washer	1		
		Inspection and Size Grading Conveyor	2		
		Conveyor and Holding Table	3		
		Sizer and Corer	4		
		Cylinder Conveyor and Elevator	5		
Crushed Pineapple		Sliced Pineapple-Tidbits-Segments		Pineapple Juice	
Peel Conveyor	15	Inspection and Trimming Conveyor	6	Manual Handling of Waste Material	
Meat Eradicator	16	Semi Automatic Slicer	7	Disintegrator	18
Screw Conveyor	17	Inspection and Can Filling Conveyor	8	Juice Extractor	26
Disintegrator	18	Tid Bit and Segment Cutter	9	Centrifugal Pump	27
Draining Chute and Holding Tank	19	Syrup Tank	10		
Centrifugal Pump	20	Exhaust Box	11	Holding Tank	28
Inspection Belt	21	Closing Machine	12	Centrifugal Pump	29
Jacketed Kettle	22	Atmospheric Cooker	13	Deareator - Pasteurizer	30
Positive Displacement Pump	23	Cooling Tank	14	Piston Filler	24
Piston Filler	24	Bright Can Storage		Closing Machine	25
Closing Machine	25	Labelling	78	Cooling Tank	14
Cooling Tank	14	Casing	79	Bright Can Storage	
Bright Can Storage		Shipping	80	Labelling	78
Labelling	78			Casing	79
Casing	79			Shipping	80
Shipping	80				

SOURCE: Appendix G

(1) Grading. Fruit is transported hydraulically to the elevator and conveyed to size grades where they are separated into three sizes:

- small fruit up to 11.43 centimeters in diameter weighing about 0.99 kilograms;

- medium sized fruit that will be packed in No. 2 cans and have a diameter up to 12.06 centimeters weighing about 1.35 kilograms; and

- large fruit for the No. 2-1/2 can line that can measure up to 13.97 centimeters in diameter and weighs up to 2.7 kilograms.

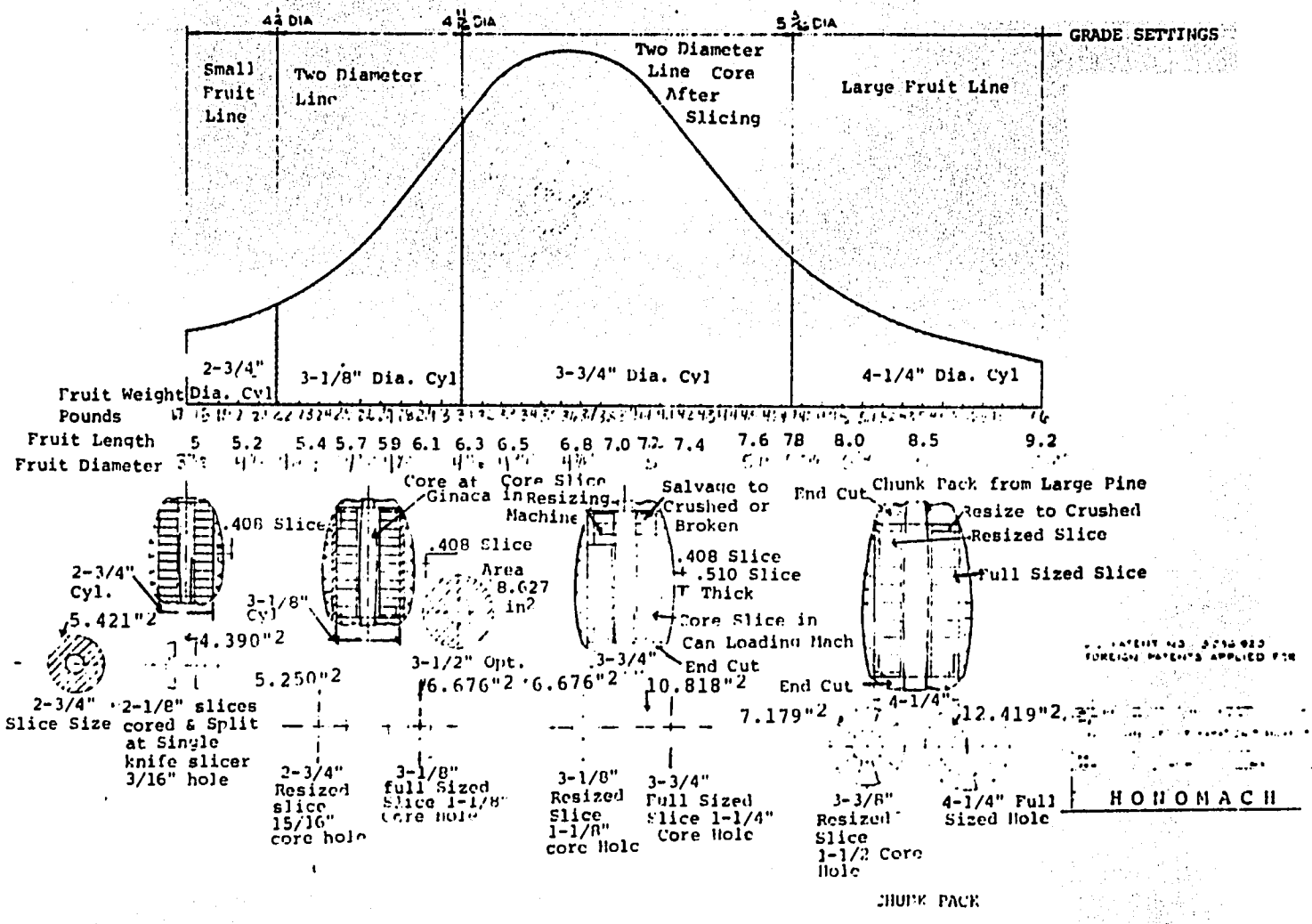
The volume of fruit to be handled does not warrant a mechanical grader. This can be done by manual inspection where workers separate the fruit into three sizes, one for each of the sizer-corers. After grading, the sized fruit drops onto a storage conveyor that supplies the sizers with a continuous flow of material.

(2) Sizing and Coring. The semi-automatic sizer-corer machines require a worker to place each pineapple into the unit that cuts a cylinder and core from the fruit and slits the peel into half lengths so any fruit remaining in the peel can be removed by a meat eradicator. The sizer-corer operator can handle 10 to 15 pineapple per minute, and as the workers observed in Burma are dexterous, they should be able to average 12.5 pineapple per minute, which has been used as the production norm in this study.

The clean fruit can be used for crushed pineapple, while the second cut containing some of the eyes and pieces of skin are removed in the juice pressing operation.

Figure 10 shows a two diameter line in which fruit to be used for No. 2 cans is cored at the sizer while larger fruits are cored at the can loading station. Fruit for the 2-1/2 cans is cut to a 7.94 centimeters cylinder, fruit for a No. 2 can should have a diameter of 6.99 centimeters, while the small fruit has a cylinder 6.99 centimeters that can be used for small slices, chunks, dices, spears, or tidbits (Appendix H).

FIGURE 10. PINEAPPLE SIZE DISTRIBUTION CURVE



SOURCE: Appendix H

e. Cored Pineapple. The cored pineapple cylinders are conveyed and elevated to an inspection and trimming conveyor. Workers remove any bits of skin or eyes that remain on the fruit and inspect the pineapple for ripeness, discarding overripe fruit, and trimming white or discolored portions. Good fruit is sliced into the proper thickness for each can size and loaded manually into cans.

The cylinders then pass through a pineapple slicer and onto an inspection belt where slices are separated into fancy and choice grades which are placed in the can loaders that fill the containers. The two diameter preparation line cores the sliced fruit and loads it into cans. The resizer removes any remaining bits of skin and eyes and cuts the fruit into a smaller size cylinder that can be packed into a No. 2 can. Scrap material and cores are sent to the juice line. Slices that are not suitable for can loading or resizing are passed to the end of the line for salvage where they can be cut into segments, chunks, or tidbits. Pineapple skin waste material can be fed to cattle as wet silage; however, it should be analyzed carefully to insure that it does not contain chemicals injurious to animal health.

f. Crushed Pineapple and Juice. Peels from the sizer are conveyed to a meat eradicator where an oscillating knife cuts usable flesh from the peel. A screw conveyor transports the meat to a disintegrator that crushes the material into small particles. As this unit has ample capacity to meet the requirements for these lines, it will be used for both crushed pineapple and juice. Waste material from the other lines may also be used for these products. The crushed pineapple moves over a draining chute that allows free flowing juice to drop into a holding tank, while the solid material goes to an inspection belt where any bits of skin or eyes remaining in the

fruit are removed. The crushed pineapple falls into one of two mixing kettles where the product is preheated to 93.3 ^{o} C and sugar or syrup added according to the market demands. The heated pineapple is pumped to a piston filler and closing machine. A filling temperature of 87.8 ^{o} C or higher precludes the need for further sterilization, as the heat from the product will sterilize the can and its contents. The closed cans are held for 1/2 to 2 minutes and are then water cooled to a product temperature of about 37.8^{o} C. The cans may then be palletized until needed for labeling, casing, and shipping.

Free flowing juice from the crushed line is pumped to a holding tank. Material from the disintegrator that will not be used as crushed pineapple can be pumped to a holding tank and then to a screw type juice extractor. The juice flows into a collecting tank where it is held until needed for filling. A centrifugal pump moves the product through a deaerator pasteurizer where the product is heated to 90.6^{o} C and filled at not less than 87.8^{o} C prior to closing. The closed cans are inverted and held for 2 to 3 minutes on a conveyor to sterilize the lids and head space before water cooling to bring the product temperature down to 37.8 ^{o}C. The cans may then be stored until needed for labeling, casing, and shipping to the market.

g. Production. So the lowest prices can be paid for the raw product, it is essential that the factory only purchase the raw product during the peak harvest period as shown in Table 21. At this point, there is more product available then the fresh market can absorb. If this demand is very high for any given product, then this season for the purchase of raw product can be extended beyond regular harvest time.

TABLE 21. MONTHLY PRODUCTION SCHEDULE BASED ON FRUIT GROWING SEASONS

Product	Annual Volume	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Passion Fruit													
Raw Material MT	360												
Canned Product (actual cases)	8,200												
Hours Worked	89												
Guava													
Raw Material	83	4	8	8	5				12	21	21	4	
Canned Product	7,575	379	757	757	379				1,136	1,894	1,894	379	
Hours Worked	533	27	53	53	27				80	133	27		
Tropical Fruit Cocktail MT													
Raw Material MT	375												
Canned Product	16,030												
Hours Worked	321												
Total Raw Material MT	3,853	99	32	115	134	600	751	788	243	21	69	76	190
Total Canned Products (actual cases)	181,585	4,149	2,150	8,081	11,207	33,828	32,892	34,220	12,156	1,894	4,680	4,558	7,540
Total Hours Worked	2,919	62	76	180	225	484	378	395	231	133	179	96	70

The monthly totals and the annual volumes are not in accord since passion fruit and tropical fruit cocktail have not been included in the monthly breakdown as this data is not available.

TABLE 21. MONTHLY PRODUCTION SCHEDULE BASED ON FRUIT GROWING SEASONS

Product	Annual Volume	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Pineapple													
Raw Material MT	1,900	95				380	570	570	95				190
Canned Products (actual cases)	75,400	3,770				15,080	22,620	22,620	3.770				7,540
Hours Worked	700	35				140	210	210	35				70
Mango													
Raw Material MT	350			35	105	193	17	-	-	-	-	-	-
Canned Products (actual cases)	31,450			3,145	9,435	17,298	1,572	-	-	-	-	-	-
Hours Worked	583			58	175	321	29	-	-	-	-	-	-
Papaya													
Raw Material MT	240		24	72	24						48	72	-
Canned Product (actual cases)	13,930		1,393	4,179	1,393						2,786	4,179	
Hours Worked	230		23	69	23						46	69	
Rambutan													
Raw Material MT	545					27	164	218	136				
Canned Product (actual cases)	29,000					1,450	8,700	11,600	7,250				
Hours Worked	463					23	139	185	116				

h. Closing and Packing

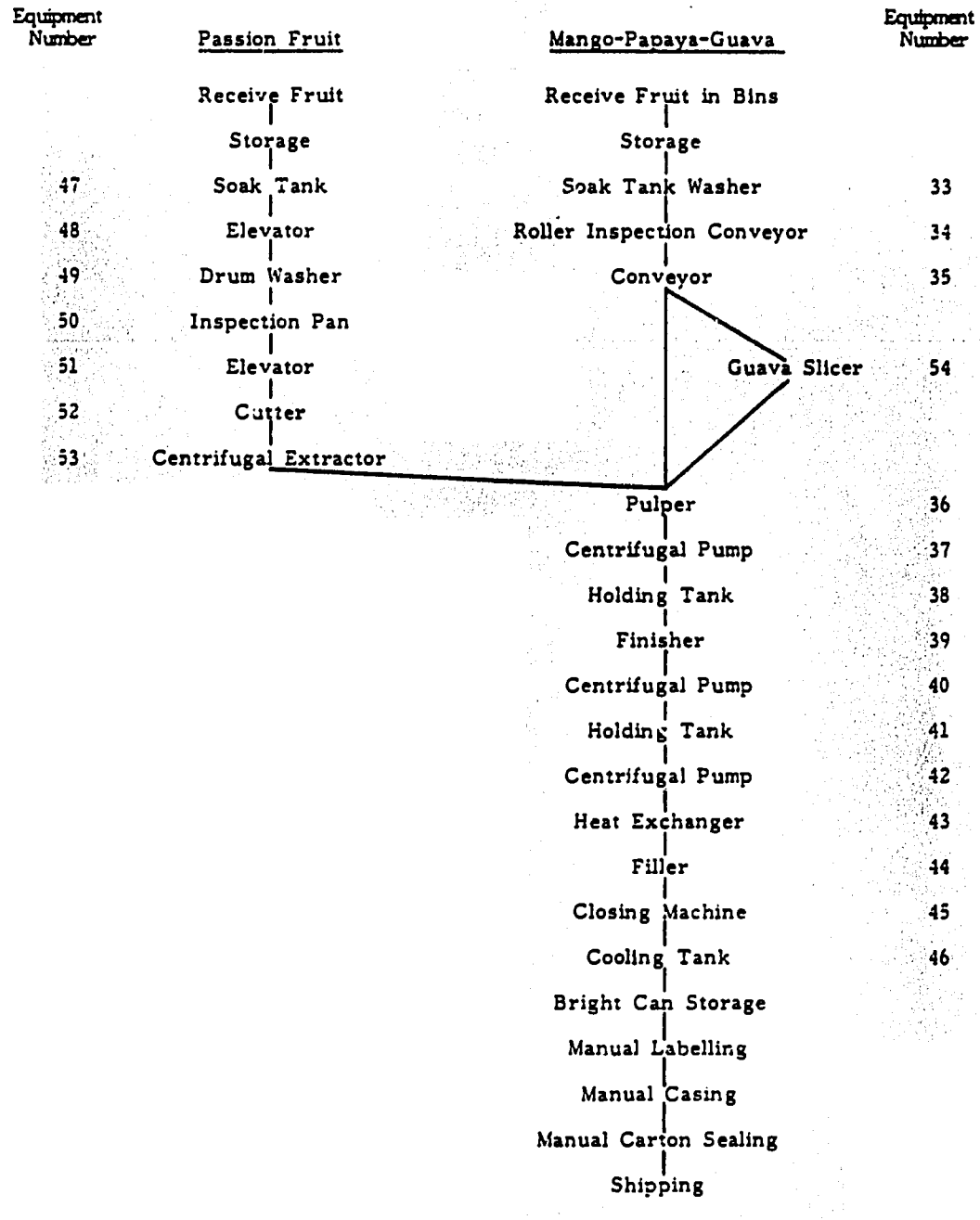
(1) Tidbits, Chunks, Spears and Slices. The cans are manually filled with syrup according to the marketing requirements. A 16 percent brix svrup has been selected for light syrup that can vary between 14 and 18 percent brix. Following the syruping operation, the cans go through a steam exhaust box for about 6-1/2 minutes at 93° C to heat the product and evacuate air entrapped in the fruit. After exhausting, the cans are closed atmospherically since the heated product should produce a satisfactory vacuum in the closed can. The cans are sterilized in a hot water tank of 98.8° C for about 12 minutes and are water cooled for about 4 minutes or until the average temperature of the can contents is about 37.7° C. The cans may then be stored until needed for labeling, casing, and shipping.

3. Pulp Line

Figure 11 details the line to be used to process No. 10 cans of mango, papaya, passion fruit, and guava pulp for resale to other manufacturers. Common equipment will be used wherever possible for all of the products. Specialized machinery will be used on those fruits that require a different method of handling.

a. Mango and Papaya. Mango and papaya are conveyed through a steam tunnel to soften the outer part of the fruit and, in the case of papaya, to coagulate the latex and inactivate enzymes in the skin. These fruits can either be peeled manually or mechanically as is suggested in this report. After steaming, the fruit is cooled by means of a spray cooler located on the elevator. Papaya is sliced, then dropped into a crusher-scraper that removes the pulp and seed from the peel. Citric acid is

FIGURE 11. FLOW CHART FOR PULP LINE



SOURCE: Appendix G

added to the macerated pulp to inhibit gelation and development of off flavors, and to prevent microbiological spoilage. Mango goes through a macerator that opens the fruit carefully to avoid breaking the seed.

b. Guava and Passior

through a rotary washer a

the fruit open. A centrifugal separator is used on the fruit to separate peel and seeds from the pulp. The former are discharged into a waste bin, and the pulp is passed through a pulper with a .045 or .033 screen to remove any remaining seed. If a fine pulp is desired, the pulp is passed the through a finisher with either a .033 or .020 screen.

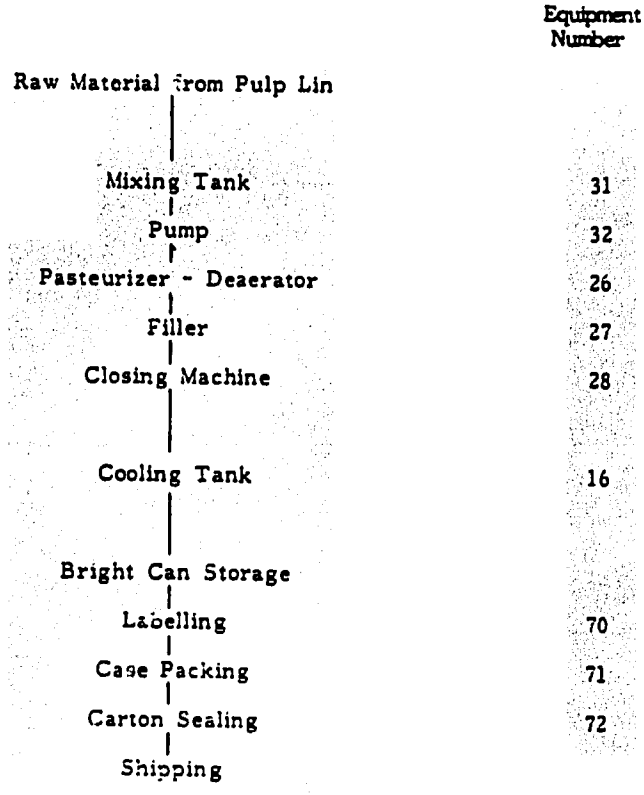
The pulp is stored in a holding tank where citric acid is added to the mango and papaya pulp. The pulp is pumped through a plate heat exchanger that raises the temperature to 92.2 °C where it is held for 1 to 2 minutes to inactivate enzymes. The heated pulp should be filled into cans at 85 °C but preferably around 87.8 °C. This avoids the need for further sterilization after closing. The cans should be inverted and held for 2 to 3 minutes to sterilize the lids and head space, spray cooled to 37.8 °C, dried, and stored.

The volume of No. 10 cans does not warrant mechanized labeling and casing equipment and should be done manually.

4. Nectar Line

The nectars that have been suggested are mango, papaya, passion fruit, and guava that will be packed in No. 300 and No. 2 cans (Figure 12).

FIGURE 12. FLOW CHART FOR NECTAR LINE (MANGO, PAPAYA, PASSION FRUIT, GUAVA IN NO. 300 AND NO. 2 CANS



SOURCE: Appendix G

Pulp can be taken directly from the line or from No. 10 cans that have been stored until slack times at the cannery. This will improve equipment utilization and allow the plant to operate on a longer production schedule. The fruit can either be stored in a holding tank or placed directly into one of two mixing tanks where water, sugar, and citric acid are added. After the product has been thoroughly mixed, it is pumped through a deaerator-heat exchanger that removes air entrapped

in the nectar and heats the mixture to 90.5° C prior to filling and closing. Closing temperature must not be less than 87.8° C. The cans should be inverted and held for 2 to 3 minutes prior to spray cooling and drying.

The basic nectar formulations used in Table 22 may have to be modified to meet local tastes or to standardize the brix and acidity of each batch that is being prepared.

TABLE 22. NECTAR FORMULATIONS OF SELECTED FRUITS

Fruit	Brix	Formulation	Percent
	(percent)		
Mango	12-15	Pulp	32.26
		Water	54.84
		Sugar	9.68
		Citric Acid to 3.7 pH	3.22
Papaya	12	Pulp	35.0
		Water	57.5
		Sugar	7.4
		Citric Acid to 4.0 pH	0.1
Passion fruit	15	Pulp	15
		Water	10
		Sugar	75
		Citric Acid to 4.0 pH	0.1
Guava	11	Pulp	27.7
		Water	62.3
		Sugar	9.9
		Citric Acid to 3.7 pH	0.1

SOURCE: Industry Contacts
4098A

5. Slices, Dices, and Whole Fruit

Due to the variety of fruit to be processed, a separate line has been adapted to handle mango, papaya, rambutan, guava, and tropical fruit cocktail, which requires a lot of manual labor (Figure 13).

FIGURE 13. FLOW CHART FOR SLICES-DICES-WHOLE FRUIT

Mango-Papaya-Rambutan-Guava Shells-Tropical Fruit Cocktail. #300 & #2 Cans

	Equipment Number
Receive Fruit in Bins	
Storage	
Soak Tank Washer	33
Roller Inspection Conveyor	34
Conveyor	55
Peeling Trimming Conveyor	56
Manual Can Filling Conveyor	57
Semi-Automatic Syruping	58
Exhaust Box	61
Closing Machine	63
Cooking Tank	64
Cooling Tank	65
Bright Can Storage	
Labelling	70
Case Packing	71
Carton Sealing	72
Shipping	

SOURCE: Appendix G

From the discharge conveyor, the fruit is dropped onto a roller inspection conveyor, where any damaged or unuseable material is discarded. Mature wholesome fruit is transferred to peeling conveyors, where each fruit is peeled manually and trimmed to remove bruised areas that would appear unsightly in the finished product.

Mango can be sliced into quarters and papaya cut into chunks or diced into 3/4 inch to 1 inch cubes, while rambutans should have the seed carefully removed to minimize damage to the pulp. Guavas do not need to be peeled if the fruit is sound and not diseased, but the blossom end is removed and the fruit cut in half with the seed center scooped out. Fruit for cocktail should be cut into 1/2 inch to 3/4 inch cubes and the rambutans cut in half.

The fruit is placed manually into cans and a 40 percent brix syrup that has been heated to about 82.2° C is added to the product. Citric acid may be needed depending on the acidity of the raw fruit. 5.5 to 7.0 fluid ounces of syrup will be required to bring the cans up to the standard label weight. The filled cans should be exhausted for sufficient time to allow the contents to be heated to 85° C. After closing, the cans are processed in boiling water until a center can temperature of 87.8° to 96.1° C has been achieved. The cans are then removed from the cooker and water cooled to 37.8° C. The cans may be stored until needed for labeling, casing, carton sealing, and shipping.

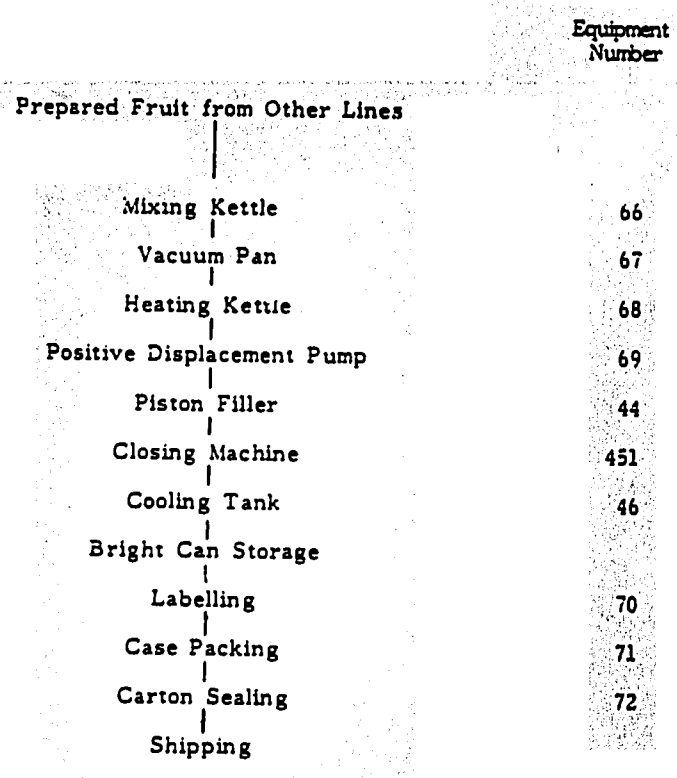
One formulation used for tropical fruit cocktail in No. 2-20 ounce cans is:

	Ounces	Percent
Pineapple	5.5	27.5
Papaya	5.5	27.5
Banana	1.0	5.0
Rambutan	1.3	6.5
Passion fruit pulp	0.7	3.5
Syrup at 40 percent brix	6.0	30.0
TOTAL	20.0	100.0

6. Jams and Jelly

Guava and pineapple are the only fruits selected for jams, as seen in Figure 14. However, other local fruits may be used should there be a market for these products.

FIGURE 14. FLOW CHART FOR JAM AND JELLY LINE (GUAVA AND PINEAPPLE IN NO. 300 AND NO. 2 CANS)



SOURCE: Appendix G

Prepared clean fruit from the other lines will be used for jams and can be transported manually to a mixing kettle where sugar and water are added. A 45 to 55 formulation 1/ consisting of the following ingredients has been used in this report.

Ingredient	Pounds	Percent
Puree	82.00	9.8
Sugar	100.00	40.5
Water	20.00	49.4
Pectin	0.25	0.1
Fruit acid to 3.3 pH	.4	0.2
	202.65	100.0

The puree, sugar, and water are mixed in a heated kettle at about 60° C and are then drawn into a vacuum pan where the product is concentrated at 48.9 to 60° C. This method avoids over-cooking the jam, and the lower temperatures provide a better color and flavor. Guava jam is concentrated to 65 percent soluble solids and pineapple jam to 68 percent.

After concentration, the product is transferred to a second heating kettle where the temperature is raised to 87.8 to 90.5 °C. Pectin is added, and the mixture is adjusted to the proper pH with the addition of fruit acid. The cans are filled in a piston filler and closed atmospherically. No further processing is required if the closing temperature is above 85° C; however, some plants overseas do place the cans in boiling water until a center can temperature of 87.8 °C has been reached as an added precautionary measure. The filled cans can then be water cooled, dried, and stored.

1/ Standard industry fruit formulation.

B. Fresh and Canned Small Tropical Fruit Plant Engineering (Including Pineapple)

1. Background

The Mudon area of Burma produces a wide variety of tropical fruits that are currently being sold on the fresh market. The abundance of fruit at the peak of the harvesting season floods the market which has difficulty in absorbing all of this production, with resulting low prices and fruit going to waste. The small processing plant that has been proposed could process this fruit for sale throughout Burma and also grade and package some of the more exotic fruits that could be exported fresh.

The plant will have to be a multi-purpose cannery, capable of handling small quantities of fruit and processing them into saleable items such as fruit in syrup, juices or nectars, jams and pulps or concentrates. This will require batch-type operations on semi-automatic equipment and a considerable amount of manual labor since the volume of each fruit does not warrant specialized high speed machinery.

The plant management would work with small farmers and not require large-scale commercial plantations. The experimental farm would continue to assist these farmers in developing new varieties of fruit that produce higher and more consistent yields, in addition to improving their husbandry methods through modern technology.

Processing the many different types of fruit that are available will allow the plant to operate throughout the year and provide employment for a permanent work force. During peak

seasons, temporary workers will be required to augment the permanent staff. The plant has limited capacity based on using semi-automatic equipment that can handle the anticipated volumes of fruit. However, it may be necessary to work more than one shift per day during part of the pineapple and rambutan harvesting season, when the plant will be operating close to its rated capacity. This is normal for a canning plant as it is very difficult to regulate the volume of fruit to be received on a given day.

2. Plant Design

The prime considerations in planning a small plant are flexibility of operations and the ability to handle a variety of fruits on a seasonal basis. The plant has been designed to produce pineapple products, fruit pulps, nectars, sliced fruits, and jam. In order to manufacture all of these products, a two line plant has been developed; one line primarily for pineapple and fruit nectars and the other for pulp, sliced fruits, and jams.

By purchasing fruit from many small farmers, one of the major problems the plant will face is scheduling deliveries on a daily basis so there is an even flow of raw material. In the case of pineapple, line speed is controlled by the sizer and corer that has a maximum capacity of 15 cpm per unit, while the other lines are limited by the filling and closing equipment which in the small size cans is 30 cpm and about 20 cpm on No. 10 cans. Actual operating capacity will depend on the dexterity of the operators. The figure used for estimating production capacity has been 12.5 cpm for each of the sizers and corers, 20 cpm on small can sizes and 15 cpm for No. 10 cans. This will allow flexibility in the operation of the plant. However, it may be necessary to work overtime on some days when large volumes of fruit are received.

The design of a multi-purpose small canning plant is usually a compromise between the amount of mechanization used and the investment required for automatic higher speed machinery. In the case of the Mudon plant, the availability of the raw material and a limited domestic market dictate the type of equipment selected. Most of the machinery is semi-automatic and has a greater production capacity than required by the anticipated sales. The volume of processed pineapple and rambutan may be increased by working more than one shift per day during the peak growing periods, which is customary in seasonal canning plants. The other products may be processed during a single shift as the projected volumes are far below line production capabilities. Appendix I details the tropical fruit processing plant site and floor plan.

3. Fresh Fruit Production

a. Fresh Fruit Packing. Shipping fresh fruit from the Mudon area to potential export markets is a new concept for Burma and should be approached on an experimental basis until the success of this operation is assured.

The line that has been designed for packing will handle both large fruit such as pineapple, durian, and jackfruit, in addition to mango, mangosteen, papaya, and rambutan. A minimum amount of mechanization has been included due to the variety of fruit to be handled. The line consists of a soak tank washer, an inspection conveyor to eliminate unsuitable material, a brush washer, a wax applicator, a distribution conveyor, and packing stations.

Small fruit can be handled on this line while the large fruit can be removed and dipped manually into a wax tank for coating. Waxing provides a protective coating on the fruit which retards fruit decay and prolongs the product shelf life.

b. Production. There is relatively little overlap in the harvesting seasons for the different fruits, with greatest production coming in May, June, July, and August when both pineapple and rambutan will be processed as shown in Table 23. During this period this will be done on separate lines, and should not present a manufacturing problem other than the need for additional personnel. The balance of the fruit to be processed arrives in small quantities throughout the year and can be easily handled on the existing lines. Nectars will be produced on the pineapple line, so will have to be manufactured in the off season from pulp or fresh fruit. This is an advantage as it provides a more efficient use of plant personnel by extending the operating schedule.

TABLE 23. ESTIMATED PRODUCTION SCHEDULE FOR PACKAGING FRESH FRUIT

Month	Mango 350 MT	Mangosteen 100 MT	Papaya 400 MT	Rambutan 200 MT	Pineapple 1,200 MT	Total Days Per Month
	days					
January					3.3	3.3
February			5.0			5.0
March	4.4		15.0			19.4
April	13.1		5.0			18.1
May	24.1	2.5		2.5	13.3	42.4
June	2.1	5.0		15.0	20.0	42.1
July		2.5		20.0	20.0	42.5
August						--
September						--
October			10.0			10.0
November			15.0			15.0
December					6.6	6.6
TOTAL	43.7	10.0	50.0	37.5	63.2	204.4

SOURCE: Experience, Incorporated.

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c. Fresh Fruit Production Costs. Table 24 outlines fresh pack costs which are mainly in the raw product itself. The major outside additive is packaging which only amounts to 4.5 percent of sales. There are no ingredients or cans involved.

TABLE 24. ESTIMATED DIRECT PRODUCTION COSTS OF PACKAGING FRESH FRUIT

	Mango 350 MT	Mangosteen 100 MT	Papaya 400 MT	Rambutan 200 MT	Pineapple 1,200 MT	Total Cost
	Kyats					
Raw material	476,350	354,000	882,000	762,000	531,000	3,005,350
Direct labor	12,500	2,900	14,300	14,300	19,000	63,000
Packaging	36,500	12,500	42,900	20,700	125,000	237,600
Other a/						
TOTAL	525,350	369,400	939,200	797,000	675,000	3,305,950

a/ Administration, maintenance, depreciation, interest, and amortization are included in general plant expense and are not included as part of the production costs.

SOURCE: Experience, Incorporated

4098A

4. Production

a. Factory Area. The plant has two main production lines; one for pineapple products and nectars, the other for fruit pulp slices and jam. Each line can operate independently from the other so two or more varieties of fruit may be processed simultaneously. Line capacities have been based on filling and closing machine speeds of 20 cpm, and each line has two of these units that should be ample for the anticipated production volume. In terms of raw material, this should represent about 2,700 to 3,000 kilograms per hour. Dimensions needed for the building are described in Table 25.

TABLE 25. BUILDING AREAS NEEDED FOR THE SMALL PLANT FACILITIES, BURMA

	Dimensions	Square Feet (ft.^{2})	M^2
Fruit Receiving Platform	130' x 20' less 105 ft^2	2,495	232
Production Area	130' x 90' less 420 ft^2	11,280	1,048
Plant Office	20' x 15'	300	28
Quality Control Laboratory	15' x 15'	225	20
Rest Rooms	30' x 20'	600	55
Machine Shop	40' x 20'	800	75
Boiler Room	30' x 20'	600	55
Warehouse	125' x 110' less 2,000 ft^2	11,750	1,092
Fresh Fruit Packing	100' x 20'	2,000	185
Main Office	40' x 30'	1,200	112
Restaurant	40' x 30'	1,200	112
Dressing Room	50' x 30'	1,500	140
Watchman's Room	10' x 10'	100	9
TOTAL		34,050	3,163

SOURCE: Appendix I.

4098A

b. Fruit Receiving Platform. All of the fruit should arrive at the plant in wooden field boxes that can be manufactured locally. A popular size in the United States has inside dimensions of 24 inches long x 12 inches wide x 12 inches high and has a capacity of 1.8 cubic feet or 0.051 m^3 (0.61 m x 0.30 m x 0.30 m). The weight of the contents will vary according to the fruit; however, this should average out around 60 pounds (27 kilograms).

The boxes should be unloaded and stacked four high to facilitate their movement by hand truck. The boxes are weighed on a platform scale to record the amount of fruit purchased and stored on the platform until needed on the production line.

The boxes are then moved to the soak tank washer area. The receiving platform will be used for storing fruit for both fresh fruit and the processing lines.

(1) Pineapple Line. The pineapple line will produce slices, tidbits, chunks, or segments on two preparation conveyors that will use the same syruper, exhaust box, and closing machine. Slices are fed directly to the syruper while products from the other line will be transported manually to the syruper conveyor and fed into the line. The closing machine has sufficient capacity to handle both products but will be run separately so each product can be coded. Material that cannot be used for slices or tidbits will be transported manually to the disintegrator and used for crushed pineapple or juice, as will pulp from peel.

The amount of raw material that will be allocated to crushed or juice depends on market demand and prices for each of these products, since the plant should make every effort to sell high priced products wherever possible. These two products can be run intermittently to keep them separate as they will be filled and closed on the same equipment. If No. 10 cans are to be used for crushed pineapple, the product can be pumped to the filler and closing machine on the pulp line.

(2) Nectar Line. Nectars will be mixed in the two juice tanks and processed on the pineapple line since they cannot be manufactured during the pineapple season. Should it be necessary to produce nectars at this time, they could be made on the pulp line, utilizing the two storage tanks for mixing, the deaerator-pasteurizer from the pineapple line for sterilization, and filled and closed on the pulp equipment. In this case, pineapple juice could be pumped through the pulp heat exchanger, then filled and closed in the normal equipment for this product.

(3) Pulp, Slices, or Jam. Fruit destined for pulp, slices, or jam will be washed and inspected on the same line. The best fruit should be used for slices, while off-size, over-ripe or second grade material can go into the pulp line. The pulp line is simple to operate as the pulper and finisher are used to remove peel and seeds mechanically. Passion fruit will be handled on a separate line, then go through the pulper and finisher. A tubular heater sterilizes the pulp which can then be filled into No. 10 cans and closed.

The sliced fruit line consists of two peeling and trimming conveyors, a can filling conveyor, semi-automatic syruper, exhaust box, and closing machine.

Jam can be made from fresh fruit or pulp which is mixed with sugar in a heating kettle, concentrated in a vacuum pan, and standardized and brought to closing temperature in a second heating kettle. The jam is then pumped to the filler and closing machine on the pulp line.

Sterilizing and cooling will be done in tanks on the production floor. After cooling, the bright cans are palletized and moved to the warehouse where the pallets are stored until needed for labeling.

Waste material can be removed from the production area by means of conveyors or placed in bins. Both methods have been used in the plant, as material from the pineapple and pulp lines are accumulated in bins while waste from the sliced fruit line falls onto a conveyor and is transported to a waste bin outside of the production area.

c. Ingredients. Sugar is the principal ingredient to be used at the plant and is included in all products except pineapple juice as seen in Table 26. Citric acid will also be

TABLE 26. SUGAR REQUIREMENTS FOR FRUIT PROCESSING

Product	Syrup Brix	Amount
	(percent)	(pounds)
Pineapple slices-tidbits-chunks	16	51,900
Pineapple jam	50	147,500
Crushed pineapple	16	9,700
Mango slices	40	50,000
Mango nectar	15	39,700
Papaya dices - chunks	40	20,800
Papaya puree or pulp	35	22,800
Papaya nectar	12	10,850
Rambutan	40	117,200
Passion fruit nectar base	15	58,600
Passion fruit nectar	15	5,200
Passion fruit juice or pulp	15	7,200
Guava jam and jelly	15	79,300
Guava nectar	11	5,000
Guava shells in syrup	40	10,300
Tropical fruit cocktail	40	52,200

Total Sugar 688,250 pounds x K2.05 per pound = K1,410,912

Estimated Citric Acid Requirements:

	Pounds
Nectars	650
Jams and jellies	1,200
TOTAL	1,850

1,850 pounds x US$3.00 per pound CIF Burma = US$5.550 x 7 = K38,850

Estimated Pectin Requirements for Jams and Jelly

570 pounds pectin x US$15.00 per pound CIF Burma = US$8,550 x 7 = K59,850

Summary of Ingredient Costs

Sugar	K1,410,900
Citric Acid	38,850
Pectin	59,850
TOTAL	K1,509,600

SOURCE: Experience, Incorporated.
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required; however, the amounts used will depend on the acidity in Burmese fruit as the pH should be adjusted to between 3.7 and 4.0. This will allow fruit to be processed in boiling water instead of pressure sterilization that would affect the flavor of the product. Pectin is used in jam and jelly manufacturing.

5. Raw Material Costs

The tropical fruit cannery has been designed to utilize excess small farm production. During the low production season, produce should flow to the fresh market to allow farmers to obtain the most advantageous prices. The plant should purchase fruit during the peak production period when the fresh market cannot absorb the available fruit and prices are depressed (Table 27).

6. Utilities

a. Electricity. Electricity for the plant will be generated by a 106.5 HP motor producing 80 KW per hour. This figure is derived by multiplying the HP by a conversion factor of 0.745. On a yearly basis, the amount of electricity generated would be 80 KW x 8 hours per day = 640 KWH per day x 300 days per year or 192,000 KWH per year. More data are available in Appendix J.

TABLE 27. TROPICAL RAW PRODUCT FRUIT COSTS FOR MUDON, BURMA

	Usage (First Year Operation)	Kyats Per Metric Ton	Total
	(metric tons)		(Kyats)
Pineapple	1,900	378	718,200
Mango	350	1,361	476,350
Papaya	240	2,205	529,200
Rambutan	545	3,810	2,076,450
Passion Fruit a/	360	1,930	694,800
Guava	83	339	28,137
Tropical Fruit Cocktail			
Pineapple	180	442	79,650
Papaya	140	2,205	308,700
Banana	15	1,312	19,680
Rambutan	21	3,810	80,010
Passion Fruit Pulp a/	22	1,680	42,460
TOTAL RAW MATERIAL COST			5,053,637

a/ Not in commercial production.

SOURCE: Experience, Incorporated

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b. Boiler Fuel. The boilers will use diesel fuel at a rate of 89.5 US gallons per hour or 74.5 IG (Imperial gallons) per hour. On a yearly basis the breakdown would be as follows:

74.5 IG per hour x 8 hours per day = 596 IG per day x 300 days per year = 178,800 IG per year at an annual cost of K2.60 per IG or K464,880 per year

7. Packaging Materials

Table 28 outlines the can size dimensions and quantity needed for packaging materials, while Table 29 is the basic can tin plate specifications used in can manufacturing.

TABLE 28. SIZE, DIMENSION, AND QUANTITY NEEDED FOR CANS, LABELS, AND SHIPPING CASES

	Can Size	Dimension	Quantity	Cost/M	Annual Cost
	(Number)			------Kyat-----	
Cans a/	300	300 x 407	1,744,215	1,288	2,246,549
	2	307 x 409	2,275,090	1,650	3,753,898
	10	603 x 700	84,690	3,535	299,379
TOTAL					6,299,826
Labels	300	4-1/9" x 9-5/8"	1,750,000	84	147,000
	2	4-1/4" x 11"	2,300,000	91	209,300
	10	6-5/8" x 19-3/4"	85,000	91	7,735
TOTAL					364,035
Shipping Cases b/	300 4x3x2 Pack	12-1 16" x 9-1/16" x 8-7/8"	73,000	1,750	127,750
	2 4x3x2 Pack	13-3/16" x 10-3/8" x 9-1/8"	95,000	2,170	206,150
	10 3x3x1 Pack	18-5/8" x 12-3/8" x 7"	14,200	2,590	36,778
	TOTAL				370,678

SUMMARY OF PACKAGING MATERIAL COST

	Can Cost at 75 Percent a/	Cost
	----------Kyat----------	
Cans	4,724,870	6,299,826
Labels	364,035	364,035
Shipping Cases	370,678	370,678
TOTAL PACKAGING MATERIALS	5,459,583	7,034,539
USE	5,459,600	7,034,500

a/ Once can manufacturing plant is on full schedule, can costs will drop approximately 25 percent.
b/ Shipping cases.

SOURCE: Experience, Incorporated

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TABLE 29. BASIC CAN SPECIFICATIONS

	Bodies	Ends
Pineapple products	100/25 Differential plate Plain inside and out #300 Base Weight 75 pounds #2 Base Weight 85 pounds #2-1/2 Base Weight 90 pounds #10 Base Weight 107 pounds	100/25 Differential Plain inside and enamel outside #300 Base Weight 80 pounds #2 Base Weight 80 pounds #2-1/2 Base Weight 85 pounds #10 Base Weight 107 pounds
Mango	100/25 Differential plate Plain inside and out Base weights as above	100/25 Differential plate Plain inside and enamel outside Base weights as above
Papaya	100/25 Differential plate Enameled inside-Plain outside Base weights as above	100/25 Differential plate Enameled inside and outside Base weights as above
Rambutan	100/25 Differential plate Plain inside and out Base weights as above	100/25 Differential plate Plain inside-Enamel outside Base weights as above
Passion Fruit	100/25 Differential plate Plain inside and out Base weights as above	100/25 Differential plate Plain inside and enamel outside Base weights as above
Guava	100/25 Differential plate Plain inside and out Base weights as above	25 Electrolytic plate Enamel inside and outside Base weights as above
Tropical Fruit and Cocktail	100/25 Differential plate Plain inside and outside Base weights as above	25 Electrolytic plate Enamel inside an outside Base weights as above

SOURCE: American Can Company

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8. Administrative

a. Salaries of Administrative Personnel. A plant of this size should not require expatriate personnel as people can be found in Burma to assume the managerial and supervisory responsibilities required. Table 30 shows salaries for local personnel in Burma. Estimated administration and sales expenses are based on current costs or expressed as a percent of gross sales.

TABLE 30. ESTIMATED ADMINISTRATIVE PERSONNEL SALARIES

	Skill	Number	Monthly Cost	Annual Cost
			----Kyats----	
General manager	M	1	800	9,600
Fieldman	M-E	1	450	5,400
Sales manager	M-E	1	450	5,400
Quality control supervisor	M-E	1	450	5,400
Production supervisor	M-E	1	450	5,400
Accounting-financial supervisor	M-E	1	450	5,400
Mechanical supervisor	M-E	1	450	5,400
Secretary	S	1	300	3,600
Order clerk	S	1	210	2,520
Laboratory technician	S	1	320	3,840
Accounting-payroll clerk	S	1	210	2,520
Inventory-billing clerk	S	1	210	2,520
Mechanics	S	2	320	7,680
Electrician	S	1	320	3,840
Typists	S	2	160	3,840
Telephone-receptionist	S-S	1	160	1,920
Watchmen	N-S	5	170	10,200
Truck drivers	N-S	5	170	10,200
TOTAL		28		94,680

M-E = Managerial Executive
S = Skilled
S-S = Semi-skilled
N-S = Non-skilled

SOURCE: Experience, Incorporated

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b. Personnel Requirements. The labor needs for the plant can be divided into two periods: a slack season which lasts for about eight months when small quantities of fruit will be handled on a daily basis, and a four month heavy season when pineapple and rambutan are being processed. To avoid burdening the plant with excessive labor costs, the plant should operate with minimum permanent staff and hire temporary workers during the peak period. This will require considerable flexibility in scheduling the work force to avoid conflicts over the tasks to be performed in the slack season. However, since most of the work does not require a high degree of specialization, the permanent staff should be available for work throughout the plant as needed.

Table 31 shows the number of people required on each line and labor costs derived therefrom. The work force has been divided into two groups, a permanent staff and temporary personnel that will be hired during the rambutan period. The development of an organizational chart can be found in Figure 15.

c. Administration Office Expenses. An amount of 0.5 percent of sales has been allocated to cover the cost of operating the office. This should cover stationery, telephone, cable or Telex, entertainment, and local travel.

d. Sales Expenses. The plant should concentrate on selling its products on the Burmese markets until such time as it can compete on the world market in both quality and price. An amount of 1 percent of sales should cover the cost of advertising and office expenses for national sales. A further analysis of product sales is included in Table 32.

TABLE 31. PERSONNEL REQUIREMENTS AND LABOR COSTS FOR PERMANENT AND TEMPORARY WORKERS

Job Description	Skill	Number of People	PERMANENT STAFF			TEMPORARY WORKERS		
			Number	Monthly Wage	Annual Cost	Number	Monthly Wage	Annual Cost (4-months)
Raw Fruit Receiving								
Foreman	SU	1	1	K 320	K			K
Fruit Handlers	N-S	9	3	170	6,120	6	K 170	4.080
		10	4		K 9,960	6		K 9,080
Pineapple Line								
Foreman	SU	1	1	K 320	K 3,840	-	-	-
Size Grading	N-S	6	3	170	6,120	3	170	K 2,040
Sizer - Corer	S	2	2	210	5,040	-	-	-
Trimming Tables	N-S	12	4	170	8,160	8	170	5,440
Slicer	S	1	1	210	2,520	-	-	-
Tidbit Cutter	N-S	1	-	170	2,040	1	170	680
Can Loading	N-S	6	2	170	4,080	4	170	2,720
Can Handling	N-S	2	1	170	2,040	1	170	680
Syruper	N-S	1	1	170	2,040	-	-	-
Can Closing Machine	S	1	1	210	2,520	-	-	-
Transport Cans to Cooker	N-S	1	1	170	2,040	-	-	-
Meat Eradicator	S	1	1	210	1,520	-	-	-
Disintegrator	S	1	1	210	2,520	-	-	-
Inspection Belt	N-S	4	2	170	4,080	2	-	-
Filler	N-S	1	1	170	2,040	-	-	-
Can Closing Machine	S	1	1	210	2,520	-	-	-
Juice Extractor	S	1	1	210	2,520	-	-	-

TABLE 31. PERSONNEL REQUIREMENTS AND LABOR COSTS FOR PERMANENT AND TEMPORARY WORKERS

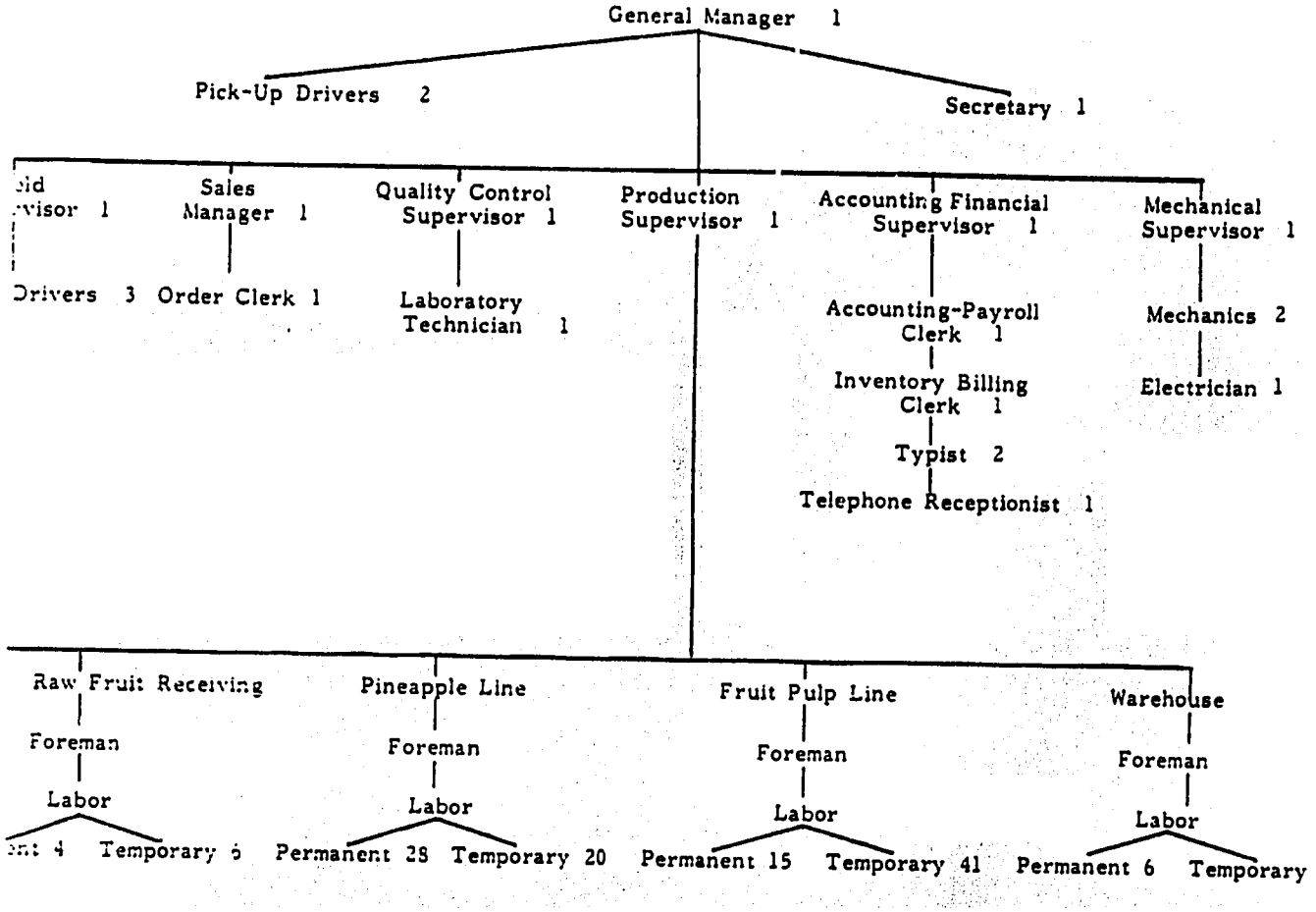
Job Description	Skill	Number of People	PERMANENT STAFF			TEMPORARY WORKERS		
			Number	Monthly Wage	Annual Cost	Number	Monthly Wage	Annual Cost (4-months)
Pineapple Line (cont.)								
Cooking and Cooling	S	1	1	K 210	K 2,520	-	K -	K -
Stacking Cans on Pallets	N-S	2	1	170	2,040	1	170	680
Waste Material and Clean-up	N-S	2	2	170	4,080	-	-	-
		48	28		K 65,280	20		K 12,240
Pulp and Sliced Fruit Line								
Foreman	S-U	1	1	K 320	K 3,840	-	-	-
Size Grading - Inspection	N-S	6	1	170	2,040	5	170	K 3,400
Pulper	S	1	1	210	2,520	-	-	-
Finisher	S	1	1	210	2,520	-	-	-
Storage Tanks-Heat Exchanger	S	1	1	210	2,520	-	-	-
Filler	N-S	1	-	-	-	1	170	680
Can Closing Machine	S	1	1	210	2,520	-	-	-
Moving Cans to Cooler	N-S	1	*	-	-	-	-	-
Fruit Peeling - Trimming	N-S	36	6	170	12,240	30	170	20,400
Can Loading	N-S	6	2	170	4,080	4	170	2,720
Syruping	N-S	1	-	-	-	1	170	680
Can Closing Machine	S	1	1	210	2,520	-	-	-
Moving Cans to Cooker	N-S	1	*	-	-	-	-	-
		58	15		K 34,800	41		K 27,880

TABLE 31. PERSONNEL REQUIREMENTS AND LABOR COSTS FOR PERMANENT AND TEMPORARY WORKERS

Job Description	Skill	Number of People	PERMANENT STAFF			TEMPORARY WORKERS		
			Number	Monthly Wage	Annual Cost	Number	Monthly Wage	Annual Cost (4 months)
Jams and Jelly								
Mixing Kettle	S	1	*	-	-	-	-	-
Heating Kettle	S	1	*	-	-	-	-	-
Filler	N-S	1	*	-	-	-	-	-
Can Closing Machine	S	1	*	-	-	-	-	-
Moving Cans to Cooler	N-S	1	*	-	-	-	-	-
		5	-	-	-	-	-	-
Fruit Nectars								
Mix Ingredients	S	1	*	-	-	-	-	-
Filler	N-S	1	*	-	-	-	-	-
Can Closing Machine	S	1	*	-	-	-	-	-
Moving Cans to Cooler	N-S	1	*	-	-	-	-	-
		4	-	-	-	-	-	-
Warehouse								
Foreman	SU	1	1	K 320	K 3,840	-	-	-
Fork Lift Truck Operator	S	1	1	210	2,520	-	-	-
General Labor	N-S	8	4	170	8,160	4	170	K 680
Sub Total		10	6		K 14,520	4		K 680
Total Estimated Labor Costs		135	53		K 124,560	71		K 44,880

* Low Season Production Using Permanent Staff Workers

FIGURE 15. ORGANIZATIONAL CHART FOR THE TROPICAL FRUIT CANNERY



Total administration and sales expenses will be a rounded figure of K378,000.

Personnel Salaries	K94,680
Administration - Office Expenses	94,425
Sales Expenses	188,850
TOTAL	K377,955

TABLE 32. SUMMARY OF ESTIMATED SALES, SMALL CANNERY, MUDON, BURMA

	Cases of No. 2 Can Size Equivalents	Selling Price Per No. 2 Case Equivalent a/	Sales Value
		---------Kyats--------	
Pineapple products	67,010	112.82	7,560,068
Mango products	26,218	108.84	2,853,567
Papaya products	14,016	86.94	1,218,551
Rambutan	29,000	184.25	5,343,250
Passion fruit	9,864	82.97	818,416
Guava products	7,114	95.60	680,063
Tropical fruit cocktail	14,651	120.01	1,758,267
TOTAL b/	167,873		20,232,182

a/ Averages for all can sizes and styles of pack.
b/ First year of operation; second to ninth year 21,701,515; tenth through twentieth year 22,359,772.

SOURCE: Experience, Incorporated

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9. Maintenance

Maintenance of a food processing plant facility is of utmost importance since down time during the production season can represent the difference between a loss and a profit. The amounts used in Table 33 are those commonly used by the industry.

TABLE 33. MAINTENANCE SCHEDULE

	Value	Amount	Maintenance Budget
	(Kyats)	(Percent)	(Kyats)
Site improvements	77,300	1	773
Buildings	3,709,200	1	37,092
Production and supporting equipment	5,407,850	3	162,236
Automobiles - trucks	1,033,200	5	51,660
Office, laboratory and machine shop	613,900	3	18,417
TOTAL	10,841,450		270,178 a/

a/ Use 270,200 as rounded off number.

SOURCE: Experience, Incorporated.

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10. Depreciation

Depreciation charges are normally based on the original value of fixed investments according to the methods and rates adopted by management and approved by local tax authorities. A straightline method has been used in Table 34 according to the useful life of the asset.

11. Amortization

Table 35 covers items that will require funding before the plant starts its operations that should be amortized over a period of years.

TABLE 34. DEPRECIATION SCHEDULE

	Value	Years	Percent Per Year	Maintenance Budget
	(Kyats)			(Kyats)
Site improvements	77,300	20	5	3,865
Buildings	3,709,200	25	4	148,368
Production and supporting equipment	5,407,850	10	10	540,785
Automobiles - trucks	1,033,200	5	20	206,640
Office, laboratory and machine shop	613,900	10	10	61,390
TOTAL	10,841,450			961,048 a/

a/ Use K961,100 as rounded figure.

SOURCE: Experience, Incorporated calculations.

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TABLE 35. AMORTIZATION SCHEDULE

	Value	Amount Per Year	Annual Cost
	(Kyats)	(percent)	(Kyats)
Plant engineering and design	249,200	10	24,920
Organizational expenses	70,000	10	7,000
Equipment installation and start-up	159,100	10	15,910
TOTAL	478,300		47,830 a/

a/ Use K47,800 as rounded figure.

SOURCE: Experience, Incorporated calculations

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12. Interest, Loan Repayment, and Taxes

Table 36 shows interest calculated at 18 percent on short-term loans. The actual short-term borrowing will depend on sales since inventory is a major item in the working capital requirements. Long-term borrowing is based on an interest rate of 12 percent on a fully amortized loan with a fixed payment per year. Interest payments decline throughout the 20 year loan term while the principal payment increases.

TABLE 36. INTEREST AND DEBT REPAYMENT SCHEDULE

	Amount	Interest Rate	Annual Cost
	(Kyats)	(percent)	(Kyats)
Long term loans	4,319,000	18	777,420
Short term loans	10,308,700	12	1,362,100 a/

a/ In first year interest portion is K1,229,900 (compounded monthly) and principal portion is K132,200 by the 20th year the interest portion declies to K84,600 and the principal portion increases to K1,277,500.

SOURCE: Experience, Incorporated calculations.

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Taxes have not been included in this report as these data were not made available by the Burmese authorities.

13. Plant Facilities

a. Land. Land for the plant will be furnished by the Burmese Government so there will be no capital investment required for this item. A minimum of 5 acres or 20,200 m^2 should be acquired for the plant site.

b. Site Improvements. The site will require grading and access roads around the plant. The actual amount of grading will depend on terrain conditions, consequently for estimating purposes, an area of one acre has been used at a cost of K0.652 per square foot or K28,362 per acre. Access roads and parking areas have been estimated at approximately 16,300 square feet at a cost of K3.00 per square foot for a total of K48,900.

c. Buildings. The buildings included in the investment for this plant consist of the main production facility, the office, dressing rooms, and restaurant and watchman's quarters. Residences for the staff and permanent workers are to be furnished by the Burmese Government, and are eliminated from the amount of investment required. Cost of the buildings has been calculated in Table 37.

TABLE 37. COST OF BUILDINGS AND SPACE REQUIRED

	Cost Per Square Foot a/	Square Foot	Total Cost
	(Kyats)		(Kyats)
Plant and warehouse	103.25	30,150	3,113,000
Office, restaurant, dressing rooms	158.88	3,900	596,200
TOTAL		34,050	3,709,200

a/ Based on construction data obtained from Marshall Evaluation Service.

SOURCE: Experience, Incorporated based on industry contacts.

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d. Processing and Supporting Equipment. The cost of the processing and supporting equipment has been estimated at US$772,550 C&F Rangoon, Burma or K5,407,850.

e. Plant Office. A small plant office is located between the receiving platform and production area to allow the plant supervisor to control both areas. The scale platform has been placed next to the office with the digital indicator and printer mounted on a desk inside the office where one of the clerks can record all of the fruit purchases.

f. Office Equipment. Desks, chairs and other office furniture that can be obtained in Burma should be purchased locally to avoid the necessity of using foreign exchange for these items. An amount of K53,200 has been allocated to cover this cost.

Office equipment will require foreign exchange as this material is not manufactured in Burma and must be imported. The equipment that has been included in this list are four electric typewriters, eight calculators, and one copier, for a total of US$12,500 C&F Rangoon.

g. Laboratory. A small laboratory is essential to maintain quality control standards in the plant. An amount of US$22,350 should cover all of the equipment and supplies that will be needed for this facility.

h. Quality Control Laboratory. This room has easy access to the production area and is between the two main lines which will allow laboratory personnel to spend time on the floor inspecting the work that is being done.

i. Rest Rooms. Men's and women's toilets are located to the rear of the production area. This will eliminate the need for personnel to leave the plant to use the facilities in the dressing room.

j. Machine Shop. A small machine shop is necessary to repair and maintain plant machinery. The equipment for the plant is uncomplicated, and this work can be accomplished with basic machinery such as a metal lathe, drill press, grinder, and welding equipment for both iron and stainless steel, in addition to hand tools. An amount of US$45,250 should cover the cost of this machinery C&F Burma.

k. Boiler Room. The boiler room is in the rear of the building next to the machine shop and close to the equipment that will require steam. The boiler requirements are listed in Table 38.

TABLE 38. BOILER REQUIREMENTS CALCULATIONS

Boiler Number		Horsepower
11	Syrup Tanks 75 gallons each	10
13	Exhaust Box	60
14	Cooking Tanks	10
24	Kettles 100 gallons each	40
26	Deaerator-Pasteurizer	30
43	Heat Exchanger	20
59	Syrup Tanks 75 gallons each	12
61	Exhaust Box	50
64	Cooking Kettles	10
66	Mixing Kettle 100 gallons	20
67	Vacuum Pan 100 gallons	15
68	Mixing Kettle	20
TOTAL ESTIMATED MAXIMUM BOILER REQUIREMENTS		297

SOURCE: Experience, Incorporated

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A 300 HP boiler has been selected to meet the peak load when all of the equipment is operating. Fuel consumption and the volume of steam produced have a direct relationship; consequently, when the plant operates at half to two-thirds capacity, the amount of fuel used will drop accordingly.

1. Automotive Equipment. The vehicles shown in Table 39 should provide the plant with adequate transportation equipment.

TABLE 39. AUTOMOTIVE EQUIPMENT REQUIRED FOR PLANT

Number	Equipment	Each	Total Cost
		---------US$-------	
1	Station wagon for use by the general manager		15,000
1	4-wheel drive unit for the fieldman		14,000
2	Half ton pick-up trucks for general plant	17,000	34,000
3	Flatbed trucks two to three tons capacity for hauling raw material	28,200	84,600
	TOTAL		147,600

SOURCE: Experience, Incorporated based on industry contacts.

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m. Equipment Installation and Start-Up Costs. The machinery for this plant is not complicated, so much of the installation work can be accomplished by the local staff. Foreign personnel have been suggested to supervise the installation of the boiler and deaerator. An amount of US$11,300 has been allocated to cover this expense that includes a salary of US$300 per man day for the installation engineer and US$2,000 for transportation.

n. Organizational Expenses. The foreign exchange component consists of US$26,600 for detailed engineering drawings and US$9,000 for legal and other expenses incurred outside of Burma. K70,000 should cover local expenses to form a company in Burma.

o. Warehouse. The warehouse will be used for finished product, empty cans, cartons, ingredients and labeling, casing, and carton sealing equipment. All of the material in this area should be palletized to facilitate handling.

A 55 inch x 44 inch (1.37 m x 1.12 m) pallet has been suggested as this will hold all of the products with relatively little loss of space due to differences in carton sizes. By stacking the pallets 3 high and allowing 30 percent aisle space, the warehouse area should be sufficient to store all of the products needed during the peak production period. The warehouse should have a minimum height at the eaves of 18 feet (5.5 m) to fully utilize the storage area.

p. Main Office. The main office, restaurant, and plant dressing rooms have been separated from the main building as is customary in Burma.

The office area is small but should be adequate for a small cannery, especially since some of the plant accounting functions can be performed in the production supervisor's office.

q. Restaurant. A restaurant has been included to feed office and plant personnel. Food can be served cafeteria style with a minimum amount of cooking equipment and most of the area used for seating facilities.

r. Dressing Rooms. The dressing rooms have separate facilities for female and male personnel and should include lockers, showers, and toilets.

s. Watchman's Room. A watchman's room has been located at the main entrance to control movements in/out of the plant area.

t. Miscellaneous Expenses. An amount of 7.34 percent of the total capital investment has been allocated to cover unforeseen costs that occur in starting up a new plant. If these funds are not needed for this purpose, they can be transferred to the working capital account and thus lower the amount of short term borrowing that will be needed.

14. Working Capital Requirements

The three major working capital needs are to finance imported packaging materials, accounts receivable and inventory as indicated in Table 40 (K8,919,000). The plant will be working on a twelve month production schedule, so inventory can possibly be reduced to avoid stocking large volumes of the different products like all other seasonal operations. The working capital for seasonal requirements are not considered as part of the overall financial structure but are obtained as needed for a short period on warehouse receipts or other financial instruments. This is estimated at K4,319,000 leaving K4,600,000 for the regular year around financing which is included in total plant investment costs.

15. Production Costs

The major effects on production will be the cost of raw material, direct labor, and packaging required for handling fresh fruit. Table 41 outlines these amounts.

TABLE 40. WORKING CAPITAL REQUIREMENTS

	Time Frame	Total Value	Amount
	(months)	---------Kyats-------	
Raw materials	1	5,053,600	421,100
Ingredients (sugar-citric acid-pectin)	3	1,509,600	377,400
Packaging materials	3	5,459,600	1,364,900
Accounts receivable	1	16,213,500	1,351,100
Inventory	4	16,213,500	5,404,500
TOTAL		44,449,800	8,919,000

SOURCE: Experience, Incorporated calculations

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TABLE 41. ESTIMATED PRODUCTION COSTS a/

	Cost	Amount
	(percent)	(Kyats)
Raw materials	30.22	5,053,600
Ingredients	9.03	1,509,600
Direct labor costs	1.01	169,500
Utilities	3.12	522,000
Packaging materials (cans discounted at 75 percent of actual cost)	42.06	7,034,500
Administration and sales expenses	2.25	378,000
Maintenance	1.62	270,200
Depreciation	5.75	961,100
Interest	4.65	777,400
Amortization	0.29	47,800
TOTAL	100.00	16,723,700
Profit		

a/ Excludes long-term debt servicing.
b/ Cans are discounted to K5,459,600 after seventh year of operation.

SOURCE: Experience, Incorporated.

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a. Cost Revenue and Profitability. Based on the assumptions used, total sales for the small tropical fruit cannery will reach K24,364,382 in the first year which includes K20,232,182 for processing and K4,132,200 for the fresh market. Total operating costs are K15,714,800 for processing and K3,305,950 for the fresh market totaling K19,020,750. Operating costs exclude depreciation and amortization of organizational, plant engineering, and equipment installation expenses. This yields a profit before debt servicing and taxes of K5,343,632. During the second to the ninth year, total sales will average K27,507,715 and will increase to K30,923,172 from years ten through twenty. Total costs increase in years two through seven, but fall in years eight and nine as cans are discounted. From the tenth through twentieth years costs increase again as plant operations increase. Profit before taxes and debt servicing from year two through seven are K6,783,751, K9,122,665 in year eight, K7,246,427 in year nine, K7,073,284 in years ten through twelve, and level off to K8,949,522 in years thirteen through twenty. 1/

b. Discussion of Investment Costs. Table 42 outlines the investment costs necessary for the success of the small tropical fruit plant.

C. Large Pineapple Processing Plant Design and Engineering

1. Background

Pineapple production in the Mudon area consists of many small farms growing Kew varieties for the fresh market.

1/ See Table 116, "Basic Data for Before Tax Cash Flow Analysis for Small Tropical Fruit Plant, Mudon, Burma" in the financial section of this report.

TABLE 42. SUMMARY OF INVESTMENT COSTS

	Foreign Exchange Cost	Local Cost	Total
	(US$)	----------Kyats--------	
Land			
Site improvements		77,300	77,300
Buildings		3,709,200	3,709,200
Processing and supporting equipment	772,550	--	5,407,850
Office equipment	12,500	53,200	140,700
Laboratory equipment	22,350	--	156,450
Machine shop	45,250	--	316,750
Automotive equipment	147,600	--	1,033,200
Equipment installation and start-up	11,300	80,000	159,100
Organizational expenses	35,600	70,000	319,200
Miscellaneous expenses		1,261,410	1,261,410
Working capital		4,600,000	4,600,000
TOTAL	1,047,150	9,851,110	17,181,160
Capitalization			
Equity Capital 40 percent	-		6,872,460
Long-Term Loan 60 percent	-		10,308,700
GRAND TOTAL KYATS			17,181,160

SOURCE: Experience, Incorporated

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Although this is an English selection of the Smooth Cayenne variety, it is not the type of fruit that is most suitable for processing as it lacks the acidity necessary in a canned product. It is also a small pineapple and consequently, there will be an excess amount of waste in the peeling and sizing operations. Before attempting a large-scale commercial plantation, an experimental nursery should be established to develop Smooth Cayenne varieties that can be grown under the existing climatic conditions in Mudon. Heavy rainfall in the monsoon season, lack of adequate sunshine during the growing period, and high night temperatures are all factors that may affect the quality of the fruit and viability of the project.

2. Plant Size

No historical data are available on commercial pineapple growing in Burma, so the plant has been designed according to industry standards. Fruit sizes vary from a minimum diameter of 9.53 centimeters to a maximum of 19.05 centimeters, with an average fruit weight of 2.04 kilograms. In order to utilize all the available pineapple, a three line plant has been selected to process slices in No. 2, No. 2-1/2, and No. 10 can sizes, with the latter being used for both small and large size fruit. Defective pineapple that cannot be used for slices will be processed as chunks, spears, tidbits, and diced. The first cut material from the peel will be used for crushed pineapple as will waste from the sliced line that cannot be used for the higher priced items. Juice will be produced from the second peel cut; cores and wholesome waste material from the other lines.

3. Production Capacity

Production capacity for the three lines operating 20 hours per day during a 75 day working season will be 49,500 MT of fruit. Based on an estimated yield of 28.6 cases of No. 2-1/2 cans per MT of pineapple, an annual volume of 1,415,771 cases can be anticipated. Marketing study results indicate that the greatest demand for pineapple products is in No. 2 and No. 10 cans. Forty percent of production has been allocated to each of these sizes and 20 percent to No. 2-1/2 cans. Table 43 shows the product breakdown that may be expected from the plant.

The type of product mix will be determined by the fruit received and the market demand for individual products. Therefore, the production lines should have the flexibility to meet these requirements. There is ample capacity in all of the

lines to handle the anticipated production except on the No. 2 can size for slices. As there is substantial excess production on the No. 2-1/2 can size, this line can be changed over to No. 2 cans as needed (Table 44). Due to variations in raw material quality, the closing and filling equipment for crushed pineapple and juice can operate at higher speeds than those mentioned above.

There is sufficient space in the production room for a fourth line should future expansion become necessary. This would entail moving the No. 2-1/2 crushed pineapple and juice line under the mezzanine and the No. 2 crushed and juice line to the rear of the room to allow for filling, cooking, and cooling equipment for the new line.

4. Production Costs

a. Raw Material. In order to supply the processing plant with fresh pineapple, a large-scale plantation should be developed. Climatic conditions in the Mudon area are not the most suitable for growing pineapple commercially (Appendix A). Test plantings must be developed and accurate result records maintained on both planting tests and production costs. As production cost data are not currently available, estimations using modern agricultural technology to grow and harvest pineapple have been developed.

The estimated price for fresh pineapple used in this report is US$54 per MT or K378.00 per MT. 49,500 MT per pineapple season x K378.00 per MT = K18,711,000. Raw product prices of US$48.60 or K340.20 are also considered in the financial analysis.

TABLE 43. PRODUCT BREAKDOWN BASED ON 1,415,700 CASES OF NO. 2-1/2 CAN SIZE EQUIVALENT, LARGE PINEAPPLE CANNERY, MUDON, BURMA

	Percent	Number 2-1/2 Case Equivalent	Sizes No. 2's 40 Percent	No. 2-1/2's 20 Percent	No. 10's 40 Percent
Slices	24.4	345,430	200,515	69,086	150,234
Tidbits	6.3	89,189	51,772	17,838	38,790
Chunks	16.2	229,343	133,129	45,868	99,745
Cubes	0.4	5,663	3,287	1,133	2,463
Crushed	17.1	242,085	140,525	48,417	105,288
Juice	35.6	503,990	292,556	100,798	219,195
TOTAL a/	100.0	1,415,700	821,784	283,140	615,715

a/ The reason why the 2-1/2 equivalent amount is less than the total is because of the concentration on the No. 2 size.

SOURCE: Experience, Incorporated
4098A

TABLE 44. LINE CAPACITY SIZES FOR NO. 2-1/2, 2 AND NO. 10 CANS-CASES a/

	No. 2-1/2 Cans-Cases			No. 2 Cans-Cases			No. 10 Cans-Cases		
	Sales	CPM	Production	Sales	CPM	Production	Sales	CPM	Production
Slices-Chunks-Tidbits, etc.	133,925	80	300,000	388,703	100	375,000	291,232	36	540,000
Crushed	48,417	13	48,750	140,525	38	142,500	105,288	15	225,000
Juice	100,798	27	101,250	292,556	79	296,250	219,195	36	540,000
TOTAL	283,140			821,784			615,715		

a/ Total capacities exceed budgeted cases for sale so that there can be shifting among lines because of product variability.

SOURCE: Experience, Incorporated
4098A

b. Ingredients. The main ingredient needed by the plant is sugar for syrup used in all of the products except pineapple juice. The three commonly used concentrations are:

- Light Syrup — 14 percent or more but less than 18 percent brix
- Heavy Syrup — 18 percent or more but less than 22 percent brix
- Extra Heavy Syrup — 22 percent or more but not more than 35 percent brix

The type of syrup concentration is normally specified by the buyer based on the market demands in each country. In order to allow some degree of flexibility in meeting these specifications, 16 percent brix syrup was used in preparing this cost analysis. A price increase should be made for concentrations above 18 percent brix.

Table 45 reflects the amounts of sugar presently being used in preparing syrup.

TABLE 45. SYRUP PREPARATION FOR PINEAPPLE PRODUCTS

Product	Can Size	Kilograms
	(number)	
Slices-Tidbits-Chunks-Segments	2	317,515
	2-1/2	164,155
	10	327,856
Crushed Pineapple	2	268,526
	2-1/2	101,695
	10	157,079
TOTAL		1,336,736

SOURCE: Experience, Incorporated

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A rounded out figure of 1,336.736 kilograms of sugar has been used at a price of K4.524 per kilogram for a total of K6,047,500.

c. Direct Labor Costs. In calculating labor costs, a 75-day season has been used (Table 46). While this method of costing may not agree with current Burmese practices, it is customary in seasonal fruit processing plants.

5. Plant Facilities

Pineapple will be received at the plant in wooden bins measuring 2.438 meters wide x 4.572 meters long x 0.762 meters deep, holding about 4 MT of fruit. The plant has a capacity of 33 MT per hour or 660 MT in 20 operating hours. This will require 165 bins of fruit per day. Fresh fruit will be harvested during 12 daylight hours, and trucks between the fields and the plant will operate 10 hours a day. Table 47 indicates the building areas required to house all of the plant facilities.

a. Covered Shed for Pineapple. When the trucks arrive at the plant, they are weighed to record the fruit that is purchased, and the bins can be either discharged directly into the production line or stored in a covered shed until needed. The storage area can hold 110 bins stacked three high which represents over 13 hours of production at the above rate.

b. Fresh Fruit Receiving Line. The pineapple is dumped into water holding tanks where it is pumped to the fresh fruit elevator. These tanks are made of concrete and can be constructed on site.

TABLE 46. ANALYSIS OF DIRECT LABOR REQUIREMENTS FOR EACH 8-HOUR SHIFT

Description of Work	Skills	Quantity	Cost Month	Cost Season
			-----Kyats-----	
Raw Fruit Receiving				
Foreman (12 months)	SU a/	1	320	3,840
Scale operator	S b/	1	210	630
Hydraulic dumper	S	1	210	630
Water storage system	N-S c/	2	170	1,020
Graders	S	2	210	1,260
Conveying distribution system	N-S	2	170	1,020
Forklift truck operator	S	1	210	630
Clean-up	N-S	2	170	1,020
TOTAL		12		10,050
Solid Pack Preparation Line				
Foreman	SU	2	320	7,680
Sizing and coring 3 lines	S	3	210	1,890
Fruit trimming 3 lines	S-S	30	195	17,550
Fruit inspection	S-S	20	195	11,700
Can coring and loading	S-S	8	195	4,680
Resizing and coring	S-S	4	195	2,340
Can loading	S-S	4	195	2,340
Salvage	S-S	4	195	2,340
Prevacuumizing and closing	S	3	210	1,890
Bright can palletizing	S	2	210	1,260
Small fruit transferring cans	N-S	4	170	2,040
Bright can manual palletizing	N-S	2	170	1,020
Syrup mixing	S	2	210	1,260
Clean-up	N-S	3	170	1,530
TOTAL		90		59,520
Juice Line				
Foreman	SU	1	320	3,840
Disintegrator	S-S	1	195	585
Juice reception and heating	S-S	1	195	585
Juice extraction and desludging	S	1	210	630

Continued . . .

TABLE 46. ANALYSIS OF DIRECT LABOR REQUIREMENTS - Continued

Description of Work	Skills	Quantity	Cost Month	Cost Season
			-----Kyats-----	
Juice filling and closing 3 lines	S	3	210	1,890
Bright can manual palletizing	N-S	6	170	3,060
TOTAL				10,590
Crushed Line				
Foreman	SU	1	320	3,840
Crushed fruit reception	S-S a/	1	195	585
Pineapple crusher	S	1	210	630
Inspection belt	S-S	8	195	4,680
Heater and draining	S	1	210	630
Crush filling #10 cans	S	1	210	630
Can closing #10 cans	S	1	210	630
Bright can manual palletizing	N-S	1	170	510
TOTAL		15		12,135
Filled Can Warehouse				
Foreman	SU	1	320	3,840
Forklift truck operators	S	3	210	4,410
Bright can depalletizing	S	1	210	1,470
Can labeling #3 and #2-1/2 cans	S-S	1	195	1,365
Can casing #2 and #2-1/2 cans	S-S	1	195	1,365
Case sealing #2 and #2-1/2 cans	--	--	--	--
Placing cases on conveyor	N-S	1	170	1,190
Bright can depalletizing #10's	N-S	2	170	2,380
Can labeling #10's	N-S	1	170	1,190
Can casing and sealing #10's	N-S	1	170	1,190
Placing cases on conveyor	N-S	1	170	1,190
Loading containers	N-S	4	170	4,760
TOTAL		17		24,350

Continued . . .

TABLE 46. ANALYSIS OF DIRECT LABOR REQUIREMENTS - Continued

Description of Work	Skills	Quantity	Cost Month	Cost Season
			------Kyats-----	
Empty Can Handling				
Forklift truck operator	S	1	210	630
Line #2-1/2 slices	N-S	1	170	510
Line #2 slices	N-S	1	170	510
Line #2-1/2 juice and crush	N-S	1	170	510
Line #2 juice and crush	N-S	1	170	510
TOTAL		5		2,670
GRAND TOTAL				119,315

a/ SU = Supervisor
b/ S = Skilled
c/ N-S = Non-Skilled
d/ S-S = Semi-Skilled

SOURCE: Salaries for Burmese Nationals furnished by the Foodstuff Industries Corporation

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c. Fruit Elevator and Tank. The elevator is equipped with pressure sprays to remove any dirt that may adhere to the pineapple and conveys the fruit to the size graders.

d. Fruit Grading, Storage, Conveying and Peeling. The two size graders separate fruit into 3 diameter sizes, one for each of the peelers. After sizing, the fruit is held on a conveyor that maintains a constant flow of fruit to the Ginaca, where the pineapple is peeled with the cylinders going to the sliced product line and the meat eradicated from the peels conveyed to the crushed and juice lines.

TABLE 47. BUILDING SIZE AND DIMENSIONS FOR LARGE PLANT FACILITIES

Building Size	Dimensions	M2
Covered storage shed	10 m x 45 m	450 m^2
Fresh fruit receiving	14 m x 20 m	280 m^2
Fruit elevator and tank	4 m x 7.5 m	30 m^2
Fruit grading - storage - conveying	14 m x 26 m	364 m^2
Main processing room	26 m x 75 m	1,950 m^2
Can making and tin plate storage	16 m x 50 m	800 m^2
Finished product storage and rest room	50 m x 75 m	3,750 m^2
	75 m x 75 m	5,625 m^2
Labeling-casing-carton sealing-storage	8 m x 55 m	440 m^2
Sugar storage-syrup room	8 m x 23 m	184 m^2
Quality control office	6 m x 8 m	48 m^2
Plant entrance	2 m x 8 m	16 m^2
Production office	8 m x 8 m	64 m^2
Machine shop-maintenance garage	8 m x 36 m	288 m^2
Boiler room	9 m x 10 m	90 m^2
Loading and unloading platforms	a/	260 m^2
Main office	20 m x 20 m	400 m^2
Restaurant	20 m x 20 m	400 m^2
Dressing rooms	20 m x 25 m	500 m^2
Watchman and scale room	5 m x 5 m	25 m^2
TOTAL BUILDING AREA		15,964 m^2

a/ No specific dimensions are required.

SOURCE: Appendix L.

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e. Main Processing Room. The three lines for sliced pineapple consist of a trimming section, slicing machine, and an inspection and can filling area. Filled cans from the No. 2 and No. 2-1/2 can sizes will be conveyed to the prevacuumizing syruper, while the No. 10 cans will be moved on hand trucks. After the steam flow closing, the cans are conveyed to an atmospheric cooker for processing. The cooking time used for No. 2 cans is 14 minutes followed by a 12 minute cool. Number

2-1/2 cans have a 15 minute cook and 12 minute cool; while the No. 10 cans are cooked for 20 minutes and cooled for the same amount of time. Processing times may vary depending on the fruit quality. The criterion of a process is to obtain a center can temperature of 88° C which should be maintained for 5 minutes. The cans are then cooled to an average temperature of 38° C and the bright cans palletized until needed for labeling with the customer's private brand.

Fruit that cannot meet the standards established for slices can be cut into segments, spears, chunks, or tidbits, depending on marketing requirements. Processing will be done on the sliced fruit lines.

Meat from the peel eradicator and waste pineapple from the slices lines will be conveyed to a disintegrator that cuts the material into small pieces that are pumped to a holding tank from where pulp is dropped into a screw-type press to extract the juice. The juice is pumped to heated holding tanks, then to a centrifugal desludger that removes some of the remaining pulp from the juice which then goes to a plate heat exchanger to raise the temperature to 88 °C. It is stored in heated tanks until required for filling as juice. Pulp from the extractor and solids from the desludger are conveyed to the waste material storage hopper.

The first cut from pineapple peels and waste material from the sliced lines is conveyed to the crush line where it is elevated into a crusher that shreds the fruit in small particles. The crushed fruit is inspected to remove any bits of peel that might be mixed in with the fruit, then is conveyed to a cooker or heater that raises the product temperature to about 91° C. A drain screen separates free flowing juice from the crushed pineapple, with the juice going into the juice line and the crushed product dropping into a kettle to maintain a closing temperature of 88°C.

There are two lines for No. 10 cans, one for juice, the other for crushed. One line for No. 2 cans can handle either juice or crushed and another for No. 2-1/2 cans operates in the same manner. The four lines allow the plant greater flexibility in programming production and by using individual lines for No. 2 and No. 2-1/2 cans, there is no lost time changing from one can size to another as would be the case if one line was used for crushed and the other for juice.

Crushed pineapple and juice filled at 88 °C to 91° C do not require additional processing, so after closing the cans are cooled and palletized manually since the line speeds do not warrant mechanized equipment for these products.

f. Can Making and Tin Plate Storage. Table 48 shows the volume of cans required by the canning plant may justify a slow speed body making line for No. 2 and No. 2-1/2 cans. The ends could be purchased from outside sources as the quantities involved do not warrant the investment in end manufacturing equipment which normally operates at high speeds. Number 10 cans should be purchased collapsed and reformed at the plant site as the volume does not justify the added storage cost.

g. Finished Product Storage. A 110 x 522.5 centimeter pallet has been selected that can hold the following quantity of bright cans (Table 49).

Pallets would be stacked three high requiring a minimum warehouse height of about 5.5 meters. Allowing 30 percent for forklift truck aisles, a total space of 13,308 m^2 would be required for 100 percent of the plant's production. The bright can warehouse has a space of 9,245 M^2 representing about 69 percent of the season's production. Since sales are expected to take place during the 75 day operating period, the storage space should be adequate for the plant's needs.

TABLE 48. VOLUME OF NO. 2, 2-1/2, AND NO. 10 CAN SIZES

Can Size Number	Dimension	Cases	Total
2	307 x 409	821,784	19,722,816 a/
2-1/2	401 x 411	283,140	6,795,360 a/
10	603 x 700	615,715	3,694,290 b/

a/ Equivalency at 24 cans per case.
b/ Equivalency at 6 cans per case.

SOURCE: Experience, Incorporated based on industry contacts.

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TABLE 49. PALLET CAPACITY FOR NO. 2, 2-1/2, AND NO. 10 CAN SIZES

Can Size Number	No. of Cans/Pallet Size	Weight (kilograms)
2	2,200	965.70
2-1/2	1,500	1,254.18
10	504	694.00

SOURCE: Experience, Incorporated based on industry contacts.

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This area will also be used to stock empty cans from the can making line. This will not affect the finished product storage plan, for empty cans will be removed to meet the production schedule and will be replaced by filled cans. Four forklift trucks should be sufficient to handle all of the pallet movements in the plant.

h. Labeling - Casing - Carton Sealing - Storage. Two automatic lines have been planned for this operation, one for No. 2 and No. 2-1/2 cans and the other for No. 10 cans. The small can sizes will be depalletized mechanically while the larger cans will be handled manually. On a one shift operation, the first line has a capacity of 6,400 cases per day and the second line 3,600 cases.

The packaging materials required by the plant consists of cans, labels and shipping cases. Prices were obtained from United States manufacturers and ocean freight was calculated to place all of the items C&F Mudon and are shown in Table 50. Can costs are very high so consideration should be given to making cans at the plant site to avoid transportation from a central plant located close to Rangoon. Collapsed cans could also be furnished from sources closer to Burma, such as Malaysia or Singapore, which would lower container costs by approximately 25 percent.

Most of the cans will be sold under the customer's private brand label. As orders are received, they can be shipped directly to the port of embarkation in containers to avoid storing the cases at the plant.

i. Sugar Storage and Syrup Room. A separate room has been planned to store sugar and prepare the various types of syrup that may be required to meet customer specifications.

j. Quality Control Laboratory. The laboratory is essential to insure high quality products that conform to international specifications. Sufficient space has been allocated to perform all the necessary tests on raw materials and finished products.

TABLE 50. ESTIMATED PACKAGING MATERIAL COSTS

Can Size/ Number	Dimension	Quantity	Cost/M	Annual Cost
			--------Kyats-------	
Collapsed Can Prices C&F Mudon				
2 Cans	307 x 409	20,000,000	1,650	33,000,000
2-1/2 Cans	401 x 411	6,800,000	2,110	14,348,000
10 Cans	603 x 700	3,700,000	3,535	13,079,500
Cost of Labels				
2 Cans	4-1/4 inches x 11 inches	20,000,000	91	1,820,000
2-1/2 Cans	4-3/8 inches x 13 inches	6,800,000	119	809,200
10 Cans	Spot label	3,700,000	91	336,700
Cost of Shipping Cases - Inside Dimensions				
2 Cans	13-13/16 inches x 3/8 inches x 9-1/8 inches	820,000	2,170	1,779,400
2-1/2 Cans	16-5/16 inches x 12-1/4 inches x 9-3/8 inches	283,000	2,870	812,210
10 Cans	18-5/8 inches x 12-3/8 inches x 7 inches	616,000	2,590	1,595,440
Summary Packaging Material Costs				
Collapsed Cans			60,427,500	45,320,625 a/
Labels			2,965,900	2,965,900 a/
Shipping Cases			4,187,050	4,187,050 a/
TOTAL ESTIMATED PACKAGING MATERIAL			67,580,450	52,473,575 b/

a/ Can price at 75 percent based on full schedule at can manufacturing plant.
b/ Use K52,473,600.

SOURCE: Experience, Incorporated.
4098A

k. Plant Entrance. Entrance to the production room is through a corridor between the quality control laboratory and production office so movement into the working area can be controlled.

l. Production Office. A separate office has been planned for the production supervisor and his staff. This is adjacent to the main processing room to allow supervisory personnel access to the area and to control production.

m. Machine Shop - Maintenance Garage. A large area has been allocated for this service function as there are no adequate facilities in Mudon to handle the plant's maintenance needs. The machine shop should be able to repair and maintain the equipment in good operating condition, including rolling stock for the farm and highway transportation equipment.

n. Boiler Room. The boiler room is in a separate building outside of the plant which is customary for this type of installation. It is close to the processing areas that require steam to minimize heat and pressure losses.

o. Loading and Unloading Platforms. Covered loading platforms have been planned for the receiving and shipping areas of the plant.

p. Rest Rooms. Two rest rooms have been placed next to the main processing room to avoid the necessity of having operating personnel use the outside dressing room facilities.

q. Main Office. The main office has been separated from the main plant building as this appears customary in Burma. There is sufficient space for management personnel required to control all of the plant operations.

r. Restaurant. An eating area for office and plant personnel has been placed in the main office building. This area is large enough for a cafeteria style restaurant or to allow workers to bring their own food and sit at tables to eat.

s. Dressing Rooms. The two dressing rooms for male and female workers contain showers, locker space, and toilets. The actual size of each room will depend on the ratio of male to female personnel; however, the total space should be adequate for the number of people needed to operate the plant.

t. Watchmen and Scale Room. A building at the entrance to the property will allow the watchmen to control the movements into the plant and weigh farm trucks to record raw fruit purchases as they enter and leave the premises.

6. Utilities

a. Electricity. Electricity will be generated by a 420 horsepower (HP) motor or an equivalent of 313 KW. On a yearly basis, the amount generated would be 313 KW x 24 hours per day = 7.512 KWH per day x 75 days per year = 563,400 KWH per season. This would round off to K167,900 (563,400 KWH per season x K0.298).

b. Boiler Fuel. For the large processing plant fuel consumption is estimated at K465,660. The breakdown is arrived at as follows:

> 1,195 GPH = 99.5 Imperial gallons (IG) hour x 24 hours per day x 75 days = 1,800 hours per season or 179,100 IG.

7. Discussion of the Investment Costs

Table 51 shows the investment cost for the large pineapple cannery.

TABLE 51. SUMMARY OF INVESTMENT COST FOR LARGE PINEAPPLE CANNERY

	Foreign Exchange	Local Cost	Total Cost
	(US$)	----------Kyats--------	
Land			
Site improvements		158,000	158,000
Buildings		18,380,900	18,380,900
Processing and supporting equipment	3,316,525		23,215,700
Office equipment	19,600	89,600	226,800
Laboratory equipment	38,500	--	269,500
Machine shop	200,000	--	1,400,000
Automotive equipment	321,250	--	2,248,750
Equipment installation and start-up	180,600	338,000	1,602,200
Organizational expenses	210,000	175,000	1,645,000
Miscellaneous expenses		5,429,000	5,429,000
Working capital		39,818,750	39,818,750
TOTAL	4,286,475	64,389,250	94,394,600

Summary

Capitalization -	Equity at 40 percent	37,757,840
	Long-Term at 60 percent	56,636,760
		94,394,600

SOURCE: Experience, Incorporated.

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a. Land. Land for the pineapple cannery will be furnished by the Burmese Government, consequently no capital has been allocated to cover this item.

b. Site Improvements. Careful attention should be given to the selection of a plant site to insure that it will require a minimum amount of improvement. Some of the items that have been included in this section are grading for the buidings and hard surfaced roads. It does not include a fresh water supply,

waste water disposal, railroad sidings nor electrical connections as it is difficult to estimate the amount of money required for these installations without having a definite plant site in mind.

c. Buildings. Cost for the main building and watchman's quarters have been calculated at K1,111.37 m^2 or US$14.75 per square foot while the main office, restaurant and dressing rooms are based on K1,645.61 m^2 or US$ 21.84 per square foot. Building costs are broken down in Table 52.

TABLE 52. BREAKDOWN OF BUILDING COSTS

	Dimension	Cost
		(Kyats)
Main building	14,614 m^2 x K1,111.37 m^2 =	16,241,561
Office-Restaurant-Dressing Rooms	1,300 m^2 x K1,645.61 m^2	2,139,293
TOTAL BUILDING COSTS		18,380,854

SOURCE: Experience, Incorporated.

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d. Processing and Supporting Equipment. The estimated C&F Cost of importing plant equipment is shown in Appendix G and amounts to US$3,316,525 or K23,215,700.

e. Office Equipment. Desks, chairs, and office furniture can be purchased locally while items such as typewriters, calculators and copiers should be imported. The office equipment has been broken down in Table 53.

TABLE 53. OFFICE EQUIPMENT BREAKDOWN

Number	Description	Each	Foreign Purchases	Local Purchases	Total Purchases
		------US$-----		-------Kyats-----	
	Office furniture			89,600	89,600
6	Electric typewriters	1,000	6,000		42,000
14	Calculators	400	5,600		39,200
2	Copiers	4,000	8,000		56,000
TOTAL			19,600		226,800

SOURCE: Experience, Incorporated

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f. Laboratory Equipment. A detailed list of laboratory equipment has not been prepared as this should be done by the production manager and quality control supervisor. An amount of US$38,500 has been allocated to this account which should cover laboratory supplies and items such as a microscope, pH meters, scales, etc.

g. Machine Shop and Maintenance. A modern machine shop has been included for the pineapple cannery as it should have sufficient equipment to repair and maintain both the plant and farm machinery. An amount of US$200,000 has been allocated for this facility which should cover the items used in a shop of this nature.

Maintenance is an important function in a pineapple cannery as the plant will be operating three shifts a day during the canning season and a breakdown of the production equipment would seriously affect the production schedule. Preventive maintenance should be done on a daily basis with a complete plant overhaul after the season has been completed, since pineapple is a highly acid product that will corrode the equipment without proper maintenance. Table 54 outlines a maintenance schedule with budget amounts given.

TABLE 54. MAINTENANCE SCHEDULE

	Value	Amount	Maintenance Budget
	(Kyats)	(percent)	(Kyats)
Site improvements	158,000	1	1,580
Buildings	18,380,900	1	180,381
Production and supporting equipment	23,215,700	3	696,471
Automotive	2,248,750	5	112,375
Office-laboratory machine shop	1,896,300	3	56,889
TOTAL			1,047,696 a/

a/ Use K1,047,700

SOURCE: Experience, Incorporated.

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h. Automotive Equipment. The number of automobiles and trucks required by the plant will vary according to how the field and finished product shipments are handled. The following list of equipment should be adequate for the first few years of operation and additional trucks may be rented should this become necessary.

i. Automotive Equipment. Table 55 shows the foreign capital required for automotive equipment.

j. Equipment Installation and Start-Up. Foreign personnel will be required to supervise the installation of many of the specialized machines needed for the plant. This will include factory engineers from companies such as Honomach, Food Machinery Corporation (FMC), Cleaver Brooks, Wesphalia, and an electrical specialist. The production manager and mechanical supervisor should also be present during this period so that

TABLE 55. AUTOMOTIVE EQUIPMENT NEEDED FOR PROCESSING PLANT

Number of Units	Equipment Item	Each	Value
		------US$------	
1	Pneumatic tired forklift truck for outside work		25,000
6	Station wagons for plant personnel	15,000	90,000
3	Half-ton pick-up truck for utility purposes	17,000	51,000
5	Trucks for field and plant use	28,250	141,250
1	Jeep or similar for the field supervisor		14,000
TOTAL			321,250

SOURCE: Experience, Incorporated

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they will become familiar with the machinery and its operation. The installation period has been estimated at six months and would require 27 man-months of work from the expatriate personnel and foreign technicans.

Local personnel such as mechanics, electricians, general nonskilled labor and watchmen will also be required during this period.

Some of the equipment is heavy and bulky that will need heavy lifting machinery to move these items into their locations in the plant.

Table 56 is an estimate of the personnel and costs for the installation and start-up period.

TABLE 56. PERSONNEL NEEDED FOR PLANT START-UP AND COST

	Foreign Currency	Local Cost	Total Cost
	(US$)	------Kyats-------	
Foreign technicians - 27 man-months	162,600		1,138,200
Plane transportation	18,000		126,000
Local living expenses		156,800	156,800
Local personnel - 34 men at 6 months		55,200	55,200
Heavy lifting equipment		126,000	126,000
TOTAL	180,600	338,000	1,602,200

SOURCE: Experience, Incorporated.

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k. Organizational Expenses. This account covers detailed engineering drawings, a feasibility study and legal expenses in forming a company. The engineering drawings should be prepared by a firm that has had experience in pineapple plant design and operation, to insure that the equipment selection, product flow through the plant and utilities such as the electrical installation, steam lines, water and waste material drainage meet modern technological standards. This plant will probably not be considered until the results from the experimental pineapple growing program has been analyzed and its viability determined. A new feasibility study should be prepared at that time to reflect any changes in the world pineapple situation that could affect the profitability of the plant. Legal expenses are always incurred in forming a new company and funds must be set aside to cover these expenses. Organizational expenses have been broken down and summarized in Table 57.

TABLE 57. SUMMARY OF ORGANIZATIONAL EXPENSES

	Foreign Exchange	Local Currency	Total Cost
	(US$)	------Kyats-----	
Plant engineering and design	139,212		974,484
Feasibility study	60,000		42,000
Legal expenses	10,800	175,000	250,600
TOTAL	210,012	175,000	1,267,884

SOURCE: Experience, Incorporated

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(1) Plant Engineering and Design. Six percent of the estimated building cost of US$2,320,200 or US$139,212.

(2) Feasibility Study. Update the current study to meet work conditions prior to making a final commitment for the investment for US$60,000.

(3) Legal Expenses. Legal expenses will be incurred in Burma and in the United States in forming a company. An amount of US$10,000 has been allocated for the foreign exchange component and K175,000 for local expenses.

1. Miscellaneous Expenses. In any new plant there are many unforeseen expenses that can occur which must be paid for before operations start. An amount of 5.75 percent of the total capitalization has been set aside to cover these miscellaneous items. If these funds are not needed, the money can be used for working capital and thus decrease the amount of short-term borrowing to finance current operations.

m. Working Capital. Working capital requirements for a food processing plant are necessarily large because of the relatively short growing season and the need to maintain an inventory of finished product to supply customers during the balance of the year when the plant is not in production. Part of the working capital should be provided for by long-term financing and the balance met through short-term borrowing.

Capital for seasonal operations are not considered part of the overall financial structure. Seasonal capital is obtained as needed and is secured by warehouse receipts or other financial investments. Of the total working capital needs of K120,612,150, only K39,818,750 is considered as an investment item (Table 58).

TABLE 58. WORKING CAPITAL REQUIREMENTS - 75 DAY OPERATION

	Time Requirement	Annual Cost	Amount
	(months)	---------Kyats---------	
Raw materials	3	18,711,000	18,711,000
Ingredients	2	6,047,500	3,023,750
Packaging material	3	52,473,600	52,473,600
Accounts receivable	Letter of credit when shipped	101,244,700	--
Inventory	5-1/2	101,244,600	46,403,800
TOTAL			120,612,150 a/

a/ Use K120,600,000 as rounded figure.

SOURCE: Experience, Incorporated.

4098A

The three major working capital items are for fresh pineapple, packaging material, and finished product inventory as shown in Table 58. Pineapple will be purchased daily during the

75-day operating season and money must be available to cover the cost of sales will not generate sufficient cash flow to meet this need. All of the packaging materials must be on hand prior to the start of the season, for the plant can not operate without cans and it is too much of a risk to depend upon suppliers outside of Burma to maintain a monthly shipping schedule. The amount of finished product inventory to be stored will depend on the company's sales policy and marketing requirements. A 5-1/2 month inventory should be sufficient to allow the plant to satisfy their customers' needs.

n. Interest and Loan Repayment. A rate of 18 percent has been used for short-term borrowing. Long-term borrowing is based on a 12 percent interest rate for a fully amortized loan with a fixed payment per year over the 20 year loan term. Interest rates in Burma are 5 percent on capital loans and 8 percent on government loans so if money is available locally, it may be worthwhile to apply for loans at the lower rate.

Short-Term Loan K80,793,400 at 18 percent interest	=	K14,542,812
Long-Term Loan K56,636,760 at 12 percent interest, annual fixed payment	=	K6,796,411 a/

o. Amortization. Table 59 covers expenses incurred prior to starting normal plant operations that should be amortized over a period of years. A ten year write-off has been used, however a shorter period might be advisable.

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a/ In the first year the interest portion is K6,757,300 (compounded monthly) and the principal portion is K726,100. By the twentieth year the interest portion falls to K464,500 while the principal portion increases to K7,018,900.

TABLE 59. AMORTIZATION SCHEDULE

	Value	Amount	Annual Cost
	(Kyats)	(percent)	(Kyats)
Plant engineering and detailed drawings	1,394,400	10	139,440
Organizational expenses	250,600	10	25,060
Equipment installation and start-up	1,602,200	10	160,220
TOTAL	3,247,200		324,720 a/

a/ Use K324,700 as rounded figure.

SOURCE: Experience, Incorporated.

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p. Depreciation. The straightline method of depreciation has been used in Table 60 based on the useful life expectancy of the asset.

TABLE 60. DEPRECIATION SCHEDULE

	Value	Number of Years	Amount Per Year	Annual Depreciation
	(Kyats)		(percent)	(Kyats)
Site improvements	158,000	20	5	7,900
Buildings	18,380,900	25	4	735,236
Production and supporting equipment	23,215,700	10	10	2,321,570
Automotive	2,248,750	5	20	449,750
Office-laboratory machine shop	1,896,300	10	10	189,630
TOTAL	45,899,650			3,704,086 a/

a/ Use K3,704,100 as rounded figure.

SOURCE: Experience, Incorporated.

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q. Summary Plant Operations. Table 61 summarizes the pineapple cannery's sales and production costs.

8. Administrative and Sales Expenses

Figure 16 outlines the chain of organizational structure used in determining the administrative personnel required and expense. This expense can be divided into two general categories: salaries for administrative personnel and expenses that normally can be expected in operating a business. The cost of salaries is based on actual data obtained in Burma and the United States, while administrative and sales expenses are based on current costs or expressed as a percent of gross sales (Table 62).

a. Expatriate Personnel. Table 63 shows the cost of the expatriate personnel for a two to three year assignment in Burma. The estimated cost for expatriate personnel represents 93.5 percent of the total administrative salary budget. Consequently, these key positions should be filled by Burmese Nationals as soon as individuals can be trained to assume the responsibilities that these jobs require.

b. Administrative Office Expenses. An amount of 0.5 percent of sales has been allocated to cover the cost of operating the administration office, e.g., stationery, telephone, cable or telex, entertainment, and local travel, and is broken down further in Table 64.

TABLE 61. SUMMARY OF PLANT OPERATIONS - PINEAPPLE CANNERY

	No2 Cans	No2-1/2 Cans	No 10 Cans	Total	Sales Volume	Percent
	----------US dollars--------			(US$)	(Kyat)	(percent)
Estimated Sales						
Slices	1,660,000	621,000	1,727,300	4,008,300	28,058,100	27.71
Tidbits	416,000	160,200	411,280	987,480	6,912,360	6.83
Chunks	1,223,600	417,690	1,146,550	2,787,840	19,514,880	19.27
Cubes	19,500	9,240	23,000	51,740	362,180	0.36
Crushed	980,000	411,400	1,000,350	2,392,750	16,742,250	16.54
Juice	1,752,000	730,800	1,753,600	4,236,400	29,654,800	29.29
TOTAL	6,051,100	2,350,330	6,062,080	14,463,510	101,244,570	100.00

	Cost (percent)	Cost (Kyat)	Sales (percent)
Estimated Production Costs			
Raw Materials	17.51	18,711,000	18.48
Ingredients	5.66	6,047,500	5.97
Direct Labor Costs	0.29	310,800	0.31
Utilities	0.59	633,600	0.63
Packaging materials	49.10	52,473,600	51.83
Administration and sales expenses	6.41	6,850,300	6.77
Maintenance	1.00	1,073,600	1.06
Depreciation	3.55	3,794,100	3.75
Interest	15.58	16,653,600	16.45
Amortization	0.30	324,700	0.32
TOTAL	99.99	106,872,800	105.57
Gross Margin		(5,628,230)	(5.56)

SOURCE: Experience, Incorporated.

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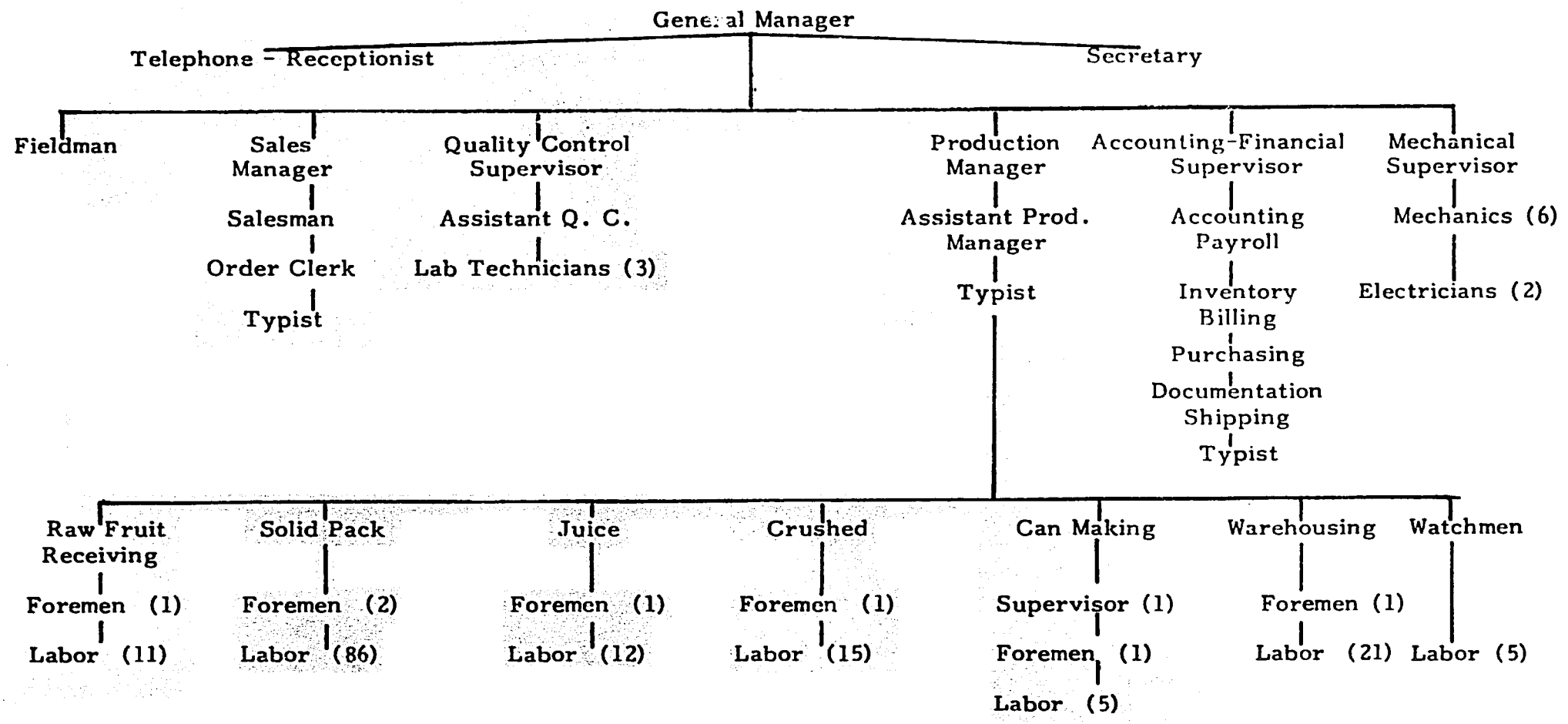
FIGURE 16. ORGANIZATIONAL STRUCTURE FOR THE PINEAPPLE PLANT, MUDON, BURMA



SOURCE: Experience, Incorporated

TABLE 62. ESTIMATED SALARIES OF ADMINISTRATIVE PERSONNEL

Description of Work	Skills	Quantity	Cost Per Month	Cost Per Season
			-----Kyats-----	
Manager	E a/	1		455,000
Field Superintendent	M-E b/	1	450	5,400
Sales Manager	M-E	1	450	5,400
Quality Control Supervisor	M-E	1	450	5,400
Production Manager	E	1		350,000
Accounting-Financial Supervisor	M-E	1	450	5,400
Mechanical Supervisor	E	1		350,000
Can Making	E	1		350,000
Secretary	S c/	1	300	3,600
Salesman	SU d/	1	210	2,520
Order Clerk	S	1	210	2,520
Assistant Quality Control	SU	1	400	4,800
Laboratory Technicians	S	3	320	11,520
Assistant Production Manager	M-E	1	450	5,400
Accounting-Payroll Clerk	S	1	210	2,520
Inventory-Billing Clerk	S	1	210	2,520
Purchasing Clerk	S	1	210	2,520
Documentation-Shipping Clerk	S	1	210	2,520
Mechanics	S	6	320	23,040
Electricians	S	2	320	7,680
Typists	S	3	160	5,700
Telephone-Receptionist	S-S e/	1	160	1,920
Watchmen	N-S f/	5	170	4,250
TOTAL		37		1,609,630

a/ E = Expatriates
b/ M-E = Managerial Executive
c/ S = Skilled
d/ SU = Supervisor
e/ S-S = Semi-Skilled
f/ N-S = Non-Skilled

SOURCE: Salaries for Burmese Nationals furnished by the Foodstuff Industries Corporation.

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TABLE 63. COST OF EXPATRIATE PERSONNEL FOR ASSIGNMENT IN BURMA

	US Dollars	Kyats
General Manager		
Salary	48,000	
25 percent overseas bonus	12,000	
Transportation expenses	2,000	
Moving household effects	3,000	
TOTAL	65,000	455,000
Other		
Salary	36,000	
25 percent overseas bonus	9,000	
Transportation expenses	2,000	
Moving household effects	3,000	
TOTAL	50,000	350,000

SOURCE: Experience, Incorporated

TABLE 64. ADMINISTRATIVE SALES AND OFFICE EXPENSES

Sales Expenses	US Dollars	Kyats
Sales trips - 4 per year at $3,000 each	12,000	
Living costs - 3 months at $150 per day	13,500	
TOTAL	25,500	178,500
Advertising and office expenses 1 percent of K101,244,500 sales		1,012,500
Brokers commission 3-1/2 percent on K101.244.500 sales		3,543,500
TOTAL		4,734,500
Administration and Sales Expenses		
Administrative personnel salaries		1,609,630
Administrative office expenses		506,200
Sales expenses		4,734,500
TOTAL		6,850,330

SOURCE: Experience, Incorporated
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D. Can Manufacturing Plant

1. Introduction

The need for a can making plant in Burma is difficult to justify based on the volume of cans that is anticipated over the next few years from canneries that are still in the planning stage. It may be preferable to import collapsed cans to be reformed in each cannery until such time as actual production volumes and can sizes have been determined. Since there is a strong sentiment toward opening this plant soon, it can be made profitable if no taxes are incurred.

Can making requires a substantial investment in equipment that should be utilized at its maximum capacity in order to lower production costs. In most countries, a one or two line plant operates three shifts per day during 250 to 300 days per year. To be competitive, the industry expects a very small profit margin on each 1,000 cans which multiplied by a large volume allows them to make a reasonable return on their investment.

Should a can plant be established, the recommended location would be Pegu, as this town has rails and highway connections to both the northern and southern sections of the country where future canning plants will be established. Transportation costs will play an important role in the ultimate can price to the canneries, for once a can has been assembled, it is a bulky item that is shipped by cube and not weight. Box wagons in Burma have interior dimensions of 17' x 7' x 7' for a total of 833 cubic feet and it costs K553 to move the wagon 100 miles. A case of 24 No. 2 cans measures 0.81 cu. ft. so as each car would have a theoretical capacity of about 1,000 cases, the cost would be about K0.553 per case. The inside dimensions of

a six ton Japanese-made highway truck are 16' x 7' x 7' or 784 cu. ft. and transportation cost per 400 mile trip is K1.400 or K350 per 100 miles.

An expatriate can making specialist will be required until such time as a local engineer can be trained to assume this responsibility. All other management and plant personnel should be Burmese.

2. General

Modern can making technology dates back to the turn of the century with the introduction of a three piece can manufactured on a continuous production line. During the first fifty years, great strides were made in reducing plate weight and tin coatings to lower container costs, however, the manufacturing process remained basically the same other than increasing line speeds from about 100 cpm to over 400 cpm.

In the past 30 years, new techniques have been developed such as the welded side seam on three piece cans and the drawn and ironed two piece container made of steel or aluminum. The latter is gradually replacing the three piece can as it is less expensive to manufacture.

Can making has always been a high production item in which raw materials represent the largest cost factor and profits are based on volume. Most can plants operate two or three shifts per day to utilize the investment in plant facilities and equipment to its utmost capacity. Efficiency is measured by the minute amount of tin plate waste that is left from each sheet during the cutting and press operations, the number of cans that are defective, and the amount of down time on the production lines due to equipment changeovers or maintenance and repairs to the machinery.

3. Technology

A welded side seam can has been recommended for this application as the cost of a drawn and ironed tin plate can manufacturing line is much greater than for the three piece can, and the low production volume in Burma cannot justify this investment. The soldered side seam can was eliminated because many countries abroad are apprehensive over the danger of lead contamination in food cans. High tin solder is used for side seams and every precaution is taken to eliminate solder inside the container, however, at some future date these countries may prohibit the importation of this type of food can.

Tin plate is received from steel mills in bundles that weigh from 1.5 to 2 MT, depending on the sheet size that has been ordered, and is stacked two high in the tin plate storage area until needed for production.

The bundles are moved by means of a forklift truck to the Dexter feed conveyor, where the export packing is removed leaving the tin plate exposed. This machine automatically lifts the tin plate from the pile and delivers each sheet to the duplex slitter that consists of two series of cutters. The first set cuts the plate into strips, while the second set cuts the strips into body blank size.

An operator removes a stack of body blanks from the slitter and places them into the feed section of the welding unit, where four operations take place. First, individual blanks are removed from the feeder; they are flexed to facilitate the following rounding operation, then the rounded body blank is welded to form a leakproof cylinder.

The bodies are conveyed to a spray applicator where a strip of varnish is placed on the inside of the cylinder over the welded are to prevent any contamination from the welding process. The bodies are conveyed through an oven where the varnish is baked on or cured so that it will become an integral part of the can.

After leaving the oven, the top and bottom sections of the cylinders are flanged so that they will accept the end. A beader has been included in the line that places a series of indentations on the outside of the cylinder that stiffens the container, making it less susceptible to denting during processing of larger size cans and allows the use of lighter weight plate.

A seamer attaches the end to the cylinder by means of chucks that roll the ends under the flange to form an airtight double seam, then the finished can goes through an air tester to insure that the cans do not have pin holes or other defects that would allow leakage and loss of vacuum in the filled cans, resulting in product spoilage.

All of the equipment in the line is connected by elevators and can conveyors to permit a continuous manufacturing operation at speeds of 350 to 400 cpm.

The finished cans are conveyed to a caser, where an operator places 24 cans into a shipping case that goes to a glue sealer which applies glue to the bottom flaps of the carton and seals it. When the case has been sealed, the cartons are palletized and stored in the warehouse until shipped to the customers.

a. End Manufacturing. End making has not been included for the can making plant as the volume does not justify the investment. Ends may be purchased from outside suppliers at competitive prices, especially since ends are shipped by weight and not cube, and consequently pay a minimum ocean freight rate. Space has been allowed for future expansion into end making when the can volume warrants this expenditure.

End manufacturing starts with moving end plate from the storage area to the Dexter feed unit that supplies the scroll shear with plate. The scroll shear cuts the plate into scroll strips that are shaped to minimize the amount of waste when ends are cut. The strips are accumulated in a stacker from which they are transferred to a double die end press. This machine cuts and forms ends from the scroll strips, and the ends go through a curler which curls the edges of the ends so they will fit onto the can at the seaming station. The ends are then transferred to a compound liner which lines the flange of the curled can end with various types of compounds to meet the requirements of the product to be packed into the cans. After lining, the ends are stacked and placed into sleeves that can be palletized in the case of ends for plant use or put into cartons that are shipped to the canning plant.

b. Containers. The can making plant will be providing containers for a wide variety of fish, fruit, meat, milk, and vegetable products that will require different container specifications. A list of specifications has been prepared for these items, but it is general in nature and should be checked once the ingredients that will be used for each product are known. The containers specified should be adequate, but some savings may be made by lowering the tin plate coatings or enamelling the cans.

(1) Tin Plate. Tin plate is a thin sheet of steel that has been coated with tin which is remarkably corrosion-resistant and is non-toxic so it may be used for food products. Tin plate is sold by the base box which is a unit of area of 112 sheets, 14" x 2" or 31.36 square inches (20.23 m^2). There are four main considerations in specifying tinplate for food containers: base weight of the sheet, tin plate coating, temper of the steel, and chemical composition of the steel.

(2) Base Weight. Base weight is determined by individual sheet thickness as expressed in weight per base box. As an example, a sheet with a theoretical thickness of 0.0083 inches would weigh 75 per base box, so in ordering, it would be referred to as 75 pound plate and not by thickness. Plate thickness provides strength to the container, thus small size cans require lighter plate than larger containers to minimize denting and buckling when the cans are being processed. Appendix L gives plate weight by can size information.

(3) Tin Plate. The amount of tin plate coating has been decreasing as improved methods of plating have been developed. Many years ago, sheets of steel were manually dipped into a molten bath of tin until sufficient tin had accumulated on the surface to protect the food product. This was known as hot dipped plate. It was difficult to control the amount of tin coating on the individual plates, consequently greater quantities of tin were used to insure that all of the sheet had sufficient coating. Coatings of 1.00 to 1.35 pounds of tin per base box were common, depending on the protection that was needed for the product. Commercial production of electrolytic tin plate began in 1936-37 in the United States. In this process, tin is electrolytically deposited on a continuous roll of steel as it moved through the bath. The main advantage of this system is that it permits the tin coating to be controlled at

any desired thickness over all of the sheet, thus requiring less tin than in the hot dipped method. Electrolytic plate can vary from 0.25 pound to 1.00 pound in its tin plate coating.

This method of tinning also allowed the development of differentially coated tin plate, where the interior surface of the plate in contact with the food product could have one weight of tin while the outside that did not require this protection would have a lighter coating. Differential plate is available in coatings of 50/25, 75/25, and 100/25 with the first digit representing the weight on the inside or 0.50 pounds and the second number the outside or 0.25 pounds. More detailed tin plate information can be found in Appendix L.

(4) Temper. Temper is the result of annealing and temper rolling that give the plate stiffness and hardness. The usual tempers for plate used in metal containers are from T-3, which has a fair degree of stiffness and can be used for can ends and bodies, to T-5, which contains rephosphorized steel to provide hardness and to resist buckling. A newer method is to anneal plate continuously to increase the stiffness and many can bodies and ends are made with TU (universal temper) as it is more buckle resistant without the use of rephosphorized steel.

(5) Steel. Steel for tinplate may contain varying amounts of chemicals such as carbon, manganese, phosphorus, nitrogen, sulpher, and copper. The amounts of these elements are controlled to meet the requirements for the end use. Type C steel is low in metalloids and residual elements and is sometimes used for improved internal corrosion resistance for certain food products. Type MR steel is similar in metalloid content to type L, but is less restrictive in residual elements and is commonly used for most tin plate applications. Type MC

steel is rephosphorized with residuals to type MR and is used for those applications which require greater strength and where internal corrosion resistance is of lesser importance.

4. Plant Engineering

The Foodstuff Industries Corporation of Rangoon has requested a can making plant with an annual capacity of 25 million cans; however, they have been unable to specify container sizes and volumes by product. This lack of information has made planning the can making plant a difficult task, especially since two of the proposed plants are still in the development stage and not operational.

a. Can Line. A three piece welded side seam can line has a capacity of 350 to 400 cpm. Operating at the lower capacity, the plant can produce 50,400,000 during a single eight-hour shift per day, 300 working days per year, so actually the plant will only be operating at 50 percent of its actual capacity. In a single line it is not advisable to manufacture more than four can sizes as it take approximately two days to make a height change and three days for a diameter change. Additional can sizes, would require more capital investment, and the down time due to changeovers would become excessive.

Burma will be producing a wide variety of fish, fruits, jams, juices, evaporated milk, nectars, meats, tomato paste, and vegetables. In order to package these products in consumer can sizes, the four cans that have been selected for production are those commonly being used for the local market and are shown in Table 65. This table also contains an estimated production schedule for the different canneries based on discussions held with members of the Foodstuff Industries staff.

TABLE 66. PLANT ENGINEERING - CAN MAKING PLANT

	300 x 304	300 x 407	307 x 409	211 x 400	Total	Percent
Estimated Can Consumption 25,000 Cans						
Fruits and vegetables - Thazi a/		1,000,000	1,000,000	5,000,000	7,000,000	27.98
Fruits and vegetables - Mandalay		1,000,000	600,000	400,000	2,000,000	7.99
Tropical fruits - Mudon b/		1,744,200	2,275,100		4,019,300	16.06
Meats - Daik - U a/			1,000,000		1,000,000	4.00
Fish - Rangoon		1,000,000			1,000,000	4.00
Condensed milk - Rangoon	10,000,000				10,000,000	39.97
Actual estimated volume	10,000,000	4,744,200	4,875,100	5,400,000	25,019,300	100.00
Recommended Production	10,000,000	4,800,000	4,900,000	5,400,000	25,100,000	

Can Size (US)	Capacity (ounce)	Can Size (MM)	Capacity (MM)	Products
Can Sizes and Nominal Capacities				
211 x 400	10	68 mm x 101.6 mm	283	Nectars - jams - tomato paste - juice
300 x 304	14	73 mm x 82 mm	397	Evaporated milk
300 x 407	15	73 mm x 113 mm	425	Fruits - vegetables - jams - fish - meats
307 x 409	20	87.3 mm x 115.5 mm	248	Fruits - vegetables - juice - jams - meats

a/ Plants being developed. Should be in operation within two years.
b/ Feasibility study just completed.

SOURCE: Appendix L and Experience, Incorporated based on Industry contacts

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Larger cans may be imported collapsed and reformed at the canneries if there is a demand for these sizes. A 401 x 411 container (29 ounce or 850 grams) called a one kilo can is popular in many European countries, while 603 X 700 can (106 ounce or about 3,000 grams) and a 153mm x 246 mm can known as a five kilo can, are used to supply other manufacturers with products to be reprocessed.

American manufactured can making equipment is designed to operate at high speeds with a minimum number of personnel. The machinery is costly, but is reliable due to the many years of practical experience in manufacturing containers, during which time modifications have been made to improve parts that have shown signs of wear or that require frequent maintenance. With the advent of the two piece can making machinery, there are numerous three piece lines available on the used equipment market. The line that has been selected for the Burmese plant would be rebuilt by the original manufacturer and carry a suitable warranty to insure that the equipment is in excellent operating condition.

Some European can making equipment manufacturers can supply slower speed lines, 100 to 250 cpm; however, in comparing their production capacity and prices with rebuilt American machinery, the latter is about twice as expensive but has two to three times more capacity. After analyzing the equipment prices, production rates, and reliability, American machinery has been recommended.

b. Production Area. The body line will occupy a space 105' by 30' which will allow ample space for movement on either side of the equipment. The line has been laid out in a straight line with all of the machinery connected by means of elevators and conveyors to permit continuous high speed operation. The one exception is that body blanks from the Duplex slitter will

be moved manually to the body welder. After testing the cans for leaks, they are conveyed to the empty can warehouse. Table 66 outlines dimensions for the plant facility proper. Appendix M outlines the plant site plan and floor plan.

TABLE 66. CAN MANUFACTURING PLANT FACILITIES, PEGU, BURMA

	Dimensions	Square Feet	M2
Production area	150' x 30'	4,500	418
Tin plate storage	50' x 30'	1,500	139
Empty can warehouse	100' x 80'	16,000	1,486
Covered loading platform	60' x 20'	1,200	111
Machine shop	40' x 30'	1,200	111
Plant office	20' x 20'	400	37
Toilets	20" x 15'	300	28
Dressing room	35' x 20'	700	65
Main office	30' x 20'	600	56
Restaurant	30' x 15'	450	42
Watchman's house	10' x 10'	100	9
TOTAL		26,950	2,502

SOURCE: Experience, Incorporated

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c. Tin Plate Storage. Tin plate storage has been placed in front of the production area, with access to a covered unloading platform that will be shared with empty cans being shipped from the plant. The area allocated for tin plate stacked two bundles high should be sufficient for the plants' normal needs.

d. Empty Can Warehouse. In large operations, cans are normally palletized and stacked in the warehouse until needed by the canneries. The canneries that are planned for Burma are small, and, as it would be costly for each of them to purchase a can depalletizer, the cans will be placed into shipping cases

holding 24 cans each, that can be palletized and stacked up to 5 meters high. The cartons would be removed from the pallets for delivery to the canneries. The warehouse will hold approximately 26 days' supply of empty cans, which should allow the plant to maintain sufficient stock of the different types of containers required by the canneries. The warehouse can be expanded in two directions should additional space be required.

e. Covered Loading Platform. The loading platform will serve both the tin plate storage area and empty can warehouse. Shipments of tin plate will be received once every three to four months. Consequently, there should be no problem in shipping empty containers from the plant on a daily basis.

f. Machine Shop. Can making machinery is precision equipment that must be maintained properly and kept in excellent operating condition to avoid spoilage. This will require some fairly sophisticated machine shop equipment, but the area allocated to the shop is adequate for the plant needs.

g. Plant Office. An office for the can maker is located off the production floor to permit easy access to this area. The office should double as a quality control room, since the can maker or master mechanic will be responsible for this function in the plant.

h. Rest Rooms. Toilets for the workers are also close to the production floor to avoid having the men leave the plant to use these facilities.

i. Dressing Room. The dressing room is outside the main building near the plant entrance which allows the plant manager or his staff to control people entering or leaving the plant.

j. Main Office. A separate building has been designed to house the administration personnel and restaurant facilities.

The administration section should be adequate for the six people required to handle the management functions at the plant.

k. Restaurant. The restaurant area is small and can be increased if necessary. However, since the plant will only require 10 people and the office 15, they can be fed in two sittings to alleviate crowding.

l. Watchman's House. The watchman's house has been placed at the main entrance to the property so he can control people entering and leaving the plant.

5. Production Costs

a. Material Cost. Table 67 details the necessary raw material costs necessary for can production.

TABLE 67. PRODUCTION COSTS OF RAW MATERIAL FOR CAN MANUFACTURING PLANT

	Size Cans	Base Box	Diameter	Cost Per 1,000	Total Cost
				-------Kyats------	
Tin Plate					8,164,800
	211 x 400	6,020		1,483,300	
	300 x 304	11,145		2,878,800	
	300 x 407	6,570		1,600,500	
	307 x 409	7,865		2,202,200	
Ends					7,708,400
	211		10,800,000	1,436,400	
	300		29,600,000	4,351,200	
	307		9,800,000	1,920,800	
Components					665,550
	Wire for welding	88,570		616,350	
	Inside side seam coating	2,400 US/gallons		49,200	

SOURCE: Appendix L.
4237A

b. Direct Labor. Can making equipment is highly automated, so the plant will require a minimum number of operating personnel. To meet the anticipated sales volume, the line will only have to work about 50 percent of the time, consequently when the line is being changed over to another size, the warehouse personnel can ship empty containers to avoid the need for additional men when the line is in production.

Personnel sufficient to operate the plant are shown in Table 68.

TABLE 68. PERSONNEL REQUIREMENTS AND LABOR COSTS

	Skill	Number of People	Monthly Wage	Annual Cost
			----Kyats----	
Duplex slitter and body welder	S a/	1	210	2,520
Inside spray and oven	S	1	210	2,520
Double seamer	S	1	210	2,520
Line mechanic	S	1	310	3,840
Case filling	S	1	210	2,520
Glue sealer and palletizing	N-S b/	2	170	4,080
Forklift truck operator	S	1	210	2,520
Relief	S	1	210	2,520
General labor	N-S	1	170	2,040
TOTAL		10		25,080 c/

a/ Skilled.
b/ Nonskilled.
c/ Use K25,100 as rounded figure.

SOURCE: Experience, Incorporated.

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c. Utilities. Below is an electrical and diesel oil breakdown of consumption for the can manufacturing plant.

(1) Electricity. 129,000 KWH will be needed for the plant's overall production of electricity. This is derived by usage of 108 KW per eight hours, 105 operating days per year. The resultant cost will be K31.04 or K0.24 per KWH.

(2) Diesel Oil. Diesel fuel usage consumption has been estimated to be 130,000 BTU per hour. For cost purposes, an amount of K2,399 has been arrived at by taking 0.773 Imperial gallons per hour x 1,194 operating hours per year at K2.60 per Imperial gallon.

(3) Summary.

Electricity	K30,960
Diesel Oil	2,400
	K33,360

This can be rounded off to 33,400.

d. Packaging Material. Cans should be packed into shipping cartons at the can making plant to facilitate handling at the canneries (Table 69). Can ends will be received in cartons from international suppliers, so the cannery ends will not require additional packaging.

TABLE 69. PACKAGING CARTONS FOR MATERIAL AND COST, CAN MANUFACTURING PLANT

Carton for Can Size	Cases	Cost Per 000	Total
		------Kyats-----	
211 x 400	225,000	1,420	319,500
300 x 306	416,700	1,425	593,800
300 x 407	200,000	1,750	350,000
307 x 409	204,200	2,170	443,100
TOTAL PACKAGING COSTS			1,706,400

SOURCE: Experience, Incorporated.
4237A

e. Administration and Sales Expenses. The can making plant is a very small operation so the administrative personnel should be kept at a minimum to avoid excess overhead. The staff suggested in Table 70 should be ample to meet the control funtions.

TABLE 70. ESTIMATED ADMINISTRATIVE PERSONNEL SALARIES

	Skill	Number of People	Monthly Wage	Annual Cost
			------Kyats	-----
General manager	M a/	1	800	9,600
Can maker - production manager	E b/	1	--	350,000
Accounting-financial-purchasing supervisor	M-E c/	1	450	5,400
Secretary	S d/	1	300	3,600
Accounting clerk	S	1	210	2,520
Mechanic-electrician	S	1	320	3,840
Typist	S	1	160	1,920
Telephone-receptionist	S	1	160	1,920
Watchmen	N-S e/	5	170	10,200
Truck drivers	N-S	2	170	4,080
TOTAL		15		393,080 f/

a/ Manager
b/ Expatriates
c/ Managerial executive.
d/ Skilled.
e/ Nonskilled.
f/ Use K393,100 as rounded figure.

SOURCE: Experience, Incorporated.

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The expense of a production manager for a two to three year assignment in Burma has been calculated in the following manner:

Salary	US$36,000
25 percent overseas bonus	9,000
Transportation	2,000
Moving household effects	3,000
TOTAL	US$50,000 or K350,000

f. Administration and Sales Expenses. Sales should be handled by either the general manager or production manager as the number of customers and volumes do not warrant a separate sales manager. Administration and sales expenses have been calculated at 1 percent of gross sales. This should cover stationery, telephone, cable or telex, entertainment, and local travel. A summary of administration and sales expenses is as follows.

Personnel salaries	K393,080
Administration and sales expenses	237,287
TOTAL ADMINISTRATION EXPENSES	K630,367

Use K630,400 as rounded figure.

g. Maintenance. As shown in Table 71, maintenance will be an important function in the can manufacturing plant in providing the respective plants with adequate can supplies during the processing season.

h. Depreciation. The straightline method of depreciation in Table 72 has been used for the useful life expectancy of the asset.

TABLE 71. MAINTENANCE EXPENSE

	Amount	Amount	Maintenance Budget
	(Kyats)	(percent)	(Kyats)
Site improvements	49,300	1	493
Buildings	2,842,900	1	28,429
Production and supporting equipment	9,656,500	3	289,695
Automobiles - trucks	724,500	5	36,225
Office equipment and machine shop	618,100	3	18,543
TOTAL	13,891,300		373,385 a/

a/ Use K373,400 as rounded figure.

SOURCE: Experience, Incorporated.
4237A

TABLE 72. DEPRECIATION SCHEDULE AND EXPENSE

	Amount	Time Period	Amount Per Year	Depreciation Allocation
	(Kyats)	(years)	(percent)	(Kyats)
Site improvements	49,300	20	5	2,465
Buildings	2,842,900	25	4	113,716
Production and supporting equipment	9,656,500	10	10	965,650
Automobiles - trucks	724,500	5	20	144,900
Office equipment and machine shop	618,100	10	10	61,810
TOTAL	13,891,300			1,288,541 a/

a/ Use K1,288,500 as rounded figure.
SOURCE: Experience, Incorporated.
4237A

i. Interest and Loan Repayment. Interest expense on short-term funds is calculated at 18 percent. Long-term borrowing is based on a 12 percent interest rate for a fully amortized loan with a fixed payment per year over the 20 year loan term.

Long-Term Loan a/	K12,600,000 @ 12 percent, annual fixed payment = K1,664,842
Short-Term Loan	K4,463,400 @ 18 percent = K803,412

a/ In the first year the interest portion is K1,503,307 (compounded monthly) and the principal portion is K161,535. By the twentieth year the interest portion falls to K103,348 while the principal portion increases to K1,561,494.

j. Amortization. Table 73 covers expenses incurred prior to starting normal plant operation which should be amortized over a period of years.

TABLE 73. AMORTIZATION SCHEDULE AND COST

	Amount	Amount Per Year	Annual Cost
	(Kyats)	(percent)	(Kyats)
Equipment installation and start-up	331,600	20	66,320
Organizational expenses	278,500	20	55,700
TOTAL			122,020 a/

a/ Use K122,000 as rounded figure.

SOURCE: Experience, Incorporated.

4237A

k. Summary Can Manufacturing Plant Operations. Table 74 summarizes the can manufacturing plant sales and production costs.

TABLE 74. WORKING CAPITAL REQUIREMENTS

	Total Frame	Total Annual Value	Amount
	(months)	--------Kyats--------	
Raw materials	4	15,873,200	5,291,100
Component parts	3	665,550	166,400
Packaging materials	3	1,706,400	426,600
Accounts receivable	1	--	1,700,000
Inventory	1	--	1,700,000
TOTAL			9,284,100

SOURCE: Experience, Incorporated

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1. Working Capital. Working capital requirements for the can plant are indicated in Table 75. It will be essential for the plant to have an ample supply of cans on hand prior to the processing season to meet the needs of the cannery.

6. Investment Costs

The amount of capital required for the can plant is in Table 76 with a discussion given herein of the various components tested.

a. Land. Investment capital has not been allocated for land purchase as this item will be furnished by the Burmese Government. 10,000 m^2 or 2-1/2 acres should be sufficient for present plant requirements and future expansion.

TABLE 75. SUMMARY OF OPERATING COSTS, CAN MANUFACTURING PLANT

	Volume of Cans	Cost of Imported Cans	Estimated Sales Value	Sales
		(US$)	(Kyats)	(percent)
Estimated Sales				
211 x 400 cans	5,400,000	126.30	4,774,100	20.12
300 x 304 cans	10,000,000	130.50	9,135,000	38.50
300 x 407 cans	4,800,000	133.00	4,468,800	18.83
307 x 409 cans	4,900,000	156.00	5,350,800	22.55
TOTAL			23,728,700	100.00

	Cost (percent)	Amount (Kyats)
Estimated Production Costs a/		
Raw materials	73.76	15,873,200
Components	3.09	665,550
Direct labor	0.12	25,100
Utilities	0.16	33,400
Packaging materials	7.93	1,706,400
Administration and sales expense	2.93	630,400
Maintenance	1.74	373,400
Depreciation	5.99	1,288,500
Interest expense on working capital	3.73	803,410
Amortization	0.57	122,000
TOTAL	100.02 b/	21,521,360
GROSS MARGIN		2,207,340

a/ Excludes long-term debt servicing.
b/ Figures may not add due to rounding.

SOURCE: Experience, Incorporated.

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b. Site Improvements. The amount of grading and roads that will be required depends on the site selection. Grading has been limited to the actual plant area or about one acre (4,000 m^2) at an estimated cost of K28,300, calculated at K0.65 per square foot. 12 foot (3.66 m^2) wide roads have

TABLE 76. SUMMARY OF INVESTMENT COSTS, CAN MANUFACTURING PLANT

	Foreign Exchange	Local Costs	Investment
	(US$)	---------Kyats-------	
Land	--	--	--
Site improvements		49,300	49,300
Buildings	--	2,842,900	2,842,900
Processing and supporting equipment	1,379,500	--	9,656,500
Office equipment	9,500	26,600	93,100
Machine shop	75,000	--	525,000
Automotive equipment	103,500	--	724,500
Equipment installation and start-up	30,300	119,500	331,600
Organizational expenses	35,500	30,000	278,500
Miscellaneous expenses	--	1,577,900	1,577,900
Working capital		4,920,700	4,920,700
TOTAL	1,633,300	9,566,900	21,000,000

Summary

Capitalization -	Equity Capital 40 Percent	8,400,000
	Long-Term Loan 60 Percent	12,600,000
TOTAL KYATS		21,000,000

SOURCE: Experience, Incorporated
4237A

been planned for the plant, which with the loading area amounts to about 7,000 square feet (650 m^2). Paving costs have been estimated at K3.00 per square foot for a total of K21,000.

c. Buildings. The tin plate storage area will require heavier footings than the rest of the plant due to the concentrated weight of the plate and has been calculated at K108.72 per square foot (K10.10 m^2), while a figure of K103.25 per square foot (K9.59 m^2) has been used for the main building and watchman's quarters. The office and restaurant area have been calculated at K152.88 per square foot (K14.20 m^2, Table 77).

TABLE 77. TIN PLATE STORAGE BUILDING DIMENSIONS

	Square Feet	Cost	Total Cost
		------Kyats-----	
Main plant and watchman's quarters	24,400	103.25	2,519,300
Tin plate storage	1,500	108.72	163,080
Office and restaurant area	1,050	152.88	160,524
TOTAL	26,950		2,842,904 a/

a/ Use K2,842,900 as rounded figure.

SOURCE: Experience, Incorporated.
4237A

d. Processing and Supporting Equipment. The cost of rebuilt can making equipment has been estimated at US$734,375; however, this will depend on the availability of the various pieces of machinery at the time an order is placed with the manufacturer. The welder and side seam strip applicator system would be new, as would the other supporting equipment. Ocean freight for all of the machinery has been estimated $44,675, based on 232 m^2 at a cost of US$192.50 per m^2.

e. Office Equipment. Office furniture such as desks, chairs, and tables should be purchased in Burma to avoid using foreign exchange for items that can be obtained locally. An amount of K26,600 has been allocated for these items. The imported equipment consists of three typewriters, four calculators and a copier that total US$9,500.

f. Machine Shop. The major pieces of machinery for the shop are a metal lathe, milling machine, surface grinder, drill press, a band saw, welding equipment, and hand tools. An amount of US$75,000 has been provided for this machinery.

g. Automotive Equipment. Two station wagons have been suggested for use by the General Manager and Production Manager, a pick-up truck for general plant use and two highway trucks that can be used to deliver empty cans to customers. The following price have been used for these items.

2 Station wagons, US$15,000 each	US$30,000
1 Pick-up truck	17,000
2 Delivery trucks, US$28,250 each	56,500
TOTAL	US$103,500 = K724,500

h. Equipment Installation and Start-Up. Foreign exchange costs cover the services of an oven specialist, an installation supervisor, and a can track mechanic, all for a period of one month each. Salaries at US$300 per man day and plane transportation would total US$30,300, while local living expenses for these people have been estimated at K25,500.

The can manufacturing supervisor, two mechanics and the forklift truck operator should do most of the installation work, with part-time assistance from two additional mechanics, an electrican, and four non-skilled workers. An amount of K62,500 has been allocated to cover this expense.

Tin plate and other supplies will be used to test the equipment before it can be finally approved, and an amount of K31,500 should cover these items. Equipment manufacturers and prices can be located in Appendix L.

i. Organizational Expenses. US$30,500 or 8 percent of the estimated local building cost of K2,682,280 has been set aside for detailed engineering drawings and US$5,000 for legal expenses incurred in the United States. K30,000 has been allocated for organizational expenses in Burma.

j. Miscellaneous Expenses. In order to cover any unforeseen expenses that might occur prior to the time plant operations commence, an amount of K1,577,900 or 7.51 percent of the capital investment has been set aside for this purpose. Should this money not be required, it can be transferred to the working capital account to lower the amount of short-term borrowing that would be needed.

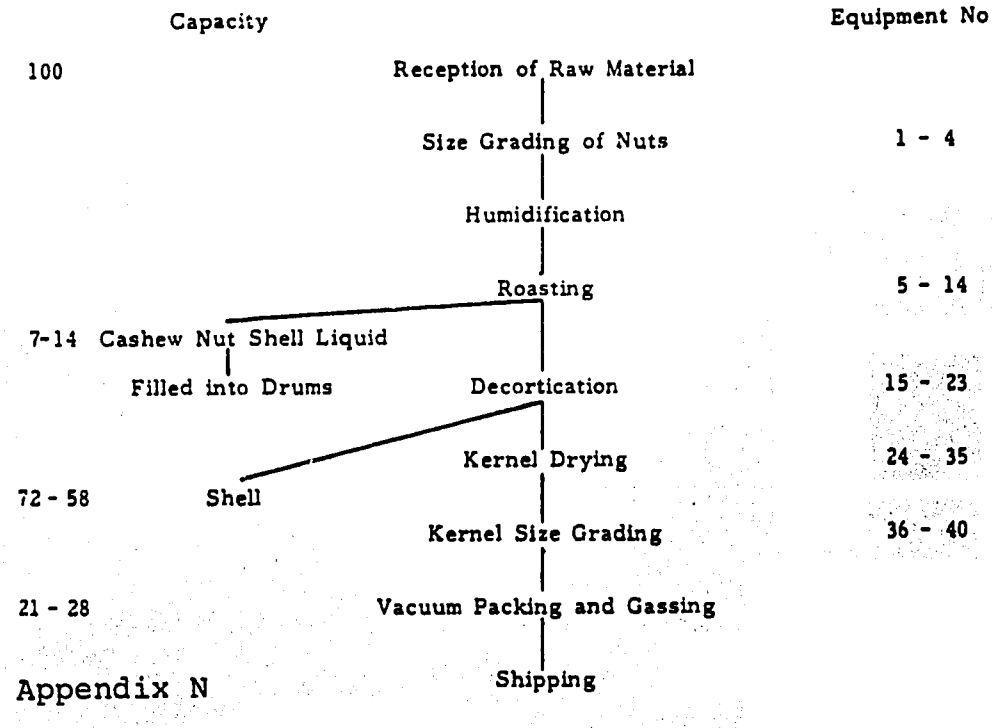
k. Working Capital. The amount of working capital needed for plant operations has been estimated at K9,284,100 of which K4,920,700 or 53 percent would be provided for in the original capital investment.

E. Cashew Nuts

1. Introduction

There is an excellent world market for cashew nuts, with prices increasing as the supply cannot keep up with the demand. The major producing nations are India, Brazil, Tanzania, Kenya, Mozambique and Madagascar. Production has been relatively steady averaging around 400,000 MT of raw nuts per year. Both India and Tanzania are expanding production and the latter is constructing three new processing facilities that should be in operation during the 1982-83 season. Figure 17 is a flow chart of a cashew nut plant. The market for cashew nut shell liquid (CNSL) has been rather slow the past year due to world economic conditions, as it is used in the manufacture of insultaing varnishes, typewriter rolls, oil and acid resistant cements and tiles, brake linings and similar industrial products. Current prices are in the range of US$250 per MT, though several years ago the prices quoted were between US$500 to US$550 per MT and have reached a high of US$700 to US$750 per MT. Shelled cashew nuts imported into the United States are shown in Table 78 for 1975 to 1981.

FIGURE 17. FLOW CHART FOR CASHEW NUTS



SOURCE: Appendix N

2. Production

Cashew trees can be grown under a wide variety of climatic conditions as the tree is hardy and drought resistant, though it is damaged by frost. Plantation trees are planted with a spacing of 30 feet x 30 feet or 48 trees per acre and may be thinned to 60 feet x 60 feet spacings after 10 years if they become crowded. Economic production starts when the trees are about three years old and by the 10th year are in their maximum production period, though they may continue bearing for another 20 years or more. Yields from different countries show a wide variation, depending in part on the husbandry methods used (Appendix B). However, an average annual yield of 850 to 1,000 pounds per acre for mature trees may be expected.

A small number of cashew trees are being grown south of Mudon and additional acreage could be made available if there were a plant to process the nuts. A cashew nut plant requires a minimum capital investment; therefore, it may be worthwhile to consider this labor intensive industry as a project that could provide economic benefits to this part of Burma.

TABLE 78. CASHEW NUTS, SHELLED: IMPORTS INTO THE UNITED STATES, 1975 TO 1981

	1975	1976	1977	1978	1979	1980	1981
	metric tons						
Brazil	8,927	7,862	5,624	8,638	8,589	10,544	11,020
Canada	804	698	117	159	118	47	56
China, Mainland	448	2,024	1,397	1,804	1,395	84	51
China, Taiwan	2	71	26	56	25	5	--
Hong Kong	--	75	48	5	37	3	--
India	17,128	21,760	10,858	5,445	12,548	7,728	4,024
Kenya	194	682	702	487	469	619	259
Laos	16	70	57	--	--	--	--
Mozambique	14,607	14,115	13,871	12,469	8,587	8,540	9,306
South Africa	156	187	109	90	92	107	233
Tanzania	562	1,439	1,766	1,788	1,705	1,635	2,123
Other	207	274	8	161	313	266	529
TOTAL	43,051	49,257	34,583	31,102	33,878	29,578	27,601

SOURCE: United States Department of Agriculture
4246A

3. Prices

Raw cashew nut prices in Kenya and Tanzania during the 1980-81 season were US$0.36 per kilogram (K2.52 per kilogram or K2.520 per MT) Table 79. Prices for the 1981-82 season were increased to US$0.68 per kilogram (K4.76 per kilogram or K4.760 per MT) in Kenya and US$0.61 (K4.27 per kilogram or K4.270 per MT) in Tanzania in order to induce growers into producing larger crops. An average of these two prices was used in preparing the economic analysis in this report which was only marginally profitable. However, if the 1980-81 prices had been used, the plant would have a gross margin of K2,704,100 or 29.5 percent of sales. Consequently, a fair purchase price that would benefit both farmers and the plant would be someplace between K2.520 per MT and K4.510 per MT.

TABLE 79. SELECTED MONTHLY CASHEW PRICES FOR CALENDAR YEARS 1975 THROUGH 1980

(DOLLARS PER KILOGRAM)

YEAR AND ITEM	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	AVERAGE
1975													
Whole 320 1/	2.43	2.47	2.54	2.54	2.64	2.60	2.50	2.46	2.44	2.37	2.30	2.30	2.46
Whole 300-320 2/	2.58	2.58	2.54	2.80	2.80	2.80	2.76	2.76	2.76	2.76	2.47	2.47	2.67
Large white pieces 1/	1.67	1.70	1.71	1.70	1.71	1.68	1.62	---	---	---	---	---	1.68
Fancy pieces 2/	1.24	1.24	1.19	1.21	1.24	1.24	1.26	1.30	1.30	1.30	1.32	1.37	1.27
1976													
Whole 320 1/	2.32	2.47	2.44	2.60	2.62	2.61	2.77	2.85	2.84	2.83	2.99	3.13	2.71
Whole 300-320 2/	2.47	2.47	2.47	2.56	2.88	2.88	2.88	2.88	2.88	3.06	3.06	3.09	2.80
Large white pieces 1/	---	---	---	---	---	---	---	---	1.54	1.46	1.49	1.55	1.51
Fancy pieces 2/	1.34	1.34	1.34	1.48	1.79	1.79	1.79	1.79	1.79	1.81	1.87	1.87	1.67
1977													
Whole 320 1/	3.32	3.64	4.34	5.05	5.07	5.25	5.29	5.05	4.99	4.90	4.69	4.35	4.66
Whole 300-320 2/	3.57	3.88	4.56	5.45	5.42	5.56	5.56	5.45	5.36	5.25	5.09	5.07	5.02
Large white pieces 1/	1.65	1.73	2.28	2.71	2.75	2.75	2.75	2.57	2.52	2.50	2.28	2.20	2.39
Fancy pieces 2/	1.98	2.16	2.60	3.06	3.00	2.91	2.91	2.89	2.78	2.78	2.49	2.49	2.67
1978													
Whole 320 1/	4.38	4.18	4.03	4.09	4.33	4.58	4.58	4.44	4.36	4.36	3.88	3.79	4.25
Whole 300-320 2/	4.67	4.56	4.35	4.50	4.86	4.67	4.69	4.74	---	4.43	4.24	4.09	4.53
Large white pieces 1/	2.24	2.14	2.06	3.10	2.53	2.11	2.17	2.20	2.21	2.24	2.24	2.40	2.30
Fancy pieces 2/	2.32	2.26	2.13	2.25	2.34	2.36	2.36	2.36	---	2.58	2.62	2.63	2.38
1979													
Whole 320 1/	3.79	3.86	3.93	4.00	3.92	4.03	4.40	4.35	4.38	4.51	5.11	5.18	4.29
Whole 300-320 2/	4.08	4.17	4.19	4.30	4.30	4.54	4.74	4.83	4.78	4.85	5.18	5.40	4.61
Large white pieces 1/	2.47	2.36	2.37	2.41	2.40	2.46	2.63	2.72	2.73	2.76	3.21	3.41	2.65
Fancy pieces 2/	2.62	2.58	2.58	2.62	2.62	2.87	3.02	3.11	3.33	3.42	3.57	3.86	3.02
1980													
Whole 320 1/	5.41	5.58	5.49	5.54	5.81	5.99	6.08	6.10	6.41	6.39	6.28	6.23	
Whole 300-320 2/	5.69	5.95	6.04	6.11	6.39	6.50	6.50	6.50	6.50	6.50	6.57	6.72	6.33
Large white pieces 1/	3.67	3.84	3.82	3.87	4.15	4.35	4.50	4.52	4.61	4.65	4.58	4.46	
Fancy pieces 2/	3.81	4.12	4.32	4.59	4.78	4.81	4.81	4.81	4.81	4.81	4.74	4.52	4.57

---Denotes not available, unknown, or not applicable.

1/ C&F, U.K. 2/ Spot, New York.

SOURCE: U.K. Publications Ltd. The Public Ledger (London), weekly editions and the New York Journal of Commerce, weekly edition. June, 1981 Commodity Programs, FAS, USDA

4. Processing Methods

This plant has been designed to handle 1,250 MT of nuts operating two 8-hour shifts a day, 300 days per year. Finished product yield will vary between 21 to 28 percent of the raw nut or 252 to 336 MT of kernels of which 53 to 65 percent would be white whole kernels. Cashew nut shell liquid (CNSL) is a by-product of the operation and should yield 7 to 14 percent by weight of the raw nut or 87.5 to 175 MT of CNSL.

a. Receiving. The raw nuts can be received at the plant in bags that are dumped into a hopper on the grading unit. The first section eliminates dirt and trash that might be included with the nuts and the succeeding sections separate the nuts into five sizes, ranging from under 12 mm when measured across the girth of the nuts to over 1 qmm. Control of the nut size is important during processing as it will produce a better quality product and improve the accuracy of the workers in the final size grading.

Each grade size is stored in a humidifying bin and when a full days production has been accumulated, about 4 MT, water is sprayed over the nuts for up to 48 hours or until the nuts have reached the proper humidity required for processing. The cashews are then moved manually to the roasting oven where they are loaded into the feed hopper.

b. Roasting. The nuts are roasted in an air heated oven that utilizes waste shell from the decorticator as the heat source. The roasting process allows the CNSL in the shell to exude from the nut so that it can be collected in a holding tank and pumped to a drum loading area. Any oil remaining on the surface of the nut is removed by means of small quantities of sawdust as they go through a revolving cylinder. The oil free roasted nuts are then conveyed pneumatically to the

decorticating unit where the shells are broken gently to avoid damaging the kernel. The broken shells are separated from the kernels that are discharged onto a conveyor leading to the dryer, while the shells are collected and used for heating.

The nuts go through a drying unit to lower the moisture content to 4 or 4.5 percent. After drying the kernels are dropped onto a peeling and grading conveyor for final inspection. The sizes are based on the number of kernels in a pound and the commercial grades for whole kernels are 210 per pound, 240 per pound, 320 per pound, and 450 per pound. Other lower commercial grades are butts, splits, large pieces, pieces and baby butts. These products are sold to confectionary and other general food processors.

c. Packaging. Once the nuts have been graded each size is packed into a container and air is evacuated to prevent rancidity. The container is then closed and placed in a shipping carton which can be stored until an order has been completed. In past years, the nuts were packaged in large metal cans measuring 9-1/2 inches x 9-1/2 inches x 13 inches high (241 mm x 241 mm x 330 mm) holding 25 pounds of product. As it is difficult to dispose of these cans, the current trend is to use laminated flexible bags that are placed into corrugated shipping cartons for protection.

5. Specifications for Cashew Kernels

Specifications for cashew kernels are extracted from the relevant notifications issued by the Government of India in regard to details of the 24 different grades of cashew kernels approved for export.

a. Whole Cashew Kernels Grade Designation. Cashew kernels shall have been obtained through shelling and peeling cashew nuts (Anacardium occidentale), shall have the characteristic

shape, shall be white, pale ivory or light ash in color reasonably dry, and free from insect damage, damaged kernels and black or brown spots. They shall be completely free from rancid kernels. The kernels shall be completely free from testa.

	Number of Kernels per Pound
W 210	200/210
W 240	220/240
W 280	260/280
W 320	300/320
W 400	350/400
W 450	400/450
W 500	450/500

Tolerance: Broken kernels and kernels of the next lower grade, if any, shall not together exceed 50 percent at the time of packing.

b. Scorched Cashew Kernels (Whole). Cashew kernels shall have been obtained through shelling and peeling cashew nuts (Anacardium occidentale) shall have the characteristic shape, shall be reasonably dry and free from insect damage, damaged kernels and black spots and testa. They shall be completely free from rancid kernels. The kernels may be light brown, light ivory, light ash or deep ivory in color due to scorching as a result of overheating.

Grade Designation	Trade Name
SW	Scorched Wholes

Tolerance: Broken kernels and kernels of the next lower grade, if any, shall not together exceed 5 percent at the time of packing.

c. Dessert Cashew Kernels (Whole). Cashew kernels shall have been obtained by shelling and peeling cashew nuts (Anacardium occidentale), shall have the characteristic shape, shall be reasonably dry and free from insect damage and testa. Slightly scorched kernels and kernels with a slight speckling and discolouration permitted. They shall be completely free from rancid kernels. The kernels may also be immature. The kernels may be light brown, light blue or light ivory in color due to scorching.

Grade Designation	Trade Name	Blemish
SSW or SW. 1 A	Scorched wholes or Scorched whole 1.A.	Slightly shrivelled kernels

Grade Designation	Trade Name
DW or SSW	Dessert Wholes

Tolerance: Broken kernels or kernels of the next lower grade, if any, shall not together exceed 5 percent at the time of packing.

d. Cashew Kernels (White Pieces). Cashew kernels shall have been obtained by shelling and peeling cashew nuts (Anacardium occidentale), shall be white, pale ivory or light ash in color, reasonably dry and free from insect damage, damaged kernels and black spots. They shall be completely free from rancid kernels. The pieces shall be completely free from testa.

Grade Designation	Trade Name	Description
B	Butts	Kernels broken crosswise and naturally attached.

S	Splits	Kernels split naturally lengthwise.
LWP	Large White Pieces	Kernels broken into more than two pieces and not passing through a 4 mesh 16 SWG sieve.
SWP	Small White Pieces	Broken kernels smaller than those described as LWP but not passing through a 6 mesh 20 SWG sieve.
BB	Baby Bits	Plemules and broken kernels smaller than those described as SWP but not passing through a 10 mesh 24 SWG sieve.

Tolerance: Up to 5 percent of the next lower grade or pieces at the time of packing.

e. Cashew Kernels (Scorched Pieces). Cashew kernels shall have been obtained through shelling and peeling cashew nuts (Anacardium occidentale), shall be reasonably dry and free from insect damage, damaged kernels, black spots and testa. They shall be free from rancid kernels. The pieces may be light brown or deep ivory in color due to scorching as a result of overheating.

Grade Designation	Trade Name	Description
SB	Scorched Butts	Kernels broken crosswise and naturally attached.

SS	Scorched Splits	Kernels split naturally lengthwise.
SP	Scorched Pieces	Kernels broken into pieces and not passing through 4 mesh 16 SWG sieve.
SSP	Scorched Small Pieces	Broken kernels smaller than those described as SP but not passing through a 6 mesh 20 SWG sieve.

Tolerance: Up to 5 percent of the next lower grade or pieces at the time.

f. Dessert Cashew Kernels (Pieces) Cashew kernels shall have been obtained through shelling and peeling cashew nuts (Anacardium occidentale), shall be reasonably dry and free from insect damage and testa. Scorched pieces with surface speckling and discolouration permitted. The kernels may be light brown, deep ivory or light to deep blue in color. May be deformed due to immature nuts and may have spots.

Grade Designation	Trade Name	Description	Blemish
SPS	Scorched Pieces Seconds or Scorched Pieces 1A.	Kernels broken into pieces but not passing through a 4 mesh 16 SWG sieve.	Pieces of shrivelled kernels. May be deformed due to immature nuts and black spots.

DP	Dessert Pieces	Kernels broken into pieces but not passing through a 4 mesh 16 SWG sieve.	More shrivelled than those described as SPS and deeply scorched.
DSP	Dessert Small Pieces	Kernels of the same description as, but smaller than DP and not passing through a 6 mesh 20 SWG sieve.	--- ---

6. Plant Engineering

The Fletcher and Stewart Cashew Nut Processing Plant was developed by the Tropical Products Institute of London to provide a simple and rugged plant that could be used in tropical countries to process large and small quantities of cashew nuts economically. The plant is modular in concept, so production from a small plant can be increased by adding modules without having to purchase an entire new plant.

The line selected for Burma is the smallest module with a capacity of 1,250 MT of raw nuts per year, operating 16 hours a day. By adding modules, production can be increased to 2,500 MT per year or 5,000 MT when availability of raw nuts warrants such an expansion.

The plant has been designed to permit the production area to be increased on one side for additional roasting and decortication equipment and in the rear for the peeling, grading,

and packaging (Table 80). When more modules are purchased, it may be worthwhile to consider automatic peeling equipment to reduce the number of people needed for this task. Appendix N outlines the site and floor plan of the cashew nut processing plant.

TABLE 80. BUILDING AREA FOR THE CASHEW NUT PLANT

	Building Dimensions	Square Meters
Raw nut storage area	10 m x 16 m	160 m^2
Grading and humidifying	10 m x 12 m	120 m^2
Roasting and decortication	10 m x 13 m	130 m^2
Nut drying area	10 m x 14 m	140 m^2
Peeling and grading	20 m x 25 m	500 m^2
Finished product storage	10 m x 20 m	200 m^2
Laboratory	4 m x 6 m	24 m^2
Plant office	6 m x 7 m	42 m^2
Machine shop	6 m x 10 m	60 m^2
Toilets	4 m x 8 m	32 m^2
CNSL tank and drum storage	4 m x 9 m	36 m^2
Loading platforms	4 m x 4 m + 4 m x 4 m	32 m^2
Main office	6 m x 8 m	48 m^2
Restaurant	6 m x 8 m	48 m^2
Dressing rooms	6 m x 10 m	60 m^2
Watchmen's quarters	4 m x 4 m	16 m2
TOTAL		1,648 m^2

SOURCE: Experience, Incorporated based on industry design.

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a. Raw Nut Storage Area. Usually nuts are received in bags that should be weighed to determine the amount of each purchase, then stored until needed for production. The length of the harvesting season in Burma is not known at this time, however, sufficient quantities of nuts should be purchased and stored to permit the plant to operate during a 12 month period.

The nuts do not deteriorate in storage if the shells are not broken or cracked in handling. Stacking bags can be done manually to avoid the need for a forklift truck as the daily volume does not justify this investment.

b. Grading and Humidifying Section. It may be worthwhile to grade the nuts before storage as this would eliminate the dirt and trash that is brought in with the raw nuts and would provide better control over the quality of nuts that are purchased, for the growers would only be paid for nuts and not extraneous material.

After grading, each size of nut is placed in the humidifying bins and sprayed with water until the moisture content has reached the desired level for roasting. Four bins have been provided for this purpose which should be sufficient for the anticipated production.

c. Roasting and Decortication Section. The roasting and decortication equipment has a capacity of 250 kilograms of nuts per hour and after the nuts have been dropped into the roaster loading hopper, the balance of these operations are continuous. Cashew nut shell liquid is removed in the roaster and accumulated in a collection tank from where it can be pumped to the outside holding tank until filled into 50 gallon drums. The amount of CNSL that can be expected from this process can vary from 7 to 14 percent of the raw nut weight, depending on the size and quality of the nut.

There is sufficient room around the equipment to permit the workers to have access to the machinery for maintenance and to move the decorticated nuts to the dryer. Additional equipment will be needed in this section when production is increased.

d. Nut Drying Area. The drying process is continuous and lowers the moisture content in the kernel to about 4 percent. The kernel yield after drying can vary from 21 to 28 percent of the raw nut weight and a 23 percent yield has been used in this study as an attainable average.

After drying the kernels pass over a selection belt to facilitate the manual peeling and grading operations. About 50 percent of the peeling labor requirement can be eliminated through the use of a testa removal unit that produces about 65 percent completely clean kernels. This unit can be added to the line as production increases.

e. Peeling and Grading Section. Peeling and grading will be done manually at stainless steel topped tables. The average rate used for peeling was 1-1/2 kilograms per hour per person while graders can handle 2-1/2 kilograms per hour. This of course will depend on the dexterity of the operators and the size and quality of nuts.

After grading, the nuts are placed into a flexible package which is weighed to insure that each bag has the proper amount of product. Air is then evacuated from the bag which is sealed and put into a carton for protection during shipping.

f. Finished Product Storage. The filled cartons are moved manually to the storage area and stacked until sufficient product has been accumulated to fill an order. The plant will operate on a 16 hour day basis; consequently, as there is a good market for cashew nuts, a minimum amount of storage space will be required.

g. Laboratory. The laboratory will have equipment to test the moisture content of raw nuts, kernels, and shell. In addition to other quality control procedures, the plant must be

kept clean to avoid the possibility of insect infestation in the finished product which is a major problem in some countries as is rancidity in the nuts due to a lack of vacuum in the package.

h. Plant Office. An office for the plant manager has been located off the main production floor to allow the supervisor to control all of the processing operations.

i. Machine Shop. The machine shop is located outside of the production area with access to the central section of the plant to facilitate moving equipment or parts into the shop for maintenance or repairs.

j. Rest Rooms. The grading and peeling area will require the largest number of operators, so restrooms for male and female workers have been located near this section of the plant.

k. CNSL Tank and Drum Storage. The CNSL storage tank has been placed on the outside of the plant adjacent to the roaster. This area should be covered for protection against rain and wind but does not require walls as the tank and empty or filled drums will not be damaged by the elements.

l. Loading Platforms. Covered loading platforms are located at the raw nut storage area and finished product warehouse.

m. Main Office. The main office, restaurant, and dressing rooms have been placed outside of the production building as this is customary in Burma. The office is large enough for the adminstrative personnel for some of the people will be working out of the plant office.

n. Restaurant. The restaurant area is rather small so it may be necessary to feed the personnel in two or more sittings. This area can be enlarged by moving the office towards the parking lot as there is ample room for expansion in the section of the plot.

o. Dressing Rooms. The dressing rooms for male and female workers should be large enough to accomodate the personnel since there are toilet facilities inside the plant.

p. Watchmen's Quarters. A small building near the plant entrance will house the watchmen and allow them to control vehicles and personnel entering or leaving the premises.

7. Plant Operations

Table 81 gives estimated sales of K8,834,900 based on 634,200 pounds of cashew nuts. Total gross margins are allocated at K852,600 before taxes and debt servicing.

8. Estimated Production Costs

a. Raw Material. The Burmese government has not furnished prices for raw cashew nuts, consequently an average of 1981-82 prices paid growers in Kenya and Tanzania has been used as a basis for calculating a fair market price. This amounts to K4,510 per MT of raw nuts. 1980-81 prices in those countries were considerably lower, K2,520 per MT, however producers were not supplying large quantities of nuts as these prices.

b. Direct Labor Requirements. Labor requirements are based on the number of various jobs needed for the can plant. At first, when the volume is low, only one line will be operated at a time; later this will be increased. There will be no expatriate personnel requirements and only three supervisory personnel. This is further outlined in Table 82.

TABLE 81. SUMMARY OF OPERATIONS FOR THE CASHEW NUT PROCESSING PLANT

	Percent	Quantity	Price Per Pound	Sales Volume	Percent
		(pounds)	------Kyats-----		
Estimated Sales Prices					
Whole white	55	348,600	16.54	5,765,844	65.26
Scorched wholes	6	38,000	14.79	562,020	6.36
Desert white	4	25,400	10.24	260,096	2.94
Large broken pieces	30	190,100	9.54	1,813,554	20.53
Small broken pieces	5	31,700	8.84	280,228	3.17
Cashew nut shell liquid (CNSL)		87.5 a/	1,750 a/	153,125	1.73
TOTAL	100	634,200		8,834,867 b/	99.99
Estimated Production Costs c/					
Raw material at K				5,637,500	
Direct labor				380,900	
Utilities				33,500	
Packaging materials				151,100	
Administration and sales expense				540,900	
Maintenance				157,100	
Depreciation				554,900	
Interest on working capital				468,000	
Amortization				58,400	
TOTAL				7,982,300	
Gross Margin				852,567	

a/ Metric ton.
b/ Round off to K8,834,900.
c/ Excludes long-term debt servicing.

SOURCE: Experience, Incorporated

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TABLE 82. DIRECT LABOR REQUIREMENTS PER SHIFT

	Skill	Number	Wage/ Month	Annual Cost
			----Kyats----	
Raw Nut Storage-Grading-Humidifying				
Foreman	SU	1	320	3,840
Workers	N-S	3	170	6,120
SUBTOTAL		4		9,960
Roasting-Decortication-Drying				
Foreman	SU	1	320	3,840
Workers	N-S	7	170	14,280
Operators	S	2	210	5,040
SUBTOTAL		10		23,160
Grading-Peeling-Packaging				
Foreman	SU	1	320	3,840
Primary kernel grading	N-S	12	170	24,480
Peeling	N-S	38	170	77,520
Finish grading	N-S	23	170	46,920
Weighing-filling-vacuum packaging	S	1	210	2,520
SUBTOTAL		75		155,280
Warehouse - Can Making				
Workers	N-S	1	170	2,040
SUBTOTAL		1		2,040
TOTAL LABOR COST/SHIFT		90		190,440

Labor costs for 2 shifts per day = K190,440 x 2 = K380,880 or rounded of to K380,900
180 People for 2 shifts per day

SU - Supervisor
N-S - Nonskilled
S - Skilled

SOURCE: Experience, Incorporated

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9. Utilities

a. Water. Estimated water useage will be 1,250 liters per day or 275 Imperial gallons per day.

b. Electricity. The below table gives standard motor horsepower requirements and representative KW needed for electrical generation (Table 83).

TABLE 83. ELECTRICAL REQUIREMENTS FOR CASHEW PLANT

Process	Motor HP	KW
Grading	1.50	1.10
Roasting-CNSL extraction	29.00	22.00
Drying	4.50	3.30
Kernel selection	1.60	1.20
Packaging	2.00	1.50
TOTAL	38.60	29.10

29.10 KW x 16 hours per day = 465.6 KWH
x 300 days per year = 139,680 KWH per year
x K0.24 KWH = K33,523 or rounded off to K33,500

SOURCE: Experience, Incorporated.

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10. Packaging Material

a. Flexible Packaging. Laminated poly-aluminum foil bags should be used for packaging of nuts. At US$0.50 each/C&F Burma x 25,300 bags the total cost will be US$12,650 x K7 or K88,550.

b. Corrugated Shipping Cartons. Shipping carton cost will be K65,527 based on 25,300 cartons x K2,590 per M cartons.

c. Summary of Packaging Material

Flexible Packaging	K 85,550
Shipping Cartons	65,527
TOTAL	K151,077 or rounded off to K151,100.

11. Administration and Sales Expenses

a. Administration Salaries. Total personnel costs will be K99,000 based on 28 employees. Table 84 gives the breakdown of monthly and annual costs.

TABLE 84. PERSONNEL COSTS

	Skill	Number	Wage Month	Annual Cost
			-----Kyats----	
General manager	M	1	800	9,600
Fieldman	M-E	1	450	5,400
Sales manager	M-E	1	450	5,400
Laboratory technician	M-E	2	320	7,680
Production supervisor	M-E	1	450	5,400
Accounting-financial supervisor	M-E	1	450	5,400
Mechanical supervisor	M-E	1	450	5,400
Secretary	S	1	300	3,600
Order and documentation clerk	S	1	210	2,520
Assistant production supervisor	S	1	400	4,800
Accounting-payroll clerk	S	1	210	2,520
Mechanics	S	3	320	11,520
Electrician	S	2	320	7,680
Typist	S	2	160	3,840
Telephone receptionist	S-S	1	160	1,920
Truck drivers	N-S	3	170	6,120
Watchmen	N-S	5	170	10,200
TOTAL		28		99,000

M - Manager
M-E - Managerial executive
S - Skilled
S-S - Semiskilled
N-S - Nonskilled

SOURCE: Experience, Incorporated.
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b. Administration Expenses. The expenses included in this section cover stationery, postage, office supplies, telephone, local travel, entertainment, and miscellaneous items. Of the gross sales figure (K8,834,900) an amount of 1.5 percent (K132,523) has been allocated to this account.

c. Sales Expenses. The major sales expenses will be a three week trip once a year to visit the major importing countries in Europe and the United States. This should cost approximately US$6,000 for plane travel, living expenses and entertainment. This expense and local sales costs can be covered by 1 percent of sales or K88,500.

Sales are normally conducted through exclusive representatives who in turn sell to nut importers. These representatives charge a commission of 2.5 percent on their sales or K220,870.

d. Summary of Administration and Sales Expenses. Total administrative expenses are K540,900 as outlined in Table 85.

TABLE 85. ADMINISTRATIVE AND SALES EXPENSES

Description	Amount (Kyats)
Administration Salaries	K99,000
Administration Expenses	132,500
Sales Expenses:	
Travel and local sales expenses	88,500
Representatives commission	220,900
TOTAL	K540,900

SOURCE: Experience, Incorporated

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e. Maintenance. Daily, monthly, and annual maintenance will be required for roads, buildings, production equipment and transportation equipment. The following amounts in Table 86 are suggested to keep all of these facilities in good operating condition.

TABLE 86. MAINTENANCE SCHEDULE

	Value	Amount	Maintenance Budget
	(Kyats)	(percent)	(Kyats)
Site improvements	75,000	1	750
Buildings - plant	1,914,900	1	19,149
Production and supporting equipment	3,213,000	3	96,390
Automobile equipment	519,750	5	25,988
Office - laboratory - machine shop	492,600	3	14,778
TOTAL	6,215,250		157,055

Use K157,100.

SOURCE: Experience, Incorporated
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12. Depreciation

A straight line method of depreciation has been used in this study, based on the original value of the asset and its estimated useful life (Table 87).

13. Interest and Loan Repayment

Interest expense on short-term funds is calculated at 18 percent. Long-term borrowing is based on a 12 percent interest rate for a fully amortized loan with a fixed payment per year over the 20 year loan term.

TABLE 87. DEPRECIATION SCHEDULE

	Value	Useful Life	Amount Per Year	Depreciation Schedule
	(Kyats)	(years)	(percent)	(Kyats)
Site improvements	75,000	20	5	3,750
Building - plant	1,914,900	25	4	76,596
Production and supporting equipment	3,213,000	10	10	321,300
Automotive equipment	519,750	5	20	103,950
Office-laboratory-machine shop	492,600	10	10	49,260
TOTAL	6,215,250			554,856 a/

a/ Use K554,900 as rounded figure.

SOURCE: Experience, Incorporated.

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Short-Term Loan K2,600,000 @ 18 percent = K468,000

Long-Term Loan a/ K6,000,000 @ 12 percent, annual fixed payment = K720,000

14. Amortization

Organization expenses and start-up should be amortized to their full benefit as shown in Table 88.

a/ In the first year the interest portion is K715,861 (compounded monthly) and the principal portion is K76,922. By the twentieth year the interest portion falls to K49,213 while the principal portion increases to K743,569.

TABLE 88. AMORTIZATION SCHEDULE

	Amount	Amount Per Year	Total
	(Kyats)	(percent)	(Kyats)
Organizational Expenses	70,000	20	14,000
Start-up	222,000	20	44,400
TOTAL	292,000		58,400

SOURCE: Experience, Incorporated.

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15. Working Capital Requirements

The major working capital items for cashew nuts are raw material and inventory. Money must be available for purchase and storage of the raw product. This is further expanded upon in Table 89. Nearly 53 percent of the working capital or K2,838,000 has been included in the capital investment for the plant.

TABLE 89. WORKING CAPITAL REQUIREMENTS

	Time Frame	Total Value	Amount
		---------Kyats-------	
Raw material	10 months	5,637,500	4,700,000
Packaging material	3 months	151,100	38,000
Accounts receivable	Letter of Credit	--	--
Inventory	1 month	8,400,000	700,000
TOTAL			5,438,000

SOURCE: Experience, Incorporated

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16. Investment Costs

Investment costs for the cashew plant are K10,000,000 or US$626,500 based on 40 percent equity and 60 percent long-term capital. Table 90 outlines the other expenditures utilized and specifics about each item are below.

TABLE 90. SUMMARY OF INVESTMENT COSTS - CASHEW PLANT

	Cost	Cost	Total Cost
	(US$)	---------Kyats----------	
Land			
Site improvements		75,000	75,000
Buildings plant		1,914,900	1,914,900
Processing and supporting equipment	459,000	--	3,213,000
Office equipment	10,000	53,000	123,000
Laboratory equipment	12,500	--	87,500
Machine shop	40,300	--	282,100
Automotive equipment	74,250	--	519,750
Equipment installation and start-up	25,500	43,500	222,000
Organizational expenses	5,000	35,000	70,000
Miscellaneous expenses	--	654,750	654,750
Working capital		2,838,000	2,838,000
TOTAL	626,550	5,614,150	10,000,000
Capitalization - Equity capital	40 percent = K 4,000,000		
Long-term loan	60 percent = 6,000,000		
	K10,000,000		
TOTAL	626,550	5,614,150	10,000,000

SOURCE: Experience, Incorporated.
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16. Discussion of Investment Costs

a. Land. Land for the plant site will be furnished by the Burmese Government, therefore investment capital will not be required for this item. An area of 200 m x 150 m or 30,000 m^2 should be ample for the present plant and to allow space for future expansion.

b. Site Improvements. The cost of grading the property and building access roads will depend upon the nature of the terrain selected for a plant site. In order to prepare an estimate of grading costs, the minimum area required would cover the buildings or about 100 m x 60 m or 6,000 m^2. Based on grading costs of K0.65 per square foot or K7.00 m^2 the expense for this work would be K42,000.

Twelve foot (366 m) wide access roads have been planned with paving around the loading and parking areas. This would amount to about 1,020 m^2 at a cost of K3.00 square foot or K3,235 m^2, totaling K33,000.

c. Buildings. The main plant building and watchmen's quarters require an area of 1,492 m^2 at an estimated cost of K103.25 square foot or K1,111.38 m^2 equal K1,658,184. The office, restaurant and dressing rooms occupy an area of 156 m^2 and building costs would be K152.88 square foot or K1,645.60 for a total of K256,714.

d. Processing and Supporting Equipment. Most of the processing machinery would be imported from England while the supporting equipment would originate in the United States. The former have been quoted at 217,586 Pounds Sterling and converted at a rate of US$1,706 per Pound equal US$371,200. The supporting machinery costs US$49,500 for a total of US$420,700. Ocean freight charges to place the equipment in Burma have been estimated at US$38,300. Further information on cashew nut equipment can be found in Appendix N.

e. Office Equipment. Office furniture can be purchased in Burma with the K53,000 that has been allocated for this purpose. Foreign exchange will be needed to buy four typewriters, five calculators, and a copying machine. US$10,000 should be sufficient to pay for these items.

f. Laboratory. The most important piece of equipment in the laboratory will be a moisture tester used on raw nuts, kernels and shells that cost 1,362 Pounds or US$2,325. The balance of the money in this account will be used for a microscope, scales, and similar quality control equipment.

g. Machine Shop. The machinery needed for processing cashew nuts is relatively simple but will require maintenance as it will be operating 16 hours per day. A small machine shop should be capable of handling this type of repair and the US$40,300 will cover the cost of the basic equipment and hand tools that will be needed.

h. Automotive Equipment. Transportation equipment recommended for the plant consists of a station wagon for the general manager at US$15,000, a four-wheel drive vehicle for the fieldman that costs US$14,000, a 1/2 to 1-ton pickup truck for general plant use, US$17,000, and a 2 to 3-ton flatbed truck to collect raw material at US$28,250.

i. Equipment Installation and Start-Up. The foreign exchange component includes the services of an engineer for a period of 60 days and a commissioning engineer during start-up for 30 days. The cost for these men is based on a per diem of US$250 plus $3,000 plane transportation for a total of US$25,500. Living costs in Burma have been calculated at K32,900.

Local personnel salaries during a three month installation and start-up period should amount to about K10,600.

j. Organizational Expenses. The equipment supplier will furnish all drawings for the erection and installation of the plant that include layouts, foundation plans, wiring diagrams,

spare parts list, operating and maintenance manuals for all of their equipment. The US$5,000 should cover any incidentals not included in the above mentioned items. Local cost for organizing the Burmese Company has been estimated at K35,000.

k. Miscellaneous Expenses. An amount of K654,750 or 6.55 percent of the investment has been set aside to cover any unforeseen expenses that might be incurred in developing this project. If these funds are not needed for this purpose, they can be used to augment working capital.

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VII. MARKETS AND MARKETING

A. Background

As noted earlier, Burma has unique opportunities available for developing both domestic and export markets for tropical agricultural food products. The experimental farm, situated near the Mudon plant site, has excellent stands of many varieties of tropical fruits and nuts. These include most, if not all, of the products given in the product overview of the preceding section. The experimental farm is well managed and should be valuable to the project in the selection of appropriate varieties and in providing agronomic assistance. The potential for growing export quality pineapple, however, needs further testing and investigation in relation to selection of suitable varieties for commercial application and their adaptation to Mudon's unique climatic conditions. Excessive rainfall for five months of the year and drought during the remainder provides a real challenge to pineapple production in this area of Burma.

B. Statement of Work

Although the domestic market is not overlooked, the marketing component of this study focuses on the potential for developing export outlets. Specific tasks for the market and marketing analysis are as follows:

1. Review secondary data sources for general overview of world markets for products considered.

2. Survey major current markets by personal reconnaissance, i.e., contact marketing agents, brokers, and representatives to estimate potential markets for:

a. Established fresh and processed products
b. Potential new products for fresh and processed products (e.g. tropical fruits)
c. Type of market, type of pack preferred, and container sizes
d. Price estimates and trends by product specified

3. Determine quality standards demanded for export markets.

4. Estimate marketing promotion, brokerage, transportation, and other marketing costs and requirements.

5. Determine market potential for each type of market:

a. Industrial market (reprocessing)
b. Institutional market (food service)
c. Consumer market

C. Products Considered

The products considered include all those described in Section II, General Product Overview of this report. They include:

- Pineapple
- Mango
- Rambutan
- Mangosteen
- Guava
- Papaya
- Passion fruit
- Durian
- Jackfruit
- Cashew
- Other, e.g., ginger, fruit salad/cocktail, bamboo shoots

D. Organization and Limitations of the Study

The report is organized around the tasks outlined in the statement of work given in paragraph II (B and C) above. The report concentrates on 10 major products mentioned above and three minor products for which there appear to be reasonable sales opportunities in selected markets situated in the Orient, Middle East, and Europe. Marginal attention is given also to markets in the United States and Canada. Fifteen markets are investigated in relative detail. These include: a) Oriental markets of Hong Kong, Japan, and Singapore; b) Middle Eastern markets of Kuwait, Saudi Arabia, and the United Arab Emirates, and c) European markets of the Federal Republic of Germany, France, the United Kingdom, the Netherlands, Belgium, Sweden, and Switzerland. Comments relative to the United States, Canadian, Austrian, Danish, and Norwegian markets are in the final section.

Major limitations of the study involve the lack of reliable production and trade data, particularly for products other than pineapple. The more exotic tropical fruits such as mangosteen, papayas, mangos, and rambutan have only started to enter world commerce and are often grouped together in published statistical data. To obtain additional data on these products, major producing areas and markets were surveyed by the marketing specialist of the Experience, Incorporated team. Personal visits of short duration were made to Bangkok, Hong Kong, Tokyo, Singapore, Paris, and London. Additional production and trade data were obtained -- primarily from British sources -- for major exporters in the Philippines, Taiwan, Malaysia, Ivory Coast, and Union of South Africa 1/.

1/ Data were obtained from the British Overseas Trade Board, Export Intelligence Service located at Export House, 50 Ludgate Hill, London and from Market Information services in Tokyo, Hong Kong, Paris, and Singapore. Additional data were obtained from the Rungis and Covent Garden markets, and from trade associations in the cities visited.

These data will be discussed under the individual crops and markets considered.

E. Selected Crops

1. Pineapple

World pineapple production has increased from 5 million MT during the period 1969-71 to slightly over 7.6 million MT in 1980 1/. This production comes from 85 countries, a distribution that makes it among the most widely cultivated crops in the world (Appendix B).

The nine leading producing countries of Australia, Ivory Coast, Malaysia, Mexico, Philippines, South Africa, Taiwan, Thailand, and the United States produce 4.84 million MT or about 64 percent of the total world output (Table 91). Of this total, the processed weight of canned (solid pack) pineapple was about 852,000 MT; single strength juice, 205,000 MT; and 52,480 MT of concentrated juice. In terms of fresh or farm weight equivalents, the total amount processed by canning amounted to roughly 2.1 million MT, or about 43 percent of the total amount produced in the nine countries considered. 2/ The remaining 57 percent was consumed fresh in the home countries, processed in frozen form, or shipped to fresh export outlets.

1/ FAO, United Nations, World Agricultural Production Statistics, Rome, 1981.

2/ Relationships between farm and processed weights vary widely among seasons and localities. Conversion factors to convert processed weight to farm weight equivalents were: canned solid pack and single-strength juice times 1.71; 3 x 1 concentrate quantities times 5.83. Source: Conversion Factors and Weights and Measures, USDA, Economics, Statistics, and Cooperative Service, Statistical Bulletin No. 616, March, 1979.

TABLE 91. PINEAPPLE PRODUCTION IN SPECIFIED COUNTRIES, 1970 TO 1980

Year	Australia	Ivory Coast	Malaysia	Mexico	Philippines	South Africa	Taiwan	Thailand	United States	Total
	metric tons									
Total Production										
1970	128,021	110,579	283,246	248,800	365,000	160,539	338,191	242,489	865,453	2,742,318
1971	128,000	135,746	268,190	297,300	380,000	173,506	358,529	124,826	854,567	2,720,664
1972	126,000	201,304	255,391	218,200	375,000	173,994	334,384	318,789	859,103	2,862,165
1973	126,000	210,010	241,538	268,300	333,235	147,389	327,982	483,493	734,819	2,863,766
1974	119,761	229,000	245,339	397,800	405,000	184,226	307,851	803,720	635,029	3,327,726
1975	95,451	240,000	199,292	371,300	400,000	169,374	318,978	1,151,865	653,172	3,599,432
1976	119,000	267,000	194,418	442,000	752,000	172,317	278,830	1,295,850	616,885	3,580,640
1977	101,000	242,000	191,844	510,000	780,000	158,825	282,193	1,499,400	625,957	4,391,219
1978	103,000	312,000	190,344	568,300	815,000	167,300	249,627	1,540,000	612,349	4,557,920
1979	133,000	287,000	192,646	632,100	875,000	212,119	244,777	1,372,000	617,792	4,566,434
1980	123,000	306,000	185,000	604,600	901,000	210,535	233,291	1,680,000	596,020	4,839,446
Canned										
1970	33,761	NA a/	66,760	27,400	140,000	59,536	90,294	NA a/	245,516	663,267
1971	33,455	NA a/	61,999	33,060	145,000	59,863	91,031	NA a/	255,905	680,313
1972	32,353	67,981	57,516	27,420	140,000	58,740	61,469	NA a/	226,736	672,215
1973	35,496	63,730	59,676	27,450	137,500	45,288	57,795	17,950	194,935	639,820
1974	37,191	66,697	60,641	43,840	139,000	55,146	44,469	32,820	165,541	645,345
1975	28,618	57,544	44,008	42,660	141,000	52,234	34,246	41,500	167,378	609,188
1976	39,252	72,453	47,622	48,330	175,000	50,546	25,754	67,250	168,807	695,014
1977	28,148	53,329	49,931	61,950	257,227	51,025	18,537	94,250	173,298	787,695
1978	32,475	72,000	50,389	63,650	257,662	54,132	25,828	108,750	155,539	820,425
1979	42,130	62,400	48,188	70,700	265,218	54,965	28,458	118,900	152,478	843,437
1980 b/	36,742	64,360	43,000	72,350	276,000	54,413	37,089	126,150	141,659	851,763

Continued . . .

TABLE 91. PINEAPPLE PRODUCTION IN SPECIFIED COUNTRIES, 1970 TO 1980 - Continued (See note below)

Year	Australia	Ivory Coast	Malaysia	Mexico	Philippines	United States	Total
	metric tons						
Single-Strength Pineapple Juice							
1976	14,003	15,673	1,492	8,870	a/	107,957	147,995
1977	11,063	13,622	2,005	9,850	38,584	110,849	185,973
1978	10,920	18,000	2,121	11,950	27,010	115,861	185,862
1979	10,757	15,600	1,227	12,300	31,872	115,861	1[illegible]7,617
1980	10,206	16,000	2,189	11,750	41,500	123,572	205,217

Year	Philippines	South Africa b/	Thailand	United States	Total
	metric tons				
Pineapple Juice Concentrate					
1976	NA a/	9,997	2,500	6,169	18,666
1977	21,220	10,075	2,500	5,205	39,000
1978	21,257	10,623	4,700	5,109	111,689
1979	21,880	7,833	12,500	5,398	47,611
1980	20,000	6,835	21,500	4,145	52,480

Year	Australia	Philippines	Total
	metric tons		
Tropical Fruit Salad			
1976	6,532	NA a/	6,532
1977	6,940	15,434	22,374
1978	5,797	15,460	21,257
1979	6,103	15,913	22,016
1980	5,817	18,500	24,317

NOTE: Information for 1970-1975 is not available for single strength, juice concentrate and tropical fruit salad.

a/ Data not available.

b/ Includes some single strength juice.

SOURCE: Baker, B.M., "Fresh and Canned Pineapple Situation in Major Producing Countries", USDA, FAS Circular FCAN-82, Washington, D.C., February 1982.

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a. Canned Pineapple. Table 91 shows that pineapple production in all utilizations rose substantially during the period 1970-80. During that period, total pineapple production increased 76 percent and canned solid pack by 28 percent. During the last five years of the decade (1976-80), single-strength and concentrated pineapple juice increased 36 and 180 percent, respectively.

Major producers and exporters of canned pineapple with which Burma must compete are shown in Table 91. Among these, the major Asiatic producers are Thailand, Taiwan, the Philippines, and Malaysia. These countries not only supply the lucrative markets of Hong Kong, Tokyo, and Singapore but supply large amounts of canned pineapple to the European, United States, and Canadian markets. In 1980, the Philippines exported slightly over 187,000 MT out of a total production of 276,000 MT of canned pineapple with an FOB (Manila) value of US$6.17 1/ per case of No. 2 can-size equivalents. Thailand exported about 127,000 MT of canned pineapple in 1980 with an estimated FOB value of around $7.69 per case of No. 2 can-size equivalents. 2/ Taiwan's exports have declined 37 percent since 1970 due to increasing labor rates which have reduced Taiwan's cost competitiveness in world markets. Further declines in Taiwan's production and export volume are forecast for 1981 and beyond.

Thailand is continuing to expand pineapple acreage and forecasted acreage for 1982-83 calls for an increase to about

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1/ Dollar values given are US dollars unless otherwise specified. Thailand's data converted from 1980 Bahts to US dollars on basis of 20.63 Bahts = US$1.00. The Philippines values are given in US dollars in their Trade Statistics.

2/ All values for the three countries (Thailand, Philippines, Taiwan) were derived from the original trade statistics of the countries involved. The statistics did not indicate the proportions of the various types of solid pack that were canned (i.e., slices, chunks, tidbits, etc.).

325,000 hectares, up from the 302,000 reported the previous year. The Thai pineapple canning industry currently (1982) produces about 12 million cases per year, a level that is much below their rated capacity of 30 million cases. 1/ The Thai production capability poses formidable obstacles to Burma's attempts to establish a viable canned pineapple industry that will be competitive in world markets.

Quantities imported into the major world markets are given in Table 92. The 1980 data show that the United States is by far the largest market (209,520 MT), followed by West Germany (77,869 MT), the United Kingdom (48,230 MT), France (39,611 MT), Singapore (39,500 MT), and Canada (32,922 MT). The Middle Eastern countries, led by Saudi Arabia, have recently become significant markets, particularly for Asiatic suppliers.

b. Fresh Pineapple 2/. Total imports of fresh pineapple into the leading markets reviewed increased from about 185,000 MT in 1975 to slightly over 289,000 MT in 1978 (Table 92). In 1980, Japan, with 105,000 MT, was the leading importer, followed by the United States, France, and the United Kingdom.

The largest supplier of fresh fruit for export is the Philippines with shipments totaling 115,000 MT in 1980.

1/ Attache Report, American Embassy, Bangkok, Thailand, April 7, 1982.

2/ This entire section and much of the material for fresh pineapple markets draws heavily on the publication: Selected European Markets for Tropical & Off-Season Fresh Fruit & Vegetables, International Trade Center, United Nations Conference Trade Development/General Agreement Tariffs Trade (UNCTAD/GATT), Geneva, 1981. The analysis also gains much from a conference between the marketing team specialist and Mr. James Joughin of the Tropical Products Institute, 127 Clerkenwell Road, London, June 1982.

TABLE 92. IMPORTS OF PINEAPPLE PRODUCTS INTO SELECTED MARKETS, SELECTED YEARS

Products/Country	Fresh 1975	Fresh 1978	Fresh 1980	Canned 1978	Canned 1980
	metric tons				
United Kingdom	5,157	7,641	12,906	39,083	48,230
Germany, Federal Republic	13,144	19,212	12,589	84,296	77,869
Netherlands	2,638	9,530	8,076	12,356	16,243
Belgium	4,030	5,710	5,689	9,051	9,019
France	34,788	48,928	39,373	40,496	39,611
Switzerland	2,466	4,295	3,886 a/	-- b/	612
Sweden	956	1,356	1,499 a/	-- b/	4,133
Denmark	772	1,400	1,032	3,876	3,211
Norway	208	328	300 a/	-- b/	790
Austria	660	1,040	987 a/	-- b/	68
United States	34,429	60,637	69,006	173,049	209,520
Canada	7,171	6,990	5,371	28,511	32,922
Japan c/	54,218	101,478	105,010	24,266	15,835
Hong Kong d/	1,317	1,588	1,792	-- b/	4,180
Singapore	23,000	19,226	18,524	-- b/	39,500
Kuwait	-- b/	-- b/	1,044	-- b/	1,459
United Arab Emirates	-- b/	-- b/	29 e/	-- b/	2,757
Saudi Arabia	-- b/	-- b/	2,884	-- b/	11,754
TOTAL	184,954	289,359	-- f/	414,982	452,460

a/ 1979 data.
b/ Data not available for the sources searched.
c/ Japan - 122,829 MT fresh and 16,176 of canned (solid pack) pineapple in 1981.
d/ Hong Kong imported 1,342 MT of fresh pineapple in 1981.
e/ From Thailand.
f/ Not totaled because some data are estimated on basis of 1979 imports.

SOURCE: Individual country statistics and USDA Foreign Agricultural Circular FCAN-1-82, "Fresh and Canned Pineapple Situation in Major Producing Countries", Washington, D.C. February, 1982.

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Next in importance is the Ivory Coast with 58,000 MT, followed by Mexico, 37,000 MT, Malaysia, 18,000 MT, and Taiwan 15,000 MT. The United States is a large market for fresh pineapple, but obtains most of its supplies from the state of Hawaii and from Mexico. The United States picks up almost 100 percent of Mexico's exports.

Published CIF average unit values and volumes of fresh pineapple are given for major markets in Asia, Europe, and North America in Tables 93 and 94. Unit values ranged from $130 per ton for sea shipments to the United States to over $1,000 for air-freighted pineapples entering the United Kingdom.

Average wholesale prices for selected European markets for the October-April period of 1979-80 and for July, 1982 are given in Table 95. In 1979-80 air-freighted pineapple ranged from $1.25 to $1.93 per kilogram. Prices for air-freighted pineapple for the United Kingdom, West Germany, and France averaged $1.39 to $1.66 in July, 1982. These quotations imply that prices have changed very little, if at all, over the last two years.

The commonly accepted variety for most major markets is the Smooth Cayenne; other commercial varieties are the Queen, Red Spanish, and the Abacaxis. The latter varieties are not marketed in any significant volume.

The color, weight, and condition of the crown are the major quality parameters in the fresh pineapple market. 1/ Consumers prefer fruit of a deep yellow to coppery-orange shade, green being associated with immaturity. 1/ Pineapples with slightly

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1/ For consumer and trade preferences in France, see Vlandes, Sylvie, La Consommation des Fruits exotiques en France, Service des Etudes Economiques du Centre Technique Interprofessionnel des Fruits et Legumes, Paris, 1981.

TABLE 93. IMPORT VOLUMES AND AVERAGE CIF UNIT VALUES FOR FRESH TROPICAL FRUITS AND NUTS FOR SELECTED MARKETS, VARIOUS YEARS, 1979-81

Market and Product	Annual Volume	CIF Unit Values a/
	(metric tons)	(US dollars)
Japan, 1981 (US$1 = 211.45 Yen)		
Pineapples b/	122,829	400
Mangoes	1,573	2,638
Papayas c/	3,267	2,392
Mangosteens d/	143	3,352
Cashew nuts (Processed) e/	2,198	6,843
Durian f/	15	744
Singapore, 1980 (US$1 = S$2.0935)		
Pineapples	18,524	69
Mangoes	3,555	542
Papayas	6,737	85
Mangosteens	517	80
Cashew Nuts	480	5,822
Guavas	2	1,913
Durian	5,889	414
Jackfruit	6	160
Gingerfruit	2,763	141
Rambutan h/		
Hong Kong, 1981 (US$1 = $5.6561)		
Pineapples	1,342	203
Mangoes	8,420	544
Papayas	2,780	546
Cashew Nuts	4,671	2,085
Ginger	5,816	330
Rambutan f/	24	NA
Durian f/	3,136	484

Continued . . .

TABLE 93. IMPORT VOLUMES AND AVERAGE CIF UNIT VALUES - Continued

Market and Product	Annual Volume	CIF Unit Values a/
	(metric tons)	(US dollars)
United Kingdom 1979-80 (1 pound = US$2.30)		
Pineapples	11,906	1,011
Mangoes, guavas, mangosteens	2,253	1,872
Cashew nuts (1980 1 pound = US$2.39)	2,368	4,732
Rambutans f/	4.2	402
Durians f/	0.2	NA
Germany, Fed. Republic 1979 (US$1 = 11.76 RM)		
Pineapples	16,204	798
Mangoes	947	1,938
Avocados, Guavas, Mangosteens	8	784
Papayas f/	1.8	566
Durians f/	0.7	NA
Rambutans f/	6.1	626
France 1979 (US$1 = 4.025FF)		
Pineapples	44,485	541
Mangoes (1979)	1,859	1,879
Mangoes (1980) (1US$ = 4.49FF)	2,268	1,709
Avocados, Guavas, Mangosteen	34	766
Rambutans f/	21	522
Papayas f/	2.3	514
Durians f/	64	1,068
Netherlands, 1979 (US$1 = 1.8988g)		
Pineapples	9,489	712
Mangoes	1,534	1,538
Papayas f/	4.6	372
Rambutans f/	27.4	626
Durians f/	16	812

Continued . . .

TABLE 93. IMPORT VOLUMES AND AVERAGE CIF UNIT VALUES - Continued

Market and Product	Annual Volume	CIF Unit Values a/
	(metric tons)	(US dollars)
Belgium, 1979 (US$1 = 31.30BF)		
Pineapples	6,267	745
Mangoes, Guavas, Mangosteens	322	1,676
Rambutans (1980)	0.11	886
Papayas (1980) f/	3.8	381
Sweden, 1979 (US$1 = 5.582K)		
Pineapples	1,499	567
Mangoes (partly air-freighted)	44	NA
Rambutans f/	1.7	NA
Switzerland, 1979 (US$1 = 1.765SF)		
Pineapples	3,886	980
Mangoes	237	NA
Durians f/	8	594
Papayas f/	0.44	NA
Austria, 1979		
Pineapple	1,000	NA
Mangoes	152	NA
Denmark, 1979		
Pineapples	1,665	NA
Mangoes	6	NA
Rambutans and papayas f/	0.68	NA
Norway, 1979		
Pineapples	300	NA

Continued . . .

TABLE 93. IMPORT VOLUMES AND AVERAGE CIF UNIT VALUES - Continued

Market and Product	Annual Volume	CIF Unit Values a/
	(metric tons)	(US dollars)
Middle East, 1980		
Pineapples		
Saudi Arabia f/	3.4	183
Saudi Arabia g/	2,881	214
United Arab Emirates f/	29.4	260
Kuwait h/	244	214
Mangoes		
Saudi Arabia i/	0.55	1,190
United Arab Emirates f/	6.0	728
Jackfruit (to Saudi Arabia)	1.3	1,104
Rambutan f/		
Kuwait	0.7	NA

a/ Prices are CIF except for rambutans, papayas, and durians that are quoted as FOB Thailand.
b 99 percent from Philippines.
c/ All from United States (Hawaii).
d/ From Mexico.
e/ All from India.
f/ Thailand exports only. Note prices are FOB Thailand.
g/ Also imported 14.5 MT canned at a unit price of US$1,353 per MT.
h/ Also imported 153 MT canned at US$1,104 per MT.
i/ Data from Philippines and Trade Statistics.

NOTE: Saudi Arabia also imported 4.6 metric tons of canned mangoes from the Philippines with a CIF value of $2,318 per metric ton. The FOB unit value was $1,963 per metric ton.

SOURCE: Individual country Trade Statistics and ITCUNCTAD/GATT, op. cit.

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TABLE 94. FRESH FRUIT QUANTITIES IMPORTED AND AVERAGE CIF UNIT VALUES FOR SELECTED TROPICAL FRUITS AND NUTS FOR THE UNITED STATES AND CANADIAN MARKETS

Market/Product	Quantity 1980	Quantity 1981	CIF Unit Value 1980	CIF Unit Value 1981
	---metric tons---		---US dollars--	
United States				
Pineapples, canned	206,697	191,441	533	598
Pineapples, fresh	69,040	63,697	130	149
Mangoes, fresh	19,588	17,439	596	714
Mangoes, paste, pulp	595	825	933	965
Papayas, fresh	739	597	426	405
Papayas, preserved	1,009	1,356	723	918
Papaya, paste, pulp	290	261	500	586
Cashew nuts, shelled	29,578	27,932	4,069	5,118
Cashews, in shell	294	63	4,398	6,000
Guavas, paste, pulp	4,222	3,161	455	468
Guavas, jam, jelly	303	464	465	463
Guavas, sliced	562	460	770	804
Bamboo shoots, canned	7,110	12,801	687	1,009
Cashew apples, prep.	23	c/	1,304	c/
Cashew apples, paste, pulp	138	228	659	1,083
Ginger root, candied	215	229	1,781	2,253
Durian a/	3	c/	2,750	c/
Jackfruit, canned b/	59	c/	2,422	c/
Ginger root, unground	4,085	4,372	795	858
Canada				
Pineapple, canned	35,000	c/	641	c/
Cashew nuts, shelled	3,276	c/	5,545	c/

a/ Thailand Trade data. Prices are FOB Bangkok.
b/ Philippines trade data.
c/ Data not available.

SOURCE: United States Foreign Agricultural Trade, Statistical Report, April, 1982, Canadian Agricultural Statistical Montreal, 1981

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TABLE 95. AVERAGE WHOLESALE PRICES OF SELECTED FRESH TROPICAL FRUITS IN SIX MAJOR EUROPEAN MARKETS, DURING SELECTED MONTHS 1979-80 AND JULY, 1982

Product and Origin	United Kingdom	France	Germany FR	Nether-lands	Belgium	Switzer-land	Aver-age
	(October-April) 1979-80						
	US dollars per kilogram a/						
Pineapple							
Ivory Coast (sea)	0.85	0.73	1.10	0.86	0.88	1.15	0.93
Ivory Coast (air)	-- 1.16	--	--	1.33	--	1.25	
Kenya (air)	1.38	--	1.16	--	1.20	1.63	1.34
Mangoes							
Kenya	1.91	2.70	2.81	2.35	2.25	3.21	2.54
Mali	-- 2.28	3.09	2.28	1.87	--	2.38	
South Africa	-- 2.20	--	2.84	2.25	2.90	2.55	
Passion Fruit							
Kenya	2.45	2.46	2.77	3.61	2.55	3.03	2.81
	July, 1982						
Pineapples	1.25	1.24	1.93	--	--	--	--
Mangoes	1.70	1.65	1.93	--	--	--	--
Passion Fruit	-- 2.63	--	--	--	--	--	

a/ Converted to dollars by international exchange rates. Should be interpreted with caution as exchange rates may be completely under or over valued.

SOURCE: ITCUNCTAD/GATT, op. cit.

yellow ("turning") color have good shelf-life, but fruit that is predominantly green is unlikely to contain enough sugar to meet good eating quality standards. The pineapples should arrive about two-thirds colored (i.e. "turning") in order to allow for market distribution time in the importing country. In Oriental markets such as Singapore, Tokyo, and Hong Kong, importers prefer the incoming fruit to be fully mature and highly colored. In all markets, the crown leaves should be firm and bright green; limp or brown leaves detract from appearance of the fruit and reduce its value.

The most commonly accepted weight for individual pineapples is between 0.9 and 1.3 kilograms, although high quality fruit weighing up to 2.7 to 3 kilograms will sell readily in the Orient and in the United Kingdom. Fruit of around 1 to 1.5 kilograms is generally preferred in the Middle East countries of Kuwait, Saudi Arabia, and the United Arab Emirates.

The cost of sea freight is calculated according to volume displaced. Cubic measurements of any given lot can be decreased by reducing the crown either during growth in the field, where care must be taken to avoid sunburn, or by partial removal after harvesting. The after-harvest operation requires the use of a scoop knife or spoon to remove part of the crown; a plastic plug is used to replace the missing crown segment.

Freight rates have increased considerably during the last ten years and will probably continue to do so. Because of continued, but erratic increases in fuel prices, general inflation tendencies, and fluctuations in exchange rates, it is not possible to provide reliable information on sea and air freight rates. A sample of recent sea freight rates (June, 1982) for tropical fruits originating from Bangkok and Thailand is given in Table 96. The table is self explanatory, but the entries will change almost monthly and can only be used as a rough indication of current rates.

TABLE 96. SHIPPING FREIGHT COST OF FRESH AND CANNED TROPICAL FRUITS FROM BANGKOK TO SPECIFIED DESTINATIONS, JUNE, 1982

Destination	Company Name		
	MITSUI	Neptune Orient Lines (NOL)	MAERSK
	-----US dollars per metric ton-----		
Hong Kong		450/SU a/ 25/ cans 34/ fresh	500/SU a/ 27/ cans 36/ fresh
Tokyo	54/ton		700/SU a/ 38/ canned 53/T fresh
Europe		1,500/SU a/ 82/ canned 113/ fresh	1,450/SU a/ 179/ canned 109t fresh
United States West			88/ F or canned
United States East			102/ canned
Canada (Montreal)			111/ for canned
Middle East (Kuwait)		1,700/SU a/ 93/ canned 128/ fresh	1,800/SU 98/ canned 135/ fresh
Singapore	450/SU a/ 25/ can 34/Fresh		

a/ SU=Standard Unit of 8' x 8' x 20'

Holds 1,120 cases of 24/No. 2 cans at 36 pounds per case = 18.29 MT per standard unit.

Holds 27 pounds per foot fresh fruit with 85 percent storage factor = 13-1/3 MT per standard unit.

SOURCE: Private Communications (June 12, 1982) with R.J. Frankel of Siam Technology Company Ltd., Bangkok

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In 1982, air transport rates from Bangkok to the principal European and United States airports range from about US$0.73 to US$1.08 per kilogram. Reference should be made to local carriers for the latest freight charges. These rates not only differ among the different carriers, they change frequently in relation to backhaul opportunities, etc. Insurance costs also vary depending on the coverage desired, but are estimated as roughly 0.15 percent of the cargo FAS value.

Air transport provides a superior product that commands higher prices because it allows shipment of fresher, more mature fruit with a higher sugar content. Air-freighted fruit supplies the so-called gourmet or luxury market and is usually left with complete crowns. Although air-freighted shipments apparently are declining somewhat, tradesmen interviewed believe that the air freight market will pick up with the recovery of major importing countries from the current worldwide recession.

Pineapples are packed in fibreboard cartons with a test weight of at least 79 to 90 kilos to allow for high stacking. High grade packs are usually packed four to eight pineapples per carton, while other commercial grades go from 10 to 20 per carton. At this point in time, fibreboard containers have not been standardized, although importers are beginning to demand standard sizes designed to hold approximately 20 to 22 kilos of fruit.

2. Mangoes

Production statistics published by the Food and Agriculture Organization of the United Nations list 57 countries as producers of mangoes (Appendix B). World production is estimated to have increased from an average of 12.3 million MT in 1969-71 to 14.3 million MT in 1980 - an increase of over 16 percent during

the 10 year period. 1/ Asian countries produce about 78 percent of the reported world production of mangoes. India is by far the largest with an estimated production of 9.5 million MT in 1980, followed by Pakistan and the Philippines with 560,000 and 330,000 MT, respectively. Among leading African countries, production is rather evenly balanced (140,000 to 170,000 MT) for Madagascar, Tanzania, and Zaire. Leading producers in North and Central America are Mexico, 610,000 MT; Haiti, 326,000 MT; and the Dominican Republic with 172,000 MT in 1980. Brazil and Venezuela lead the South American countries with 690,000 and 118,000 MT, respectively.

a. Fresh Mangoes. Total estimated annual imports for the 18 markets considered reached about 40,500 MT, over the years 1979-81 as specified in Tables 93 and 94. The largest markets were the United States with imports of nearly 20,000 MT, followed by 9 European countries with 7,352 MT, Hong Kong 8,420 MT, and Japan with 1,573 MT. Among individual markets, the United States was by far the largest, followed by Hong Kong and Singapore. The United Kingdom, France, and the Netherlands are the leading European importers. No single country dominates the import markets because the production period for high quality mangoes is of short duration with peaks for the different countries coming at different times of the year. The French market is supplied mainly by French-speaking African countries; the United Kingdom mainly by India, Mexico, Venezuela, and the Dominican Republic. Because of seasonal differences in supply areas, imports into France are greatest in the April-May period which corresponds to peak harvest periods in the Upper Volta and Mali, while the United Kingdom imports are highest in the

1/ Production is substantially underestimated because of lack of published data for many large producers in Asia (Burma, Laos, Viet Nam, Thailand), Guatamala and other tropical areas in the Orient, Americas, and Africa.

May-September period. The huge United States market receives its supplies from the American tropics (mostly Mexico) in addition to its own production from the states of Florida and Hawaii. Canadian trade statistics report no mango imports. Although relatively small at the pre- sent time, the Middle East Arab-speaking countries have recently started to enter the market and trade specialists predict that imports of mangoes and other tropical fruits will continue to grow (Table 93). The Middle East is presently supplied entirely from India, Thailand, and the Philippines.

The CIF unit values for sea-freighted mangoes range between $542 and $714 per MT (Tables 93 and 94). The fruit is mostly sea freighted to the Singapore, Hong Kong, and United States markets which accounts for the relatively low CIF prices for those countries. The CIF unit values for the principal European markets for mostly air-freighted fruit ranged between $1,538 and $1,938 per MT in 1979-80, an increase of about 40 percent since 1975. 1/ Unit CIF values for the Middle East countries of Saudi Arabia and the United Arab Emirates ranged from $728 to $1,190 per MT in 1980. Air-freighted mangoes for Japan were $2,638 in 1981, a price that reflects greater costs for insect and disease control in that country.

Wholesale prices for selected European markets are set down in Table 95, and averaged $2.49 per kilo for all markets and origins in 1979-80. In 1982, the wholesale prices for the United Kingdom, France, and Germany have remained at about the same level as 1979-80. Wholesale prices on the Hong Kong and Singapore markets, obtained by the marketing specialist of the Experience, Incorporated team, ranged from $1.10 to $2.50 per kilogram. 2/ In these markets, the red-blushed mangoes with

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1/ ITCUNTAD/GATT, Selected European Markets for Tropical & Off-Season Fresh Fruit and Vegetables, Geneva, 1981, op cit p. 12. France, Trade Statistics, 1981.

2/ May 21, 1982 (Hong Kong), May 29, 1982 (Singapore).

pink and yellow highlights commanded higher prices than the more common yellow varieties.

Mangoes are normally air freighted to the more distant destinations because of their high perishability. They should be shipped at the firm or "turning" stage to allow even ripening and coloring. Consumers prefer mature color and will not readily purchase green colored mangoes. 1/ Importers prefer the better known varieties such as the Apple, Alphonso, Kent, Hayden, Julie, Amelie, or Ruby, although consumers apparently do not distinguish among them. The fruit should be fiber free, and be free from all terpine off-flavors. The individual mangoes must be sized accurately and uniformly because they are sold by the count in most retail outlets. Traders prefer uniformly sized fruits between 225 grams (8 ounces) and 400 grams (14 ounces) that are packed in fibreboard cartons of 4.5 or 6 kilograms net weights. The individual fruits are usually wrapped in tissue paper and are placed within shock and vibration resistant materials such as synthetic fibers or padded paper sheets.

Sea and air freight rates are comparable to those for fresh pineapple given in Table 96.

b. Canned Mango Products. Mangoes are processed into many products, among which are canned whole or sliced mangoes in syrup, mango slices in syrup or brine, mango juice, pulp or nectar, jams, sauces, chutneys and pickles. The world's pack

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1/ Vlandas, Sylvie, La Consommation des Fruits Exotiques en France, Opcit p 69.

of processed mango products is not known. It is known, however, that India, Jamaica, Puerto Rico, Brazil, Mexico, Philippines, Thailand, and Taiwan process mangoes to some extent although few statistics are currently published. India apparently tripled its exports between 1969 and 1978 to an estimated 40,000 to 45,000 MT. 1/ The Philippines exported 167 MT of canned mangoes in syrup in 1980 with a CIF value of $1,403 per MT and a reported unit value of $1,297. 2/ Singapore imported some 15 MT in 1980 with an FOB unit value of about $1,353 per MT. The United States reported imports of mango paste and pulp of 595 MT in 1980 with a CIF unit value of $933.

Prospects for increased trade in processed mango products have improved during the last decade because of the increased promotion that has resulted in increased consumption of mangoes, particularly in fresh form, in developed countries. Increased promotional activities by the International Trade Center in the European Common Market and by private companies in the United States have raised consumer awareness and appreciation of the uniquely distinct mango flavor and have resulted in a corresponding increase in quantities consumed in both fresh and processed forms. Additional growth in mango canning will result also from the use of mangoes in canned tropical salads, cocktails, and fruit juice mixes. It is essential that supplier countries develop a processing component to absorb the standard and poorer qualities that are not acceptable for the higher quality export and domestic fresh markets, as well as to

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1/ Interview with W.J. Anzer, Secretary, British Association of Preserved Food Importers and Distributors, London, and J. Joughin, Tropical Products Institute, London June 2-3, 1982.

2/ In terms of cases of #2 can size equivalents, the unit values are $19.73 per case CIF and $18.24 FOB.

better exploit the need for increased supplies of processed mangoes mentioned above. Although current data are not available, the Arabic Middle East countries are reported to be among the most dynamic of the newly developing markets for fresh and processed mangoes 1/.

3. Rambutans

a. Fresh Rambutans. As noted earlier, the rambutan is a member of the lychee family, and like the lychee, is one of the premier fruits of the tropics.

Although rambutans are grouped with miscellaneous fruits in most import statistics, supply country statistics indicate that fresh rambutans are widely traded. In 1980, for example, Thailand exported over 166 MT of fresh rambutans to 15 countries in Asia, the Middle East, and Europe 2/ (Table 93). The average unit FOB value of all shipments was $525 per ton. 2/ These calculations clearly show that fresh rambutans are competitive with air-shipped fresh mangoes and pineapples.

Fresh rambutans must be handled with great care in harvesting and packing to avoid damaging the short fleshy spines that cover the fruit's exterior. The fruit is usually sold by the count except in the Orient where it is normally sold by weight (pounds or kilograms). The rambutans should be place-packed in single or double layered cartons holding two to three kilos with counts of 85 to 130 fruits. Another method of packing is the same as for strawberries, i.e., in one-pint (450 grams) plastic or fibreboard boxes or punnets and placed in a

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1/ Interviews with tradesmen by the marketing specialist of the Experience, Incorporated team. See preceding footnote.

2/ Thailand Trade Statistics, Bangkok, 1981.

fibreboard carton with a capacity for 4 to 6 of the punnets. In the latter case, the rambutans would be sold by the individual pint-sized box or punnet rather than by the number of fruit. Methods of packaging and types of containers for export have not been standardized.

Because rambutans are highly perishable and, like most tropical fruits, cannot tolerate low temperatures (less than 10-12 C.), they should be air freighted to export destinations. Wholesale prices are not published on a current basis, but tradesmen on the Rungis market in Paris say rambutans are fetching around $5.10 per 40 to 45 fruits weighing approximately one kilogram (May, 1982). Wholesale prices of rambutans on the Hong Kong market in May, 1982 ranged from $3.10 to $3.70 per kilogram, about the same as for fresh lychees.

b. Canned Rambutans. Canned rambutans are very similar to canned lychees. Although no statistics on canned rambutans were uncovered in this investigation, it is known that canned rambutans do enter into international trade channels. Canned lychees and/or rambutans are found in most Chinese restaurants worldwide and can often be found in the gourmet food sections in United States and European super-and-specialty markets. Shelf-size (303's and No. 2's) cans were observed to retail in the vicinity of US$0.90 to US$1.10 in European and United States markets and about US$0.60 in Hong Kong and Singapore.

4. Mangosteens

Although mangosteen is a common backyard tree in Burma, there are no significant commercial plantings. The fruit is abundant in south Burma and can be found in good supply in the produce markets and fruit stands of Rangoon, Moulmein, and Mudon. As noted in the product overview presented earlier, the

Mangosteen is considered one of the premier fruits of the world by nationals and foreigners alike. Until its recent appearance on European markets, the mangosteen was essentially unknown outside the Orient. Except for Singapore and Japan, there are no separate statistics available for any of the major import markets surveyed. The principal Oriental export markets considered, i.e., the Philippines, Thailand, and Malaysia, group mangosteens with other tropical fruits when publishing their trade data. In 1981, Japan imported about 143 MT of mangosteens from Mexico with an estimated CIF value of around $3,352 per MT. Singapore imported 517 MT in 1980 from Malaysia for a reported price of only $80 per MT. However, in Singapore, mangosteens and most other Malay fruits are sold on consignment at prices much below those of fruits imported from other Oriental sources. European import data group mangosteens with mangoes and guavas.

Wholesale and CIF prices for mangosteens were said to be equivalent to fresh mangoes and rambutans in the Rungis market near Paris, and on the Singapore market 1/. Good quality mangosteens were said to wholesale at $2.50 to $2.95 per kilogram on the Rungis market, but were rarely available.

Mangosteens are perishable and should be air shipped at temperatures between 12.7 °C - 18.3° C with relative humidity maintained at between 85 and 95 percent. They should be individually wrapped in tissue paper and placed in molded trays, one or two trays per fibreboard carton. Popenoe states that mangosteens can be held at the above temperatures for up to 20 days 2/.

1/ Interview with S. Joyeaux and M. Ledollet, Rungis Market, Paris, May, 1982. Also with Loh Li Yoon, Singapore Fruits & Vegetables Exchange, Singapore, May, 1982.

2/ W. Popenoe, Manual of Tropical and Sub-tropical Fruits, op. cit.

A series of fairly intensive promotional campaigns will be required to introduce mangosteens to consumers outside the Orient. Because of the mangosteen's excellent taste and eating qualities, tradesmen believe that a good market at the gourmet level can be developed in Europe and the Mideast. 1/ Possibilities for developing products and markets for processed mangosteens should be thoroughly investigated as the Mudon project proceeds.

5. Guavas

a. Processed Guavas. Guavas are processed into a number of products including slices, pulp, puree, jams, and jellies. As noted earlier, guavas are mostly harvested wild and production statistics are unreliable. It is known, however, that around 500 MT were produced in 1979-80 in India, Pakistan, Mexico, Venezuela, United States, and the United Arab Republic. Brazil, Mozambique, Kenya, South Africa, and Jamaica are also known to be large producers.

The United Kingdom and the United States import fairly large quantities of processed guava products. The United Kingdom, for example, continues to import relatively large quantities of canned guava slices (approximately 1,000 MT in 1981-82) where canned guava competes price-wise with canned peaches and pineapples. The United States imported 4,222 MT of guava paste and pulp in 1980, 562 MT of canned slices, and 303 MT of jams and jellies. Brazil's pack of guava products is among the world's largest, most of which is consumed domestically 2/.

1/ Interview with S. Joyeaux, M. Ledollet, Rungis Market Paris, France, June 1, 1982.

2/ Conversation with Edgar Lanzer of Universidade Federal de Rio Grande do Sul, Porto Alegre, Brazil, July 1976.

The 1980 CIF unit values per metric ton for United States imports reached $455 for guava paste and pulp, $465 for jams and jellies, and $770 for canned slices (Table 94). 1/ These values are to have remained steady at the 1980 levels.

The prospects for increased trade in guava products are good, primarily because it is known that guava has over five times the vitamin C content as that of oranges, and because guava is being promoted in Europe and the United States as an excellent jam and jelly and as a tasteful additive in tropical fruit and fruit juice mixtures.

b. Fresh Guava. Fresh guavas are not popular and have not been traded internationally in any volume. As shown in Tables 93 and 94, trade data combine fresh guavas with other tropical fruits. Plans for the Mudon project call for marketing processed guava products only.

6. Papaya

a. Fresh Papayas. Huge volumes of papayas are consumed fresh, primarily as a breakfast fruit, in most tropical and in many sub-tropical areas of the world. They are also increasing in international trade. World production as reported by the Food and Agriculture Organization of the United Nations, increased from 1,186,000 MT in 1969-70 to 1.917,000 MT in 1980, an increase of about 62 percent (Appendix B). Brazil, Mexico, India, and Indonesia are listed as the leading producers among the more than 30 countries for which estimates are given.

Singapore, Japan, and Hong Kong with 3,555, 3,267, and 2,780 MT, respectively, are leading importers for the years

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1/ On a 24/2 case equivalent basis the values are $6.40 to $6.54 and $10.83 per case, respectively.

indicated in Table 93. Unit CIF prices ranged from $85 per MT for Malaysian papayas supplied to Singapore, to over $2,392 per MT for air-freighted and fumigated Hawaiian papayas shipped to Japan (Table 93). Imports to major European markets were available from Thailand data only. These data showed that European fresh papaya imports from Thailand totaled approximately 12.5 MT in 1980 with an FOB price clustered closely around an average of $460 per MT. Since it is not known what proportions of European supplies were sea or air freighted, estimation of CIF prices is not possible. The United States supplies a small part of its market from domestic sources, but still imported 735 MT of fresh papayas in 1980 with a CIF value of $426 per ton.

The relatively low CIF price of $85 reported for the Singapore market in 1980 is difficult to rationalize. However, it has been observed that all fruits originating from Malaysia are discounted heavily on the Singapore market. Figures may not be comparable because exchange rates (in terms of U.S. dollars) may be grossly out of line. It is possible also that the published data may be unreliable and should be viewed with some skepticism.

b. Processed Papayas. Papaya is primarily consumed fresh; the amount of processed papaya entering international markets is very small. Prospects for papaya products are poor, except possibly for nectar or pulp. The United States imported 290 MT of papaya pulp in 1980 with a CIF value of $500 per MT. 1/ Contrary to its fresh counterpart, canned papaya is a bland product and usually must be combined with an acid fruit product to make it at all palatable. The Mudon project involves production of papaya primarily for fresh utilization.

1/ In terms of 24/2 the CIF value per case converts to $7.03.

7. Passion Fruit

The major commercial production areas of passion fruit are found in Australia, Fiji, Hawaii, Kenya, New Guinea, Brazil, New Zealand, and South Africa. The varieties of passion fruit are distinguished by their color--the purple variety which grows best in tropical highlands, and a yellow variety that is more adaptable to the tropical lowlands. There is little, if any, passion fruit now grown in the Mudon area of Burma, but it is adaptable to the region because the yellow variety has thrived in areas of identical latitude, climate, and rainfall, and has been grown with success in other parts of southern Burma.

Although there is a growing fresh market for the purple variety in Europe, both purple and yellow varieties are normally processed into juice and used in the manufacture of mixed drinks, jellies, nectars, and tropical fruit salads or cocktails. The best method of processing passion fruit juice is by freezing as this is the best means of preserving its fresh pungent flavor. The juice is often processed by thermal or heat techniques, however, and loses some of its flavor in the process. The bulk of the Hawaiian juice is quick frozen and packed in 30 pound containers.

Current statistics on quantities of passion fruit juice production and trade are not published. Production estimates place passion fruit juice in a range from about 3,000 to around 10,000 MT. 1/ Australia and the United States have successfully developed a market for passion fruit juice as a base in

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1/ Early 1970 estimates by the Tropical Products Institute, London and the Food and Agriculture Organization of the UN, 1972.

carbonated drinks. There is also evidence that pas- sion fruit juice makes an excellent additive for fruit juice mixes, tropical fruit cocktail, and as a component in mixes used in exotic alcoholic drinks served in many hotels, resorts, and restaurants.

There are no recent studies giving evidence of the profitability of processing and marketing passion fruit juice. The Swiss firm Passi Ag., was organized in 1964 to process and market passion fruit products in Europe. Since then Passi Ag. has set up plants in Brazil and Angola and has had some success in marketing a soft drink in Switzerland, West Germany, and the Netherlands. 1/ F.S. Scott of the Hawaiian Agricultural Experiment Station in a 1959 study of passion fruit processing, pointed out that if plantation yields can reach potential levels and efficency, profitability would be competitive with citrus juice products. 2/

The market prospects for passion fruit juice appear to be good. This opinion is confirmed by the growth in Passi's expansion in Kenya and Brazil, and Sri Lanka's plans to enter the market on a large scale. 1/ Plans for the Mudon project call for growing and processing small quantities of passion fruit juice for local consumption and as a component part of a recipe for tropical fruit cocktail and salad. Although a limited market for fresh passion fruit exists in Europe, the market calls for the purple, rather than the yellow variety that must be grown in the Mudon area of Burma. The purple variety can be successfully grown, however, in the inter-Himalayan mountain valleys of upper Burma.

1/ FAO, Processed Tropical Fruit, 1972, op. cit.

2/ Scott, F.S., Jr., An Economic Analysis of Passion Fruit Juice Processing, Ag. Econ. Bulletin #18, HAES, University of Hawaii, April, 1959.

8. Durian and Jackfruit

a. Durian. The durian is one of the most common fruits in Southeast Asia. As noted in the product overview, the durian's pulp and seed are both used as food. It is covered by a hard shell that prevents damage to the fruit during harvesting and distribution.

The fruit has an offensive odor to most foreigners along with a taste that is thought to improve gradually. The fruit is consumed raw, as a flavoring in ice cream and cakes, and in jams and jellies. The seeds are roasted or boiled for human consumption and are said to resemble roasted chestnuts in flavor.

In 1980, Thailand exported 3,516 MT to a total of eight Asian countries, seven European countries, and the United States. Nearly 90 percent of Thailand's reported 1980 exports of durian went to Hong Kong. 1/

Among the markets surveyed, imports of durian are given separately for Singapore only. Singapore reported 942 MT of fresh durians were imported from Thailand in 1980. 2/ Thailand, on the other hand, reported fresh exports to Singapore of only 227 MT. 3/ This discrepancy is another in a series of inconsistencies in the statistical reporting for the Asian countries investigated. The number of non-Asian countries reported to have imported durians from Thailand is somewhat surprising in view of the dislike of the fruit by outsiders. However, the

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1/ Not given as a separate entry in Hong Kong's trade statistics of 1980. Probably was entered with other tropical fruit imports, not elsewhere shown.

2/ Singapore Trade Statistics, 1981

3/ Thailand Trade Statistics, Bangkok, 1981.

amounts imported into the United States and Europe are quite small and undoubtedly represent only ethnic population demands in those countries. France and the Netherlands, countries with relatively large immigrant populations from Southeast Asia, were the two countries with the greatest imports of durians.

Despite difficulties in resolving discrepancies in trade statistics, enough is known to indicate that an export market for durians does indeed exist. That, along with a large domestic demand, provides a persuasive argument for including the durian in the planned product mix for the Mudon project.

b. Jackfruit. The jackfruit is very popular in India, Sri Lanka, and in Southeast Asia generally. Both the pulp and the seeds are eaten and both are the ingredients of many recipes in India and elsewhere. The fruit is large, cumbersome, and difficult to harvest and transport. Consequently, it does not enter into international trade except in processed form.

The only trade statistics found were in the export data for the Philippines for canned jackfruit in syrup. 1/ Total 1980 volume exported in this form was 86.7 MT with a CIF unit value of $2,482 per MT. An FOB value for these shipments was reported as $2,292 per MT giving an average freight and insurance cost of about $190 per MT to all destinations.

As was the case with durian, the wide distribution of canned jackfruit is somewhat surprising. The product found its way to eight European countries, the Middle East, and Hong Kong as well as to the United States and Canada. The United States imported 68 percent of the total Philippine shipments, and Canada was the second largest customer with 11 percent.

1/ The one exception was a shipment of 1.3 metric tons of fresh jackfruit imported into Saudi Arabia in 1980.

Jackfruit is a staple in many countries including Burma. The Mudon project is designed to process small quantities for the domestic market, with the recommendation that test shipments of small quantities be made to selected potential export markets.

9. Cashew Nuts

Total world cashew nut production estimates were relatively constant during the last decade, clustering around an average of 400,000 MT. 1/ Among the 15 countries for which estimates are given, India leads with a total production in 1980 of 160,000 MT, followed by Mozambique with 71,000 MT, Brazil with 65,000 MT, and Tanzania and Kenya with 46,000 and 20,000 MT, respectively. Estimated world totals are not available since 1980, but 1981-82 preliminary estimates for the leading suppliers by the Foreign Agricultural Service of the USDA indicate that India has increased production to 172,000 MT and Tanzania to 72,300 MT; Brazil and Kenya show decreases during the last three years.

India has excess processing facilities for cashew nut kernels and must import raw cashew nuts. Tanzania and Kenya, traditional suppliers of raw nuts to India, are constructing new processing facilities in an effort to increase sales of processed cashews to the United States and Europe. The Indian government, however, is subsidizing cashew nut production in an effort to reduce dependency on outside sources and to expand production to 300,000 MT by 1985.

1/ FAO, United Nations World Agricultural Production Statistics, 1981, op cit p. 235. Above estimates are on a raw nut basis. 1 MT of raw cashew nuts is equivalent to 230 kilograms of processed cashew nut kernels.

Imports of cashew nuts into all major European markets were not obtained. France, however, imported 754 MT of processed cashew nut kernels in 1980 with an average unit CIF value of US$5,018. During the same time the United Kingdom imported 2,368 MT of processed kernels with a CIF unit value of US$4,732 per MT.

Among the other countries surveyed, Japan's 1980 imports totaled 2,198 MT; Singapore's, 517 MT and Hong Kong's, 4,671 MT. The United States was by far the largest customer for processed cashews, importing 29,578 MT in 1980 and 27,932 MT in 1981 (Table 94). The corresponding CIF unit values of United States imports were $4,069 and $5,118 per MT in 1980 and 1981, respectively.

In 1981-82, farm or producer prices for raw nuts -- as reported by the Foreign Agricultural Service of the USDA -- were $0.61 per kilogram in Tanzania and $0.68 in Kenya. These prices were approximately double those of the preceding year. 1/

The market outlook for raw or processed cashew nuts from the Mudon project looks promising provided yields and production costs can be made competitive with those of India and Thailand. Although the latter country is not a large factor in the export market at present, a significant trade has developed. In 1980, Thailand shipped 1,620 MT of raw cashew nuts to mainland China, Hong Kong, and France. In addition, Thailand exported 111.4 MT of shelled (processed) cashew nuts to China and Hong Kong in 1980. These data imply that Thailand already has an

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1/ Foreign Production Estimates Division, Horticultural and Tropical Products Division, FAS/USDA Washington, D.C. August, 1982.

established a cashew nut industry that will become stronger as that country continues to develop export markets for its agricultural products.

10. Other Products

Other products considered as candidates for the Mudon Project include tropical fruit salad or cocktail, ginger, and bamboo shoots. Among these, tropical fruit salad and cocktail that could consist of a mixture of mango, pineapple, papaya, and bananas, in passion fruit juice base appears most promising. There are no good statistics on the status of the market for tropical fruit cocktail. It is known, however, that the Del Monte and Castle & Cooke Corporations have large tropical fruit salad and cocktail processing facilities in the Philippines and have been shipping increasing amounts to as many as 24 countries worldwide. The product consists basically of pineapple (45 to 65 percent), papayas (25 to 50 percent) and bananas (5 to 15 percent) in passion fruit juice. Addition of other tropical fruits such as mango, guava, and mandarin orange is optional. The market appears to be quite large and growing according to Philippine trade statistics. In 1979, the Philippines shipped a total of 7,429 MT of fruit salad and cocktail to many destinations with an average FOB value of $575 per MT. In 1980, Philippine exports of fruit salad and cocktail increased to 10,125 MT with an average FOB unit value of $668 per MT. These FOB values translate to an FOB value per case of No. 2 can-size equivalents of $9.39 in 1979 and to $10.91 in 1980. The increase in Philippine export sales has been dramatic, rising from only 4,500 MT in 1971 to 10,125 MT in 1980 (125 percent).

Ginger and bamboo shoots are other high value crops that could be grown and marketed in the Mudon project. However, the

addition of these products to the mix considered for Mudon area adds to the analysis involving an already large product-mix and is postponed for later consideration as the project develops over the long-term period.

F. Major Markets -- Characteristics, Profiles, and Prospects

Market characteristics, profiles and prospects are given for major markets in the Far East, Middle East, Europe, and North America. Sketches for selected markets include foreign trade outlook, industry trends, distribution and trade channels, trade regulation, and other information essential for initiating export trade for tropical fruits and nuts proposed for the Mudon agricultural project. In addition to the domestic Burmese market, specific foreign markets considered are Japan, Singapore, Hong Kong of the Far East; Saudi Arabia, Kuwait, and the United Arab Emirates of the Middle East; the European markets of the United Kingdom, France, West Germany, Netherlands, Belgium, Sweden, and Switzerland; and the North American markets of the United States and Canada. There is also some comment on the Austrian, Danish, and Norwegian markets.

Because of different amounts and types of data available, the treatment of and amount of detail given are not identical among the markets discussed.

1. Japan

The projected growth rate of 4.5 to 4.8 percent for 1982 remains the highest among the developed nations, but is much below the accepted norm of 8 percent set by Japanese government and business officials. Japan continues to expand its

consumption of fruits which occupy an extremely high place in the Japanese diet. Japan's per capita consumption of fruit in 1978 was 72.5 kilograms compared to 100.1 kilograms in the United States and 94.9 kilograms in West Germany. The fruits traditionally consumed by the Japanese are those customarily produced in temperate zones (apples, grapes, mandarin oranges, pears, peaches, plums, and strawberries). With the notable exceptions of bananas and lemons, the Japanese have only recently begun to import tropical fruits in limited volumes. The increase in demand for exotic fruits has been brought about by the rising number of tourists in line with an expanding and affluent economy. Some exporters complain that Japanese regulations are too rigorous for economic compliance. Most fruits entering Japan must be free from injurious insects, and generally must be fumigated or otherwise treated to insure compliance with Japan's Plant Protection Law, the terms of which are discussed later. For a list of non-importable items under the Plant Protection Law of Japan, see Appendix O.

a. Products -- Mudon Project. Mango, papaya, mangosteens, pineapple, and durian are imported in fresh form; guavas, passion fruit, etc. are imported in processed categores. Some of the above (e.g. pineapple, mango) are imported in both fresh and processed form.

(1) Mangoes. Imports of fresh air-freighted mangos have risen fourfold in recent years; 423 MT in 1976 to nearly 1,600 MT in 1981. Most mangoes come from Mexico and the Philippines, with Mexico supplying 65 percent and the Philippines accounting for about 32 percent of the total. The United States, Fiji, and Taiwan supply the remaining 3 percent. The CIF value for air-freighted mangoes averaged $2,638 per MT in 1981 (Table 93).

(2) Pineapple. Japan imports large quantities of fresh but only small amounts of canned pineapple as shown in Table 97. Fresh pineapple is shown to have increased 127 percent from 54,218 MT in 1975 to 122,829 MT in 1981. Imports of canned pineapple have shown substantial decrease (33 percent) since 1978 but have remained around 16,000 MT in 1980-81. Frozen pineapple has declined 58 percent since 1979 as Japanese consumers prefer fresh fruits.

TABLE 97. JAPANESE IMPORTS OF PINEAPPLE, 1978-1981

Year	Juice	Fresh	Canned	Frozen
	----------metric tons----------			
1978	b/	54,218	b/	b/
1979	b/	101,478	24,266	28,770
1980	1,143 a/	105,010	15,835	b/
1981	346	122,829	16,176	12,009

a/ From Philippines.
b/ Not available.

SOURCE: Japanese Trade Statistics, Tokyo, 1982.

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(3) Papayas. Imports of papaya into Japan have increased gradually as shown in Table 98. These quantities, all air freighted from Hawaii, had an average unit CIF value of $2,392 per MT in 1981 (Table 93).

The papaya (Solo variety) was first introduced into Japan after an inspector from the Japanese Ministry of Agriculture was sent to Hawaii in 1969. Due to intensive promotion, financed in part by the Japanese government, the University

TABLE 98. JAPANESE IMPORTS OF PAPAYAS, 1974 TO 1981

Year	Imports
	(metric tons)
1974	1,110
1975	1,300
1976	1,613
1977	1,939
1978	2,525
1979	NA
1980	2,538
1981	3,267

SOURCE: Japanese Trade Data, Tokyo, 1982.

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of Hawaii, the United States Department of Agriculture (USDA) and Japan Air Lines, a steady increase in papaya consumption of about 20 percent per year has been achieved.

(4) Other Products. Fresh mangosteens, imported from Mexico, have stayed at 140 MT in the last two years. The 1981 CIF value of these air-freighted fruits was $3,352 per MT, the highest price reported among all the markets surveyed (Table 93).

Fresh durian, shipped from Thailand in 1981, amounted to 15 MT with FOB (Bangkok) value of $744 per MT. The fresh durian fruit was probably air shipped to Japan also, as durian is thought to suffer a chemical change and become slightly sour in taste two to four days after harvesting. 1/

1/ Popenoe, W., Manual of Tropical and Sub-Tropical Fruits, op. cit.

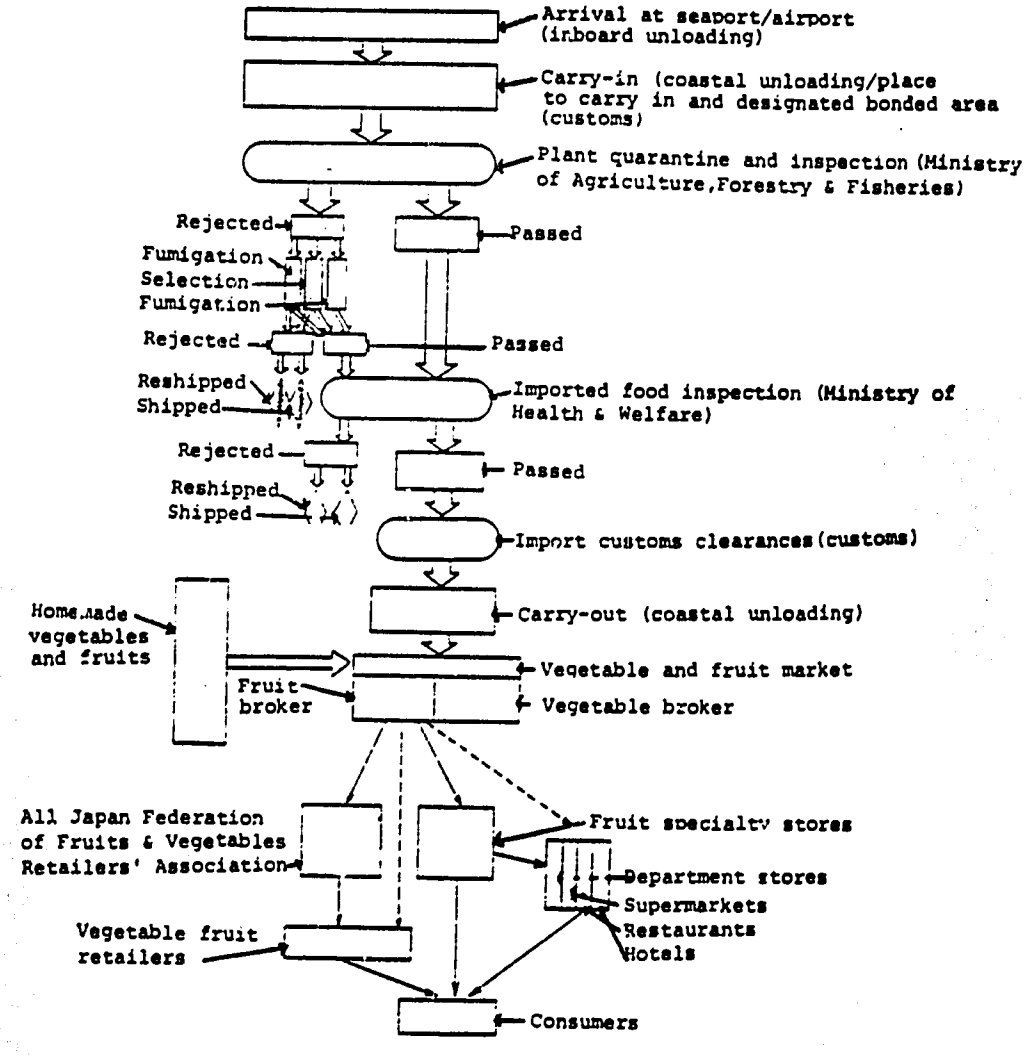
Japan also imports relatively small quantities of cashew nuts at a unit CIF value of $6,843, a price that reflects the generally high levels attained by cashews on the world market.

b. Trade Regulations and Distribution Channels. All imported fruits and vegetables arriving at Japanese ports must pass a plant quarantine inspection based on the stringent provisions of the Food Sanitation and the Plant Protection Law. The provisions of the Plant Protection Law require sending a Ministry of Agriculture inspector to the supply country to inspect its plants and procedures. Only then are the products passed and permitted to be exported to Japan. In addition, Japan prohibits imports of certain plants from many countries. The type of insects involved and the disinfection or fumigation methods required are given in Appendix P-1 and P-2.

Distribution channels including the steps involved from the receipt of shipments to final consumer are diagrammed in Figure 18. Principal importers of tropical fruits and their Japanese names are given in Appendix P-3.

c. Tariff Structure. Customs tariff schedules for principal fresh and dried fruits and vegetables entering Japan are given in Appendix P-3. Rates of duty include those for general, GATT, preferential, and temporary categories. Many developing countries, including Burma, are eligible for preferential access to Japanese markets. Fresh pineapple, cashew nuts (fresh and roasted), mangoes, guavas, and mangosteens are admitted duty free. Other products considered for the Mudon project including papaya, durian, and passion fruit are apparently subject to a 10 percent ad valorem duty (Appendix P-4).

FIGURE 18. DISTRIBUTION CHANNELS FOR VEGETABLES AND FRUITS IMPORTED INTO JAPAN



SOURCE: Japan Fresh Fruits and Vegetable Imports Managerial Association and Other Organizations

d. Summary Comments. Fresh tropical fruits consumption is trending sharply upwards in Japan. It is projected to increase dramatically as Japanese consumers become more knowledgable of tropical fruits taste and nutritional characteristics. 1/ Fresh tropical fruits consumption, because of traditional Japanese preferences for fresh varieties, will show the most notable increases, and will carry along with it some increases in the processed categories, particularly jams and jellies. 1/

Because of the rigorous regulations and standards of the Plant Protection Law, post-harvest handling costs, particularly in treatments against insect infestation, are very high. However, the treated products command premium prices on Japan's market and can offer lucrative outlets for Burma's future expansion in tropical fruit and nut production.

2. Singapore

Singapore has led all nations in economic growth since the middle 70's. The Gross Domestic Product (GDP) rose at a 17.6 percent rate in 1977-78 and continued to grow at a 16+ percent rate in 1979-80. 2/ Singapore also has the second highest per capita Gross National Product (GNP)--$3,800--in Asia, trailing only Japan. The outlook for the economy, geared to high technology and reduced labor intensity, should be excellent throughout the 80's although perhaps not quite as bright as it was in the late 70's.

1/ Interviews by marketing specialist with John Beshoar and Suzanne Hale of the Agricultural Attache's (USDA) office in the United States Embassy, May, 1982 and with Mr. Kiyomiya of JETRO, May, 1982.

2/ United States Department of Commerce, International Trade Administration; OBR 81-13, Washington.

Singapore has a continuously expanding transportation network that is considered among the best in Asia. Its present airport at Paya Lebr is able to handle any type of civil aircraft now operating. A new airport at Changri will be completed in 1982-83. There are 33 international airlines now serving Singapore on a regularly scheduled basis. American flag carriers are Pan American for passengers and cargo and the Flying Tigers airline for cargo only.

In terms of total tonnage handled, Singapore has the third largest port in the world with extensive facilities for all types of ships and shipping. Additional facilities are being constructed to handle more containerized cargo. Over 150 shipping companies from 84 countries now serve Singapore in addition to its own government-sponsored shipping line, Neptune Orient Lines (NOL). Among the American flag carriers are American President Lines, Sea Land Service, Inc., and the United States Lines. Three other shipping companies serve particular ports in the United States. Transit times range from 24 to 27 days from the West Coast and from 33 to 36 days from the East Coast.

a. Products - Mudon Project. Tropical fruits and nuts are typically imported into Singapore, primarily from its Oriental neighbors -- Malaysia, Philippines, Taiwan, mainland China, and Thailand. The fruits imported include the full line of those considered for commercial production in the Mudon project. Table 93 shows that leading fresh fruit imports are pineapple, 18,524 MT; papayas, 6,737 MT; durian, 5,889 MT; mangoes, 3,555 MT and ginger, 2,763 MT. Relatively small quantities of fresh mangosteens and rambutans are imported, also. Unit CIF prices of tropical fruits imported into Singapore are the lowest among all markets surveyed. Tradesmen contacted stated that low prices relative to Hong Kong, for example, were due to large

quantities of nearby supplies sold on consignment from Malaysia and the prevalance of small-scale peddlers hawking "backyard" fruit and vegetables. 1/ However, the investigation found that the data contained in Singapore trade statistics were frequently inconsistent and unreliable with respect to minor trade items such as tropical fruits.

b. Trade Regulations and Trade Channels. Singapore is essentially a free port; most if not all agricultural products enter free of duty with no restrictions regarding insect infestation that might otherwise require fumigation or other treatment such as that required in the United States and Japan. The port functions traditionally as a transit zone and transshipment point for the trade of nearby Southeast Asian countries. Goods, including fresh and processed fruits and vegetables, may be loaded, unloaded, stored, sorted, repacked, and reshipped with little or no customs intervention. Singapore, because of Britain's membership, is a contracting member of GATT, a position that is vitally important to external trade in Europe and the United States markets.

Distribution channels essentially follow the tri-functional route found in developed countries, i.e., port unloading to warehouses, thence to wholesalers, and retailers. Goods arriving require a bill of lading, certificate of origin, and import declaration. Labels are required on food imports which state in English a description of contents, quantities, and country of origin.

1/ J. Iso, United States Embassy, Interview May, 1982 and Cy Siow and Tong Ton, Singapore importers of fruits and vegetables, interview May, 1982.

The importation of goods is done through established trading firms that are located in, or have branches in, the Singapore area. All port facilities are under the supervision of the Port of Singapore Authority that operates efficiently on a 24-hour basis which assures a turnaround time for most ships of less than 48 hours. Warehouse space is ample and there is negligible loss from pilferage in the dock and warehouse areas.

Perhaps the best source of information for potential exporters is the Ministry of Trade and Industry at the World Trade Center, Telak Blangah Road, Singapore, 0106. This source should be contacted to obtain updated listings of importers, current rates, terms, and availabilities for air and sea freight to various markets in the Orient, Europe, and Americas. Additional listings of information sources, government and private organizations, and trade associations are given in Appendix Q-1.

c. Summary Comments. The foregoing implies that Singapore's chief contribution to the Mudon project could be its function as a reshipment and/or re-export point. It is probable that air and freight carriers regularly serving the Singapore air and sea ports will also take on shipments of produce originating from the Mudon-Moulmein areas. The prospects for markets in the Singapore area are not promising for Burmese tropical fruits because of Malaysia's close proximity and high production of low cost identical or similar products.

3. Hong Kong

a. General. Hong Kong comprises an area of 1,062 square kilometers that contain more than 200 islands plus a portion of the Chinese mainland east of the Pearl River estuary. Hong Kong Island (76.2 kilometers^2) was ceded to Britain in 1841

to which Kowloon peninsula (11.23 kilometers^2) was added under a perpetual lease in 1860. The New Territories (972.37 kilometers^2) was obtained in 1898 under a lease arrangement for 99 years. Victoria, on Hong Kong Island, is the capital and commercial center. The estimated population in 1981 totaled 5.2 million of which 98 percent are Chinese.

In 1980, Hong Kong's total external trade amounted to about $39,700 million of which domestic exports and re-exports accounted for 47 percent. Total external trade has grown over 40 percent during the period 1976-81. In terms of per capita GDP ($3,000+), Hong Kong is behind only Japan and Singapore, making it one of the most lucrative and sought after food markets in Asia.

Hong Kong, like Singapore and Tokyo, has international transportation facilities considered among the best in the world. The international airport, Kai Tok, has a large cargo complex that became fully operational in 1976. The cargo terminal has a current handling capacity of 250,000 MT and is being expanded to a capacity of over 500,000 MT per annum. In 1980, for example, the airport handled 258,000 MT of air cargo of which 153,000 MT were outbound. American flag carriers are Pan American and Northwest Orient for freight and cargo and Flying Tigers airline for cargo only. Hong Kong has one of the most perfect natural harbors in the world, ranking with San Francisco and Rio de Janeiro. The harbor, like Singapore's, ranks among the largest known in terms of tonnage handled: in 1980 nearly 110,000 1/ vessels of 128 million net registered tons cleared the port, not including an immense number of river-trade vessels. The Kwai Chung Container Terminal has 6 berths,

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1/ Government Information Services, Hong Kong.

including one roll-on-roll-off ramp, that handled 1.5 million 20-foot containers in 1980. American flag carriers serving are the same as those serving Singapore (American Pre- sident, Sea Land, United States, plus three other lines serving specific United States ports).

b. Products - Mudon Project. Hong Kong imports most of the products being considered for trial production in the Mudon area of Burma (Table 93). Except for pineapple, statistics showing past year trends for annual imports were not obtained. Reported values of food imports into Hong Kong have risen about 70 percent since 1976. Meanwhile, the consumer price index has risen 49 percent and population by 14 percent. 1/ In inflationary periods, consumption of fruits normally declines or remains steady relative to staple items such as cereals, fish, etc. In line with this observation, quantities of imported tropical fruits probably have remained relatively constant around 1981 levels, a trend that is borne out by fresh and canned pineapple statistics for the 1975-81 period discussed below.

(1) Pineapple. Hong Kong imports very little fresh and canned pineapple compared to Japan and Singapore. Imports of fresh pineapple into Hong Kong for 1975-81 along with the volume of canned pineapple imports for 1980 are given in Table 99.

1/ Government Information Services, Hong Kong, The Facts, 1980.

TABLE 99. HONG KONG IMPORTS OF FRESH PINEAPPLE, 1975 TO 1981

Year	Fresh	Canned
	------metric tons------	
1975	1,317	a/
1978	1,588	a/
1980	1,792	4,180
1981	1,342	a/

a/ Not available.

SOURCE: Hong Kong Trade Statistics, 1982

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The above figures shows that fresh consumption has stabilized at under 2,000 MT annually. The amount of canned pineapple imported in 1980 was relatively small, also, amounting to only 4,180 MT. Of this amount, the Philippines shipped 2,423 MT to Hong Kong with an FOB value of $545.61 per MT and a CIF value of $583.83. These values convert to roughly $7.67 and $8.21 per case of No. 2 can size equivalent FOB and CIF basis, respectively.

About 87 percent of Hong Kong's 1981 imports of fresh pineapple came from Taiwan. 1/ The remainder came from the Philippines (12 percent) and mainland China (1 percent). The CIF unit values average $203 per MT from all sources. This low average value was accounted for by the low prices of pineapples coming from Taiwan ($175.39).

1/ Hong Kong Trade Statistics, 1981, Table 20, P. 13.

The quantities of single strength or concentrated pineapple juice imported into Hong Kong in recent years were not available. However, the Philippines shipped 302.4 MT of single strength juice to Hong Kong in 1980, up 74 percent over its exports of 1979. The FOB unit value of the 1980 Philippine shipments of single strength juice was $375.30, rising to $412.05 on a CIF basis. In terms of cases of No. 2 can size equivalents these values amounted to $5.80 per case CIF basis and to $5.28 per case FOB.

(2) Mangoes. Hong Kong is second only to the United States in the imports of fresh mangoes. In 1981, Hong Kong imported 8,420 MT of fresh mangoes from seven countries. Because the Philippines traditionally supplies approximately 90 percent of Hong Kong's imports of fresh mangoes, it is informative to set down the shipments and values (CIF and FOB) for 1979-81 (Table 100).

TABLE 100. HONG KONG'S IMPORTS OF MANGOES FROM THE PHILIPPINES, AND VALUES, 1979 TO 1981

Year	Shipments to Hong Kong	Unit Values	
		FOB (Manila)	CIF a/(Hong Kong)
	(metric tons)	--------US$/metric ton-------	
1979 b/	6,513.3	607	NA
1980 b/	7,542.3	670	755
1981 c/	7,444.0	NA	556

a/ Unit values converted from Hong Kong dollars using 1US$ = HK$5.6561, average 1981 end of year exchange rate.
b/ Philippine Trade Statistics, 1981, in US$.
c/ Hong Kong Trade Statistics, 1982.

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Some fresh mangoes were air freighted into Hong Kong in 1981 as shown in Table 101.

TABLE 101. AIR FREIGHT SHIPMENTS OF MANGOES INTO HONG KONG, 1981

Country of Origin	Tonnage	CIF Value
	(metric tons)	(US$/metric ton)
Australia	11.9	3,176
India	2.2	2,742
Thailand	110.4	898

SOURCE: Hong Kong Trade Statistics, op cit.

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The above data appear to be consistent given the differences in air-freight rates between the countries of origin and Hong Kong. 1/ Although Hong Kong and the Philippines are in close proximity (approximately 960 kilometers), there may have been a few air shipments in the data reported for Philippine exports.

Data on canned mangoes imported into Hong Kong in recent years were not found in the trade statistics investigated as mangoes were apparently included in the general category of "canned fruits". However, it is known that the Philippines

1/ Air freight for non-chartered aircraft was about $2.30 per kilo from Australia as of July, 1982 and about $0.60 per kilo from Bangkok; the latter rate is roughly equivalent to the rate from Manila to Hong Kong. Charters, i.e., full loads of 220,000 pounds on the 747 and about 85,000 on the DC-8 are somewhat less.

shipped 55.1 MT of canned mangoes (in syrup) to Hong Kong in 1979 and 62.5 MT in 1980 with FOB unit values of $974 and $1,091, respectively. These values translate to approximately $15.90 and $17.80 per case of No. 2 can size equivalents. The CIF value per case was $19.10 giving an estimated value of $1.30 per case to cover freight and insurance.

(3) Other Products. Hong Kong imports at least five other products scheduled for trial production in the Mudon Project: papayas, cashew nuts, ginger, rambutans, and durian (Table 93). In addition, Hong Kong imports canned jackfruit along with substantial quantities of canned pineapple and mangoes as mentioned above.

Imports of fresh papaya into Hong Kong amount to 2,780 MT in 1981. Seventy-two percent of these supplies came from Thailand and 14 percent from Taiwan. Unit CIF prices were $546 per MT averaged over all supplier countries. The large quantities received from Thailand were valued at $647 per MT, CIF Victoria.

Cashew nut imports originated from 19 countries located in all tropical areas of the world. Of the total of 4,671 MT imported in 1981, Thailand accounted for 28 percent, followed by mainland China 20 percent, and the Ivory Coast with about 17 percent. Rambutan and durian, along with nearly 6,000 MT of ginger, were also imported in 1981.

c. Trade Regulations and Trade Channels. Hong Kong has no controls on imports, exports, or re-exports other than those arising from international obligations and those used for health, safety, or security. Import licenses are not required for most products including food. Hong Kong, like Singapore,

is treated as a contracting member of GATT resulting from Britain's membership. Arriving goods require a bill of lading, certificate of origin, and statement of import declaration. Labels are required on containers of fresh or processed food products that give a description of contents, quantity contained, and country of origin.

Marketing channels essentially follow the route taken in all large cities of the Far East. The off-loads generally proceed to a warehouse for temporary storage and thence go to wholesale markets for sale to retailers and final consumers. There are several large produce markets serving Victoria and Kowloon.

Turnaround time for most cargo ships is rapid, averaging 2.6 days for ships working cargo at buoys, and only 15-1/2 hours for containerships (excluding steaming, berthing, and unberthing time).

Sources of information for tradesmen or merchants are readily available from the Hong Kong Trade and Development Council and the Singapore Chamber of Commerce, both located at the Swire House in Victoria. Appendix Q-2 gives a list of selected firms belonging to the Hong Kong Fresh Fruit and Vegetable Imports Association.

d. Summary Comments. Hong Kong represents an excellent market for tropical fruits and vegetables. Many residents are affluent and patronize luxury or gourmet markets offering high quality tropical fruits largely independent of price; other residents patronize the central markets and vendor stands that emphasize price, rather than quality attributes. Burma will have keen competition in both quality and price dimensions from current suppliers--primarily mainland China, Thailand, and the

Philippines. Because of greater sea-freighting distances to Hong Kong that affect both product quality and freight costs, Burma will have better sales opportunities in offerings of air-freighted produce.

4. Saudi Arabia

a. General. The Saudi oil-based economy has become one of the strongest in the world. Land surveys are incomplete, but the total area is estimated to be about 725,000 mi^2. The estimated population in 1979 was 5 million, plus over one million expatriate workers.

In 1978, latest year for which data are available, the GDP was estimated at $65.3 billion of which two-thirds was produced by the oil sector. 1/ Per capita income was probably underestimated at around $10,000. Total trade amounted to approximately $60 billion of which imports comprised $22 billion or 37 percent. A numerical breakdown by types of food products is not available, but it is known that the Saudis imported $134 million worth of agricultural products in 1979. As only 2 percent of the land is cultivated, contributing only 1 percent to the GDP, Saudi Arabia's food imports are expected to continue a rapid growth pattern.

There are three international airports: Jedda, Dhahran, and Riyadh, but only the Saudi airline serves the latter. The new airport at Jedda, to be completed in 1982, will be the world's largest. The new airport at Riyadh, designed by Bechtel Company, will be larger than Jedda's. Pan American and Saudi

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1/ Data taken largely from United States Department of Commerce Reports OBR 79-40 and from the British Overseas Trade Board's publications.

Airways operate a joint service from New York to Dhahran. Most national airlines of foreign countries serve either Jedda or Dhahran. Saudi Airlines' modern fleet serves Singapore and other South Asian cities.

Saudi Arabia's two major ports are located in Jedda on the Red Sea and Dammam on the Gulf. Both are deep-water ports and both include container terminals. Shipping costs between Bangkok and Saudi Arabian ports are assumed to be similar to those from Moulmein or Rangoon, are given in Table 96.

b. Products--Mudon Project

(1) Pineapple. Total imports of all pineapple into Saudi Arabia are not known. It is known, however, that the Philippines and Thailand shipped fresh and canned pineapple to the Saudis in 1980 (Tables 92 and 93). Of the 11,754 MT of canned pineapple reported as imported by Saudi Arabia in 1980, 226 MT came from the Philippines at a CIF unit value of $535 or about $8.74 per case of No. 2 can-size equivalents. In 1982, Saudi Arabia received 5,306 MT of canned pineapple from Thailand with a unit value, FOB Bangkok, ranging between $10.73 and $8.03 per case of No. 2 can-size equivalents, depending on the type of product. 1/

Fresh pineapple imports into Saudi Arabia amounted to 3.4 MT from Thailand and 2,881 MT from the Philippines in 1980 (Tables 92 and 93). FOB values were $183 and $214 for Thailand and the Philippines, respectively. Wholesale prices on Saudi's markets are not known.

1/ Source: Experience, Incorporated data. Prices were estimated as $10.73 for choice chunks and slices; $9.73, $9.53, $8.53, and $8.03 for standard slices, tidbits, choice crushed, and pieces, respectively.

(2) Mangoes. Fresh mangoes from the Philippines in 1980 amounted to only 550 kilograms with an FOB unit price of $0.68 per kilogram or $680 on a per MT basis. 1/ The CIF price rose to $1.19 per kilo which translates to an air freight charge of $0.51 per kilogram, a figure that appears too low for 1980. 2/

The Philippines shipped 4.6 MT of canned mangoes in syrup to Saudi Arabia in 1980. The FOB and CIF values of the shipments were $1,963 and $2,318 per MT, respectively. 3/ Trade statistics for Thailand do not show any shipments of canned or fresh mangoes to Saudi Arabia in 1980 or earlier years.

The Saudis imported 7.2 MT of canned and 1.3 MT of fresh jackfruit from the Philippines in 1980.

The extent of Saudi Arabia's potential for importation of cashews is not known.

c. Trade Regulations and Channels. Saudia Arabia may be divided into three separate markets: the Western Province, centered on Jedda, the country's main commercial center and one of the two major seaports, and also including the holy cities of Mecca and Medina; the Central Province, centered on Riyadh, the capital; and the Eastern Province, centered on Dammam and

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1/ Tonnages from India were not found in the data sources searched.

2/ Air freight from Singapore in July, 1982, for example, was about $1.66 per kilogram on a chartered (full cargo) basis. This means that either special freight concessions were obtained or that actual rates increased by over three times.

3/ In terms of No. 2 case equivalents, these values translate to $27.60 and $32.60 per case, respectively.

Al Khobar that largely serve ARAMCO's requirements. Only Saudi nationals (individuals or corporations), may act as commercial agents in Saudi Arabia. Regulations among Saudi agents and foreign contractors are set by decree, translation of which can be obtained from the trade departments of all major trading countries. The best sales period for many products, including foodstuffs, is during the two month pilgrimage season which brings 1-1/2 million pilgrims to the Jedda/Medina area. 1/

More than half of all imports are duty free, including all foodstuffs. Trade policy is liberal with no exchange restrictions. Shipping documents are the commercial invoice, certificate of origin, bill of lading or air waybill, packing list, and insurance certificate. Documents must first be authenticated by the government of the country of origin, and then be legalized by the Saudi Consulate for a fee of $2 for the first page and $0.40 for each successive page. Food labels in Arabic are specified for some 20 to 25 products with more expected to be added later. All goods shipped to Saudi Arabia should be packed to withstand rough handling, extreme heat and high humidity, and to provide protection against pilferage. Colored units or labels should not be pink, violet or yellow as these colors have a negative impact on Saudis. Boxes or cartons should be waterproofed and double stripped with metal bands. With fresh fruits, air shipments should be in fibreboard cartons of reasonably high test strength (175 to 200 pounds) and double strapped with metal bands.

There is no procedure under Saudi law for protesting overdue or unpaid accounts. There is a Committee for this purpose, but procedures are costly and rarely effective. Terms of payment

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1/ Dates advance each year because the Islamic calendar has 12 lunar months, totaling 354 days.

are usually on letter of credit terms, but cash against document terms are used at times. Sight drafts, with payment after delivery, take up to 90 days or more. Some Saudi firms are obtaining 90, 180, and 300 days sight terms and demands are increasing to extend the period to 24 months. 1/

Trade channels at the wholesale and retail levels are traditionally through small specialized stalls in bazaars, but there are several modern supermarkets situated in residential communities. Additional sources of information are listed in Appendix Q-3.

d. Summary Comments. Any potential importer to Saudi Arabia should solicit advice from an experienced market research or consulting firm before selecting an agent or otherwise preparing to export goods to that country. The high income levels of nationals and expatriates are leading to an increasing market for all foods, particularly fresh and processed fruits and vegetables. With an aggressive and knowledgeable sales agency, prospects for marketing the full line of tropical fruits appear promising. 2/

5. United Arab Emirates (UAE)

a. General. The UAE is a Federation of 7 shiekdoms: Abu Dhabi, Dubai, Sharjah, Ajman, Um al-Quwain, Ros al-Karmah, and Fujairah. It was founded in 1971 when Britain withdrew its

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1/ United States Department of Commerce report OBR 79-40, op cit, and British Overseas Trade Board publications.

2/ Interview with S. Joyeaux of the Rungis Market, Paris and J. Joughlin of the Tropical Products Institute, London.

colonial administration from the area. The UAE has a total area of 33,000 miles^2 and a population of about 1 million of which 80 percent are expatriates. It ranks near the top of the world's highest in per capita income. Most of UAE's growth and affluence has occurred in the 1970's, with the wide variety and sophistication in consumer tastes and preferences being influenced by a large number of trade promotion exhibitions and trade fairs.

More than a dozen airlines regularly serve the UAE's four international airports. Dubai and Sharjah offer completely containerized and computerized cargo facilities. Among the four major seaports, Dubai has been the traditional center with over 100 berths now in operation.

b. Products-- Mudon Project. In 1980, the UAE imported 29.4 MT of fresh pineapple from Thailand at a unit value of $260 FOB Bangkok. 1/ In the same year, the UAE imported canned pineapple as shown in Table 102.

TABLE 102. UNITED ARAB EMIRATES IMPORTS OF PINEAPPLE, 1980

Country of Origin	Imported Metric Tons	FOB Values
Malaysia	2,542	NA
Thailand	151	$8.03-10.53 a/
United States	64	NA

a/ FOB values given in No. 2 case equivalents.

SOURCE: Foreign Trade Statistics, Department of Customs, Bangkok, Thailand, 1981

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1/ Foreign Trade Statistics, Department of Customs, Bangkok, Thailand, 1981

Trade statistics for Taiwan for 1980 were not obtained. However, Taiwan shipped the UAE over 3,000 MT of canned pineapple in 1979.

Six MT of fresh mangoes were imported from Thailand in 1980. These shipments were reported to have an average unit value of $728 per MT, FOB Bangkok.

c. Trade Regulations. All the Emirates exempt foodstuffs from import duties. The UAE prohibits trade with South Africa and participates in the Arab League's boycott of trade with Israel. Each Emirate has its own regulations concerning agents, but agents are essential to foreign traders even if not required by every Emirate. A commercial invoice, certificate of origin, steamship certificate, and insurance certificate must accompany each shipment into the UAE. The commercial invoice must give the method of packing and list the number of pieces, weights, and values.

There are no standard labeling requirements among the Emirates as each enforces its own trade regulations. Among the Emirates, only Abu Dhabi and Dubai have food labeling laws. The Abu Dhabi stipulates that:

1. All labels must include the name and address of the manufacturer;
2. Product's date of manufacture and expiry;
3. Gross and net weights; and
4. All contents must be listed, including all additives.

The Dubai food labeling requirements stipulate that expiry dates must be punched into the metal part of a can lid or printed on the cap of bottles. Arabic language is not required. Like Saudi Arabia, the Emirates do not place specific packaging

requirements on goods entering the country. However, the goods should be packed to withstand heat and humidity extremes as well as rough handling and pilferage since many shipments are transshipped en route to the UAE. Sea shipments should be in waterproofed boxes or cartons; both sea and air shipment cartons should be double strapped with metal bands. Channels of distribution are similar to those described for the Saudis: most wholesale and retail trade is done through bazaars, but the number of modern supermarkets is increasing. Transfers between ports are efficiently handled with fruits and vegetables transferred via refrigerated vans or trucks. The air and sea ports and city of Dubai have the most modern distribution and warehousing facilities among the Emirates. Additional sources of information are included in Appendix Q-4.

d. Summary Comments. Like other Middle East oil producers, the United Arab Emirates are beginning to develop markets for tropical fruits and vegetables. Trade promotions in fairs and exhibitions provide excellent opportunities to supplier countries to display and introduce products, including those of the type proposed for production in the Mudon project area. To some extent, countries such as Thailand, the Philippines, and other established exporters have already built growing markets for tropical fresh and processed fruits.

6. Kuwait

a. General. Kuwait, a small country of 7,500 miles^2 bordered by Saudi Arabia on the south, Iraq on the northwest, Iran on the northeast, and the Persian Gulf, is one of the highest oil producers in the world. The population is slightly over 1 million, a large percentage of which are expatriates. Total trade (1978) was $12.4 billion of which oil and related exports amounted to over 92 percent.

Kuwait is served by two deep water ports at Shuwaikh and Shuaiba, both equipped with modern handling facilities, including container terminals, cold storage warehouses, etc. The international airport in Kuwait is equipped with a computerized container handling terminal and is served by most major airlines.

b. Products--Mudon Project. Kuwait, like other Mideastern countries discussed earlier, has only recently started to import tropical fruits. In 1980, Kuwait imported 244 MT of fresh pineapple from the Philippines with an FOB unit value of $134 and a CIF value of $214. The fruit was sea freighted as refrigerated cargo at an apparent cost of about $80 per MT.

Kuwait imported 1,459 MT of canned pineapple in 1980 from Thailand, Malaysia, and the United States. FOB and CIF unit values are not available from the sources consulted, but are believed to be equivalent to those given in the discussion of Saudi Arabia.

Trade statistics for Thailand reported that 700 kilograms of fresh rambutans were air shipped to Kuwait in 1980. None of the other products planned for production in the Mudon area of Burma is listed in the trade statistics consulted or was mentioned by specialist personnel interviewed by Experience, Incorporated. However, the Philippines are aggressively seeking fresh and processed markets in the Middle East, as evidenced by their having shipped pineapple and mangoes to Oman, Saudi Arabia, and Qatar in 1980. With the exception of Saudi Arabia, these markets are new.

c. Trade Regulations and Channels. Importers must be registered with the Kuwait Chamber of Commerce and Industry and must hold a general import license. Except for a few specific

items such as liquor, drugs, and ammunition, specific import licenses are not required. There are no foreign exchange controls except for Israel and South Africa. Custom duties for most imported foodstuffs are exempt as are goods in transit (e.g. to Iraq).

Kuwait requirements for labeling canned foods include:

1. Contents description in descending order of proportion;
2. Date of manufacture or packing;
3. Expiry date;
4. Net weight (metric); and
5. Name and address of manufacturer (for example, an address of Mudon, Burma would be sufficient).

These labeling requirements must be in Arabic. Packing should be secure to protect goods from extreme heat in the summer months and high humidity in winter. The major quarantine and health regulations apply to the prohibition of the use of cyclamates in foods or beverages.

A successful marketing venture in Kuwait and other Mideast countries rests heavily on the development of personal contacts and relationships with Kuwaiti importers. Kuwaiti merchants expect face-to-face negotiations with exporters and the success of any marketing venture depends on following this tradition.

A number of marketing channels are available to exporters. Most Kuwaiti merchants import directly from suppliers and may be both wholesaler and retailer. They normally will demand exclusive distribution rights. It is considered appropriate, but not required, to appoint a specific agent for the Kuwait market. All agencies must be held by Kuwaiti nationals or companies under Kuwaiti control (51 percent). The food industry operates on similar lines as that of the United States

with wholesalers supplying large supermarkets for the majority of grocery sales. However, few companies specialize in a narrow range of products, it being common for leading merchants to handle diverse products such as food, hardware and automobiles.

d. Summary Comments. The comments relating to marketing potentials in Kuwait follow the same general lines as those for Saudi Arabia and the United Arab Emirates presented earlier. Direct contact with prospective buyers, in-store supervised displays, customer sampling, and other promotional techniques should have high payoffs in quantities ordered. Supplies should be uniformly and regularly distributed, even if shipments are small.

7. The United Kingdom 1/

a. General. The United Kingdom, along with France and West Germany, is a major European market for tropical fruits and nuts. Its population was about 56 million in 1980. Although the demand for tropical food products of the kind proposed for the Mudon project has been increasing in recent years, the impact of the general economic recession (1973-78) on the United Kingdom economy and the poor exchange rate of the pound sterling led to increased prices and reduced sales. Since 1978, the pound has shown some recovery and the market for tropical food products has improved somewhat.

1/ The discussion of European markets for fresh tropical fruits relies heavily on data from the publication by the ITC International Trade Center UNCTAD/GATT entitled Selected European Markets for Tropical and Off-Season Fresh Fruits and Vegetables, op cit, and interviews with tradesmen and specialists in London and Paris.

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b. Products--Mudon Project

(1) Fresh Pineapple. The United Kingdom is one of the smallest importers of fresh pineapples in Europe. Switzerland, a country with a population of only 6 million, imports about half as many pineapples as did the United Kingdom in 1979. Import figures for 1975 to 1980 are given in Table 103. The figures show that the market suddenly rose dramatically in 1978 and 1979--imports in 1979 were more than twice those of 1976. There are no Asian countries currently shipping fresh pineapples to the United Kingdom. South Africa, the Ivory Coast, and Kenya supply over 85 percent of the market.

The United Kingdom market may be divided into two sectors: the luxury market and the popular market. The luxury market, supplied mainly by Kenya with air-freighted and premium-priced large fruit (circa 2 kilograms each), consists of the catering or high-quality retail trade. The other sector is the popular market supplied largely by South Africa and the Ivory Coast with sea-freighted pineapples. South African exporters partially trim the crown after harvest while Ivory Coast producers trim it some weeks before harvesting. The Kenyan pineapple is noted for its full, bright green crowns and excellent eating qualities.

Consumers usually buy according to price and appearance of the fruit and are apparently unaware of varietal differences. Importers, however, accept only the Smooth Cayenne variety. Currently, the 1.5 to 2.0 kilogram fruit is preferred and receives the highest wholesale price. Kenyan air-freighted fruit sold around $1.38 per kilogram in 1979 and in July, 1982, the wholesale price for air-freighted pineapple arriving at Heathrow Airport was about the same, a market situation that reflects the continuing worldwide recession during the last two years.

TABLE 103. UNITED KINGDOM IMPORTS OF FRESH PINEAPPLES AND MANGOES, 1975 TO 1980

Year	Imports	
	Pineapples	Mangoes
	---------metric tons---------	
1975	5,157	1,347
1976	4,291	1,211
1977	4,813	1,162
1978	7,641	1,893
1979	8,952	2,768
1980	11,906	--

SOURCE: UNCTAD/Gatt Publication of Selected Markets, op. cit.

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(2) Canned Pineapple. The United Kingdom imported 39,083 and 48,230 MT of canned pineapple in 1978 and 1980, respectively. Quantities shipped by major exporters are given in Table 104. In 1980, shipments originating from the Philippines had an FOB value per No. 2 case of $8.11, averaged over all types of solid-pack pineapples.

TABLE 104. UNITED KINGDOM IMPORTS OF CANNED PINEAPPLE BY MAJOR EXPORTERS

Country/Origin	Quantities	
	1978	1980
	---metric tons---	
Australia	NA a/	974
Malaysia	17,235	12,933
Philippines	3,634	3,704
Taiwan	358	NA
Thailand	813	627
United States	316	19

a/ Not available.

SOURCE: Baker, B. Fresh and Canned Pineapple Situation in Major Producing Countries, February 1982, op cit.

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The United Kingdom is among the largest European importers of fresh mangoes (Table 103) partly because of its large population of Asian and West Indian immigrants. Consumption for the indigenous population is rising, however, and is thought to be the cause of the 138 percent increase in imports during 1977-78. Mexico, India, Kenya, Venezuela, and the West Indies are the major suppliers, with Mexico supplying 23 percent of the market beginning in 1979. The peak months for mango imports are May through August when about two-thirds of total supplies are received. Demand remains high, but fruit is not uniformly available--a situation that can be capitalized on by countries with peak seasons falling during the off-months of September through April. Mexico supplies mangoes from June to August, the West Indies June to September, India from April to July. Kenya is the only year-round supplier.

The Asian emigrants prefer Indian or Pakistani varieties: the Alphonso from India, and the Choso, Langra, and Sindri from Pakistan. Florida mango varieties have been widely introduced in tropical America and South Africa and are prime candidates to emerge as major export varieties; they are fiber free and ship well.

Fresh mangoes command high prices. In 1979-80, the average wholesale price in the United Kingdom for air-freighted mangoes ranged from $10 to about $13.30 per 5 kilogram carton. Prices were about the same as of July, 1982, ranging from $11.18 to $12.04 per 5 kilogram carton. These prices clearly indicate that the recession is still in effect and that the pound sterling continues to drop in value relative to the US dollar.

Quantities of canned mango products imported into the United Kingdom are not known with any certainty. The Philippines

shipped 1.2 MT of mangoes in syrup to the United Kingdom in 1980 that was reported to have an FCB value of $1,184. 1/

(3) Passion Fruit. Estimates of imports are difficult to make because passion fruit does not appear in national foreign trade statistics and most of it bypasses the conventional wholesale trade and is handled by Asian and other immigrant specialists. It is known, however, that most passion fruit imports come from Kenya. Exports to the United Kingdom were 59 MT in 1977, rising to 72 MT in 1978, and dropping to 68 MT in 1979. Additional imports probably add 40 to 50 MT to the total.

The purple variety is preferred over the yellow, but some yellow is seen on the market. Wholesale prices have been rather constant, around $2.45 per kilogram in 1979-80, and remaining at approximately that level according to July, 1982 quotes from the International Trade Center in Geneva.

(4) Other Products. Other products considered adaptable for the Mudon project are also imported into the United Kingdom. Thailand is known to have shipped 4.2 MT of rambutans into the United Kingdom in 1980. The United Kingdom also imported 230 kilograms of durian in the same year. The Philippines sent 1.6 MT of canned jackfruit into the United Kingdom in 1979 but exports from that source dropped 60 percent to only 0.63 MT in 1980. The large numbers of Asian and West Indian immigrants account for the increased shipments of tropical fruits into the United Kingdom. There has been some spill-over of demand for these products to the indigenous population, but thus far the impact has not been noticeable except for mangoes and possibly, pineapples.

1/ Converted to 24/2's cases, the FOB value is $16.65 per case.

Overseas statistics of the Department of Trade reported 7,368 tons of cashews were imported into the United Kingdom in 1980 with a CIF value per unit of $4,732 per MT. 1/ India was the largest exporter (31 percent), followed by Mozambique, mainland China, and Brazil. The Netherlands re-exported 249 MT to the United Kingdom in 1980.

Imports of ginger, known to be an important import item, were not obtained from the trade statistics investigated. The Philippines shipped slightly over 27 MT to the United Kingdom in 1980 with a value of $415, FOB Manila.

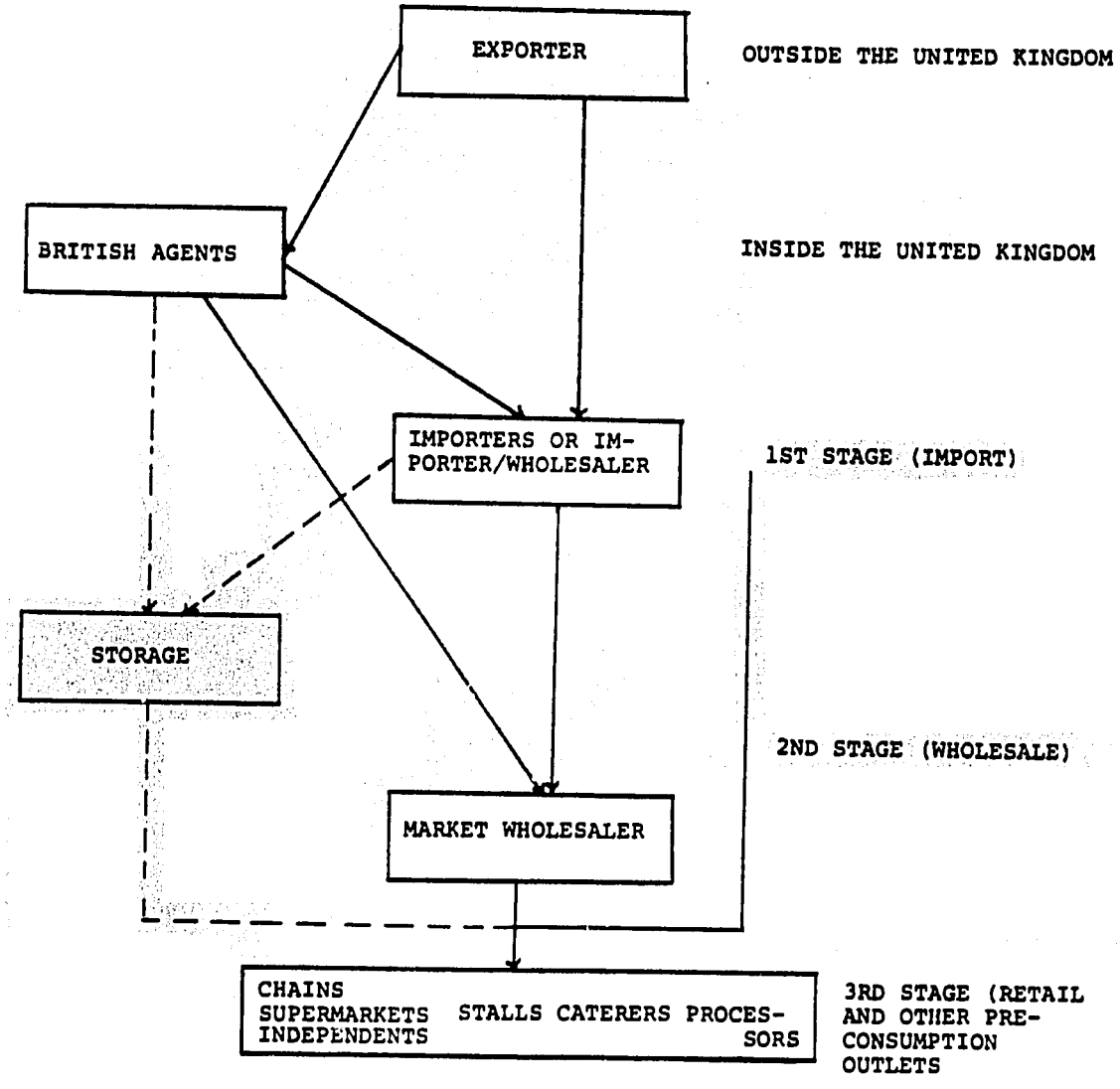
c. Trade Regulations and Trade Channels. Figure 19 illustrates the main marketing channels of imported fresh tropical fruits which follow the classical trinity of importer-wholesaler-retailer. There are some 40 wholesale markets handling fresh fruits and vegetables in the United Kingdom. The larger firms deal directly with supermarkets, but most regard this outlet as difficult to service, particularly with exotic fruits whose supplies are uncertain.

The structure of trade in exotic fruits normally consists of low-volume lines with a select clientele and only a few United Kingdom importing firms engage in this trade. These firms are centered in London, predominantly in the New Covent Garden Market (Appendix Q-5).

Margins and markups are higher for exotic fruits than for high volume produce such as citrus fruits. The secondary wholesaler's margin is about 10 percent and the retail markups usually run from 30 to 60 percent depending on the outlet, area, and perishability of the product.

1/ Department of Trade, Overseas Trade Statistics of the United Kingdom, 1981, London (Table III, Imports).

FIGURE 19. MAIN TRADE CHANNELS FOR TROPICAL FRUITS IN THE UNITED KINGDOM



SOURCE: UNCTAD/GATT Publication, "Selected Markets . . . op cit

Since January, 1978 the United Kingdom has applied all of the European Economic Community's (EEC) common external tariff rates as shown in Appendix R. As a member of the EEC, and therefore a signatory to the Lome Convention, the United Kingdom applies preferential duties--in most cases free entry--to products imported from African, Caribbean, and Pacific (ACP) countries. To obtain benefits under this arrangement, exporters must enclose the appropriate EUR 1 form with each shipment. Developing countries, e.g. Burma, Thailand, Philippines, etc., that are not signatories to the Lome Convention may also receive preferential treatment by enclosing the correct Generalized System of Preferences (GSP) form with each shipment.

There are no quantitative restrictions on any of the tropical products considered for production in the Mudon area, nor are there any particular phytosanitary regulations for them.

8. France

a. General. France is the largest European market for tropical fruits and is expected to continue so in the future. French consumers are extremely quality conscious and are willing to pay premium prices for high quality produce. Fresh is preferred over processed fruits and vegetables, and the demand for fresh exotic products continues to grow over the years for the following reasons:

(1) High incomes and the development of mass tourism have resulted in the French public spending holidays in tropical resort areas where they have developed a taste for tropical fruits;

(2) There are a large number of expatriate workers from Mediterranean countries and French Overseas Departments who have regularly consumed tropical fruits as does the majority of the indigenous population of southern France;

(3) French consumers are willing to experiment with new foods and will buy it in large quantities when it is accepted.

Although pineapples and avocadoes were introduced into the United Kingdom before they were in France, today France imports much larger quantities than does the United Kingdom. Principal markets in France are Paris and environs, Lyon, and southern France.

b. Products--Mudon Project

(1) Pineapples. France is the largest European market for fresh pineapples and is third in the world after Japan and the United States (Table 105).

TABLE 105. FRANCE IMPORTS OF PINEAPPLE AND MANGOES AND RE-EXPORTS OF PINEAPPLE, 1975 TO 1980

Year	Imports		Re-Exports
	Pineapple	Mangoes	Pineapple
	----------metric tons----------		
1975	34,788	607	1,016
1976	35,478	733	2,121
1977	31,799	913	3,333
1978	48,928	1,387	7,856
1979	44,485	1,859	7,333
1980	39,313	2,268	5,682

SOURCE: International Trade Center, UNCTAD/GATT, Selected European Markets for Tropical and Off-Season Fruits and Vegetables, op cit p. 65.

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Imports increased rather dramatically in 1978 and 1979 but dropped off sharply in 1980. This behavior is explained by the action of the Ivory Coast in the two peak years of 1978-79 during which time that country flooded the market with fresh pineapples. The higher re-export totals in those years were not

enough to stabilize supplies, and prices dropped drastically. 1/ Pineapples are re-exported to neighboring countries with some going to East Germany and Czechoslovakia since 1978.

Some 5,000 MT are air freighted annually from the Ivory Coast plus small quantities from the Azores and Kenya. All other suppliers (Cameroons, Guinea, Martinique) sea freight their produce; primarily to the port of Marseille.

French consumers no longer consider pineapple a luxury item and it is a commonly used dessert fruit by the average French family. There is a small luxury market, however, that is supplied by air from the Ivory Coast, Kenya, and the Azores. The regular retail market is supplied mainly by the Ivory Coast and the Cameroons and has been growing steadily. Fruits weighing between 1 and 1.5 kilograms are preferred and are estimated to represent 90 percent of the market. The only variety accepted by French importers is the Smooth Cayenne.

Wholesale prices fluctuate with supplies, but in 1979-80 were averaging 3.00 to 3.20 French Francs (FF) per kilogram ($0.75 to $0.80) for sea-freighted pineapples and from 4.50 to 5.50FF ($1.12 to $1.37) per kilogram for air-freighted fruit. 2/ In July, 1982, sea-freighted fruit was averaging 4.00 to 4.65FF ($0.58 to $0.68) per kilogram and air-freighted fruit from

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1/ International Trade Center, UNCTAD/GATT, Selected European Markets for Tropical and Off-Season Fruits and Vegetables, op cit p. 64.

2/ Exchange rates: End of year 1979--US$1 = 4.025FF and July 23, 1982--US$1 = 6.86FF.

the Ivory Coast and Kenya was averaging 6.50 to 8.50FF ($0.95 to $1.24) per kilogram. In terms of U.S. dollars, the prices in July dropped due to a devaluation of the French Franc by about 13 percent.

Canned pineapple imports into France totaled 5,051 MT in 1980 with a CIF unit value of US$604 per MT. 1/ Major suppliers were the Ivory Coast, 36 percent; Kenya 24 percent; Martinique, 21 percent; and South Africa, 11 percent. The origins of the remaining 8 percent of the 1980 imports were not identified.

(2) Mangoes. Mango imports into France more than tripled over the six year period (Table 105) to a total of 2,268 MT in 1980. France and the United Kingdom share the lead as the largest importers of fresh mangoes in Europe.

Mali is the leading supplier with 488 MT, or 22 percent, of the total market. The Ivory Coast, South Africa, Mexico and Upper Volta all supplied large quantities of between 180 and 260 MT each. Peru entered the market for the first time in 1980 with shipments totaling 222 MT.

Mangoes arrive in France throughout the year with no real gap in the flow of supplies. The market manages this uniformity by soliciting imports from many countries; more than 13 in 1980. The fresh mangoes arrive in cartons of 4 to 5 kilograms holding single layers of fruit averaging 12 to 16 pieces per carton. Importers prefer the Alphonso, Julie, Zyll, or Haden varieties.

1/ Overseas Trade Statistics, France, 1981, p. 185. Exchange rate end of 1980: US$1 = 4.516FF.

Prices vary according to shipments' origins with Mali and Upper Volta supplies selling at 1980 wholesale levels of 7.50 to 8.50FF during the summer months to 12.00FF during December holidays. The excellent Haden mangoes from Mexico generally bring the highest prices on the market. In July, 1982 average wholesale prices of mangoes from Senegal averaged 8.00 to 10.00FF and those from Mexico as much as 14.50FF. Considering the relative value of the French Franc vis a vis the U.S. dollar, wholesale prices have declined somewhat since 1980. 1/

France does not report separate statistics for imports of canned mangoes. Given the French preference for fresh fruits, it is probable that very few canned mangoes were imported. 2/

c. Other Products.

(1) Jackfruit, Durian, and Rambutans. Jackfruit, canned in syrup, was shipped into France in 1979 and 1980. The Philippines exported 37 MT to France in 1979 with a unit FOB (Manila) value of $1,659 per MT. 3/ Shipments dropped to less than one-half metric ton in 1980, but with an FOB unit value equivalent to $2,400.

Thailand exported 64.4 MT of fresh durian and 20.9 MT of fresh rambutans to France in 1980. Unit values, FOB Bangkok, were $,1068 per MT for durian and $522 for rambutans. 4/

1/ US$1 = 4.516FF in 1980 and 6.86FF in July of 1982.

2/ Vlandes, Sylvie, La Consommation des Fruits Exotiques en France, op cit p. 60-69.

3/ Philippine Trade Statistics, 1981, op cit p. 526. This translates to $23.33 per 24/25 cases.

4/ Thailand Trade Statistics, op cit, p. 19. Converted to US$ from Bahts: US$1 = 20.63 Bahts.

(2) Passion Fruit. France also received unreported quantities of fresh passion fruit from various countries in 1980 and 1982. 1/ Wholesale prices, however, were collected and published by the Market News Agency of the International Trade Center of UNTAD/GATT headquartered in Geneva. These wholesale prices average 10.40FF ($2.46) per kilogram in 1980 and were 18.00FF ($2.63) as of July, 1982. Wholesale prices for passion fruit, like many of the tropical fruits studied, have remained relatively constant over the past two years.

(3) Cashew Nuts. France imported 754 MT of cashew nuts in 1980 at an average CIF value of $4,900 per ton. The largest supplier by far was India with shipments of 488 MT, or 65 percent of the total. Brazil followed with 80 tons and was trailed by China, Mozambique, Tanzania, and the Overseas Departments in the West Indies.

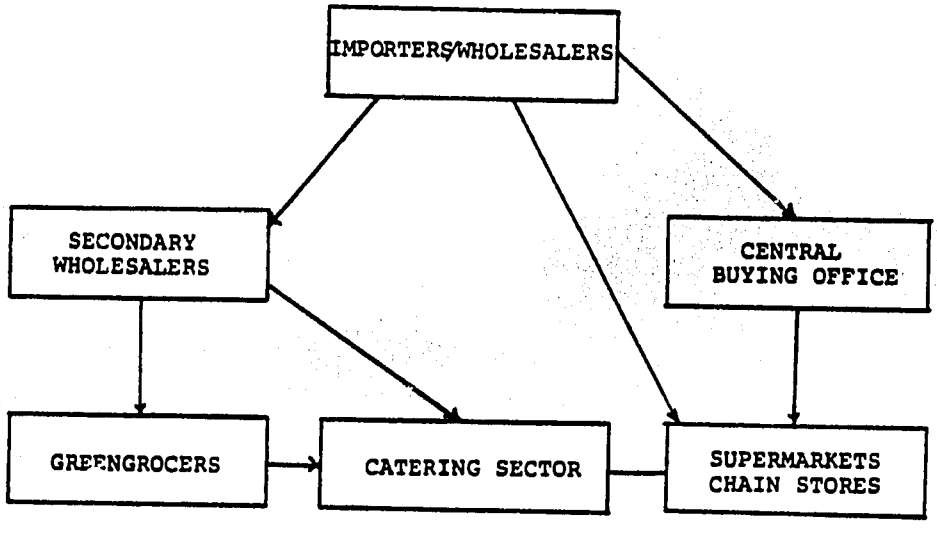
(4) Mangosteens. Mangosteens, totaling 14 tons were imported via air shipments in 1980. Four tons were re-exported, giving France net imports of 10 tons. 2/ The CIF value of these shipments were high, amounting to $2,894 per MT or to $2.89 per kilogram. Adding in a 10 to 15 percent markup, mangosteens could have easily wholesaled at $3.20 to $3.35 per kilgoram. Based on observation of the wholesale price behavior of other tropical fruits, it is highly probable that mangosteens are selling at about the same level now (1982).

1/ Kenya shipped 31 MT of fresh passion fruit to France in 1979-80. Source: Kenyan Trade Statistics 1981.

2/ French Trade Statistics, 1981. Guavas were included, but are know to be extremely small (interview with S. Joyeaux of Rungis Market, June 1, 1982).

d. Trade Regulations and Trade Channels. 1/ Principal trade channels for tropical fruits entering the French marketing system are illustrated by Figure 20. It is estimated that 50 percent of all exotic fruits are sold through supermarkets and their importance continues to grow. The catering sector, particularly restaurants, is also a large market for imported fruits. In France, the central purchasing offices of the supermarkets and chain stores do not import fresh produce directly; instead the importers bring in the fruit and perform the wholesale functions by selling directly to secondary wholesalers and supermarkets.

FIGURE 20. PRINCIPALS CHANNELS OF DISTRIBUTION FOR TROPICAL FRUITS IN FRANCE



SOURCE: UNCTAD/GATT Publication, Selected Markets . ., Op cit p. 98

1/ Interviews by Experience, Incorporated marketing specialist with tradesmen and officials of the Rungis Market, Paris, and Tropical Products Institute, London, England. Chart adapted from UNCTAD/GATT publication, Selected Markets...., op cit p. 98.

In France, like other European countries, most tropical food products (80 to 90 percent) are sold by importers on a commission basis. This is because importers are unwilling to incur the risks of handling highly perishable products without being absolutely certain that contracted agreements covering quality, quantity, and deliveries will be complied with. The commission is usually 10 to 12 percent, depending on the nature of the product, the quantities involved, and the services performed by the importer. A selected list of French importers of tropical fruits and vegetables is given in Appendix Q-6.

For sea shipments, the best port for shipping tropical produce to France is Marseille. Although all points in Europe are easily reached by the excellent road and rail network originating in Marseille, the main trade from this port is with the southern half of Europe, including the southern half of Germany, Switzerland, and Austria. All air-freighted produce should be sent, if possible, to Orly airport, which is situated only two kilometers from Rungis, the Paris wholesale market.

French custom duties are the same as those levied in all EEC countries (Appendix R). As a member of the EEC, and therefore a signatory to the Lome Convention, France applies preferential duties, in most cases free entry, to products imported from African, Caribbean, and Pacific countries. To obtain benefits under this arrangement, exporters must enclose the appropriate EUR 1 form with each shipment. Developing countries e.g. Burma, Thailand, Philippines, etc., that are not signatories to the Lome Convention may also receive preferential treatment by enclosing the correct Generalized System of Preferences (GSP) form with each shipment.

The French impose a value-added tax of 7 percent on all products included in this study. When produce arrives in France, the Service de la Protection des Vegetaux confirms that it contains no harmful parasites. Once this is done, the Service authorizes clearance through customs without further delay. The charge for this inspection service is 0.7 percent ad valorem.

9. Federal Republic of Germany

a. General. The importance of the Federal Republic of Germany market arises from its large population (circa 62 million), high per capita income, and strong currency. The continuing worldwide recession is causing a slowdown in imports, however, and is exerting strong downward pressures on prices and supplies of tropical products, many of which are still considered luxury or gourmet foods.

b. Products--Mudon Project

(1) Pineapple. Imports into the Federal Republic have been erratic and have shown a slight downward trend since 1975 (Table 106).

Countries that have exported fresh pineapples into West Germany at one time or another during the above period include Brazil, Cameroon, Taiwan, Honduras, Ivory Coast, Kenya, and South Africa. The Ivory Coast has dominated the market for all of the years involved, supplying 79 percent and 92 percent of total imports in 1979 and 1980, respectively.

Fresh pineapple imports have decreased in 1979 and 1980 because of pressures on prices brought about by the onset of a sharp recession in the Federal Republic that has worsened in

TABLE 106. FEDERAL REPUBLIC OF GERMANY IMPORTS OF PINEAPPLE AND MANGOES, 1975 TO 1980

Year	Imports	
	Pineapple	Mangoes
	--------metric tons-------	
1975	13,144	231
1976	14,336	213
1977	10,926	294
1978	19,212	678
1979	16,204	947
1980	12,589	NA a/

a/ Not available.
SOURCE: ITC UNC/GATT op. cit.
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the last two years. In view of the increasing supplies available from supplier countries, particularly the Ivory Coast, it is unlikely that the West German market will be able to easily absorb additional quantities.

Canned pineapple exports into the Federal Republic amounted to 84,296 MT in 1978, but decreased to 77,869 MT in 1980. Thailand is the leading exporter with 34 percent of the total in 1980, followed by the Ivory Coast (19 percent), and the Philippines (15 percent). 1/ FOB and CIF prices are available only for the Philippine shipments. In 1980 FOB prices averaged $422 per MT and $536 CIF Hamburg. Although imports have been gradually declining, the Federal Republic of Germany is still the largest market for canned pineapple products in Europe, and is second only to the United States on the world scene (Table 92).

1/ Data were taken from the USDA, FAS Circular FCAN 1-81, Washington, February, 1982. These data are inconsistent with data from the trade statistics of Thailand and the Philippines. The latter lists exports of 15,381 metric tons in 1980 whereas the FAS circular lists exports from the Philippines as totaling 11,460 metric tons.

(2) Mangoes. Imports into the Federal Republic of Germany rose steadily during the period 1975-79 as shown in Table 106.

The sharp increases in 1978 and 1979 were brought about mainly by an extensive promotion campaign in major consuming regions. Mangoes were promoted by a series of traditional techniques including in-store samples and displays and media advertisements. Kenya was the principal exporter to the West German market in 1975-77, but has now lost its place to Mexico and South Africa. Kenya, however, is the only supplier that is able to supply mangoes the year-round.

Preferred varieties are the Haden from Mexico, the South African Kent and Zill, the Amelie or Julie from Mali rather than the Kenyan varieties of Ngowe and Apple. The fruit is packed into single layer cartons holding 12 to 16 individual fruits.

During the period November-April, 1979-80, Kenyan and Malian mangoes brought between Deutsche Marks (DM) 4.25 and DM 5.75 per kilogram and wholesale prices of Mexican mangoes averaged about DM 6.25. In July, 1982 fresh mangoes were wholesaling at DM 4.75. In terms of U.S. dollars or 1980 DMs, the wholesale price of mangoes has declined substantially. 1/

Very little information was obtained relating to the volume of imports of canned mango products into the Federal Republic. It is known, however, that the Philippines exported 35.7 MT of canned mangoes in syrup to West Germany in 1980. The FOB and CIF values of these shipments averaged $1,443 and $1,490 per MT, respectively. On a weight per No. 2 case equivalent, these values translate to $20.30 per case FOB and $20.96 per case CIF.

1/ Exchange rates used were: US$1 = DM 1.94 in 1980 and DM 2.46 in July, 1982.

Information regarding other crops was not obtained as data on imports were not published. Export data published in Thailand's trade statistics showed that 721 kilograms of durian was shipped to the Federal Republic in 1980 at an FOB Bangkok value of $1.43 per kilogram. 1/

c. Trade Regulations and Distribution Channels. After acceptance at the port of entry, tropical fruits are distributed through the following channels:

(1) Integrated trade, i.e. consumer cooperatives such as Co-op AG, and GEDELFI,
(2) Associated trade, e.g., retailer's cooperatives such as EDEKA and REWE, and
(3) Independent importers/wholesalers.

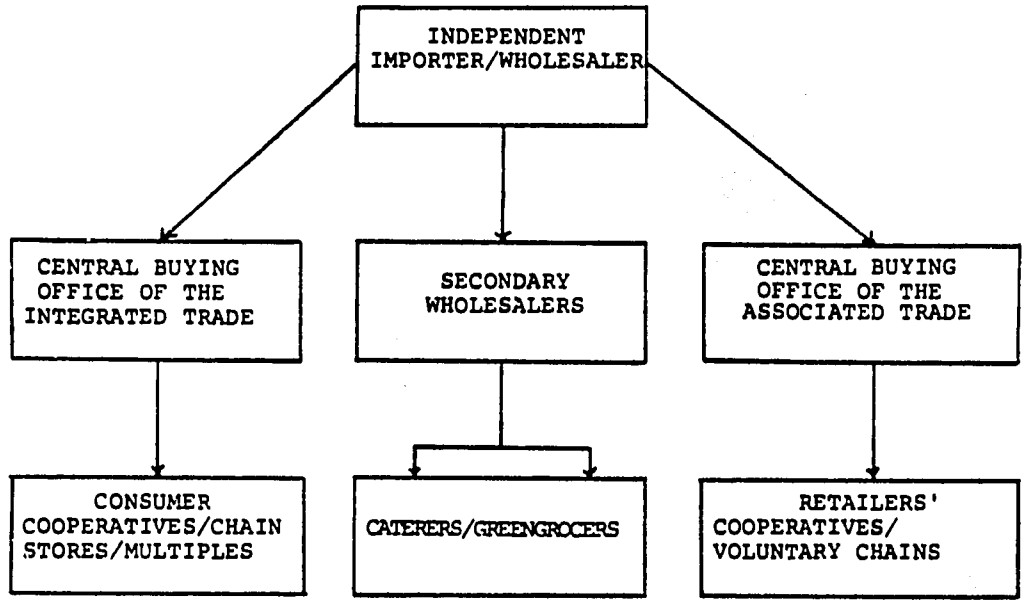
The integrated and associated traders import only those commodities arriving in large quantities such as potatoes, citrus fruit, and deciduous fruit; tropical or exotic fruit is imported by the independent importers/wholesalers. A schematic showing distribution channels is given in Figure 21.

Importers receive the produce on consignment, taking an 8 to 10 percent commission on the selling price. Importers are located mainly in Bremen, Hamburg, Frankfurt, Munich, Cologne, and Stuttgart. Principal firms are listed in Appendix Q-7.

Customs duties and levies are the same as those discussed earlier for France and the United Kingdom and are set down in Appendix R. A value added tax of 5.5 percent is added on all tropical fruit and nuts, irrespective of the shipment's origin.

1/ 1 US$ = 20.63 Bahts, 1980.

FIGURE 21. TRADE CHANNELS FOR TROPICAL FRUIT IN THE FEDERAL REPUBLIC OF GERMANY



SOURCE: ITC UNCTHD op cit

Imported goods are sampled at the port of entry for prohibited pesticide residues. If residues are above set tolerances, the shipment is rejected and not allowed to enter the channels of trade. 1/ All shipments must be accompanied by a phytosanitary certificate.

10. The Netherlands

a. General. Although the Netherlands is one of the largest importers of tropical fruits and vegetables in Europe, its main fort is its function as a central point for re-exportation. It enjoys several advantages as a re-exporter:

1/ Residue tolerances are published by Bundesministerium fur Jugend, 105-107, Kennedy Allee, 5300 Bonn - Bad Godesberg.

(1) It is centrally located in western Europe and is linked by excellent communications with principal European cities;

(2) The port of Rotterdam, the largest in Europe, is well equipped to handle shipments of fresh produce of all types; and

(3) As a large exporter of its own produce during the summer season, the Netherlands has built up a stable trade with European traders and supermarket chains that continue to buy imported produce in the off-seasons.

The Netherlands has built up its lucrative produce trade in Europe via hothouse production. It has over 8,000 hectares of hothouses, an amount that represents one-quarter of the total hothouse capacity in the world.

The actual volume of fresh and processed tropical fruits considered for the Mudon project, while a small percentage of the potential market, is nevertheless important and can be considered for further development

b. Products--Mudon Project

(1) Pineapples. Table 107 sets down the quantities imported, re-exported and apparent consumption of fresh pineapples and mangoes.

The above shows the apparent consumption as slightly over 4,000 MT in 1978-79. The figures for 1975 and 1976 appear to be extremely low and probably are the result of statistical omissions.

TABLE 107. NETHERLANDS IMPORTS, RE-EXPORTS, AND CONSUMPTION OF FRESH PINEAPPLE AND MANGOES, 1975 TO 1980

Year	Imports	Re-exports	Apparent Consumption
	----------metric tons----------		
Fresh Pineapple			
1975	2,638	2,332	306
1976	2,833	2,509	324
1977	5,660	2,539	3,121
1978	9,530	4,856	4,674
1979	9,489	5,048	4,441
1980	8,076	NA	NA
Mangoes a/			
1975	539	76	463
1976	673	64	609
1977	831	100	731
1978	1,569	330	1,239
1979	1,534	473	1,061

a/ 1980 data not available.

SOURCE: ITC UNCTAD op. cit.

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The Ivory Coast was the leading supplier to the Netherlands during the period investigated and appears to be firmly established for the future. Pineapple is considered a luxury item by consumers in the Netherlands and no significant increase in consumption is expected except, perhaps, in the re-export area.

In canned pineapple imports, the Netherlands ranked fourth among the European markets surveyed. In 1980, the Netherlands imported 16,243 MT of canned pineapple, about 30 percent more than in 1979. The Philippines supplied 7,834 MT of canned pineapple to the Netherlands in 1980, an amount that represents

48 percent of total imports to that country. The FOB and CIF unit values of these shipments were $410.00 and $522.60 per metric ton, respectively. Converted to unit values per No. 2 case equivalents, these values are $6.69 and $8.53 per case, FOB and CIF basis. In addition, the Philippines shipped 12.1 metric tons of single strength pineapple juice to the Netherlands in 1980.

(2) Mangoes. Imports leveled off in 1978 and 1979, but the large increase in mango imports (Table 107) over the five-year period makes the Netherlands the third largest European market after the United Kingdom and France.

The rising market for fresh mangoes in the Netherlands comes largely from the sizeable Indonesian community which uses it fresh and in cooking. Also, a large part of the indigenous population has lived overseas in former Dutch colonies, thereby becoming aware of the mango's place among the premier tropical fruits of the world. In 1979, Mali was the largest supplier (29 percent), followed by Mexico (17 percent), Kenya (7 percent), France (6 percent), and Senegal (4 percent). Wholesale prices of fresh mangoes in cartons of 12 to 15 pieces of fruit averaged fl.5.25 to fl.6.00 per kilogram in 1980. Based on wholesale price behavior in France and West Germany since then it is safe to assume that 1982 prices have remained in the same vicinity.

Trade statistics for the Netherlands do not report quantities imported of canned mangoes. It is known, however, that the Philippines shipped 8.2 MT of canned mangoes in syrup to the Netherlands in 1979 with an FOB value of $986 per MT.

(3) Other Tropical Fruits. Total quantities of other products considered adaptable to the Mudon project were not reported in the Netherland's trade statistics. In Table 108, export trade statistics from Thailand and the Philippines show the Netherlands imports in 1980.

TABLE 108. NETHERLANDS IMPORTS OF TROPICAL FRUITS, 1980

Product and Origin	Quantity (metric tons)	Unit Value (US$ FOB)
Thailand:		
Rambutan	27.4	626
Durian	15.8	822
Papaya	4.6	369
Philippines:		
Jackfruit, canned in syrup	1.6	2,519

SOURCE: Philippine and Thailand Trade Statistics, 1981.

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Although the quantities imported thus far into the Netherlands are comparatively small, trade opinion is that the market will continue to grow and that potential exporters will benefit from establishing themselves quickly. 1/

1/ Interviews with trade specialists in Rungis and London markets, 1982.

c. Trade Regulations and Channels. Distribution channels for tropical fruits follow essentially the same route as those described for other European markets. There are only a few wholesalers, based in Rotterdam, that handle the tropical products considered in this report (Appendix Q-8).

Duties conform to those applied in other EEC countries and are shown in Appendix R. A value-added tax of 4 percent is levied on all products regardless of origin. Normal phytosanitary procedures are followed, and as with other European countries a phytosanitary certificate must accompany all shipments.

11. Belgium

a. General. The Belgian market for imported produce including the tropical fruits considered in this study is supplied almost entirely by the Rungis market situated near Paris. The Rungis market is 300 kilometers from Brussels connected by an excellent highway. The Brussels wholesale produce market has only recently opened and handles mostly domestically produced products. In the French-speaking part of the country, consumers are extremely quality conscious and prefer fresh produce to frozen or canned goods.

b. Products--Mudon Project

(1) Pineapples. Imports of fresh pineapples increased in 1978-79, after showing a slight dip in 1977 (Table 109).

The Ivory Coast supplied 77 percent of the fresh pineapples imported to Belgium in 1979, and probably supplied most of the 736 MT re-exported to Belgium from France. The quantities of expensive air-freighted pineapples from Kenya have decreased

TABLE 109. BELGIUM IMPORTS OF FRESH PINEAPPLE AND MANGOES, 1975 TO 1979

Year	Imports	
	Pineapples	Mangoes a/
	--------metric tons-------	
1975	4,030	86
1976	4,859	94
1977	4,241	215
1978	5,710	309
1979	6,267	322

a/ 1979 mostly mangoes.

SOURCE: ITCDNC, TADIGAD, o.p. cit.

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over the period investigated and potential exporters are advised to concentrate on sea deliveries. Sea-freighted fruit was bringing about BF 25 per kilogram on the wholesale market in early 1980 ($US1.12), and is expected to be at about the same level at the present time.

Canned pineapple imports into Belgium totaled 9,051 MT in 1978 and dropped slightly to 9,019 MT in 1980. The 1980 shipments averaged $473, and $585 per MT FOB Manila and CIF Antwerp, respectively. 1/ Single strength juice imports from Manila totaled 13.6 MT in 1980 that brought $273 per MT FOB.

(2) Mangoes. Table 109 gives total imports of fresh mangoes into Belgium for the years indicated. Fairly regular supplies are supplied by re-exports from France and the Netherlands.

1/ In terms of cash of No. 2 can size requirements the unit FOB value was $6.65 and rose to $8.23 per case CIF.

Opportunities for entering the Belgian market are somewhat limited by its small size and the experience and status of its traditional suppliers. In 1980, Mexican origin mangoes brought the best price ranging from BF 60 to BF 90 per kilogram ($1.92 to 2.88).

(3) Other Products. Investigation of trade statistics showed that Thailand shipped small quantities of durian and rambutans to Belgium in 1980. These small quantities--107 kilograms of rambutans and 66 kilograms of durian--had FOB unit values of $0.66 for durians and $0.89 for rambutans.

c. Trade Regulations and Distribution Channels. Belgian importers of fresh and processed tropical fruit are located in Brussels and Antwerp. Products are imported either by sea or by air through the international airport in Brussels. A large proportion of tropical fruits arrive by motor truck from Rotterdam or Paris. Imports are purchased on commission, the importer taking 8 to 10 pecent of the selling price as payment for his services. Of the few major importers for the Belgian market, most have offices in the Brussels wholesale market which was opened in January, 1981 (Appendix Q-9).

Belgian tariffs and trade regulations are the same as those outlined for the United Kingdom and France in earlier sections of this report (Appendix R). A value-added tax of 6 percent is levied on all products irrespective of origin. European Common Market standards of quality are applicable to all imports.

12. Switzerland

a. General. In spite of the small Swiss population of 6.29 million of which 1 million are expatriate, there is a good market for exotic fruits and vegetables that is backed by high personal incomes and the ability to pay. The Swiss, like the French, prefer fresh produce over canned and frozen despite the

higher costs of the fresh products. The market, although small, offers good opportunities for potential suppliers of fresh tropical fruits that could easily spill over to a better demand for processed varieties.

b. Products--Mudon Project

(1) Pineapple. Table 110 shows fresh pineapple imports into Switzerland have remained fairly constant between 2,500 and 4,000 MT over the five-year period.

The Ivory Coast supplied about 66 percent of the fresh fruit going to the Swiss market in 1979. There has been some problem with quality of the Ivory Coast fruit as it is transported by ship to the port of Marseilles, and then by truck or train to Switzerland. Air-freighted fruit from Kenya has been growing in demand.

As in all European markets, there are two markets for fresh pineapple in Switzerland: the luxury market which is supplied by air-freighted fruit from Kenya, and the mass market which is supplied by sea-freighted fruit from the Ivory Coast. The preferred weight for household consumption is slightly over 1 kilogram, but there has been a tendency for use of larger fruit.

TABLE 110. SWITZERLAND IMPORTS OF FRESH PINEAPPLE AND MANGOES, 1975 TO 1979

Year	Imports	
	Pineapples	Mangoes
	--------metric tons-------	
1975	2,446	71
1976	2,760	70
1977	2,598	107
1978	4,295	173
1979	3,886	237

SOURCE: International Trade Center Estimates (UNTAD/GATT).
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Wholesale prices for Ivory Coast sea-freighted fruit ranged between Swiss Franc (SF) 1.80 and SF 2.00 per kilogram. Air freighted Kenyan pineapples ranged between SF 2.80 and SF 3.20 per kilogram in 1979-80. With the Swiss Franc valued at SF 1.7675 in terms of 1980 US dollars, the above prices ranged from $1.02 to 1.13 for the Ivory Coast and up to $1.81 for the air-freighted Kenyan shipments. Wholesale prices for Swiss deliveries of fresh pineapples were not obtained for 1982, but are assumed to be equivalent to those in other European markets i.e., unchanged or slightly less in the latter period, reflecting the impact of a prolonged recessionary period in the general economy.

Switzerland is a poor market for canned pineapple products. In 1980 only 612 MT were imported into Switzerland; none was reported for 1979.

(2) Mangoes. The Swiss have increased their imports of fresh mangoes by a factor of 3 during the period 1975-79 (Table 110). Interviews with trade personnel in the Rungis and Covent Garden markets expect the rising trend in imported mangoes to increase. Trade optimism, as in other European markets, is tempered by uncertainties regarding the impact of the continuing recession.

Kenya has been the traditional supplier to the Swiss market, but recently Mexico and Mali have entered the market significantly. Small shipments have also arrived from Venezuela, Upper Volta, Sri Lanka and Haiti. 1/

1/ Thailand reported exports to Switzerland of 365 kilograms in 1980.

All shipments to Switzerland are by air. Fibreboard cartons holding between 4 and 6 kilograms of mangoes, carefully packed and padded, are used in handling the product. The fruit should be uniform in size, each fruit weighing between 320 and 420 grams (11 to 15 ounces). Wholesale prices have averaged, with very little month-to-month variation, between SF 4.00 and SF 6 per kilogram.

No canned mangoes were imported into Switzerland during the periods investigated.

(2) Other Products. Thailand reported shipments of 1.5 MT of durian and 4.2 MT of rambutans to Switzerland in 1980. The shipments of durian and rambutans, like those to other European countries, were for the ethnic market. However, it is probable that some spill-over in demand for durian and rambutans will occur among the indigenous population. Thailand also exported 7.1 MT of the tropical fruit grouping (avocados, mangosteens, and guavas) in 1980.

c. Trade Regulations and Distribution Channels. Swiss custom duties are specific, e.g. the duty is levied on the weight of the product imported and not on its value. The customs duties on the tropical fruits considered in this study are given in Appendix R. The table shows that the import duties on the products considered are quite low. A 3 percent statistics tax is levied on the total duties paid, but there is no internal tax.

Phytosanitary regulations concerning foodstuffs are given in the Ordonnance Reglant Le Commerce Des Denrees Alimentaires (ODA), published by the Service Federal de l'hygiene Publique, Bern. No trace of the insecticide endrin and of the fungicide captan is allowed on fruits and vegetables entering Switzerland. No documents are required other than the customary phytosanitary certificate.

The distribution of fresh and processed fruits and vegetables is well organized. Two supermarket chains, Migros and Coop, dominate the market, along with a few specialized importers supplying major cities of Zurich, Bael, and Geneva. As noted earlier, imports arrive by train or truck from European harbours or by air direct to the international airports of Zurich and Geneva. A selected list of major importers is given in Appendix Q-10.

13. Sweden

a. General. Sweden differs in many respects from the rest of Europe. Distances between market points are much greater and the conditions for shipping and handling are more difficult because of climatic factors. Sweden is a discriminating market in that its citizens have a high standard of living that enables them to pay for highest quality product. In terms of quality parameters, Sweden is the most difficult to supply among all European nations. In addition, Swedish consumers are conservative in their eating habits and only a few of the exotic fruits considered in this study are currently purchased (e.g. pineapples and mangoes).

b. Products--Mudon Project. The principal products consumed in fresh form are pineapples and mangoes. Because of the large proportion of Swedish women in the work force, frozen foods have assumed great importance in their food budget. However, Sweden is about average in the import and consumption of fresh pineapple and mangoes as shown in Table 111.

Although the Ivory Coast has been the leading supplier to the Swedish fresh pineapple market, there has been increased competition from other exporters, namely Honduras and Kenya. A massive promotional campaign for Kenyan fruit was launched

TABLE 111. SWEDEN IMPORTS OF FRESH PINEAPPLES AND MANGOES, 1975 TO 1979

Year	Pineapples	Mangoes
	----------metric tons---------	
1975	956	NA
1976	1,222	12
1977	1,690	32
1978	1,356	17
1979	1,499	18

SOURCE: International Trade Statistics (UNTAD/GATT)

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during 1976 and lasted on into 1977 that resulted in considerable improvement of Kenya's competitive position. In addition, Kenya normally supplies larger sized pineapples than does the Ivory Coast which has increased the demand in the latter years of the 70's.

Sweden is not much of a factor in the canned pineapple market, having imported 4,133 MT in 1980. The quantities of frozen pineapple products imported were not obtained, but are probably at least as much as for the canned variety.

The distribution of fresh mango shipments into Sweden is uniform and unremarkable. Although there may be some displacement of South African supplies because of consumer's political convictions, the overall market for fresh mangoes appears to be static and unpromising. No canned mango were imported during the period studied.

c. Trade Regulations and Trade Channels. Swedish food distribution is distinguished by the fact that green grocers have been virtually replaced by supermarkets; the supermarkets are controlled by a few major groups. Almost all of Sweden's

fruit and vegetable trade is channeled through three firms: Kooperativa Forbundet, J.S. Saba AB, and ICA Frukt och Gronsaker AB. All three firms import, break up shipments, repack, and sell fresh and processed fruits and vegetables. The Saba group, a subsidiary of the Salen and Johnson shipping companies, handles transport as well.

Commission sales are estimated to cover about 80 percent of all imports into Sweden, but recent trends by the three controlling companies indicate an increasing preference for buying at firm prices. Commission charges in Sweden are typical of those charged in other European nations, e.g. 8 to 10 percent of the selling price.

Tropical fruits considered in this study are admitted duty free in Sweden (pineapple, mangoes, rambutans, etc.). Sweden is considered an open market for tropical fruits and vegetables and no quantitative and few qualitative restrictions are mandated. However, the Swedish consumer is perhaps the most quality conscious in Europe, and potential exporters to this country must take care that only top quality grades are shipped. A value-added tax of 23.65 percent is levied on all imported fruits and vegetables.

14. Austria

Austria differs from other European markets in that its per capita income is relatively low, its eating habits are conservative, and it has closer relationships with Eastern European countries, particularly Hungary and Yugoslavia. Related to these more distinctive differences, Austria is more price than quality conscious and individual families tend to carefully control food budgets.

Despite the above negative characteristics, the Austrian market can be developed into good export possibilities with careful promotion and merchandising activities.

The market for pineapples has stabilized over the 1978-79 period at about 1,000 MT. South Africa is firmly established in this market and air freights quantities of fresh pineapple to the Vienna market throughout the year. Austria imported only 68 MT of canned pineapples during 1980.

Consumption of fresh mangoes has expanded with the increase in the patronage of Chinese restaurants in Vienna, but the market is small, amounting to around 150 MT per year. A survey conducted by the International Trade Center in 1981 found that importers of fruits and vegetables were very interested in new sources of supply for mangoes.

Although the Austrian market is small and concentrated almost entirely in Vienna, it would be worthwhile for new or potential exporters of tropical fruits -- primarily pineapples and mangoes -- to investigate its potential further in relation to consumer response to minor promotional campaigns (Appendix Q-11 gives a list of Austrian importers).

15. Denmark

Despite its small population of only 5 million, Denmark's per capita income of over $9,000 makes it one of the wealthiest nations in the world. Tropical fruits are already appearing on the market and further promotion should widen the market considerably.

Fresh pineapple imports increased from 906 to 1,665 MT over the three year period 1977-79. Canned pineapple imports were

3,211 MT in 1980. Fresh pineapples are supplied by the Ivory Coast, Kenya, and Honduras; the latter taking over leadership in 1979 with exports of 452 MT.

Danish trade statistics group mangoes with guavas and mangosteens. These products, all supplied by Kenya, reached 34 MT in 1977 but have since fallen 62 percent, to only 13 MT in 1979.

New or potential exporters to this market are advised to try to enter this market early before current suppliers become too well established. The market for fresh and canned pineapples seems among the most promising, but other tropical fruits such as mangoes, mangosteens, and processed guava jellies should become popular with aggressive promotion and merchandising. Major importers are listed in Appendix Q-12.

16. Norway

With a population of 4 million and high per capita incomes, Norway should be a good market for exotic fruits and vegetables. However, this is not the case and Norway's imports of the products considered in this study are very limited. Imports of pineapples, fresh from the Ivory Coast, have stagnated at about 300 MT per year. No mangoes are imported. The market will remain small unless special efforts are made to develop it.

Tropical fruits and vegetables are imported free of duty. A list of importers in Norway is given in Appendix Q-13.

17. The United States

a. General. The United States, with a population of about 230 million and a per capita income over $8,500, is the leading

consumer market in the world. With the exception of fresh pineapple, in which Japan leads, the United States imports greater quantities of tropical fruits than any other country.

Total trade volume in 1979 was 415 million MT. Of this amount, imports accounted for 22 percent. Sea shipments of fresh fruits and vegetables from the Orient and other Pacific points are normally loaded off at the ports of Seattle, San Francisco, or Los Angeles; all of which have excellent container handling facilities. Shipments of canned or dried products utilize the same seaports where they are re-shipped to final destinations by rail and/or truck, or they may continue on through the Panama Canal to ports on the Gulf or East coasts.

b. Products - Mudon Project. Trade statistics for the United States showing imports and CIF unit values of selected tropical fruits and nuts are given in Table 94. All fruits considered for the Mudon project are shown to be imported into the United States except mangosteens and fresh passion fruit. The latter fruits are known to enter trade channels occasionally, but are grouped together and included in a general category.

Tropical fruits are largely imported from the Americas and the Philippines. Among the Asian countries considered, the Philippines are the largest suppliers, primarily because Del Monte, Castle & Cooke, and United Brands have large agricultural holdings there. Thailand also enters into the processed pineapple trade with the United States largely because of significant shipments (75,000 MT in 1981) from Castle & Cooke Corporation's growing and processing facilities in that country. The United States does, however, import pineapple products from several other countries located in Asia, Africa and Central America.

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Fresh mango imports into the United States come largely from Mexico; guavas and papayas in fresh and processed forms also enter from Mexico and other Latin American countries. The United States imports of cashew nuts leads all countries, amounting to 29,578 and 27, 932 MT of shelled nuts in 1980 and 1981 (Table 94). In 1981, most United States imports of processed cashew nuts came from Brazil (10,371 MT) and Mozambique (9,776 MT). As noted earlier, India is a large supplier and will probably remain a significant source in the future. Table 94 shows that the United States imports durian, jackfruit, ginger, bamboo shoots, guavas, and other tropical fruits that, in processed or fresh form, could be grown in the Mudon area of Burma.

c. Trade Regulations and Channels. Trade channels for tropical fruits and nuts imported into the United States follow the usual trinity -- importer, wholesaler, retailer. The supermarkets and chains also buy pineapples and mangoes directly from export organizations, but will usually rely on wholesalers/importers for supplies of small volume products. The products handled by wholesale import agencies are normally purchased on commission, the importer taking 8 to 10 percent of the selling price as payment for his services.

Average unit CIF prices for a number of tropical products are given in Table 94. Wholesale prices in major markets were not obtained except for processed pineapple products. 1/ As of March, 1982, market prices for Thailand food service cases of 6/10's were $15.80 for slices and chunks, tidbits $14.95, and crushed $12.90. In January, 1982 prices for consumer-size solid pack were $11.56 per case of 24/2's slices and chunks.

1/ Prices for processed pineapple products are given periodically in the weekly publication: Report on Food Markets by The American Institute of Food Distribution, Inc., 28-06 Broadway, Fairlawn, NJ 07410

The United States, like Japan, imposes very rigid phytosanitary, pesticide, and pest control regulations. Fruits coming from the Orient must be disinfected or fumigated against the oriental fruit fly, mango fly, melon fly, coddling moth, etc. Methods and formulas that must be used in disinfecting and fumigating procedures are similar to those specified by Japan that are set down in Appendix R. All produce is given a thorough inspection by the USDA and will be denied entry if not up to control specifications. 1/

In general, there is a 17.5 percent ad valorem tariff on most fresh and processed fruits and vegetables entering the United States. On November 24, 1975, President Ford signed Executive Order 11888, which implemented the Generalized System of Tariff Preferences authorized under the Trade Act of 1974. The Executive Order designated eligible commodities, including those programmed for the Mudon project, to be duty free within limits established by the Act. Title V, Section 504 C(1) B(iii) excludes countries that discriminate against or impose unjustifiable or unreasonable barriers to United States commerce. Former supply countries such as Ecuador and Venezuala have been excluded because of their membership in OPEC. Burma will qualify under the Trade Act and can ship to the United States free of duty. However, it will be expensive to comply with the rigorous regulations against possible insect infestation, pesticide and fungicide residuals and other phytosanitary conditions for fresh fruits. All fresh shipments of tropical fruits entering the United States must be fumigated or otherwise treated to insure compliance with these strict regulations.

1/ All tropical fruits first must have a permit specifving that the treatment for insects has been accomplished.

d. Summary Comments. The United States market for fresh tropical fruits and nuts is expanding and can continue to do so with conventional promotional and merchandising techniques. Post-harvest costs, particularly those involving chemical or other treatments against insect infestation, are high. Other supplier countries are meeting United States requirements, however, and there is no reason to assume that Burma cannot do likewise. However, the medium term projected growth for Burma's tropical fruit and nut industry is not large scale and it is anticipated that Burma can find markets for its fresh produce in the Mideast, Asia, and Europe where phytosanitary requirements and insect control regulations are less severe than in the United States.

With processed products, the scale of output in the Mudon project is also relatively small compared to current United States suppliers.

18. Canada

a. Products - Mudon Project. Canadians have become acquainted with exotic fruits because of the mass tourist movements to tropical areas that has developed steadily over the last two decades. However, trade statistics do not show imports of individual fresh tropical fruits except bananas. It is known, however, that the Philippines export a variety of fresh tropical fruits to Canada as shown in Table 112.

Canned pineapple imports amounted to approximately 35,000 MT in 1980, latest year for which complete data are available. Among the Far Eastern countries surveyed, Thailand and the Philippines export large quantities of canned pineapple to

TABLE 112. PHILIPPINE EXPORTS OF FRESH TROPICAL FRUITS TO CANADA, 1979-80

Product	Unit	Quantity	FOB Value	CIF Value
			-------US dollars------	
Pineapple	metric tons	4.5	$348.00	$2,713.00 a/
Jackfruit	kilograms	508	1.81	1.99
Guavas b/	kilograms	62	0.68	NA
Mangoes b/	metric tons	5.1	824.00	NA

a/ Implies air-freight and insurance costs of $2,365 per MT or about $1.07 per pound. This compares to 1983 air-freight rates of $1.25 per MT from Singapore to San Francisco as quoted by Flying Tigers, Inc. and $0.73 per pound for shipments over 1 MT to Paris from Bangkok as quoted by Thai Airlines.

b/ 1978-79 data.

SOURCE: Philippine Trade Statistics, 1981, op. cit., Table 17, pp. 523-534.

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Canada. 1/ In 1980 and 1981, Thailand shipped 7,309 and 9,864 MT of solid pack canned pineapple to Canada plus 550 MT of juice concentrate. 2/

1/ The United States also exports substantial quantities to Canada: (1) 5,067 MT in 1980 and 6,517 in 1981 of canned solid pack; (2) 1,639 metric tons of s/s juice plus 65 MT of 61 percent brix concentrates in 1981 as reported by FAS/USDA, August, 1982.

2/ United States Embassy estimates, Agricultural Attache's office, Bangkok, April 7, 1982.

The Philippines are the largest supplier of tropical canned fruits to Canada and will be the largest competitor of any new producers, including Burma. The amounts exported to Canada are given in Table 113.

b. Trade Channels and Regulations. Canada operates largely like the United Kingdom and France in distributing its imported tropical fruits and nuts, that is, through importer/wholesalers to other intermediary wholesalers, supermarkets, chains, and specialty shops. The importers normally sell on commission, charging 8 to 10 percent of the selling price as payment for their services.

Canada, like other developed countries surveyed, has a preferential system of tariffs for developing countries. Products imported from Burma would enter duty free with minimum phytosanitary and insect control regulations. A Phytosanitary Certificate must accompany all shipments along with the usual papers such as bill of lading, country of origin, description of contents, labeling, etc. The fresh and processed fruits should be packaged securely and care must be exercised at the shipment's origin and destination because of temperature extremes.

19. Burma

a. General. Burma's population of about 32 million has been growing at an annual rate of 2.2 percent. Nearly 90 percent of the population depends on agriculture for its livelihood. Over 45 percent of the gross national product of 5.2 billion dollars is contributed by the agricultural sector. Burma's annual per capita income of less than US$200 is among the lowest in the world. The country is, nevertheless, well

TABLE 113. PHILIPPINE EXPORTS OF CANNED TROPICAL FRUITS TO CANADA, 1980

Product	Quantity	Unit Values a/ FOB Per Ton	FOB Per No. 2 Case	CIF Per Ton	CIF Per No. 2 Case
	(metric tons)	US dollars			
Pineapple	11,407.0	485.00	6.82	585.00	8.23
Tropical fruit salad/cocktail	697.8	709.00	9.97	814.00	11.45
Jackfruit	9.4	2,290.00	32.22	2,427.00	34.13
Mangoes (syrup)	1.8	1,330.00	18.71	1,467.00	20.63
Pine juice (s/s)	3,900.0	295.00	4.14	395.00	5.55
Pine juice (conc.)	201.6	456.00	6.41	547.00	7.69

NOTE: Canada also imports substantial quantities of cashew nuts: 3,276 MT in 1980 with CIF value of $5,545 per MT.

a/ 1 case 24/No. 2's = 31.01 pounds giving 71.1 24/2 cases per MT. USDA Conversion Factors for fruits and vegetables, 1976.

SOURCE: Philippine Trade Statistics, 1981, op. cit.

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endowed with natural resources, but needs foreign exchange to purchase technology, equipment, and management expertise. Burma's territory amounts to about 260,000 miles^2 of which 45 percent is considered arable. Less than one-half of the cultivable land is presently under cultivation.

Nearly 90 percent of the foreign trade passes through the Port of Rangoon. Ports serving the Tenasserim Division, in which the Mudon project is located, are Moulmein, Tavog, and

Merqui. Moulmein, which is only 14 miles from the proposed plant site will be the principal port serving the Mudon area. This port will need additional weather controlled warehousing and containerized handling facilities to effectively handle produce outshipments from the Mudon project. Well equipped shipping lines such as NOL, MITSUI, and MAERSK call irregularly at Rangoon. The Burmese National Merchant Marine is ill-equipped with modern ships and adequate harbor handling facilities at the present time and heavy outlays will be required to bring the merchant fleet up to modern standards.

A railway spur and siding connecting the plant site with the nearby main railway is planned. This provides rail access to Moulmein, Rangoon, Mandalay, and north to Myitkyina. The Burma National Airline has a network of internal services and connects to nearby international airports in Bangkok, Calcutta, Singapore, and Chittagong. Moulmein has an airport capable of handling jet carriers, but will need additional facilities to handle air shipments of fresh tropical fruits destined for export markets outside Burma. Additional facilities and equipment requirements range all the way from warehousing, container handling, runway improvement to modernization of the Burma fleet of airplanes to include modern jet aircraft of the Boeing or Douglas type e.g., Boeing 727, 747 or DC8-10. Although the Rangoon International Airport is served by several foreign air lines, Burma does not allow foreign air carriers to serve other cities. Therefore, air-freighted produce originating from Mudon must be transported to Moulmein (14 miles) and then reloaded onto Burma Airlines for transport to Rangoon or, possibly, to Bangkok, Singapore or other airports. Double and triple handling of temperature sensitive and fragile perishables is costly in labor, time, and quality. To effectively compete in marketing fresh air-freighted produce, Burma must open the Moulmein Airport to one or more international air carriers.

Thai Air Lines, for example, presently serves Rangoon and has experience in handling cargoes of fresh pineapples, mangoes and other tropical fruits to the United States, Middle East, Asia, and Europe.

A good asphalt road connects the plant site with Moulmein. In-project roads, however, are non-existent and must be constructed as part of project development. A power line from the Moulmein electric sub-station will need to be constructed to provide power for the project's requirements. Telephone lines, connecting with Burma's national network will also have to be installed before construction crews commence operations at the project site.

Burma reopened its border to foreign aid and commerce in 1976. Since then, the GNP has grown at an annual rate of 6 percent, primarily because of increased exports of rice, pulses, fish and prawns, rubber and animal feeds. Burma has a low population density and a high literacy rate. These factors combined with low labor and land costs could give Burma a competitive advantage over many of its neighbors and could potentially make it one of the most important food producers in Asia. Reflecting the importance of the agricultural sector, a major portion of bilateral and multilateral assistance has gone to that sector. Foreign donors have contributed some US$450 million for agricultural and fishery projects. USAID is currently planning a major new project in oilseed and maize production and processing which involves some US$35 million in loans and grants over a multi-year period.

b. Burma's Domestic Market. As noted earlier, Burma now has only one canning factory. This cannery, located in Mandalay, annually processes only 1.3 million pounds (about 50,000 cases) of various fruits, vegetables, and meats. With

negligible imports of canned goods, the above production implies a per capita consumption of less of 0.04 pounds for all products. It is apparent, therefore, that a large domestic market for canned goods can be rapidly developed provided general economic conditions continue to improve. Aside from the civilian consumption potential, Burma maintains a sizeable military force for defense and internal security which provides an additional market outlet for canned goods of all types. Although Burma's national economic development strategy is based heavily on the earnings of foreign exchange through agricultural exports, the existence of a potentially large domestic market reduces the risks involved in meeting the price and quality demands of a highly volatile international marketing system.

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VIII. ECONOMIC AND FINANCIAL ANALYSIS
MUDON FRUIT FEASIBILITY STUDY

A. General

This section brings together the material and information on agricultural/processing investment, and operating costs developed in the preceding sections that, with additional data on the cost of capital and inflation, provides the basis for a financial analysis of the project's feasibility. The analysis is made from the viewpoint of increasing the tangible economic value of the project to its owner--the Burmese Government. It is recognized that many of the benefits are intangible and therefore impossible to measure in financial terms.

B. Methodology 1/

Most investments require an immediate initial capital outlay for construction of facilities that will return cash in one or more periods. Money, however, has a time value in that its present value is worth more than its value at some future date. The time value of money can be visualized as having three components:

$$T = A + R + I$$

Where T = the time value of money
A = alternative uses of money
R = an allowance for risk or uncertainty
and I = an allowance or premium for inflation

1/ For a more extensive treatment see Aplin, Richard D., Casler, George L., and Cherl P. Francis, Capital Investment Analysis Using Discounted Cash Flows, 2nd Edition, Grid Publishing Co., Columbus, Ohio, 1977.

The term "A" is a pure concept, i.e., it represents the return the investor requires for the use of his funds in the absence of both uncertainty (risk) and inflation. The term "R" represents an allowance for the fact that most investments involve risk or uncertainty and management must consider this in weighing the feasibility of new or alternate investment ventures. Although more sophisticated methods that employ probability distributions and risk aversion functions are available, the application of a higher discount rate for high-risk investment is the most commonly used technique in practical situations.

The term "I" in the above equation represents the impact of inflation on the time value of money and will affect both the cash flows of an investment project and the cost of capital to the investor. The general method for handling inflation is to consistently handle the cash flows in terms of a common unit of measure, i.e., in terms of real purchasing power or physical value units (Kyats). In this analysis, the cash flows are expressed in terms of physical value units (Kyats) that inflate the individual annual flows by the anticipated percentage rate of inflation. 1/

Given the above concepts, it is clear that a method is needed to compare cash flows occurring over future time periods. Two approaches are commonly used to evaluate investments: the discounted cash flow method, and the internal rate of return method. 2/ Both methods are used in this analysis.

1/ $FV = PV (1 + i)^n$ where FV = future value of the cash flow, PV is present value of the cash flow; "i" is the forecasted rate of inflation; and "n" is the number of years.

2/ Other methods such as the accounting rate of return and payback are used but are considered inferior because they do not consider the time element.

1. The Discounted Cash Flow Method

This procedure converts all cash flows to a lump sum to the present time; thus future cash flows are discounted to present value. The appropriate discount rate to be used is the "cost of capital" for the investor; this represents the foregone opportunity for future money benefits in alternate investments. The "cost of capital" or "cut-off" discount rate used in this analysis is identical to the time value of money discussed above and includes discount rates for alternate investment yields, risk/uncertainty, and inflation.

The decision rule is that an investment will be attractive to the investor if the estimated return, discounted at the cost of capital (cut-off rate), exceeds the investment cost, also discounted at the cost of capital. A more specific algebraic expression for the discounted cash flow model is:

$$NPV - INV + \sum_{t=1}^{T} \frac{C_{ft}}{(1+R)^t}$$

Where NPV = net present value

$\frac{C_{ft}}{(1+R)^t}$ = the expected cash flow in year t

INV = initial investment

T = economic lifetime of the investment (t-1...T)

R = cost of capital or cut-off rate

The original investment, INV, is negative because it represents a cash outlay. As the cash returns flow in, NPV will increase. When NPV=0, the break even point on the investment is reached; if NPV is positive the investment is profitable.

2. The Internal Rate of Return Method

This approach involves finding the rate of discount that will make the present value of the cash inflows (benefits) from an investment equal to the present value of the cash outlays required by the investment. This rate of discount is called the "yield of the investment". The decision rule is as follows: if the yield of the investment in percentage terms is greater than the investor's minimum acceptable percentage rate of return, the investment is considered desirable. The same formula applies as in the discounted cash flow method described earlier except the internal rate of return method sets net present value equal to zero (NPV=0).

$$0 = - INV + \sum_{t=1}^{T} \frac{C_{ft}}{(1+R)^t}$$

Where INV, T, C_{ft}, and R are the same as defined earlier.

Solving for R gives the rate of return (IRR) on the investment.

3. Relative Merits of the Two Methods

Both the net present value and internal rate of return methods represent guides to investors that, if used correctly, will suggest the same decision under most circumstances. The internal rate of return method is somewhat easier to use when programmed on a computer because the sequence NPV, C_f, ..., C_{fn} may contain only one sign reversal, i.e., if the first several cash flows are negative, they must be followed by positive values only. Both methods are used to evaluate investment proposals for the Mudon project, depending on the

nature of the discounted cash flows involved. In cases where net present value analysis is required, i.e., where sign reversals are greater than one, trial and error on the discount rate (cost of capital) is employed to determine the point near where the discounted cash flows equal zero. The discount rate then is considered as the return to the project which is consistent with the internal rate of return.

The formulas for the net present value and internal rate of return methods are obviously highly simplified representations that include within them many complex elements and timing patterns. A brief discussion of these elements follows.

4. Cost of Capital

The cost of capital or cut-off rate is a key factor in the discounted cash flow internal rate of return techniques for evaluating investment proposals. As noted earlier, the cost of capital involves the real cost of capital plus a risk or uncertainty premium. With the Mudon project, it is assumed that the government will attempt to borrow at least the amount of foreign exchange required to purchase much of the equipment plus payment for the salaries and maintenance of specialized expatriate personnel. This expense category is assumed to end before the end of the third year of operation in the agricultural, processing, and can manufacturing operations. Phasing out of expatriate salary and maintenance expenses will substantially lower the cash outflows and contribute heavily to the net revenues and profit expectations for the project.

As established by Foodstuff Industries Division of the Burmese Government, equity capital provided by the Burmese government entails interest rates of 5 percent for long-term loans and 8 percent for working capital or other short-term capital requirements. With these rates, the cost of capital

drops dramatically from a cut-off rate of 24 percent to only 16 percent. 1/ In order to describe the impact of various interest rates, discounted cash flow analyses are run for a series of possible loan rate structures for the Mudon project. Results of these alternative or sensitivity analyses are set down in tables that follow.

5. Operating Cash Flow

Discounted cash flow schedules used in this study are defined as gross sales revenues less operating and maintenance costs plus long-term debt services (principal repayment and interest charges). Non-cash items such as depreciation and amortization of equipment installation and organizational expenses (included in plant investment costs) are not included in the cash flows analyzed. The investment analysis considers project feasibility on both before and after tax bases. The current Burmese tax amounts to 30 percent against net revenues. 2/ It is felt that 30 percent tax should only be applied to the final product and not to each stage in the pineapple products, i.e., growing, can manufacturing, and processing. Otherwise, the tax would increase to 90 percent of the final product. This is not practical in a very competitive business.

1/ Burma will not be able to obtain such low rates (5 and 8 percent) when borrowing foreign exchange rate. Charging these low rates to the Mudon project would involve a subsidy by the government to the project. Interest rates on short and long-term loans in the international money market average 12 to 18 percent at the present time.

2/ Letter to Experience, Incorporated from Captain Swe Mijant, Canning Projects Director, Foodstuff Industries Corporation, Burma 8/30/82. Net revenues are calculated as gross revenues minus operating costs. Debt service and depreciation are not included in reducing the taxable revenue.

6. Investment

Investment outlays include land preparation, irrigation, equipment, construction costs, and the agricultural, processing and can manufacturing components. Recall that existing supplies of pineapples, mangoes, rambutans are to be handled in a small cannery and fresh packing house. This small-scale plant will continue operations throughout the life of the project. Local Burma retail prices are used for the sale of the products from the multi-tropical fruit plant. Larger scale pineapple production and processing are scheduled to develop in phases that permit an efficient and low-cost supply of planting materials (crowns and slips) to the project. International pricing of processed pineapple is used for the sale of processed products from the large pineapple plant.

As described earlier, full production of pineapple is not scheduled until the seventh year following the initial test plantings designed to select optimum varieties and yields. The small plant is designed to handle the plantation output up to the seventh year, at which time a specialized pineapple canning facility will be constructed at a different site.

Cashew nut processing requires specialized facilities and is considered as an investment item independent of those for tropical fruit. Because of the unique nature of cashew nut processing and marketing, this component of the Mudon investment project can be evaluated independently. USAID has just surveyed the country to obtain estimates of existing stands of cashews. They have found only 1,500 trees which is not adequate. They claim that there are 5,000 acres available to be planted. If that is clear then this would be adequate production for a two-shift operation. If adequate existing

supplies are at hand, the cashew plant can be supplied from those sources; otherwise, new plantings could be scheduled in the Mudon project area or imported raw and exported in the finished state.

Similarly, a can manufacturing plant designed to supply the can requirement for the Mudon project and other canneries in Burma is also analyzed independently of the tropical fruit and cashew nut enterprises. For the first seven years the cans from that plant would supply the small tropical fruit plant and all other can plants in Burma.

Returns can be viewed as cash returns to the overall investment irrespective of equity considerations or as returns to equity only. Cash returns, on the 100 percent equity base method, are useful to estimate economic returns to the overall investment, while the equity returns procedure embraces returns to equity only and is usually used to demonstrate the so-called leverage effect. Both procedures are utilized in this report; one analysis assumes 100 percent equity capital, the other assumes a 60 to 40 percent borrowed to equity ratio.

Allocations are made for reinvestment in production and supporting equipment, automobiles and trucks, and office, laboratory, and machine shop equipment that is fully depreciated by year 10. Though autos and trucks are fully depreciated over 5 years, it is assumed that replacement can be postponed until the other equipment is replaced. For all processing plants the replacement is spread evenly over a four year period beginning in the ninth operating year.

7. Working Capital

Working capital is the amount of money required for day-to-day operation for all purposes, including purchases of

raw product, containers, and other supplies, wages and salaries, precautionary bank balances, and other expenses. Working capital obviously should be included in estimating overall costs and in evaluating the income or returns of any business venture. The amount of working capital required in agricultural enterprises depends on the rate of inventory turnover and trade practices. If growers and other suppliers extend trade credit and customers make advance deposits, the amount could be very small. Conversely, if growers and other suppliers are paid on delivery, the rate of inventory movement is slow, or customers are given free trade credit for extended periods, the amount of working capital required could approach an entire year's operating costs. Detailed estimates of working capital requirements are given in the agricultural and processing components of this study.

8. Inflation

As noted earlier, inflation increases items such as revenues and operating expenses. For this analysis, costs and revenues were first estimated in 1982 monetary units (Kyats). These estimates were then inflated over time, so that the analysis was done using nominal monetary units. Fixed or contracted cost elements such as debt service and depreciation do not vary over time and consequently were not adjusted for inflation. Investments to replace fully depreciated equipment were adjusted for inflation. Also, the investment in the large processing plant to be combined with the small plant in year seven is adjusted for inflation.

9. Bases of Analysis

A set of base values was designed to place the various analyses in perspective. These base parameters are summarized in Table 114.

TABLE 114. DESCRIPTION OF PARAMETERS USED IN ANALYSES, BURMA, 1982

Item	Unit	Base Values	Sensitivity Values
Inflation rate	percent	6	0
Cost of capital	percent	24	15
Interest rates, short-term	percent	18	8
Interest rates, long-term	percent	12	5
Allowance for risk/uncertainty	percent	9	--
Loan type	--	fully amortized	
Long-term	years	20	--
Short-term		annual turnover	
Equity Capital	percent	100	40
Depreciation method	--	straight line	
Income tax rate	percent	0	30
Raw materials			
Pineapple			
For fresh market a/		442.50	486.75
For cannery a/		378.00	340.20
Mangoes, fresh and canned a/		1,361.00	1,497.10
Mangosteen, fresh a/		3,540.00	3,894.00
Papaya, fresh and canned a/		2,205.00	2,425.50
Cashew, bagged a/		2,520.00	2,772.00
Rambutan, fresh and canned a/		3,810	4,191.00
Guava, canned a/		339	372.90
Jackfruit a/			
Durian a/			
Selling Prices			
Pineapple			
Fresh	K/MT	703	
Canned	K/#2 case equivalents	112.82	

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Continued . . .

TABLE 114. DESCRIPTION OF PARAMETERS USED IN ANALYSES - Continued

Item	Unit	Base Values
Mangoes		
Fresh	K/MT	1,876
Canned	#2 case equivalents	108.84
Papayas		
Fresh	K/MT	2,935
Canned	#2 case equivalents	86.94
Rambutan		
Fresh	K/MT	4,981
Canned	#2 case equivalents	184.25
Passion Fruit		
Canned	K/#2 case equivalents	8.297
Guava		
Canned	K/#2 case equivalents	95.60
Tropical Fruit Salad/ Cocktail		
Canned	K/#2 case equivalents	120.01
Mangosteen		
Fresh	K/MT	4,618
Cashew Nuts		
Processed	K/Kilogram	30.73

a/ Kyats per MT.

SOURCE: Experience, Incorporated.

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C. Analyses Performed

Numerous financial analyses were completed to test the impact on the project's feasibility in relation to raw product prices, interest rates, overall cost variation, leverage and debt costs.

Independent analyses were run for the agricultural and tropical fruits processing components, cashew nut processing, and can manufacturing. The results were then viewed separately and in combination as a means of evaluating the individual components and the overall dimensions of the project.

The reader is referred to the agricultural and processing study components for detailed descriptions of the configurations involved. A brief description follows.

1. Agriculture

a. Pineapple. An initial planting of 20 acres will be made with purchased seed material of a number of varieties to aid in selection of varieties with optimum yields and quality attributes.

Seed material from the initial plot will be planted to additional acreage that approaches 1,235 acres at year seven. Although total yields will vary with the planting schedule, the targeted annual tonnage is projected to be 49,500 MT by the 10th year of project development (Appendix S). Tonnages approaching 1,900 MT per year will be handled by the small-scale tropical fruit cannery to be constructed in year one.

b. Other Products. Other products considered and tonnages involved are shown in Table 115.

TABLE 115. PRODUCTS TO BE HANDLED BY SMALL TROPICAL FRUIT CANNERY

Product	Initial Tonnage For Fresh	Initial Tonnage For Canned	Final Tonnage For Fresh	Final Tonnage For Canned
	----------metric tons----------			
Mangoes	350	150	700	300
Mangosteen	100	--	620	--
Papaya	400	600	800	1,200
Rambutan	200	300	240	360
Guava	--	80	--	160
Passion Fruit	--	500	--	500
Cashews	--	1,250	--	1,250

SOURCE: Experience, Incorporated.

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Mangoes, mangosteens, rambutans, and papava are assumed to be available for purchase from existing stands. Cashews, guava, and passion fruit will have to be planted within the project area and will not reach bearing age for several years.

2. Processing Component

As noted above, a small plant designed to handle the above tonnages of fresh and canned tropical fruits will be constructed in year one. This plant will remain in production throughout the life of the project. In addition, if the Burmese government decides to build early, this will impact favorably on the returns in the small plant. A cashew nut processing plant is also targeted for construction in year four provided supplies can be developed, plus a can manufacturing plant to be constructed in year one or two. The latter plant will supply an estimated 25,000,000 cans per year to plants located in Thazi, Mandalay, Mudon, Daik-U, and Rangoon. This

plant will have a two-shift capacity of 100,000,000 cans which we hope can be reached from all the canning factories in Burma including the large pineapple plant.

3. Basis of Analyses

a. Base Percentages. A set of base values for the various project components and summaries were designed to facilitate the presentation of results. These base parameters and sensitivity values are summarized in Table 114 with a review of the project's investment components given below and in Table 116. Internal rates of return and discounted cash flow analyses with results are converted to approximate internal rates of return.

b. Review of Project Investment Components

(1) Small cannery and fresh packing house for pineapples, mangoes, mangosteens, papayas, guavas, and passion fruit. Operations start in year one and continue over a 20-year planning horizon. Investment evaluations are performed separately and independently. (Scenarios - refer to Table 116. Sensitivity analyses - refer to Table 114.)

(2) Specific pineapple cannery (large) to be completed and operational by year seven. Investment analysis includes cash flows for small plant only to year seven, and then are combined with those generated by the large pineapple cannery through year twenty-seven. (Scenarios - refer to Table 116. Sensitivity analyses - refer to Table 114.)

(3) Specialized cashew plant to be completed and operational in year four and continue on a 20-year planning horizon if it is built at all. Investment analyses are performed separately and independently. (Scenarios - refer to Table 116. Sensitivity analyses - refer to Table 114.)

TABLE 116. INTERNAL RATE OF RETURN ANALYSIS FOR THE MUDON INVESTMENT PROJECT, 1982

Project and Scenarios	Equity	Inflation	Taxes	SR Loan Interest	Risk	LR Loan Interest a/	Operating Costs b/	Cut-off Rate	Internal Rate of Return
	percent								
Small Multi-Product Plant									
Base Conditions	40	6	0	18	12	9	--	24	82.4
	40	6	30	18	12	9	+10	24	36.0
	40	0	0	18	12	9	--	24	69.8
	40	0	30	18	12	9	--	24	43.9
	40	-	30	18	12	9	+10	24	24.4
	100	0	0	18	NA	9	--	24	36.9
	100	0	30	18	NA	9	--	24	25.8
	100	0	30	18	NA	9	+10	24	17.6
	100	6	0	18	NA	9	--	24	45.2
	100	6	30	18	NA	9	--	24	33.4
	100	6	30	18	NA	9	+10	24	24.6
	100	6	30	8	NA	9	+10	24	26.3
Large Pineapple and Small Tropical Fruit Plant Combined Raw Product Price at $54 Per MT Through Year Twenty-Seven									
Base Conditions	40	6	0	18	12	9	--	24	Negative c/
	40	6	0	18	12	9	-10	24	50+
	40	6	30	18	12	9	-10	24	24
	40	6	30	8	5	9	--	15	30
	40	6	30	8	5	9	+10	15	Negative d/
	40	0	0	18	12	9	--	24	Negative
	40	0	30	18	12	9	-10	24	7

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Continued . . .

TABLE 116. INTERNAL RATE OF RETURN ANALYSIS - Continued

Project and Scenarios	Equity	Inflation	Taxes	SR Loan Interest	Risk	LR Loan Interest a/	Operating Costs	Cut-off b/ Rate	Internal Rate of Return
	percent								
Large Pineapple and Small Tropical Fruit Plant Combined Raw Product Price at $54 Per MT Through Year Twenty-Seven - Continued									
	40	0	0	8	5	9	--	15	40+
	40	0	30	8	5	9	--	15	16
	100	0	0	18	NA	9	--	18	2
	100	0	0	18	NA	9	-10	24	10
	100	0	30	18	NA	9	-10	24	10
	100	0	30	8	NA	9	--	15	7
	100	6	0	18	NA	9	--	24	9
	100	6	30	18	NA	9	-10	24	17
	100	6	0	8	NA	9	--	15	22
	100	6	30	8	NA	9	--	15	14
Large Pineapple and Small Tropical Fruit Plant Combined Raw Product Price at $48.60 Per MT Through Year Twenty-Seven									
	40	6	30	18	12	9	--	24	Negative f/
	40	6	30	18	12	9	-10	24	50+
	40	6	30	8	5	9	--	15	50+
	40	0	0	18	12	9	--	24	Negative g/
	40	0	0	18	12	9	-10	24	50+
	40	0	30	18	12	9	-10	24	24
	40	0	30	8	5	9	--	15	30
	100	0	0	18	NA	9	--	24	9
	100	0	30	18	NA	9	-10	24	14
	100	0	0	8	NA	9	--	15	21
	100	0	30	8	NA	9	--	15	10
	100	6	0	18	NA	9	--	24	12
	100	6	30	18	NA	9	-10	24	19
	100	6	0	8	NA	9	--	15	27
	100	6	30	8	NA	9	--	15	16

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Continued . . .

TABLE 116. INTERNAL RATE OF RETURN ANALYSIS - Continued

Project and Scenarios	Equity	Inflation	Taxes	SR Loan Interest	Risk	LR Loan Interest a/	Operating Costs b/	Cut-off Rate	Internal Rate of Return
	percent								
Cashew Nut Plant									
Base Conditions	40	6	0	18	12	9	--	24	25
	40	6	30	18	12	9	--	24	11
	40	6	30	18	12	9	+10	24	Negative h/
	40	6	0	8	5	9	--	15	40.4
	40	6	30	8	5	9	--	15	23
	40	6	30	8	5	9	+10	15	7
	40	0	0	18	12	9	--	24	11
	40	0	30	18	12	9	--	24	Negative i/
	40	0	0	8	5	9	--	15	29.8
	40	0	30	8	5	9	--	15	13
	100	0	0	18	NA	9	--	24	11.8
	100	0	0	8	NA	9	--	15	15.0
	100	6	0	18	NA	9	--	24	18
	100	6	30	18	NA	9	--	24	11
	100	6	0	8	NA	9	--	15	21.9
	100	6	30	8	NA	9	--	15	14.6
Can Manufacturing Plant									
Base Conditions	40	6	0	18	12	9	--	24	30
	40	6	0	18	12	9	+10	24	0.5
	40	6	0	8	5	9	--	15	44
	40	6	0	8	5	9	+10	15	15
	40	0	0	18	12	9	--	24	17

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Continued . . .

TABLE 116. INTERNAL RATE OF RETURN ANALYSIS - Continued

Project and Scenarios	Equity	Inflation	Taxes	SR Loan Interest	Risk	LR Loan Interest a/	Operating Costs b/	Cut-off Rate	Internal Rate of Return
	percent								
Can Manufacturing Plant - Continued									
	40	0	0	8	5	9	--	15	33.4
	40	0	0	8	5	9	+10	15	13
	100	0	0	18	NA	9	--	24	17.8
	100	0	0	8	NA	9	--	15	16.3
	100	6	0	18	NA	9	--	24	20.6
	100	6	0	8	NA	9	--	15	23.3
	100	6	0	8	NA	9	+10	15	10

a/ Long run interest rate not applicable with 100 percent equity.
b/ Operating costs are based on production costs detailed in previous sections excluding depreciation and amortization of equipment installation and organizational expenses. where listed costs are adjusted up or down by 10 percent.
c/ Accumulated cash flows at 0 percent discount rate = K440,000.
d/ Accumulated cash flows at 0 percent discount rate = K121,000.
e/ Accumulated cash flows at 0 percent discount rate = K191,000.
f/ Accumulated cash flows at 0 percent discount rate = K393,000.
g/ Accumulated cash flows at 0 percent discount rate = K145,000.
h/ Accumulated cash flows at 0 percent discount rate = K6,000.
i/ Accumulated cash flows at 0 percent discount rate = K3,000.

SOURCE: Experience, Incorporated

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(4) Can manufacturing plant to be completed and operational in year one and to continue over a 20-year planning horizon. Investment analyses are performed separately and independently. (Scenarios - refer to Table 116. Sensitivity analyses - refer to Table 114.)

D. Investment Feasibility

Discounted cash flows and/or discounted internal rates of return were analyzed using an International Micro Systems Computer. The internal rate of return method of analysis was used for investment projects in which the cash flows involved no sign reversals. Where reversals occurred in the stream of cash flows, the analysis was made by using the net present value method converted to internal rates of return by deriving the discount rate where the discounted cash flows approach zero. As noted earlier, the two types were used to accommodate computer capabilities.

1. Feasibility Under Base Conditions

a. Agriculture. The internal rate of return was used to measure the levels of profitability to the growing of pineapple (Table 115). Two prices have been selected, two levels of equity, two levels of interest rates, two levels of inflation, and a risk factor of nine percent. Total fixed capital investment is $2,196,960 (K15,378,776).

With high interest rates and low pineapple prices, the 24 percent capital cut-off rate is exceeded only with a 40 percent equity position and 6 percent inflation. Lower interest rates yield a return exceeding the 15 percent capital cut-off rate with 100 percent equity capital with no inflation at either pineapple price. The highest return of 29.4 percent results

from high pineapple price, 40 percent equity, and 6 percent inflation. Returns are enhanced with inflation and higher prices.

The major unknown in the analysis, however, is the goal of 40 MT per acre. If yields do not reach the 40 MT level, acreage and equipment will have to be increased proportionately.

In a similar analysis, it is essential for the large pineapple factory that every effort be made to reduce the price of Kew pineapple to the lowest possible level. It is felt the $48.60 price can be met without much doubt. If more reductions are necessary, then there is the possibility that the "20 percent profit" (about $10 per MT) could be cut down to ten percent and this would reduce factory costs to $44.00 per MT. This last reduction in transfer price would have to be carefully analyzed to be sure that all overhead costs to the growing component are accounted for in the remaining "10 percent profit". Each reduction of ten percent on the transfer price to the factory results in US$250,000 (K1,750,000) savings to the processing plant per year.

The big question is the yield response to all known improvements under Mudon growing conditions.

b. Small Tropical Fruit Plant. The basic data used in the return on investment analysis for the small tropical fruit plant are shown in Table 117. Internal rates of return were positive for all base conditions (Table 116). In addition, sensitivity analyses with respect to taxes, variations in costs and interest rates yielded rates of return in excess of the cut-off rate in all uses except for high operating costs combined with no inflation, a 30 percent tax rate and high short-term interest rates.

TABLE 117. BASIC DATA FOR BEFORE TAX CASH FLOW ANALYSIS FOR SMALL TROPICAL FRUIT PLANT, MUDON BURMA

	0	1	2-7	8	9	10-12	13-20
	Kyats per year						
Investment Agriculture Component (separate)							
Processing	12,581,160				1,876,238 a/	1,876,238	
Working Capital	4,600,000						
TOTAL	17,181,160						
Revenues b/							
Fresh market		4,132,200	5,806,200	5,806,200	5,806,200	8,563,400	8,563,400
Processed		20,232,182	21,701,515	21,701,515	21,701,515	22,359,772	22,359,772
TOTAL		24,364,382	27,507,715	27,507,715	27,507,715	30,923,172	30,923,172
Annual Operating Costs b/							
Fresh Market		3,305,950	4,245,150	4,245,150	4,245,150	6,850,780	6,850,780
Processed		15,714,800	16,478,814	14,139,900	14,139,900	15,122,870	15,122,870
TOTAL		19,020,750	20,723,964	18,385,050	18,385,050	21,973,650	21,973,650
Cash Flow (100 percent equity)	-17,181,160	5,343,632	6,783,751	9,122,665	7,246,427	7,073,284	8,949,522
Cash Flow (40 percent equity) c/	-6,872,464	3,981,532	5,421,651	7,760,565	5,884,327	5,711,184	7,587,422

a/ Fully depreciated equipment replaced from equity funds in ninth through twelfth years.

b/ Revenues and costs vary through year ten as tonnages of fruits handled for fresh market and processed market increase. Refer to Table 115. Processed costs fall in year eight as cans are discounted. Refer to Table 28. Working capital interest component calculated at 18 percent. At a lower rate of 8 percent working capital interest charges fall by K345,520.

c/ Cash flows adjusted by debt service payments of K1,362,100 per year based on a long-term interest rate of 12 percent. At a rate of 5 percent annual debt service payments fall to K816,400.

SOURCE: Derived from Tables in Section VI-A and Experience, Incorporated calculations

Recall that cut-off discount rates were 24 percent for the base plant and 16 percent for the sensitivity analyses. These differences result from the mandated interest rates in Burma that set interest rates at 5 and 8 percent for long and short-term loans, respectively. Interest rates for loans originating from international lending agencies average 12 and 18 percent for short and long run capital, respectively. It is evident, therefore, that the Burmese government intends to subsidize the Mudon project by the difference on interest payments between international and domestic sources. In the small tropical fruit plant the amounts of this subsidy would come to about K1,668,500 per annum. However, Table 117 shows that the small multi-product plant is a good investment even with interest charges calculated at world levels. This favorable rate of return is partially due to selling the product locally at Burmese prices.

c. Can Manufacturing. The cash flow generated by can manufacturing is adequate for all base conditions to yield a return in excess of the cut-off rate. Taxes were not considered in the analysis of the can manufacturing plant. It would appear logical that only the finished canned product should be taxed. With 40 percent equity financing, assuming no operating cost increases, the facility meets the capital cut-off rate except where no inflation is combined with high interest rates.

d. Cashew Nut Plant. The return on investment considering the base conditions is in excess of the cut-off rate. However, the imposition of taxes results in a return far below the acceptable rate. In most cases the returns are above the cut-off rate if lower interest rates are assumed.

The analyses assumed that adequate supplies are available from present stands, but this assumption was wrong. Since

adequate supplies are not available, then plantings in the Mudon project site are recommended to start at the beginning of year one. The importation of raw nut for resale as processed nut should also be considered.

e. Large Pineapple and Small Tropical Fruit Plant. Because of the relatively low price for canned pineapple on the world market at this time and the use of this price seven years out, the internal rate of return was not adequate at $54 per MT for raw produce in most cases. Only if lower interest rates are considered or if operating costs are reduced does an acceptable return result. Using the same scenarios with raw product at $48.60 per MT the rates increase but again acceptable returns occur only if interest rates are reduced or if operating costs decline.

If taxes are imposed and operating costs are not reduced, the plants appear to be profitable investments only at low interest rates with 40 percent equity with or without inflation at the $54 price. At the lower price, 100 percent equity funding results in an acceptable return.

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IX. FOREIGN EXCHANGE

The foreign exchange requirement is made up of three different items in addition to repayment of foreign loans. The first item includes the non-processing and expatriate item that will exist even if there is no processing. The other group is made up of packaging material ingredients, fuel, etc., and finally there is interest on foreign loans supplied to Burma.

In Table 118 all the major capital expenditures and working capital requirements have been itemized to complete the entire Mudon project including the can plant at Pegu (except the cashew nut plant).

TABLE 118. SUMMARY OF INVESTMENT COST AT ALL BURMA FACILITY PROJECTS EXCEPT PINEAPPLE GROWING

	Foreign Exchange	Local	Working Capital	Total Cost
	--------US$	----------	---------Kyats	---------
Large pineapple	4,286,475	26,740,925	39,818,750	96,545,000
Less residence		2,250,400	--	
Net Total	4,286,475	24,490,525	39,898,750	94,394,600
Small tropical fruit plant	1,047,150	9,069,910	4,600,000	20,999,960
Less residence		3,818,800		
Net Total	$1,047,150	5,251,110	4,600,000	17,181,160
Can manufacturing plant	1,633,300	4,646,200	4,920,700	21,000,000
Cashew nut plant	626,550	2,775,150	2,838,000	10,000,000
GRAND TOTAL				
With cashew plant	7,593,475	37,163,985	52,177,450	142,575,760
Without cashew plant	6,966,925	34,387,835	49,339,450	132,575,762

SOURCE: Experience, Incorporated

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In Table 119 the major foreign exchange items for equipment, agricultural supplies, and the cost of expatriates have been itemized. The greatest demand for foreign exchange will be during the second year, of K16,330,753 or $2,332,962.

The cost for packaging and ingredients will be K7,638,300. To recover the imports related to products, it will require 29 percent of the production sold in the international market to cover all long-term interest. As well, it would require 33 percent and if short-term interest is being paid to foreign sources and not Burma, then the percentage of sales that must be exported is 36 percent.

It is much easier to recover foreign exchange with fresh product than processed product. While processed product and fresh together require 29 percent of sales to recover packaging and ingredients, the fresh pack only requires 4.5 percent. Besides this advantage the fresh market is much more dynamic than the processed market especially in pineapple.

For the large pineapple, foreign sales requirements to cover the imported packaging material and ingredients have been itemized. This will require 58 percent of the total sales to be exported. This is not a problem since it is an intended that all of the production for the plant will be exported.

If all loans came from outside Burma, the internal rate of return during the first year of operation would increase the export sales requirement to 68 percent for interest on short-term money and to 75 percent to include interest or long-term money. The annual interest amount would only be one-half that amount if the loans are paid off on schedule.

TABLE 119. FOREIGN EXCHANGE REQUIREMENTS, MUDON PROJECT: SUMMARY BY YEAR

TABLE 119. FOREIGN EXCHANGE REQUIREMENTS, MUDON PROJECT: SUMMARY BY YEAR

	Years									
	1	2	3	4	5	6	7	8	9	10
	U.S. Dollars									
Tropical Fruit Processing Plant	1,047,150									
Pineapple Processing Plant							4,286,475			
Cashew Processing Plant				626,550 b/						
Can Factory		1,673,000								
Crowns	100,000	--		--	--	--	--	--	--	--
Farming and Irrigation Equipment	166,033	498,000	290,300	507,550	197,350	277,925	386,125	354,000	17,700	
Fertilizer	4,702	2,316	18,807	28,070	84,489	187,505	363,998	403,501	403,501	433,324
Insect Control Material	180	180	899	1,438	4,313	9,345	19,723	27,944	27,944	27,944
Weed Control Material	483	483	2,417	3,867	11,800	25,133	53,045	75,158	89,537	89,537
Tools	40,000	15,000	15,000							
Polyethylene	3,000	--	12,000	12,000	48,000	96,000	185,250	185,250	185,250	185,250
Expatriates	100,000	150,000	150,000	75,000	25,000	--	215,000	215,000	215,000	
TOTAL U.S. DOLLARS a/	1,461,548	2,299,279	489,423	1,254,475	370,952	595,908	5,477,317	1,248,103	926,182	693,482
Kyat	10,230,836	16,094,953	3,425,961	8,781,325	2,596,664	4,171,356	38,341,219	8,736,721	6,483,274	4,854,374

a/ During the developmental stage it is assumed that any cost in the importation of cans, boxes, ingredients, and labels will be offset the sale of finished goods to the export market.
b/ Not included in total.

SOURCE: Experience, Incorporated.

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Table 120 outlines the export sales necessary to recover the cost of packaging material and ingredients for the large pineapple plant.

TABLE 120. REQUIRED EXPORT SALES TO RECOVER FOREIGN EXCHANGE AND COST OF IMPORTED MATERIAL USED IN PROCESSING FRUIT

Item	Amount
	(Kyats)
Large Pineapple Plant	
Ingredient	6,047,500
Utilities	633,600
Packaging material a/ (cans at 75 percent)	52,473,600
Subtotal	59,154,700
Plus short-term interest first year	9,695,200 a/
Subtotal	68,849,900
Plus long-term interest first year	6,958,440 b/
Subtotal	75,808,340
Net Sales	101,244,570
Percent foreign exchange needed for purchased material outside Burma	58
Percent required with short-term interest added	68
Percent required with long-term interest added	75

a/ Includes tin plate and covers.
b/ If the loans are paid off on schedule, the interest charge for the average year would be half that indicated.

SOURCE: Experience, Incorporated

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In addition to the special long-term items listed in Table 120 there will be other items directly associated with processing such as packaging material ingredients. If short-interest is added at 12 percent it will amount to 68 percent of sales. If long-term interest is added it will amount to 75 percent of each sales Kyat.

X. INTERPRETATION

Individual internal rate of return of the five enterprises considered are as follows:

A. Small Tropical Fruit Plant

The internal rate of return exceeds the cut-off rate under base cost conditions when sensitivity analyses include 30 percent taxes, 100 percent equity, 0 percent inflation, and cost plus 10 percent factor.

Local prices for canned and fresh product were used.

B. Canned Manufacturing Plant

The plant has a favorable internal rate of return under the base conditions and becomes increasingly favorable as volume demand increases. During the initial low volume periods, margins will be low. However, when the plant is in full production, can cost should be reduced by approximately 25 percent compared to importing cans.

C. Cashew Nut Plant

The base cost conditions show a favorable rate of return for the proposed cashew plant, providing the availability of cashew nuts.

D. Agricultural Growing of Pineapple

If yields and cost can be developed as outlined, a favorable rate of return will result. This will require 40 MT

per acre at a selling price of $48.60 per MT. Yield and cost may vary independently and reduce the required total average yield.

E. Combination of the Large Pineapple Facility with the Small Tropical Fruit Plant

Although the small tropical fruit plant earns a favorable margin, when it is combined with the large plant the overall operations become negative under many scenarios. To make this positive, it will require an improvement in all of the following:

- Cost menu 10 percent
- Lower interest rate
- Lower raw product cost

It will also require either a reduced operating cost, or lower internal and product cost. The return increases but the cut-off rates are not exceeded. A price increase for the finished product, over the depressed price of today, would also favorably affect the plant.

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PN-AAS-143

AID CONTRACT NO. PDC-1406-I-02-1142-00

EXPERIENCE, INCORPORATED NO. 8402

APPENDICES

FEASIBILITY STUDY FOR THE GROWING, PROCESSING AND MARKETING OF TROPICAL FRUITS, AND THE ESTABLISHMENT OF A CAN MANUFACTURING FACILITY IN THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

EXPERIENCE, INCORPORATED
MINNEAPOLIS, MINNESOTA 55402

NOVEMBER, 1982

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TABLE A-1. 1977 AVERAGE MONTHLY CLIMATIC DATA, AKYAB, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	21.2	16.6	0	0
February	22.0	17.2	0	0
March	26.8	24.7	4	0
April	27.4	27.6	132	8
May	27.6	29.8	424	13
June	26.9	31.5	1,171	24
July	27.2	31.5	842	29
August	27.1	30.5	686	28
September	27.6	31.7	406	19
October	28.0	29.5	162	26
November	26.8	25.9	0	0
December	15.7	18.6	0	0
TOTAL			3,827 (150.67) a/	147
Average	25.4	26.3	331.4 (13.26) a/	12.3

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-2. 1978 AVERAGE MONTHLY CLIMATIC DATA, AKYAB, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	20.3	14.3	0	0
February	22.8	16.4	0	0
March	25.4	18.0	0	0
April	27.8	26.1	95	3
May	28.5	31.1	495	2
June	27.5	31.9	900	22
July	27.0	31.3	662	27
August	26.8	31.9	1,197	27
September	27.2	31.1	490	17
October	27.9	30.5	187	10
November	26.0	22.9	0	0
December	23.4	18.2	0	0
TOTAL			4,026 (140.84) a/	108
Average	25.9	25.3	335.1 (11.74) a/	9.0

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-3. 1979 AVERAGE MONTHLY CLIMATIC DATA, AKYAB, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	22.4	16.8	0	0
February a/	24.1	19.1	0	0
March	25.8	21.3	0	0
April	28.8	27.4	30	3
May	30.2	31.3	49	3
June a/	28.7	31.6	372	15
July	27.1	31.9	695	27
August	26.4	31.3	1,589	26
September	27.5	31.7	547	18
October	28.0	29.3	148	7
November	24.7	24.7	0	0
December	23.2	19.6	91	3
TOTAL			3,521 (158.50) b/	102
Average	26.4	26.3	293.4 (13.19) b/	8.5

a/ February and June data missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-4. 1980 AVERAGE MONTHLY CLIMATIC DATA, AKYAB, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	21.6	15.4	0	0
February	22.5	21.0	0	0
March	26.4	22.9	1	0
April	29.8	29.3	6	1
May	28.9	30.2	382	12
June	26.8	31.7	1,746	28
July	27.0	31.8	1,402	30
August	27.1	32.0	1,075	25
September	27.8	32.4	423	20
October a/	25.0	28.5	211	10
November	26.4	24.7	0	0
December	23.7	18.8	0	0
TOTAL			5,246 (206.53) b/	126
Average	26.1	26.[illegible]	43.7 (1.720) b/	10.5

a/ October data missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-5. 1981 AVERAGE MONTHLY CLIMATIC DATA, AKYAB, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	21.5	17.0	11	1
February	23.4	16.5	2	1
March	26.1	21.0	3	1
April	28.1	27.4	90	5
May	28.9	28.8	193	12
June	27.7	31.1	914	25
July	26.5	31.3	3	1
August	27.4	32.2	684	27
September	29.7	30.9	365	15
October a/	28.2	28.4	182	7
November	26.6	25.9	0	0
December	24.1	20.9	0	0
TOTAL			2,447 (96.34) b/	95
Average	26.5	25.9	204.9 (8.07) b/	7.9

a/ Data for October missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-6. 1977 AVERAGE MONTHLY CLIMATIC DATA, MANDALAY, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	20.3	17.0	0	0
February	22.9	16.5	0	0
March	28.1	20.5	14	0
April	29.6	25.0	76	5
May	30.3	29.3	91	8
June	30.5	30.9	121	6
July	30.1	28.4	53	4
August	30.3	28.4	93	7
September	28.5	30.5	183	14
October	26.9	28.2	97	6
November	26.0	25.2	110	2
December	17.3	19.5	40	2
TOTAL			878 (34.56) a/	54
Average	26.7	24.9	76.2 (3.00) a/	4.5

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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Month	Mean Temperature °C	Vapor Pressure	Rainfall: Millimeters	Rainfall: Number of days of Rainfall
January	19.9	15.7	0	0
February	23.6	15.4	0	0
March	27.6	16.2	0	0
April	31.4	22.5	16	3
May	30.8	28.8	251	12
June	29.5	30.0	132	9
July	28.5	32.4	98	9
August	29.1	30.5	255	9
September	28.0	31.1	220	10
October	27.8	28.8	130	6
November	25.4	23.1	0	0
December	21.3	18.3	0	0
TOTAL			1,102 (43.39) a/	58
Average	26.9	24.4	1.9 (3.62) a/	4.8

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-8. 1979 AVERAGE MONTHLY CLIMATIC DATA, MANDALAY, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	20.8	15.1	0	0
February a/	24.6	16.6	0	0
March	28.4	18.1	0	0
April	32.2	22.8	23	2
May	33.5	29.8	21	5
June a/	32.1	29.9	57	7
July	30.7	30.0	93	8
August	28.8	30.4	326	12
September	29.6	30.9	54	6
October	28.0	27.1	1	0
November	27.1	23.9	0	0
December	22.0	19.5	18	4
TOTAL			593 (23.35) b/	44
Average	28.2	24.5	49.4 (1.945) b/	3.7

a/ February and June data missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-9. 1980 AVERAGE MONTHLY CLIMATIC DATA, MANDALAY, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	20.9	15.8	0	0
February	23.1	14.9	0	0
March	28.3	16.7	1	0
April	33.5	20.9	21	4
May	32.4	30.0	183	5
June	29.7	29.5	181	10
July	29.7	30.7	151	11
August	29.9	31.3	50	6
September	28.9	32.0	310	12
October a/	27.4	27.9	155	6
November	25.8	23.8	0	0
December	22.4	19.6	0	0
TOTAL			1,052 (41.42) b/	54
Average	27.7	24.4	87.7 (3.45) b/	4.5

a/ October data missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-10. 1981 AVERAGE MONTHLY CLIMATIC DATA, MANDALAY, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	21.5	15.9	0	0
February	23.8	14.8	5	1
March	27.9	17.4	0	0
April	30.0	20.2	37	5
May	31.3	28.6	162	5
June	29.1	30.2	260	15
July	29.6	29.8	7	1
August	30.0	30.7	40	4
September	29.7	31.1	111	6
October a/	27.4	28.9	56	3
November	25.0	26.6	0	0
December	22.1	19.9	3	1
TOTAL			681 (26.81) b/	41
Average	27.6	24.7	56.8 (2.24) b/	3.4

a/ October data missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-11. 1977 AVERAGE MONTHLY CLIMATIC DATA, RANGOON, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	24.0	20.2	25	3
February	26.6	19.5	1	0
March	30.0	26.1	1	0
April	30.8	27.2	11	2
May	29.4	29.1	210	17
June	27.9	31.3	313	25
July	27.1	31.5	591	26
August	26.9	30.5	686	28
September	27.3	31.7	282	18
October	27.8	30.0	139	10
November	27.0	25.9	0	0
December	15.8	20.4	160	3
TOTAL			2,419 (95.24) a/	132
Average	26.7	26.9	201.6 (7.94) a/	11.0

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

12/3960A

TABLE A-12. 1978 AVERAGE MONTHLY CLIMATIC DATA, RANGOON, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	24.7	19.5	0	0
February	26.8	21.0	22	1
March	28.0	24.1	0	0
April	31.1	27.4	0	0
May	30.0	30.0	398	14
June	27.7	31.1	369	20
July	27.2	31.1	406	23
August	26.6	31.1	685	28
September	27.2	30.7	344	19
October	28.0	30.5	144	12
November	27.5	25.8	7	2
December	25.6	20.6	0	0
TOTAL			2,375 (93.50) a/	119
Average	28.5	26.9	197.9 (7.79) a/	9.9

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

13/3960A

TABLE A-13. 1979 AVERAGE MONTHLY CLIMATIC DATA, RANGOON, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall: Millimeters	Rainfall: Number of days of Rainfall
January	26.1	18.8	0	0
February a/	27.6	21.0	0	0
March	29.1	23.2	0	0
April	31.1	27.9	35	2
May	29.6	30.9	287	15
June a/	28.4	31.3	355	19
July	27.2	31.7	423	23
August	20.1	32.8	308	16
September	27.8	31.5	273	15
October	27.7	31.1	126	9
November	26.9	25.5	0	0
December	25.6	20.8	0	0
TOTAL			1,807 (71.14) b/	99
Average	27.3	27.2	150.6 (5.93) b/	8.2

a/ February and June data missing - figures interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-14. 1980 AVERAGE MONTHLY CLIMATIC DATA, RANGOON, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	24.9	18.9	0	0
February	26.0	18.9	0	0
March	29.3	25.9	1	0
April	31.5	29.1	0	0
May	30.5	30.0	509	12
June	27.2	31.1	486	24
July	26.6	31.7	601	30
August	26.9	31.5	506	25
September	27.2	31.5	469	24
October a/	27.6	29.6	236	13
November	28.0	27.7	6	1
December	26.6	23.4	15	2
TOTAL			2,829 (11.14) b/	131
Average	27.7	27.5	23.6 (0.93) b/	10.9

a/ Data for october missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

15/3960A

TABLE A-15. 1981 AVERAGE MONTHLY CLIMATIC DATA, RANGOON, BURMA

Month	Mean Temperature °C	Vapor Pressure	Rainfall	
			Millimeters	Number of days of Rainfall
January	25.1	20.2	0	0
February	26.3	20.6	7	1
March	29.0	23.8	6	1
April	31.0	27.1	20	3
May	30.0	30.5	228	13
June	27.9	31.3	452	22
July	27.2	31.8	6	3
August	26.9	31.7	651	25
September	28.1	32.2	382	19
October a/	27.7	30.4	191	10
November	27.2	28.6	0	0
December	24.7	22.8	0	0
TOTAL			1,943 (76.50) b/	97
Average	27.6	27.6	161.9 (6.37) b/	8.1

a/ Data for October missing - figures are interpolated.
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-16. AVERAGE MONTHLY RAINFALL DATA, MUDON TOWNSHIP, BURMA, 1977-1980

Month	1977		1978		1979		1980	
	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall
January	0.18	1	0	2	0	0	0	0
February	3.38	1	0	1	0	0	0	0
March	1.91	1	0.15	0	0	0	0.15	1
April	10.51	6	1.17	6	7.34	6	1.17	3
May	49.86	17	90.83	20	128.22	19	90.83	17
June	75.34	22	95.45	23	76.84	19	95.45	23
July	78.46	24	88.67	25	107.34	22	88.67	26
August	86.08	25	84.91	29	147.12	25	84.91	22
September	103.12	21	62.92	24	45.65	16	62.92	23
October	17.20	9	0	11	15.60	7	0	0
November	1.35	1	0	1	0	0	0	0
December	1.32	1	0	0	0	0	0	0
Millimeters								
TOTAL	428.71		424.10		528.11		424.10	
Average	35.52		35.34		44.01		35.34	
Inches								
TOTAL	16.88	132	16.70	142	20.79	114	16.70	115
Average	1.40	11	1.39	11.83	1.73	9.5	1.39	9.4

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TABLE A-17. AVERAGE MONTHLY RAINFALL DATA, THANBYUZAT TOWNSHIP, BURMA, 1977-1980

Month	1977		1978		1979		1980	
	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall	Milli-meters	Number of days of Rainfall
January	3.12	2	0.18	1	0	0	0	0
February	0	0	7.37	2	0	0	0	0
March	1.55	1	0	0	0	0	1.90	1
April	5.84	10	9.80	5	14.40	4	1.70	3
May	56.56	18	62.50	17	119.86	22	72.11	19
June	67.53	24	98.17	28	69.50	24	85.98	26
July	93.87	28	93.07	30	147.04	24	124.79	29
August	91.54	27	180.85	31	143.69	27	114.22	28
September	104.03	26	86.77	26	52.98	18	106.98	21
October	17.12	14	55.68	4	31.37	9	0	0
November	0.10	1	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0
Millimeters								
TOTAL	441.26		594.39		578.84		507.68	
Average	36.77		49.53		48.24		4.23	
Inches								
TOTAL	17.37	151	23.40	144	22.79	128	19.99	127
Average	1.45	12.6	1.95	12.0	1.90	10.7	1.67	10.6

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TABLE A-18. 1981 AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1968-1975

Month	Rainfall							
	1968	1969	1970	1971	1972	1973	1974	1975
	millimeters							
January	0	0	0	0	0	0	0	75
February	0	0	52	0	0	0	0	0
March	0	11	5	0	9	26	50	9
April	80	67	62	52	66	54	149	15
May	159	1,011	511	281	213	435	690	645
June	755	1,003	841	1,329	665	972	805	931
July	1,254	1,488	1,012	1,053	1,505	1,075	839	1,000
August	1,135	1,255	1,580	732	1,118	997	1,277	1,192
September	555	764	443	354	195	418	1,250	438
October	294	126	146	201	191	134	197	286
November	6	56	0	8	28	12	168	110
December	0	0	30	5	6	0	0	0
Millimeters								
TOTAL	4,238	5,781	4,682	4,015	3,996	4,123	5,425	4,701
Average	353.17	481.8	390.17	34.58	333.0	343.6	452.1	391.8
Inches								
TOTAL	166.85	227.60	184.33	158.07	157.32	162.32	213.58	185.08
Average	13.90	18.97	15.36	13.61	13.11	13.53	17.80	15.43

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TABLE A-19. AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1976

Month	Relative Humidity 09.30 Hr	Relative Humidity 18.30 Hr	Ambient Temperature Maximum °C	Ambient Temperature Minimum °C	Rainfall (millimeters)
January	63	52	31.0	16.0	0
February	63	58	34.0	18.0	0
March	66	66	34.0	21.0	0
April	67	68	35.0	25.0	62
May	89	88	29.0	23.0	624
June	94	89	28.8	22.0	1,125
July	95	96	27.0	23.0	1,083
August	93	92	28.0	23.3	814
September	94	92	27.9	23.5	706
October	83	84	31.0	23.0	287
November	66	63	31.3	22.1	29
December	69	63	31.7	19.0	4
TOTAL					4,734 (186.38) a/
Average	78.5	75.9	30.7	21.6	394.5 (15.53) a/

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-20. AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1977

Month	Relative Humidity 09.30 Hr	Relative Humidity 18.30 Hr	Ambient Temperature Maximum °C	Ambient Temperature Minimum °C	Rainfall (millimeters)
January	71	60	31.8	18.5	4
February	66	56	33.4	19.5	23
March	65	68	34.6	23.5	11
April	69	64	34.8	23.9	67
May	83	79	32.1	23.0	786
June	89	89	27.3	24.2	752
July	92	94	27.9	23.5	1,124
August	94	92	27.3	23.2	1,110
September	93	91	29.8	23.5	938
October	91	81	32.9	23.2	178
November	62	65	32.5	21.1	7
December	60	55	33.4	NA	1
TOTAL					5,001 (196.80) b/
Average	77.9	74.5	31.5	22.3 a/	416.75 (16.41) b/

a/ Partly estimated
b/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-21. AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1978

Month	Relative Humidity 09.30 Hr	Relative Humidity 18.30 Hr	Ambient Temperature Maximum °C	Ambient Temperature Minimum °C	Rainfall (millimeters)
January	63	56	32.0	19.0	0
February	65	58	35.0	20.0	8
March	62	59	35.0	22.0	0
April	70	67	35.0	24.0	104
May	78	80	32.0	25.0	637
June	90.2	90	28.9	24.1	849
July	90	88	28.0	23.0	1,856
August	97	97	27.0	23.0	1,981
September	91	91	28.0	23.0	608
October	80	78	31.0	23.0	287
November	66	65	34.0	22.0	3
December	55	54	33.0	19.0	0
TOTAL					6,333 (249.33) a/
Average	75.6	73.5	31.6	22.1	527.75 (20.78) a/

a/ Converted to inches.

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-22. AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1979

Month	Relative Humidity 09.30 Hr	Relative Humidity 18.30 Hr	Ambient Temperature Maximum °C	Ambient Temperature Minimum °C	Rainfall (millimeters)
January	69	59	35.0	19.9	0
February	63	58	35.7	20.7	0
March	63	68	35.9	30.7	0
April	67	67	35.2	25.2	14
May	84	84	31.5	24.6	1,128
June	89	86	29.9	24.1	795
July	91	89	29.8	23.8	921
August	95	94	28.8	23.8	1,356
September	86	85	30.8	23.8	331
October	74	74	32.9	23.2	
November	57	60	33.1	19.5	
December	74	73	32.9	23.2	
TOTAL					4,545
Average	76.0	74.8	32.6	23.5	378.75

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-23. AVERAGE MONTHLY CLIMATIC DATA, MOULMEIN, BURMA, 1980

Month	Relative Humidity 09.30 Hr	Relative Humidity 18.30 Hr	Ambient Temperature Maximum °C	Ambient Temperature Minimum °C	Rainfall (millimeters)
January	65	54	33.0	21.0	
February	63	56	34.4	19.6	
March	61	65	36.7	26.7	
April	65	71	37.3	23.5	
May	79	77	32.2	27.0	
June	92	92	29.7	24.2	
July	92	92	28.3	24.3	
August	93	92	28.1	24.0	
September	92	92	29.0	24.0	
October	79	84	32.0	25.0	
November	65	68	35.0	23.0	
December	61	61	33.0	24.0	
TOTAL					
Average	75.6	75.3	32.4	23.9	

SOURCE: Monthly Climatic Data for the World, National Climatic Center, Asheville, N.C.

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TABLE A-24. 1970 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	63	27.3	19.9	.5	2
February	68	27.6	20.63	6.9	4
March	69	29.4	22.96	24.6	5
April	72	29.4	23.51	109.5	11
May	74	29.6	24.18	147.9	17
June	75	29.1	23.91	224.5	21
July	73	28.7	23.29	163.5	17
August	75	28.3	23.28	161.5	23
September	76	28.5	23.46	199.0	17
October	75	27.4	22.38	95.8	14
November	65	27.1	19.64	48.2	4
December	75	26.4	21.24	60.1	7
TOTAL				1,242.0	142
AVERAGE	72	28.2	22.3	103.5	11.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-25. 1971 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	68	24.7	18.01	7.8	1
February	68	26.8	19.86	24.5	7
March	68	28.2	21.18	29.0	4
April	71	29.3	23.16	85.6	7
May	75	28.8	23.6	189.6	18
June	71	28.8	22.86	108.1	16
July	72	28.3	22.68	108.6	16
August	75	28.0	22.95	345.2	19
September	77	28.1	23.55	259.0	18
October	75	27.1	22.24	186.8	17
November	66	24.8	17.39	1.9	2
December	65	25.7	18.26	.2	1
TOTAL				1,346.3	126
AVERAGE	71	27.4	21.3	112.2	10.5

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-26. 1972 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
Rainfall				Millimeters	Number of days of
January	61	24.5	15.67		
February	73	27.1	21.60	15.9	3
March	67	27.6	20.47	25.0	6
April	76	28.2	23.22	85.11	11
May	65	30.8	22.97	15.4	3
June	75	28.7	23.64	212.0	14
July	74	28.7	23.43	77.5	13
August	72	28.6	22.87	67.7	13
September	82	27.4	23.87	383.9	21
October	80	27.8	23.91	119.6	17
November	81	26.8	23.01	135.2	15
December	75	25.9	20.8	46.1	3
TOTAL				1,183.4	119
AVERAGE	73	27.7	22.1	98.6	9.9

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-27. 1973 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	68	26.0	18.99		
February	71	28.1	21.84		
March	75	28.7	23.45	52.2	10
April	69	30.4	23.72	13.7	3
May	77	29.4	24.22	189.4	17
June	77	28.7	24.10	105.4	16
July	74	29.0	23.63	172.6	16
August	77	28.1	23.61	210.7	22
September	82	27.3	23.88	323.7	24
October	78	27.1	22.55	118.5	14
November	71	25.4	19.49	54.0	7
December	61	24.0	15.43	1.1	1
TOTAL				1,241.3	130
AVERAGE	73	27.7	22.1	103.4	10.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

28/3960A

TABLE A-28. 1974 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	70	24.4	18.10		
February	67	26.0	18.96	4.3	3
March	72	27.3	21.66	38.6	6
April	78	28.0	23.57	301.7	15
May	78	28.1	23.58	127.9	17
June	73	28.6	23.16	51.3	11
July	74	28.4	23.00	125.4	16
August	76	28.2	23.35	188.2	16
September	80	27.5	23.55	231.3	15
October	83	26.9	23.59	555.3	22
November	75	26.0	20.97	90.9	4
December	64	26.1	18.63		
TOTAL				1,714.9	125
AVERAGE	74	27.1	21.8	142.9	10.4

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-29. 1975 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	74	25.3	19.85	90.2	8
February	69	27.2	20.58		
March	72	28.8	23.10	12.6	3
April	71	29.6	23.36	23.5	6
May	76	28.5	23.69	116.4	15
June	75	28.6	23.63	81.7	14
July	76	28.0	23.14	134.8	18
August	76	28.0	23.37	182.3	19
September	83	27.0	23.54	305.3	19
October	80	26.9	23.13	91.7	20
November	74	25.6	20.3	202.1	8
December	63	22.6	14.72	6.1	4
TOTAL				1,246.7	134
AVERAGE	74	27.2	21.9	103.9	11.2

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-30. 1976 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	63	23.2	15.17		
February	76	26.2	21.31	92.4	4
March	74	27.5	22.17	48.1	6
April	72	29.2	23.29	92.4	8
May	77	28.1	23.54	150.0	14
June	70	29.1	22.69	78.2	7
July	74	28.3	23.07	136.0	17
August	78	27.6	23.28	269.2	24
September	79	27.6	23.41	306.7	19
October	82	27.2	23.73	232.9	23
November	74	25.3	19.98	117.0	8
December	66	26.0	18.68		
TOTAL				1,472.9	130
AVERAGE	74	27.1	21.7	122.7	10.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-31. 1977 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	69	26.3	19.72	4.0	2
February	63	26.2	17.88	53.5	3
March	70	27.5	21.29	33.8	2
April	72	29.2	23.34	121.4	4
May	76	28.9	24.05	199.8	11
June	71	29.7	23.71	57.0	9
July	75	28.7	23.62	94.6	14
August	74	28.6	23.19	118.0	13
September	78	27.7	23.37	189.6	20
October	76	27.8	23.38	60.7	13
November	68	26.3	19.43	36.0	5
December	64	26.4	18.46	.5	1
TOTAL				968.9	97
AVERAGE	71	27.8	21.8	80.7	8.1

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

32/3960A

TABLE A-32. 1978 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	70	26.8	20.46	80.8	1
February	75	26.6	21.61	103.5	5
March	72	29.2	23.27	4.4	2
April	72	29.9	23.83	70.6	8
May	77	29.0	24.47	204.3	14
June	77	28.6	23.98	162.9	16
July	79	27.9	23.81	220.4	24
August	75	28.4	23.31	50.8	11
September	81	27.3	23.67	463.6	22
October	76	27.4	22.39	109.4	14
November	68	27.0	20.21	19.5	4
December	62	26.2	17.7		
TOTAL				1,489.8	121
AVERAGE	73	27.9	22.4	124.2	10.1

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-33. 1979 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	71	27.4	21.6	2.6	1
February	69	28.3	21.4		
March	66	29.9	22.47	.1	1
April	70	29.8	23.46	51.8	9
May	71	30.0	23.89	92.0	11
June	75	29.3	24.23	45.4	15
July	73	29.0	23.53	56.3	12
August	73	28.7	23.22	164.1	15
September	82	27.6	23.98	178.0	23
October	68	27.8	20.27	130.5	5
November	60	26.9	17.89	19.3	1
December	60	25.9	17.07	.8	1
TOTAL				740.9	94
AVERAGE	70	28.4	21.9	61.7	7.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-34. 1980 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	65	26.4	18.6		
February	67	28.0	20.6	.7	1
March	70	29.4	23.0	43.6	3
April	71	30.2	24.1	69.6	4
May	69	30.9	24.1	60.6	8
June	79	28.2	24.1	262.9	21
July	75	28.7	23.6	166.7	17
August	75	28.3	23.3	227.0	17
September	79	27.8	23.7	259.7	21
October	82	27.4	23.7	200.7	19
November	72	27.0	21.2	22.7	5
December	62	26.8	18.5		
TOTAL				1,314.2	116
AVERAGE	72.2	28.3	22.4	109.5	9.7

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-35. 1981 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	63.52	26.05	17.28	.2	1
February	72.73	27.54	21.37	54.5	3
March	72.74	29.00	22.89	23.6	3
April	76.34	29.36	23.91	186.4	13
May	78.52	29.24	24.37	247.5	15
June	75.21	29.08	23.94	68.3	15
July	76.73	28.52	23.68	169.8	19
August	75.55	28.55	23.37	106.4	19
September	82.32	27.96	23.93	477.4	22
October	79.10	28.10	23.35	177.3	15
November	78.60	26.97	21.88	113.1	14
December	64.08	24.86	16.42		
TOTAL				1,624.5	139
AVERAGE	74.6	28.0	22.2	135.375	11.6

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-36. 1982 AVERAGE MONTHLY CLIMATIC DATA CHONBURI PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	66.8	25.94	17.86		
February	73.33	28.25	22.11	10.5	1
March	72.96	29.17	23.17	49.3	4
April	72.24	29.70	23.19	29.2	8
TOTAL				89.0	8
AVERAGE	71.3	28.3	21.6	22.3	5.3

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-37. 1970 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	81	25.0	21.5	238.6	4
February	84	25.5	22.4	165.1	7
March	83	27.2	23.9	52.5	4
April	81	28.0	24.3	42.1	6
May	79	28.5	24.2	97.7	11
June	79	27.8	23.8	102.9	19
July	79	27.1	23.0	133.6	18
August	80	26.9	23.1	126.7	18
September	78	27.7	23.3	46.2	13
October	80	26.7	22.9	89.0	17
November	76	26.3	21.6	402.9	7
December	81	25.4	21.8	230.1	14
TOTAL				1,727.4	138
AVERAGE	80	26.8	23.0	144.0	11.5

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-38. 1971 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	76	23.6	14.0	3.7	4
February	82	25.1	21.7	10.3	4
March	79	26.4	22.4	5.7	3
April	79	28.2	24.0	15.7	4
May	78	28.1	23.7	156.1	13
June	78	27.1	22.9	91.1	19
July	80	26.7	23.0	158.8	21
August	78	27.0	22.8	60.1	17
September	79	27.4	23.2	125.4	15
October	80	26.2	22.4	117.6	16
November	70	24.7	18.5	256.3	5
December	72	25.3	19.9	2.2	1
TOTAL				1,003.0	122
AVERAGE	77	26.3	22.0	83.6	10.2

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-39. 1972 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	73	23.2	17.8	9.3	1
February	78	26.2	21.8	3.8	2
March	78	26.4	22.1	55.8	4
April	81	27.5	23.9	96.9	9
May	71	29.4	23.3	44.2	7
June	78	27.7	23.3	161.1	16
July	79	27.2	23.1	112.9	24
August	80	26.9	23.0	153.0	19
September	80	27.4	23.6	66.9	14
October	84	27.0	24.1	143.0	17
November	87	26.0	23.7	528.7	25
December	82	25.0	21.7	280.8	6
TOTAL				1,656.4	144
AVERAGE	79	26.6	22.6	138.0	12

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-40. 1973 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
Rainfall				Millimeters	Number of day of
January	79	25.0	21.0	2.2	1
February	81	26.4	22.8	9.3	4
March	81	27.4	23.6	58.2	8
April	76	29.0	24.2	.5	1
May	80	29.0	24.2	95.9	13
June	82	27.6	24.1	207.2	17
July	81	27.2	23.7	244.3	20
August	82	27.0	23.6	146.5	21
September	81	27.1	23.6	77.7	12
October	83	26.6	23.3	290.4	14
November	78	25.3	21.0	607.7	12
December	68	24.0	17.6	5.6	2
TOTAL				1,745.5	125
AVERAGE	79	26.8	22.7	145.5	10.4

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-41. 1974 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of Rainfall
January	76	23.2	18.4	.2	1
February	77	25.0	20.4	3.8	3
March	79	26.4	22.2	78.8	7
April	81	27.5	23.7	71.8	8
May	82	27.1	23.7	127.3	19
June	80	27.2	23.5	90.8	23
July	79	27.5	23.4	58.3	11
August	80	27.1	23.3	136.8	25
September	84	27.0	24.0	141.2	13
October	86	26.2	23.5	203.9	22
November	81	25.7	22.1	81.1	9
December	76	25.1	20.4	33.0	4
TOTAL				1,027.0	145
AVERAGE	80	26.2	22.4	85.6	12.1

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-42. 1975 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	83	24.5	21.5	231.2	9
February	82	25.5	22.1	34.4	3
March	80	27.5	23.6	.3	1
April	79	28.4	24.2	29.8	3
May	81	27.7	23.9	325.3	19
June	83	26.5	23.3	138.9	26
July	77	27.3	22.8	13.9	10
August	81	26.8	23.3	113.7	23
September	82	26.7	23.1	89.0	14
October	83	26.3	23.0	155.4	23
November	79	25.1	21.1	248.3	12
December	66	23.2	15.9	15.7	3
TOTAL				1,395.9	146
AVERAGE	80	26.3	22.3	116.3	12.2

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-43. 1976 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	74	21.8	16.6		
February	81	25.1	21.5		
March	80	26.5	22.5	119.0	4
April	78	28.1	23.7	56.0	6
May	81	27.0	23.3	269.4	24
June	76	27.5	22.7	87.1	12
July	76	27.7	22.8	46.8	18
August	83	27.0	23.6	187.3	16
September	78	27.2	22.8	39.9	11
October	85	26.5	23.5	461.1	18
November	78	25.1	20.7	399.3	13
December	76	24.6	19.7	.3	1
TOTAL				1,666.2	123
AVERAGE	79	26.1	22.0	138.9	10.3

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-44. 1977 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
Rainfall				Millimeters	Number of days of
January	79	25.1	21.0	.2	2
February	78	25.2	20.8	96.9	5
March	81	25.9	22.1	42.6	5
April	80	28.1	24.2	25.5	2
May	78	28.3	23.9	116.8	10
June	75	28.5	23.3	81.2	15
July	76	27.5	23.2	107.2	21
August	76	27.6	22.7	100.7	15
September	79	27.2	22.9	125.9	18
October	84	26.9	23.7	126.2	13
November	76	25.5	20.8	124.4	9
December	75	24.8	19.7	2.6	2
TOTAL				950.2	117
AVERAGE	78	26.7	22.4	79.2	9.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-45. 1978 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	80	25.6	21.5	49.7	3
February	84	25.6	22.5	218.8	11
March	81	27.6	23.8	4.2	1
April	80	28.4	24.3	62.0	7
May	82	28.0	24.5	209.5	19
June	76	28.1	23.4	30.3	18
July	77	27.8	23.2	63.9	13
August	82	27.0	23.5	130.1	26
September	79	27.1	23.0	87.4	17
October	81	26.3	22.6	308.7	21
November	77	25.8	21.2	38.4	3
December	71	25.2	19.0	1.0	1
TOTAL				1,204.0	140
AVERAGE	79	26.8	22.7	100.3	11.7

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-46. 1979 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall	
				Millimeters	Number of days of
January	79	25.6	21.5	4.1	3
February	79	26.7	22.3	20.2	3
March	74	28.3	22.9		
April	75	28.8	23.7	13.8	6
May	75	29.2	23.9	97.0	13
June	81	28.2	24.4	88.1	16
July	80	27.5	23.6	115.1	19
August	81	27.3	23.7	152.6	17
September	81	27.5	23.7	68.5	16
October	77	26.9	22.2	73.0	9
November	73	26.2	20.7	45.3	3
December	76	24.5	19.7	1.9	1
TOTAL				679.6	106
AVERAGE	77	27.2	22.7	56.6	8.8

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-47. 1980 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	80	24.7	20.65	1	1
February	82	26.4	22.72	51.8	3
March	77	27.8	23.09	37.2	2
April	79	29.1	24.91	17.9	3
May	77	29.3	24.65	39.3	8
June	82	27.6	24.02	150.2	21
July	82	27.7	24.3	67.4	18
August	74	28.0	22.65	59.7	18
September	80	27.8	23.8	62.2	15
October	83	27.0	23.7	185.1	18
November	75	26.7	21.7	69.8	6
December	72	25.4	20.3	112.0	4
TOTAL				853.6	117
AVERAGE	78.7	27.3	23.0	71.1	39

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-48. 1981 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	77.55	23.98	19.31	.8	1
February	84.74	25.75	22.82	91.2	6
March	82.95	26.99	24.00	22.1	4
April	81.17	28.44	24.65	42.3	14
May	82.53	28.75	24.75	106.9	24
June	82.29	28.11	24.13	100.7	22
July	77.16	28.82	23.53	33.4	20
August	81.63	27.99	23.77	142.0	27
September	81.85	28.05	23.93	164.7	20
October	83.89	27.79	24.16	109.3	17
November	86.21	26.05	23.11	335.7	18
December	77.82	24.13	18.43		
TOTAL				1,149.1	173
AVERAGE	81.22	27.07	23.05	95.8	14.4

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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TABLE A-49. 1982 AVERAGE MONTHLY CLIMATIC DATA FOR PRACHUAB KIRIKHAN PROVINCE, THAILAND

Month Rainfall	Percent Relative Humidity	Temperature (°C)	Dew Point (°C)	Rainfall Millimeters	Rainfall Number of days of
January	76.98	23.63	18.85		
February	82.7	25.75	22.82	30.6	2
March	82.45	26.93	22.84	56.2	5
April	80.33	28.05	24.09	88.9	11
May					
TOTAL				175.7	18
AVERAGE	80.6	26.1	22.4	43.9	4.5

SOURCE: Department of Meteorology, Ministry of Communication (June 8, 1982).

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APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, PAPAYAS, AND CASHEW NUTS, 1969-1971, 1978-1980 a/

	Mangoes				Pineapples			
	1969-1971	1978	1979	1980	1969-1971	1978	1979	1980
	000 metric ton							
World	12,276	13,751	14,067	14,342	4,952	7,125	7,532	7,636
Africa	658	784	813	821	745	1,107	1,157	1,180
Angola	--	--	--	--	19	20 F	20 F	20 F
Benin	11	12 F	12 F	12 F	3	3 F	3 F	3 F
Cameroon	--	--	--	--	5	14 F	11 F	11 F
Central Africa Republic	4	6 F	6 F	6 F	--	1 F	1	1 F
Chad	24	28 F	29 F	29 F	--	--	--	--
Congo	--	--	--	--	90	100 F	102 F	103 F
Egypt	61	91	91 F	91 F	--	--	--	--
Ghana	4	4 F	4 F	4 F	28	29 *	30 *	31 F
Guinea	--	--	--	--	22	16 F	16 F	17 F
Ivory Coast	11	10 F	13 F	13 F	127	312 F	315 F	320 F
Kenya	--	--	--	--	28	130 F	140 F	145 F
Liberia	--	--	--	--	6	7 F	8 F	8 F
Madagascar	113	142	144 F	145 F	39	48	48 F	48 F
Malawi	19	25 F	26 F	27 F	--	--	--	--
Mauritius	--	--	--	--	1	1	--	1 F
Mozambique	35	30 F	30 F	30 F	18	13 F	13 F	13 F
Reunion	--	--	--	--	1	3	4 F	4 F
Senegal	25	27 F	28 F	29 F	--	--	--	--
Sierra Leone	4	4 F	4 F	4 F	--	--	--	--
Somalia	1	1 F	1 F	1 F	--	--	--	--
South Africa	7	15	15	10	158	186	212	208
Sudan	48	64 F	66 F	68 F	3	4 F	4 F	5 F
Swaziland	--	--	--	--	10	28F	35 F	40 F
Tanzania	142	168 F	172 F	175 F	37	45 F	46 F	47 F
Upper Volta	2	2 F	4 F	4 F	--	--	--	--
Zaire	145	155	170 F	173 F	150	147	150 F	156 F

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APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, . . . (Continued)

	Mangoes				Pineapples			
	1969-1971	1978	1979	1980	1969-1971	1978	1979	1980
	000 metric ton							
North and Central America	848	1,168	1,251	1,299	1,316	1,398	1,389	1,430
Cayman Island	1	1 F	1 F	1 F	--	--	--	--
Costa Rica	--	--	--	--	5	9 F	9 F	9 F
Cuba	18	19	66	60 F	15	18	14	13 F
Dominica	2	3 F	3 F	3 F	--	--	--	--
Dominican AP	153	168 F	170 F	172 F	13	20 *	18 *	20 *
El Salvador	25	25	25 F	25 F	33	17	23	23 F
Guadeloupe	1	1	1	1 F	1	--	--	--
Guatemala	--	--	--	--	17	20 F	21 F	21 F
Haiti	257	310 F	318 F	326 F	1	2 F	2 F	2 F
Honduras	12	13 F	13 F	13	F6	30 F	31 F	32 F
Jamaica	3	4 F	4 F	4 F	4	5 F	5 F	5 F
Martinique	1	1	1	2	25	17	15	15
Mexico	298	541	566	610	262	568	550	583
Nicaragua	--	--	--	--	25	36 F	33 F	34 F
Panama	23	26	26	26 F	5	8	8	8 F
Puerto Rico	11	7	7	5	50	34	40	36
Saint Lucia	38	42 F	43 F	43 F	--	--	--	--
St. Vincent	4	8 F	8 F	8 F	--	--	--	--
Trinidad	--	--	--	--	2	2 F	3 F	3 F
USA	-- b/	--	--	--	850	612	618	622 F
South America	859	929	945	958	724	963	987	1,021
Argentina	3	2	1	1 F	1	4	3	3 F
Bolivia	3	4	4 F	4 F	6	11	11 F	12 F
Brazil	668	670 F	680 F	690 F	437	575	572	572
Colombia	14	18	19	20	85	85	105	127
Ecuador	10	26	26	26 F	57	125	125	125 F
Guyana	2	2 F	2 F	3 F	1	2 F	2 F	2 F
Paraguay	22	13	14	14 F	35	33	34	35 F
Peru	62	86	80 F	82 F	63	58 F	59 F	60 F
Surinam	--	--	--	--	--	--	--	--
Venezuela	76	108	118	118 F	37	69	76	85 F

Continued . . .

APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, . . . (Continued)

	Mangoes				Pineapples			
	1969-1971	1978	1979	1980	1969-1971	1978	1979	1980
	000 metric ton							
Asia	9,904	10,862	11,050	11,255	2,013	3,532	3,843	3,866
Bangladesh	424	255	214	215 F	97	140	140 F	142 F
Brunei	--	--	--	--	2	2 F	3 F	3 F
China	169 F	211 F	257 F	250 F	804 F	873 F	888 F	888 F
India	8,300	9,000 F	9,300 F	9,500 F	98	112 F	114 F	116 F
Indonesia	300	418	300 F	316 F	107	151	182	182 F
Israel	1	1	1	1	--	--	--	--
Japan	--	--	--	--	80	55 F	60 F	60 F
Kampuchea DM	31	10 F	7 F	8 F	23	7 F	5 F	6 F
Laos	1	1 F	1 F	1 F	25	26 F	30 F	32 F
Malaysia	8	11 F	11 F	11 F	270	187	193	203
Oman	2	3 F	3 F	3 F	--	--	--	--
Pakistan	486	561	538	560 F	--	--	--	--
Philippines	143	335	359	330 F	251	465	605	600 F
Sri Lanka	39	56	57	58 F	38	78	94	95 F
Thailand	--	--	--	--	187	1,400 F	1,500 F	1,500 F
U.A. Emirates	1	2 F	2 F	2 F	--	--	--	--
Vietnam	--	--	--	--	34	37 F	30 F	39 F
Europe	--	--	--	--	2	2	1	1
Portugal	--	--	--	--	2	2	1 F	1 F
Oceania	7	8	8	9	152	122	154	138
Australia	1	1	1 F	1 F	139	105	137	120
Cook Islands	2	2 F	2 F	2 F	2	2	3 F	3 F
Fiji	--	--	--	--	1	1 F	1 F	1 F
Fr Polynesia	--	--	--	--	--	1 F	1 F	1 F
New Zealand	--	--	--	--	--	--	--	--
Papua N Guin	--	--	--	--	7	8 F	8 F	8 F
Samoa	4	5 F	6 F	6 F	4	5 F	5 F	5 F

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APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, CASHEW NUTS, AND PAPAYAS, 1969-1971, 1978-1980 a/ (Continued)

	Cashew Nuts			
	1969-1971	1978	1979	1980
	000 metric ton			
World	519,464	408,911	389,636	379,275
Africa	311,115	173,378	151,178	145,150
Angola	1,267	1,200 F	1,200 F	1,200 F
Guinea Bissau	2,400	3,000 F	3,000 F	3,000 F
Ivory Coast	400	500 F	550 F	550 F
Kenya	16,200	36,000	20,000 *	20,000 *
Madagascar	2,400	3,200 F	3,300 F	3,400 F
Mozambique	180,067	61,000 *	66,000 *	71,000 *
Tanzania	108,382	68,478	57,128	46,000
North Central America	2,521	2,897	3,073	3,075
Dominican Republic	804	850 F	860 F	870 F
El Salvador	1,717	2,042	2,208	2,200 F
Guadeloupe	--	5 F	5 F	5 F
Mexico	--	--	--	--
USA	--	--	--	--
South America	24,118	77,000	80,000	65,000
Argentina	--	--	--	--
Bolivia	--	--	--	--
Brazil	24,118	77,000 *	80,000 *	65,000 *
Asia	181,710	155,636	155,385	166,050
India	175,667	150,000 F	150,000 F	160,000 F
Malaysia	200	600 F	700 F	700 F
Pakistan	--	--	--	--
Philippines	5,570	4,235	3,800	4,500 F
Sri Lanka	274	801	885	850 F
Turkey	--	--	--	--

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APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, CASHEW NUTS, AND PAPAYAS, 1969-1971, 1978-1980 a/ (Continued)

	Cashew Nuts			
	1969-1971	1978	1979	1980
	000 metric ton			
PAPAYAS				
World	1,186	1,839	1,905	1,917
Africa	201	225	228	229
Guinea Bissau	1	2 F	2 F	2 F
Mozambique	30	36 F	38 F	38 F
South Africa				
Zaire	148	164	170 F	172 F
NC America	197	420	422	426
Costa Rica	3	3 F	3 F	3 F
Cuba	19	53	23	40 F
Dominican Republic	7	9 F	9 F	9 F
El Salvador	2	2	2 F	2 F
Jamaica	25	35 F	35 F	36 F
Mexico	130	285	326	309
JSA	10	29	19	22
South America	300	569	593	614
Argentina	1	2	2 F	2 F
Bolivia	5	8	8 F	8 F
Brazil	108	366	380 F	400 F
Chile	1	--	--	--
Colombia	39	58	65	65
Equador	50	21	17	17 F
Paraguay	10	13 F	13 F	13 F
Peru	56	66 F	67 F	68 F
Venezuela	31	36	42	42 F
Asia	471	609	645	631
Bangladesh	22	20	21 F	22 F
China	20 F	26 F	63 F	31 F
India	220	250 F	250 F	265 F
Indonesia	150	220	220 F	220 F
Malaysia	4	6 F	6 F	6 F
Philippines	55	86	85	87 F

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Continued . . .

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APPENDIX B. TOTAL PRODUCTION OF MANGOES, PINEAPPLES, CASHEW NUTS, AND PAPAYAS, 1969-1971, 1978-1980 a/ (Continued)

	Cashew Nuts			
	1969-1971	1978	1979	1980
	----------000 metric ton----------			
Oceania	17	16	17	17
Australia	5	3	3 F	4 F
Fiji	2	3 F	3 F	3 F
Samoa	10	11	11	11
Developed ME	36	55	41	44
N. America	10	29	19	22
Oceania	5	3	3	4
Other developed	21	24	19	18
Developing ME	1,131	1,758	1,800	1,843
Africa	180	202	210	211
Latin America	487	960	996	1,018
Far East	451	583	582	600
Other Ov. Ping	12	13	14	14
Central Planned	20	26	63	31
Asian CPE	20	26	63	31
Developed All	36	55	41	44
Developing All	1,150	1,784	1,864	1,874

b/ Florida and Hawaii do produce commercial quantities of mangoes but were not shown in the source for this table.

F = Estimated

SOURCE: Food and Agriculture Organization of the United Nations, World Agriculture Statistics, 1981, Rome.

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APPENDIX C. SOIL SAMPLE KEY

Sample	Location	Description
1	S_1 on map, Kyaikmaraw side	topsoil
2	S_1 on map, Kyaikmaraw side	2 ft down
3	S_2 on map, Kyaikmaraw side	topsoil
4	S_4 on map, Kyaikmaraw side	1.5 ft down
5	S_5 on map, Mudon side	topsoil
6	S_6 on map, Mudon side	topsoil
7	S_6 on map, Mudon side	topsoil
8	S_7 on map, Mudon side	topsoil

APPENDIX C. SOIL RESULTS OF SAMPLES OBTAINED FROM BURMA

Sample Number	Soil pH	Buffer pH	Lime Needed Per Acre	Excess Lime	Available Nutrients: Residual Nitrate ppm	Residual Nitrate Pounds/Acre	Phosphorus ppm	Potassium ppm	Zinc ppm	Zinc Avail-ability	Org. Matter
1	4.3	6.0	--	--	--	--	6.2	53	--	--	3.9
2	4.7	6.6	--	--	--	--	15.0	13	--	--	0.5
3	4.7	6.2	--	--	--	--	1.8	24	--	--	2.4
4	5.3	6.6	--	--	--	--	0.9	46	--	--	0.5
5	4.6	5.8	--	--	--	--	3.9	19	--	--	4.8
6	4.7	6.0	--	--	--	--	2.1	91	--	--	7.0
7	5.0	6.0	--	--	--	--	0.9	18	--	--	4.6
8	4.7	6.2	--	--	--	--	2.4	19	--	--	2.5

SOURCE: Cooperative Extension Service, University of Nebraska, Lincoln, NE 1982

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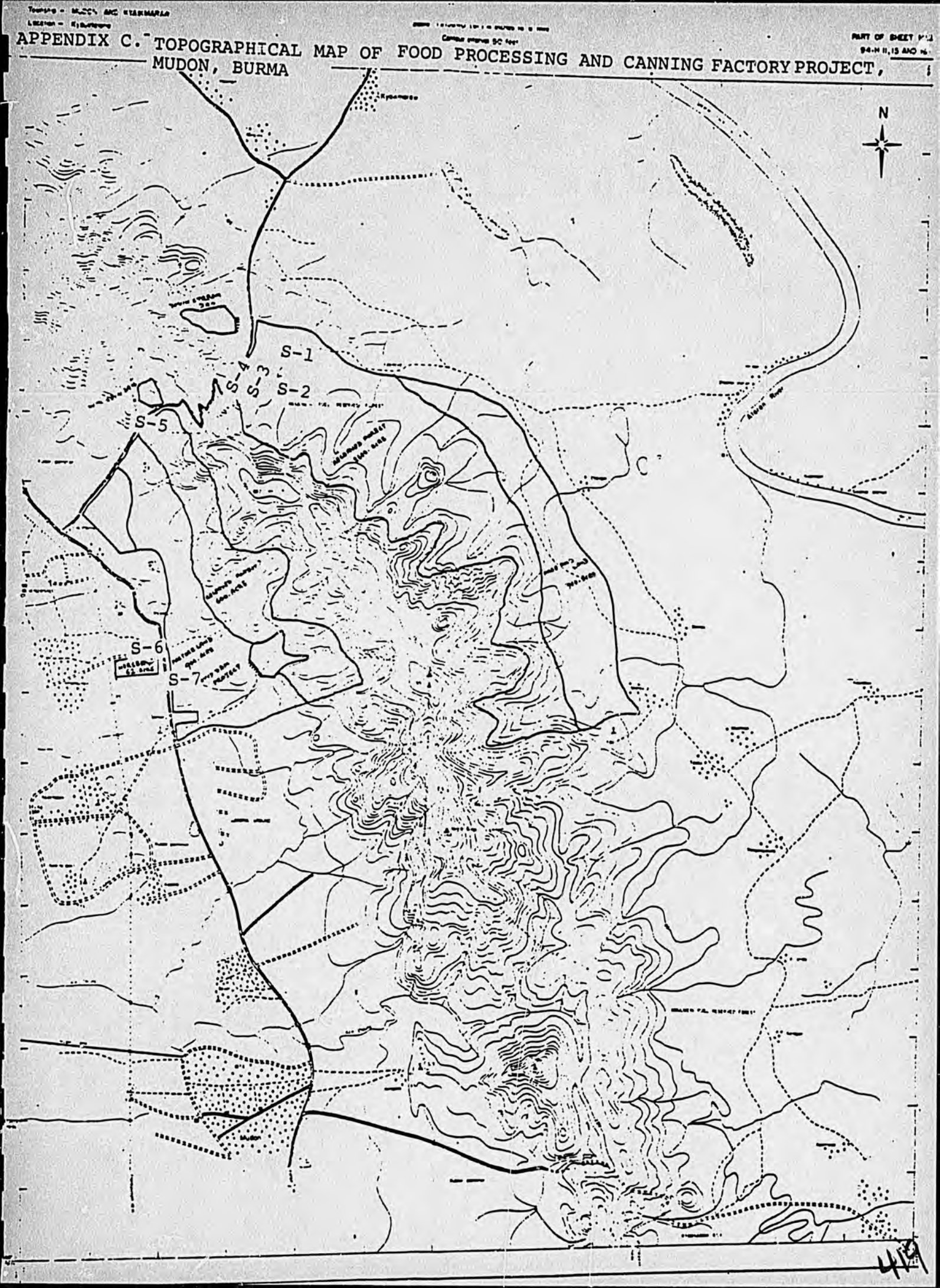
APPENDIX C. TOPOGRAPHICAL MAP OF FOOD PROCESSING AND CANNING FACTORY PROJECT, MUDON, BURMA



APPENDIX D. YIELD RESPONSE OF INDIAN GIANT KEW PINEAPPLE TO NITROGEN

Nitrogen (lbs/A)	Yield (T/A)	
	Irrigated	Non-Irrigated
00.0	17.8	10.4
44.5	18.3	12.4
89.1	20.0	15.2
178.1	28.0	18.4
356.3	33.1	21.9
712.6	39.1	28.0

Source: Singh, et al., 1975. Nitrogen Requirement of Pineapple Under Irrigation and Rainfed Conditions, Indian Journal of Horticulture.

AG-RAIN 3250 AND 3225
WATER-REEL TRAVELING SPRINKLERS

Here are Ag-Rain's new high value energy efficient mid-size travelers. Some of their special features are:

DRIVE: The drive is Ag-Rain's patented radial inflow turbine coupled with a vari-speed primary drive, worm gear secondary drive and double chain final drive. Power output is maximized with minimum pressure usage through the turbine.

TRAVEL SPEED: The energy efficient drive permits any travel speed from 6 to 60 inches per minute at any system flow rate from 200 GPM and up. Depending on flow rate and spacing as little as 1/3-inch water may be applied.

SPEED CONTROL: After one-time high and low speed adjustment, desired travel speed is set simply by turning a knob.

CHASSIS: 2-wheel single axle, adjusts 96 to 108 inches. Designed for easy maneuvering, tongue weight (empty) is 800 lbs. Has heavy duty tongue and jack.

SWIVEL OR NON-SWIVEL REEL: Customer's choice of easy one-man 360° swiveling reel or non-swiveling reel. Hose layout from non-swiveling reel may be from either side or rear. To change positions requires removing six bolts, lifting and turning reel to desired position, then re-installing bolts.

GUN CART: Versatile, sturdy, convenient 3-wheel cart stays connected between runs. Lift hook is always in line for lifting gun cart at the end of the run. Lifts easily with hand operated jack screw. Gun cart width adjusts from 72 to 110 inches using another hand operated jack screw. Choice of 61-inch high clearance cart or 38-inch low clearance cart.

OTHER CONVENIENCE & PERFORMANCE FEATURES: Automatic speed compensator maintains smooth uniform travel speed for even watering. Heavy duty stabilizers lift from chassis for easy removal from soil after the run. Storage reel for supply hose. Clutch disengages drive during PE tube reel-out. Solid core reel for extra strength. Flotation tires are 9.5L x 15. Automatic travel stop.

ADDITIONAL SPECIFICATIONS:

Model 3250 has heavy duty 3-3/4" I.D. x 1000' PE tubing.

Model 3225 has heavy duty 3-1/4" I.D. x 1200' PE tubing.

Model 3250 handles 200 to 400 GPM for up to 80 acres.

Model 3225 handles 200 to 250 GPM for up to 50 acres.

Operating dimensions:

Overall height ---- 131 inches.

Overall width ----- 96 inches (adjusts to 108 inches).

Overall length ---- 172 inches.

Weight (empty):

Model 3250 with gun cart ---------- 6000 lbs. (approx.).

Model 3225 with gun cart ---------- 6200 lbs. (approx.).

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3 WATER-REEL MODELS TO CHOOSE FROM

Model	Hose (Polyethylene) I.D. (inches) X Length (feet)	Operating Dimensions Feet and Inches Length	Width	Height	Weight, Lbs. No Water	With Water*
3590	4½ x 900	20-5	9-8	12-6	7120	11,200
3570	4⅛ x 1150	20-5	9-8	12-6	7120	11,200
3550	3¾ x 1250	20-5	9-8	12-6	7120	11,200

*When disconnected, the hose drains partially.

Depth of Water Applied, Inches

GPM	SPACING FEET	TRAVEL SPEED, IN./MIN. 6	9	12	18	24	30	36	48
200	160	4.0	2.7	2.0	1.3	1.0	0.8	0.7	0.5
	190	3.4	2.3	1.7	1.1	0.8	0.7	0.8	0.4
	235	2.7	1.8	1.4	0.9	0.7	0.5	0.5	0.3
225	170	4.2	2.8	2.1	1.4	1.1	0.9	0.7	0.5
	205	3.5	2.3	1.8	1.2	0.9	0.7	0.6	0.4
	250	2.9	1.9	1.4	1.0	0.7	0.6	0.5	0.4
250	175	4.6	3.1	2.3	1.5	1.1	0.9	0.8	0.6
	210	3.8	2.5	1.9	1.3	1.0	0.8	0.6	0.5
	280	3.1	2.1	1.5	1.0	0.8	0.6	0.5	0.4
300	180	5.4	3.8	2.7	1.8	1.3	1.1	0.9	0.7
	215	4.5	3.0	2.2	1.5	1.1	0.9	0.7	0.8
	265	3.6	2.4	1.8	1.2	0.9	0.7	0.8	0.5
350	190	5.9	3.9	3.0	2.0	1.5	1.2	1.0	0.7
	230	4.9	3.3	2.4	1.8	1.2	1.1	0.8	0.8
	290	3.9	2.6	1.9	1.3	1.0	0.8	0.6	0.5
400	200	–	4.3	3.2	2.1	1.8	1.3	1.1	0.8
	240	–	3.6	2.7	1.8	1.3	1.1	0.9	0.7
	300	–	2.8	2.1	1.4	1.1	0.9	0.7	0.5
450	210	–	4.6	3.4	2.3	1.7	1.4	1.1	0.9
	250	–	3.9	2.9	1.9	1.4	1.2	1.0	0.7
	310	–	3.0	2.3	1.6	1.2	0.9	0.8	0.6
500	225	–	4.8	3.6	2.4	1.8	1.4	1.2	0.9
	270	–	4.0	3.0	2.0	1.5	1.2	1.0	0.7
	330	–	3.2	2.4	1.8	1.2	1.0	0.8	0.6
550	235	–	5.0	3.8	2.5	1.9	1.5	1.3	0.9
	280	–	4.2	3.2	2.1	1.6	1.3	1.1	0.8
	345	–	3.4	2.6	1.7	1.3	1.0	0.9	0.6
800	240	–	5.4	4.0	2.7	2.0	1.6	1.3	1.0
	290	–	4.4	3.3	2.2	1.7	1.3	1.1	0.8
	385	–	3.5	2.6	1.8	1.3	1.0	0.9	0.7

SPECIFICATIONS SUMMARY

	MODEL 3590	3570	3550
Recommended capacity, GPM	up to 600	up to 400	up to 300
Sprinkler	Nelson P200R flange connection	Nelson P200R flange connection	Nelson P150R flange connection
Recommended spacing, ft.	up to 330	up to 300	up to 270
Travel speed, inches per minute			
Turbine drive	9 to 40	9 to 40	9 to 40
Engine drive	up to 72	up to 72	up to 72
Max. travel distance, ft.	900	1150	1250
Approx. total maximum Distance watered uniformly considering sprinkler throw and use of dwell timer, ft.	1070	1300	1380
Hose, in. I.D. by length, ft.	4½ x 900	4⅛ x 1150	3¾ x 1250
Supply hose	Recommended is 20 or more feet length by 4- or 4½-inch internal diameter flexible hose, 150 PSI operating pressure.		
Supply hose connection	4-inch female ring lock adapted with chains for attaching Ag-Rain 4- or 4½-inch pull coupler, swivels 180°.		
Drive	Ag-Rein patented radial inflow turbine, totally gear driven, no belts or engine drive.		
Gun cart	Tricycle type, new rubber tires, one 18 x 9.50-8, two 6.70 x 15. Adjustable tread width 53 to 144 inches. Crop clearance 47 inches. Sprinkler nozzle height 75 inches.		
Conformation	4-wheels with supporting frame of cold drawn square steel tubing. Hose reel swivels 360° on ball bearings.		
Hose reel core diameter, inches	96	96	96
Tires	4 new rubber tires, flotation type, 9.5 x 15.		
Towing	Up to 3 MPH in farm fields, up to 12 MPH on smooth roadways.		
Shipping dimensions ft. and inches			
Length	12-1	12-1	12-1
Width	8-0	8-0	8-0
Height	11-6	11-6	11-6

Because of continuing product improvements photos of machines in this leaflet may not be identical to current production. The performance information in this leaflet is based on tests conducted under a particular set of conditions. Actual field performance may vary from this data depending on variable circumstances of time, place, weather, human judgment and other factors.

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TABLE F-1. ESTIMATED CAN CONSUMPTION - Continued

	Fruit		300 Can - 300 x 407			#2 Can - 307 x 409			#10 Can 603 x 700			Total Production 2-1/2 Case Equivalent
	Raw	Total	Capacity		15 Ounce	Capacity		20 Ounce				
	(metric tons)	(percent)	(percent)	(cases)	(cans)	(percent)	(cases)	(cans)	(percent)	(cases)	(cans)	(cases)
Guava	83	100		4,310	103,440		1,885	45,250		1,380	8,280	4,770
Jam or Jelly		40	60	2,350	56,400	40	1,160	27,840				2,000
Nectar		20	100	1,960	47,040							1,000
Puree		30							100	1,380	8.280	1,270
Shells		10				100	.725	17,410				.500
Tropical Fruit Cocktail	375			5,870	140,880		10,160	243,840				10,000
Tropical Fruit Cocktail		100	30	4,870	140,880	70	10,160	243,840				10,000
TOTAL ACTUAL CASES				72,675	1,744,215		94,795	2,275,090		14,115	84,690	115,441

SOURCE: Experience, Incorporated

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TABLE F-1. ESTIMATED CAN CONSUMPTION DURING FIRST YEAR OPERATION

	Fruit		300 Can - 300 x 407			#2 Can - 307 x 409			#10 Can 603 x 700			Total Production 2-1/2 Case Equivalent
	Raw	Total	Capacity		15 Ounce	Capacity		20 Ounce				
	(metric tons)	(percent)	(percent)	(cases)	(cans)	(percent)	(cases)	(cans)	(percent)	(cases)	(cans)	(cases)
Pineapple	1,900		100	35,700	856,800	100	39,700	952,800				45,600
Slices						25	9,925	238,200				6,845
Tidbits-Chunks, etc.			23	8,211	197,064	23	9,130	219,120				10,485
Jam			25	8,925	214,200							4,560
Crushed						18	7,145	171,480				4,924
Juice			52	18,564	445,536	34	13,500	324,000				18,786
Mango	350	00		18,350	440,415		9,700	232,800		3,400	20,400	19,187
Slices		50				100	9.700	232,800				6,685
Pulp		25							100	3,400	20,400	3,127
Nectar		25	100	18,350	440,415							9,375
Papaya	240	00		5,900	141,600		4,350	104,400		3,680	22,080	9,400
Dices-Chunks	93	30				100	4,350	104,400				3,000
Pulp	122	40							100	3,680	22,080	3,385
Nectar	25	30	100	5,900	141,600							3,015
Rambutan	545	00					29,000	696,000				19,984
Whole fruit	545	00				100	29,000	696,000				19,984
Passion Fruit	360	00		2,545	61,080					5,655	33,930	6,500
Nectar		20	100	2,545	61,080							1,300
Nectar Base		60							100	4,240	25,440	3,900
Pulp		20							100	1,415	8,490	1,300

Continued . . .

EQUIPMENT LIST FOR TROPICAL FRUIT CANNERY

Item No.	Quantity	Description	Capacity	Dimensions	Motor HP	Supplier	Cost F.O.B. Plant USA$
A.		Pineapple Product Line					
1.	1	Soak Tank Washer	5 MT/hr	10'4" x 3'5" x 6'2"	6.00	1	7,750
2.	1	Inspection & Size Grading Conveyor	40 ppm	10'0" x 2'0" x 2'6"	2.00	1	13,400
3.	2	Conveyors & Holding Tables	40 ppm	4'0" x 1'6" x 2'6"	2.00	1	3,400
4.	2	Sizer & Corer	25 ppm	5'0" x 2'6" x4'6"	3.00	2	32,200
5.	2	Cylinder Conveyor & Elevator	25 ppm	5'0" x 2'8" x 3'0"	1.00	1	10,000
6.	2	Inspection & Trimming Conveyor	40 ppm	10'0" x 2'0" x 2'6"	2.00	1	7,700
7.	1	Slicer	500 spm	1'7" x 1'7" x 2'6"	1.00	3	14,850
8.	2	Inspection & Can Filling Conveyor	40 ppm	10'0" x 2'6" x 2'6"	3.00	1	9,600
9.	1	Tidbit & Segment Cutter	10 ppm	3'0" x 1'0" x 1'8"	0.50	1	7,900
10.	1	Semi-automatic Syruper	25 cpm	3'8" x 1'10"x 1'8"	1.00	8	4,850
11.	2	Syrup Tanks & Pump	159 gal	2'2" dia x 6' each	0.25	4-7	6,650
12.	1	Can Conveyor	25 cpm	10'6" x 4" x 2'6"	0.50	1	1,750
13.	1	Exhaust Box	260 cans	23'3" x 5'3" x 3'6"	1.50	1	22,900
14.	1	Closing Machine	30 cpm	2'6" x 2'3" x 5'5"	1.50	5	12,000
15.	2	Cooking Tank	528 cans	3'4" dia x 3'6" each	-	1	4,100
16.	4	Cooling Tank	528 cans	3'4" dia x 3'6" each	-	1	7,800
17.	1	Peel Conveyor	25 ppm	30'0" x 1'6" x 1'0"	1.00	1	5,250
18.	1	Meat Eradicator	25 ppm	5'0" x 2'6" x 4'6"	1.00	2	19,780
19.	1	Screw Elevator	400 Kgs/hr	7'0" x 1'0" x 3'0"	1.00	1	1,900
20.	1	Disintegrator	22 ppm	2'0" x 2'8" x 3'0"	15.00	6	12,000
21.	1	Drain Chute & Holding Tank	50 gal	2'0" dia x 4'0"	-	4	1,700

EQUIPMENT LIST FOR TROPICAL FRUIT CANNERY

Item No.	Quantity	Description	Capacity	Dimensions	Motor HP	Supplier	Cost F.O.B. Plant USA$
A.		Pineapple Product Line (cont.)					
22.	1	Centrifugal Pump	2-10 gpm	2'0" x 1'0" x 1'8"	0.50	7	850
23.	1	Inspection Belt		10'0" x 2'0" x 2'6"	1.00	1	3,850
24.	2	Jacketed Mixing Kettles	200 gal	3'0" dia x 4'2"	2.00	4	16,[illegible]50
25.	1	Positive Displacement Pump	12 gpm	2'0" x 2'0" x 1'8"	1.00	7	3,800
26.	1	Deaerator Pasteurizer	8 gpm	7'0" x 4'0"	1.50	10	42,250
27.	1	Piston Filler	15 cpm	8'0" x 3'0"	3.00	8	19,050
28.	1	Closing Machine	15 cpm	2'6" x 2'3" x 5'5"	1.50	5	12,000
29.	1	Juice Extractor	20 gpm	5'7" x 1'9" x 3'3"	5.00	9	16,500
30.	1	Centrifugal Pump	20 gpm	2'0" x 1'0" x 1'8"	0.50	4	800
31.	2	Holding Tanks	500 gals	4'4" dia x 6'0"	-	7	6,900
32.	1	Centrifugal Pump	8 gpm	2'0" x 1'0" x 1'8"	0.50	4	850
		Sub Total			59.75		123,600
B.		Pulp Line					
33.	1	Soak Tank Washer	5 MT/hr	10'4" x 3'5" x 6'2"	6.00	1	7,750
34.	1	Roller Inspection Conveyor	5 MT/hr	10'0" x 2'0" x 2'6"	2.00	1	13,400
35.	1	Conveyor	5 MT/hr	12'0" x 2'0" x 2'6"	1.00	1	4,200
36.	1	Pulper	20 gpm	4'1" x 1'9" x 3'3"	7.50	9	16,500
37.	1	Centrifugal Pump	20 gpm	2'0" x 1'0" x 1'6"	0.25	7	775
38.	1	Holding Tank	250 gal	3'4" dia x 4'		4	3,500

EQUIPMENT LIST FOR TROPICAL FRUIT CANNERY

Item No.	Quantity	Description	Capacity	Dimensions	Motor HP	Supplier	Cost F.O.B. Plant USA$
B.		Pulp Line (cont.)					
39.	1	Finisher	20 gpm	4'1" x 1'9" x 3'3"	7.50	9	16,500
40.	1	Centrifugal Pump	20 gpm	2'0" x 1'0" x 1'6"	0.25	7	775
41.	2	Holding Tank	1000 gal	4'4" dia x 6'10"	–	4	9,800
42.	1	Centrifugal Pump	12.5 gpm	2'0" x 1'0" x 1'8"	0.50	7	850
43.	1	Heat Exchanger	12.5 gpm		1.50	10	29,800
44.	1	Filler	15 cpm	8'0" x 3'0"	3.00	8	19,050
45.	1	Closing Machine	15 cpm	2'6" x 3'3" x 5'5"	1.50	5	12,000
46.	2	Water Cooler	15 cpm	3'4" dia 3'6"	–	1	3,900
47.	1	Soak Tank	2.7 MT/hr	Total Line	–	3	2,400
48.	1	Elevator	2.7 MT/hr	Space Requirement	1.50	3	9,200
49.	1	Drum Washer	2.7 MT/hr	30'0" x 4'6" x 10'6"	1.50	3	9,600
50.	1	Inspection Pan	2.7 MT/hr			3	1,200
51.	1	Elevator	2.7 MT/hr		1.50	3	7,900
52.	1	Cutter	2.7 MT/hr		3.00	3	9,100
53.	1	Centrifugal Extractor	2.7 MT/hr		3.00	3	12,200
54.	1	Guava Slicer			3.00	9	7,300
		Sub Total			44.50		197,700

EQUIPMENT LIST FOR TROPICAL FRUIT CANNERY

Item No.	Quantity	Description	Capacity	Dimensions	Motor HP	Supplier	Cost F.O.B. Plant USA$
C.		Slices - Dices - Whole Fruit Product Line					
55.	1	Conveyor	2-3 MT/hr	20'0" x 2'0" x 2'6"	2.00	1	5,600
56.	2	Peeling & Trimming Conveyor	2-3 MT/hr	30'0" x 2'0" x 2'6"	3.00	1	14,700
57.	1	Manual Can Filling Conveyor	20 cpm	10'0" x 2'6" x 2'6"	1.00	1	4,800
58.	1	Semi Automatic Syruper	20 cpm	3'8" x 1'10"x 1'8"	1.00	8	4,850
59.	2	Syrup Mixing Tanks & Pump	150 gal	2'2" dia x 6'0" each	0.25	4	6,650
60.	1	Can Conveyor	20 cpm	10'0" x 4" x 2'6"	0.50	1	2,600
61.	1	Exhaust Box	20 cpm	17'3" x 5'3" x3'6"	1.50	1	15,800
62.	1	Can Conveyor	20 cpm	4'0" x 4" x 2'6"	0.25	1	1,500
63.	1	Closing Machine	20 cpm	2'6" x 2'3" x 5'5"	1.50	5	12,000
64.	2	Atmospheric Cookers	528 cans	3'4" dia 3'6" each	-	1	4,100
65.	2	Water Cooler	528 cans	3'4" dia 3'6" each	-	1	3,900
		Sub Total			11.00		76,500
D.		Jam and Jelly Line					
66.	1	Mixing Kettle	100 gal	3'2" x 5'7" x 8'5"	-	4	8,375
67.	1	Vacuum Pan	100 gal	3'2" dia x 8'	3.00	4	21,300
68.	1	Heating Kettle	100 gal	3'2" dia x 4'1"	-	4	8,375
69.	1	Positive Displacement Pump	2 gpm	2'0" x 2'0" x 1'8"	1.00	7	3,500
		Sub Total			4.00		41,550

EQUIPMENT LIST FOR TROPICAL FRUIT CANNERY

Item No.	Quantity	Description	Capacity	Dimensions	Motor HP	Supplier	Cost F.O.B. Plant USA$
E.		**Supporting Equipment**					
70.	1	Labeller	600 cpm	11'4" x 3'0" x 4'4"	0.75	1	15,745
71.	1	Case Packer	200 cpm	5'0" x 3'6" x 3'3"	0.50	11	25,000
72.	1	Glue Sealer	480 cpm	25'0" x 3'2" x4'2"	1.50	2	16,600
73.	1	Fork Lift Truck				12	19,500
74.	3	Waste Conveyors				1	14,000
75.	1	Platform Scale				13	8,100
76.	4	Handlift				14	800
77.	1	Lot of SS Piping, Clamps etc.				7	12,000
78.	1	Boiler	300 HP	19'2" x 8'2" x 8'10"	10.75	15	65,200
		Sub Total			13.50		176,950
F.		**Fresh Fruit Packing Line**					
79.	1	Soak Tank Washer with Spray	1 - 3MT/hr	4'0" x 55'0"	5.00	16	
80.	1	Roller Inspection Conveyor		For Entire Line	for line	16	
81.	1	Brush Washer				16	
82.	1	Hot Wax Applicator				16	
83.	1	Spray Wax Applicator				16	
84.	1	Manual Size Grading Conveyor				16	
85.	1	Manual Packing Bins				16	
		Sub Total			5.00		75,000

Total Cost F.O.B. Plant - U.S.A. ..... $ 691,300
ESTIMATED OCEAN FREIGHT COST 81,250
ESTIMATED COST C&F BURMA US$ 772,550
K 5,407,850

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
A. Fruit Receiving Storage - Grading and Distribution				
1	1 only	Hydraulic platform truck dump. Specifications for size and capacity of trucks to be determined by customer. 30 HP. 40 GPM hydraulic unit with (2) four-stage hydraulic cylinders - capacity 50 tons	1	US$ 55,000.00
2	1 only	Water dumping and fruit storage system complete with circulating pump, flumes, gates and pineapple control gates.		
		To be designed and detailed by Honomach and constructed by customer. Engineering Fee	1	10,000.00
3	1 only	Slat elevator and fresh water spray rinse system, with sugar mill type rivetless chain and heavy angle iron slats.	1	40,000.00
4	2 only	Honomach high tonnage pineapple graders - set up in series to give 3 sizes of fruit, graded by diameter. Each bank of graders is accurately made and individually adjustable to small tolerances.		
		Motor 3 H.P. with heavy duty reducer. Cost @ 13.560.00 each	1	27,120.00
5	1 only	Two-level, Merry-go-round, pineapple storage and fruit distribution system, consisting of 2 only 60 cm wide conveyors, side by side and running in opposite directions with side rails, chutes from graders, columns, supports and electric control panel for elevators, graders and conveyors.		
		2 only 5 H.P. motors and shaft-mounted reducers.	1	58,000.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
6	2 only	Stainless steel Chutes from distribution conveyors to 2 Ginaca machines with provision for taking pineapple from either #2 belt or #2-½. Chutes are equipped with air-operated controls for directing pineapples off the conveyor onto the Ginaca feed chutes as required. Cost @ 3,000.00 each	1	US$ 6,000.00
7	1 only	Chute and accumulating conveyor for small #1 pineapple to Sizing machine. Cost	1	6,000.00
				US$ 202,120.00

B. Slices - Chunks - Tidbits - Processing Line.

8	3 only	Honomach Ginacas, to be set as follows: (a) 1 machine to be set for sizing 95.3 mm dia (3-3/4" dia No. 2-½) size cylinders (b) 1 machine to be equipped with change parts to cut 79 mm (3-1/8" dia. No. 2) cylinders (c) 1 machine to be equipped with change parts to cut 70 mm (2-3/4" dia. No. 1) cylinders Standard Honomach Ginacas are heavy-duty production machines designed for speeds up to 120 pineapples per minute. They are equipped with: a. Cross-feed conveyors designed for simplified feeding of the pineapple from the chutes at high speed, by one man. b. Feed track equipped with pusher feed dogs c. A bronze and stainless steel centering head		

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				
		equipped with oil-impregnated bearings and screw type adjustments for the fingers.		
		d. A special, hardened steel, rotating sizing knife assembly, mounted in precision bearings with a stainless steel barrel.		
		e. A stainless steel skin eradicator with heavy stainless cleats mounted on 3/4 pitch stainless chains. A single knife at a long shear angle removes the meat from the skin for the juice pack. The knife can be easily adjusted for depth of cut.		
		f. Crown and butt-end knives.		
		g. Standard Ginacas are equipped with a coring mechanism driven by the turret indexing cam. This is not needed on Two- Diameter lines with provision for removing the core after slicing.		
		3 H.P. Motor drive Cost @ $73,020.00 each	1	US$ 219,060.00
9	3 only	Chutes for juice, skins, ends and cylinders to cross conveyors and preparation lines.. Lot cost	1	5,000.00
10	1 only	No. 2-½ Size Two-Diameter Preparation Line, complete with:		
		A. Stainless steel conveying system for cylinders, slices, with return run of wide inspection belt used to convey table rejects, cores, resized scraps and crushed material to cannery cross conveyors.		
		Conveyor drive is equipped with a special take-up mechanism to allow the belt to be conveniently slacked a large amount for clean up and maintenance.		

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				US$
		Motor 3 H.P with variable speed pulley and reduction drive.		
		B. Honomach Single Knife Slicer capable of cutting pineapple cylinders with cores up to 2000 slices per minute		
		Motor 2 H.P. with variable speed pulley		
		C. Two (2) only Honomach Coring-Canloading machines. The Corer-Canloader automatically meters the sorted slices into a turret, cores and loads them into the cans.		
		The corer-Canloader can operate at speeds of 45 cans/min. and comes complete with a variable speed drive and feed conveyor.		
		2 - Motors - 3 H.P.		
		D. Honomach Resizer-Corer		
		Resizer-Corers perform the operation of removing bits of skin or eyes from selected slices by cutting a narrow ring of fruit from the outer diameter. The scrap material is sent to the juice return conveyor and the clean #2 size slices are cored and delivered to a short inspection conveyor. The Resizer-Corer comes complete with feed and discharge conveyors and a variable speed drive.		
		2 - Motors - 2½ H.P.		

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				US$
		E. Honomach Canloader. The Canloader follows the Resizer-Corer and fills No. 2 cans with inspected slices from the Resizer-Corer. Motor - 1½ H.P.		
		F. Salvage Segment Cutter and Corer. Slices not suitable for canloading or resizing operation are passed to the end of the belt for salvage. Salvage operators remove disease spots, eyes or other defects and place suitable slices in an air-operated machine which removes the cores and cuts the slices into two or more segments. The resulting product is then inspected and sorted to the crushed or solid pack		
		Cost - Items A thru F	1	US$ 153,090.00
11	1 only	No. 2 Size Honomach Two-Diameter line. Same as Item #10 with addition of change parts to reduce Corer-Canloaders to No. 2 size slices. Resized slices are 2-3/4" (70mm) dia. Canloader following the Resizer-Corer is not used.		
		Cost	1	US$ 131,060.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				US$
12	1 only	Simplified Small Fruit Line, consisting of:		
		A. Trimming and packing line with Single Knife Slicer feed conveyor and slicer mounting		
		B. Honomach Single Knife Slicer		
		C. Salvage Segment Cutter & Corer - same as Item #10, F		
		Cost	1	US$ 60,100.00
13	1 only	Cannery cross-conveyor for waste skins and ends with provision for conveying juice material on the return run of the belt to opposite side of cannery.		
		Cost	1	US$ 15,000.00
14	1 only	Cannery cross-conveyor for crushed material.		
		Cost	1	US$ 12,000.00
15	2 only	Filled Can Conveyors for #2 and #2½ filled cans from the Corer Can Loaders to the syruping, seaming lines.	2	US$ 8,000.00
16	2 only	Empty Can Conveying System for #2 and #2½ cans.	2	US$ 19,000.00
17	1 only	FMC #205 20 Valve Pre-Vacuumizing syruper for #2½ (401 x 411) cans of pineapple slices. To be equipped with stainless steel contact parts, adjustable headspace feature, spiral timer, no-can-no-fill device, vertical tank trap, to be direct connected and driven from CANCO 458 Steam Flow Closing Machine.	3	

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ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier		Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				US$	
		Equipped with feed disc for can inspection and feeding from spiral de-elevator or trays. Cost	3	US$	77,000.00
18	1 only	CANCO 458 Steam Flow Disc Feed Closing Machine for 401 x 411 with steam flow attachment. 5 H.P. variable speed drive and connecting drive and transfer mechanism to FMC vacuum syruper. Cost	4		59,700.00
19	1 only	FMC #205 20 Valve Pre-Vacuumizing syruper for 2T (307 x 409) cans of pineapple slices. To be equipped with stainless steel contact parts, adjustable headspace feature, spiral timer, no-can-no-fill device, vertical trap tank. To be direct connected and driven from CANCO 458 Steam Flow Closing Machine. Cost	3		77,000.00
20	1 only	CANCO 458 Steam Flow Disc Feed Closing Machine, with steam flow attachment, 5 H.P. variable speed drive with connecting drive and transfer mechanism to FMC vacuum Syruper Cost	4		59,700.00
21	1 only	FMC 125 12 Valve PUS Pre-vacuumizing syruper for #10 (603 x 700) cans of pineapple slices, tidbits or diced products. To be equipped with stainless steel contact parts, adjustable headspace feature, spiral timer, no-can-no-fill device, vertical tank trap. To be direct connected and driven from CANCO 600-IS-0 Closing Machine	3		74,800.00
22	1 only	CANCO 600-IS-0 Closing Machine with steam flow attachment, 5 H.P. variable speed drive with connecting drive and transfer mechanism to FMC vacuum syruper. Cost	4	US$	31,800.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
B. Slices - Chunks - Tidbits - Processing Line. Cont.				US$
23	1 only	FMC 55" Diameter atmospheric cooker for 2½ (401 x 411) cans, approximately 1200 can holding capacity. 3 H.P. variable speed drive, left side feed elevator.	3	
24	1 only	FMC 55" Diameter open spray cooler, holding 960 cans, drive from cooker. Cost	3	130,000.00
25	1 only	FMC 55" Diameter atmospheric cooker for 2 T (307 x 409) cans, approximately 1400 can holding capacity, 3 H.P. variable speed drive, left side feed elevator.	3	
26	1 only	55" Diameter open spray cooler holding approximately 1200 2 T cans, drive from cooker. FMC Cost	3	125,000.00
27	1 only	FMC 55" Diameter atmospheric cooker for #10 (603 x 700) cans approximately 720 can holding capacity. 3 H.P. variable speed drive left side feed elevator.	3	
28	1 only	FMC 55" Diameter open spray cooler holding approximately 720 cans, drive from cooker.	3	165,000.00
29	1 only	BFM Can Dryer for 2½ cans and 10 H.P. Motor. Cost	5	3,550.00
30	1 only	BFM Can Dryer for 2 T Cans and 10 H.P. Motor. Cost	5	3,550.00
			US$	1,429,410.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
C. Juice Processing Line				US$
31	1 only	Reitz Disintegrator, Model RP-12-K122, 3600 RPM 20 H.P. drive, stainless steel angle type construction, 5/8" dia round perforated sizing screen, full circle construction, round elbow inlet and square chute outlet. Cost	6	12,000.00
32	1 only	Crepaco #4 stainless steel, positive displacement, rotary pump, with variable speed drive 100-300 RPM, 5 H.P. Motor and stainless steel feed tank. Cost	7	5,200.00
33	1 only	3" (7.62 cm) dia stainless steel tubing and fittings to bring juice material to extractor	7	2,600.00
34	1 only	500 gal. (1,900 liter) stainless steel surge tank with conical bottom, 4" (10 cm) outlet and plastic plug valve for even flow to extractor. Cost	8	4,900.00
35	1 only	Brown International Model 2503 Screw-type extractor with stainless steel contact parts .020" Screen. 15 H.P. motor and drive unit. Cost	9	26,700.00
36	1 only	Holding and Deaeration Tank. Stainless steel with cover, steam jacket, thermostatic control and special baffles and piping, 5000 liter (1328 gal) capacity, including Crepaco rotary stainless steel pump with variable speed drive 5 H.P. Motor to pump juice to centrifuge. Cost	8	32,100.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
C. Juice Processing Line Cont.				US$
37	1 only	Westfalia SA35 automatic, centrifugal desludger, all welded parts stainless steel. Includes automatic timing units, solenoid valves, motor switches.		
		Motor 40 H.P. Cost	10	83,300.00
38	1 only	6" dia (15 cm) x 25 ft. long (7.62 meters) screw conveyor with stainless steel trough and screw for moving pulp discharge from press and centrifuge back to waste material conveyor		
		Motor 1 H.P. and Drive Cost	11	4,300.00
39	1 only	Model SC Crescent plate heat exchanger, press frame of mild steel with vinyl plastic coating, plates and all surfaces in contact with juice of type 316 stainless steel.		
		Unit includes instrument controls, hot water circulating pump, pressure tube. Cost	7	7,500.00
40	3 only	200 gal stainless juice holding tanks with steam coil and thermostat. Cost	8	24,900.00
41	1 only	Model C-610, 6 valve FMC juice filler for #10 cans. Type 316 stainless steel contact parts to be direct connected and driven by CANCO 08 Closing Machine, Motor 5 H.P. variable speed drive. Cost	3-4	110,800.00
42	1 only	55" diameter open spray cooler with variable speed drive for #10 and #12 cans, holding 726 cans right side feed elevator.		
		Motor 2 H.P. Cost	3	92,700.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
C. Juice Processing Line Cont.				US$
43	1 only	Model 060 C Series FMC Piston type filler for #2 cans (307 x 409) Type 316 stainless steel contact parts to be direct connected and driven by CANCO 422-IE-00 Closing Machine.		
		Motor 3 H.P. with variable speed drive. Cost	3-4	US$ 80,700.00
44	1 only	55" diameter open spray cooler with variable speed drive for #2 cans, holding 720 cans.		
		Motor 3 H.P. with variable speed drive. Cost	3	70,300.00
45	1 only	Model 060 C Series FMC Piston Type Filler, for #2½ cans (401 x 411) Type 316 stainless steel contact parts to be directly connected and driven by CANCO 422-IE-00, Closing Machine.		
		Motor 3 H.P. with variable speed drive Cost	3-4	80,700.00
46	1 only	55" diameter open spray cooler with variable speed drive for #2½ cans, holding 660 cans.		
		Motor 3 H.P. with variable speed drive Cost	3	73.100.00
D. Crushed Pineapple Processing Line				US$ 711,800.00
47	1 only	12" wide (30.5 cm) cleated belt elevator with molded cleats on 9" (23 cm) centers. Stainless steel belt pan - to elevate crushed material from cannery cross conveyor to Honomach		
		Motor 1 H.P. and Reducer Cost	11	6,000.00
48.	1 only	Honomach Pineapple Crusher, stainless steel product contact parts.		
		Motor 3 H.P. with variable speed drive Cost	1	23,500.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
D. Crushed Pineapple Processing Line Cont.				US$
49	1 only	A. K. Robbins 24" (61 cm) wide x 16 ft (4.9 meters) long pre-engineered modular sanitary conveyor for inspecting diced product with raised edges on belt to retain juice.		
		Motor 1 H.P. with variable speed drive. Cost	11	5,900.00
49-A	1 only	Screw Elevator Cost	11	3,850.00
50	1 only	Combination crushed heater and drain screen, inclined, stainless steel construction with long horizontal feed hopper portion. Steam jacketed in heated portion. Recirculated juice is heated in a juice heater and used to raise temperature of entering crushed.		
		Double elevating screws thru heating and draining section. Heating time approx. 6 min. to 90°C. Thermostatic controls for process and for recirculated juice, used to heat crushed.		
		Motor 2 H.P. with variable speed drive Cost	11	40,000.00
51	2 only	200 gal (757 liter) stainless steel tanks for brix control and consistency of crushed pack. Tanks to be jacketed for 90 psig (6.32 Kg/cm2) with 3 H.P. gear motor for stirring mechanism, 3" sanitary outlet and hinged top cover. Cost.....	8	30,000.00
52	1 only	Simplex Model "Dual F" Piston Filler 316 stainless steel contact parts, 30 gallon hopper, 8 foot Delrin flat top chain conveyor.		
		Motor 2 H.P. with variable speed drive	12	22,300.00
53	1 only	CANCO No.1 Western Semi-Automatic Closing Machine, with end feed, fitted for #10 cans (603 x 700).		
		Motor 1½ H.P. Cost	4	12,000.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
D. Crushed Pineapple Processing Line Cont.				US$
54	1 only	Roll thru, agitating type cooler for #10 cans of crushed material with variable speed drive and atomizing spray cooler nozzles		
		Motor 2 H.P.	Cost 3	11,900.00
E. Supporting Equipment				US$ 155,450.00
55	1 only	A syrup mixing and supply system for dissolving granulated sugar, adjusting to desired Brix and delivering to the cannery by gravity flow about 4,400 liters (1170 gal) per hour of syrup at two different Brix values. The system consists of: a. (2) 1000 gal (3785 l.) mixing tanks. b. (4) 500 gal (1892 l.) cannery syrup tanks with side entering agitators. c. (1) 250 gal (946. l.) citric acid solution tank. d. (4) sets of 100 mesh screens. e. (1) syrup mixing and delivery pump f. (1) set of valves. g. Stainless syrup piping. All parts in contact with syrup to be of stainless steel.		
			Cost 8	54,000.00
56	1 only	Empty Can Handling System	Cost 2	5,800.00
57	1 only	Pressure blower for Ginaca machine and cuts. Required pressure approximately 2 psi (.14 Kg/cm^2) 50 cu ft/min (.99 cu m/m per Ginaca. Recommended blower similar to Buffalo Forge Type CB 30-1.		
		Motor 5 H.P.	Cost 13	11,200.00
58	1 only	8" (20 cm) Dia Plastic pipe - air accumulator for low pressure air to Ginaca, 12 meters long with 1¼" pipe connections and values to Ginaca.	Cost 13	1,600.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
E. Supporting Equipment Cont.			US$	
59	1 only	Vacuum pump for vacuum syruper operation. Nash Model CL-401 water ring vacuum pump - standard cast iron construction, "V" belt driven at 980 RPM by a 20 H.P. motor. A fabricated steel base to accomodate the vacuum pump motor and a sliding base is included. Rated capacity is 300 cfm at 15" Mercury. Cost	14.	12,000.00
60	1 only	One Lot of motor control equipment consisting of across the line magnetic starters and circuit breakers, mounted in panels with separate start-stop push buttons to be located on or near machine Also to be included are flexible connections, outlet boxes, wiring and fittings. Cost	15	51,000.00
61	1 only	Water Chlorination system based on making a solution of sodium hypochlorite for safety and accuracy of control. Sodium Hypo chlorite mixing, storage and pump station consisting of: a. 500 gal (1900 liter) S.S. tank with top entering agitator and cover. b. Chemical solution pump; max. 0.5 gal (1.94 liter) per hour. c. Lot of ¼" PVC tubing & fittings. Chlorinator - (sodium hypochlorite solution injection system) Cost	8	10,200.00
62	2 only	Curtis Air Compressors, Model CVH 808 Single stage 60 gal (227 liter) receiver 100 psi (7.03 Kg/cm^2) on-off control 3 H.P. each Cost	16	4,800.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
E. Supporting Equipment Cont.				US$
63	4 only	Yale Fork Lift Trucks, Model ERC 30TAE Electric three wheel rider complete with two 630 AH batteries each and single phase charger. Cost	17	92,400.00
64	100	Aluminum trays for transporting #10 cans and special #2 packs from preparation lines to syrupers. Cost	-	1,000.00
65	1 only	Mateer-Burt Model 408 wrap around labeler complete with heated glue pot. Equipped with 3/4 H.P. variable speed drive and set for 2T and 2½ can sizes, with 2 year supply of parts Cost	18	15,745.00
66	1 only	Mateer-Burt Model 704 for #10 cans. Label size 6" to wrap around half of the can Cost	18	14,800.00
67	1 only	Mateer-Burt Model PDA Caser to handle 2T cans. This is a roll-in gravity type case filler with a maximum speed of about 16 cases/min (24 cans per case) with ½ H.P. drive, electric foot control and bar elevator, fitted for 2T and 2½ can sizes Cost	18	25,000.00
68	1 only	Mateer-Burt Model PCE Case Packer, set for #10 cans in a 2 x 3 pattern. Maximum speed of about 10 cases/min. Cost	18	9,400.00
69	1 only	Elliot Case Sealers Type 66-24 with 14 ft. (4.2 meters) compression section, top and bottom glue rollers, 1½ H.P. drive, set for 2T cases. Cost	19	16,600.00
70	1 only	Same as above - Set for #10 cases Cost	19	16,600.00

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ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
E. Supporting Equipment		Cont.		US$
71	3 only	FMC Model BCP-210 Bright Can Palletizers - One for #2 cans the other for #2½ cans. Cost.....	3	96,000.00
72	2 only	FMC Model BCP-310 Filled Can Palletizer/Depalletizer One for use in the can labbeling area and the other in the can making plant. Cost.....	3	72,000.00
73	1 only	Empty Can Handling Systems for all #2 and #2½ can sizes	2	21,000.00
74	1 only	Clever Brooks CB-400 boiler. 400 H.P, 150 psi (10.54 Kg/cm^2) design pressure Equipped for operation on diesel oil. Supplied with feed pump 350 gal (1324 liter) feed water tank, blow off valves, Leader valve and water softener. Cost.....	20	77,900.00
75	1 only	5000 gal (19,000 liter) underground storage tank U.L.Standards to be designed and fabricated in Burma. Estimated Cost....	Local	3,300.00
76	1 only	Steam piping to cannery Cost	20	4,500.00
77	1 only	Lot of Stainless Steel Sanitary Tubes, Clamps and Piping to connect the different pieces of machinery. Estimated Cost....	7	18,000.00
78	1 only	18" (4517 cm) wide cleated belt elevator approximately 30 ft. (9.1 meters) long to lift waste skins and ends to storage hopper. Motor 5 H.P. Estimated Cost.....	1	5,100.00

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT: Rangoon - Burma

Item	Quantity	Description	Supplier	Estimated F.O.B. Plant Cost
E. Supporting Equipment Cont.				US$
79	1 only	10-Ton Waste Hopper with air operated gates for loading into trucks. To be made locally		
		Estimated Cost.....	1	6,800.00
80	1 only	Toledo Model 2794 Pit Type Truck Scale 10' x 34' platform, 60.000 lbs x 20 lbs digital indicator with strip printer		
		Cost.....	21	17.000.00
				663,745.00
	Total Processing and Supporting Equipment			US$ 3,162,525.00
	Estimated Ocean Freight			154,000.00
	Total Estimated Cost C & F Rangoon, Burma			US$ 3,316,525.00
	Total Estimated Cost C & F Rangoon, Burma			K 23,215,675.00

Use K 23,215,700

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METHOD OF CALCULATING OCEAN FREIGHT

A. At present there is no Ocean Freight Rate covering food processing machinery from the United States to Burma, therefore a rate of machinery NOS (not otherwise specified) has been used. Once the project has been approved, but before implementation is started, an application should be filed with the Shipping Conference to obtain a more favorable Ocean Freight Rate.

B. The current machinery NOS rate from East and West Coast Ports, U.S.A. to Rangoon, Burma, with trans-shipment at Kobe, Japan, has been calculated in the following manner:

1.	Machinery NOS rate per volume of 1 cubic meter	US$ 133.50
2.	Bunker Surcharge	32.50
3.	16% Currency adjustment	26.56
		US$ 192.56

This amount has been rounded out to US$ 192.50/m^3

C. The above freight rate also applies to containerized shipments with a minimum charge for the equivalent of 21.80 m^3 or 70% of the total space in a container. Should a greater volume fit into the container the rate for the actual contents will be charged.

D. The total volume for all of the equipment specified has been estimated at 800 m^3. 800 m^3 x \$ 192.50/m^3 = US$ 154.000

E. Individual pieces of machinery will be boxed. Large bulky items will be placed on skids and crated or will have a protective covering.

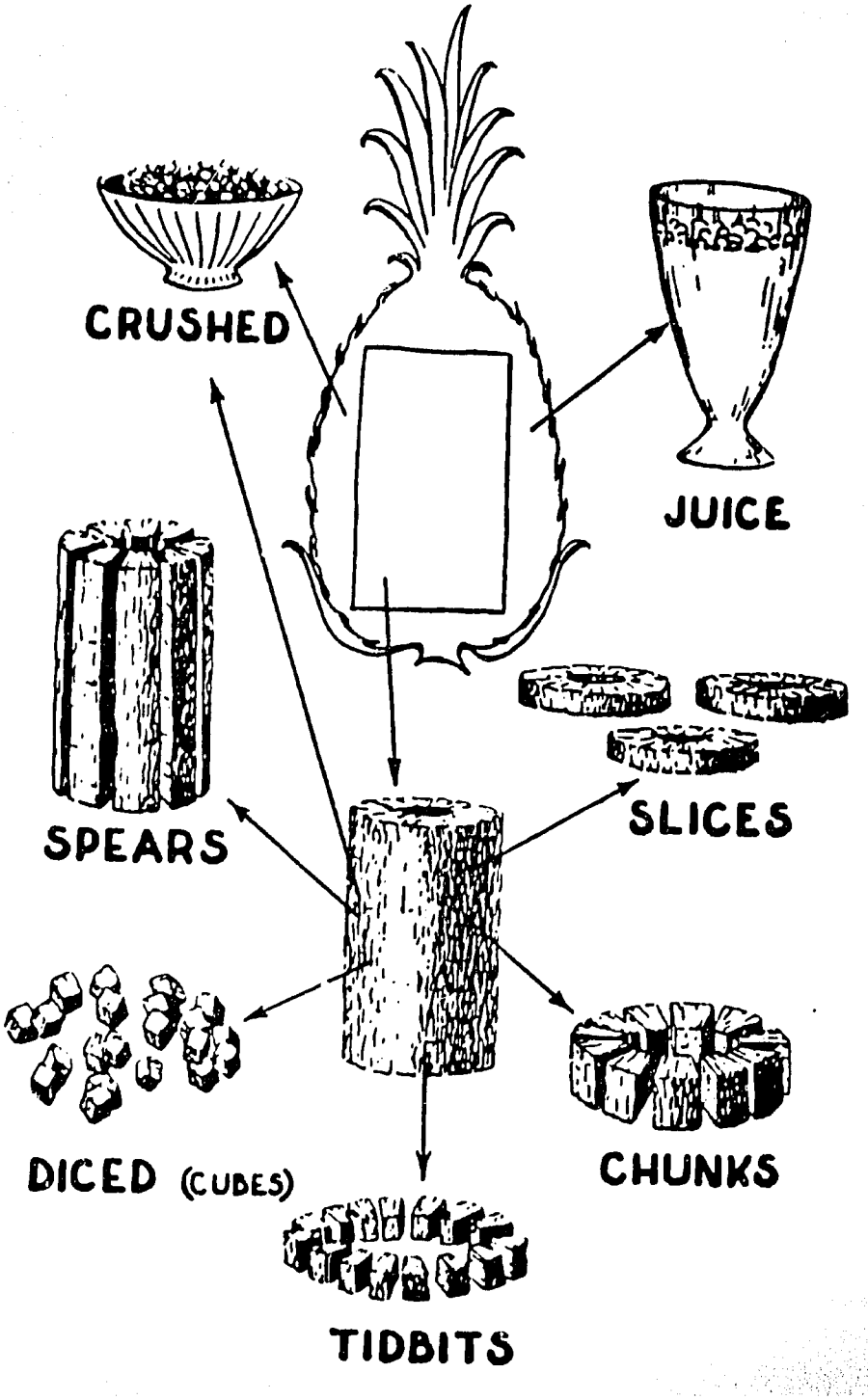
LIST OF POTENTIAL SUPPLIERS

Supplier No.	
1.	Honomach, Incorporated Subsidiary of Carter Co., Inc. 91-060 Hanua Street Ewa Beach, Hawaii 96706
2.	Great Western Conveyor 3255 Woodward Avenue Santa Clara, California 95050
3.	FMC Corporation Food Processing Machinery Division 2300 Industrial Avenue Box A Madera, California 93639
4.	American Can Company Waukegan Distribution Center 1301 Dugdale Road Waukegan, Illinois 60085
5.	BFM Machinery Corporation P. O. Box 117 Fall River, Wisconsin 53932
6.	BEPEX Corporation Rietz Division P. O. Box 880 Santa Rosa, California 95402
7.	CREPACO, Incorporated 8303 West Higgins Road Chicago, Illinois 60631
8.	Lee Process Systems Company Division of Lee Industries, Incorporated 512 West Pine Street Philipsburg, Pennsylvania 16866
9.	Brown International Corporation 633 North Barranca Avenue Covina, Califorinia 91722
10.	Westfalia Separator AG Werner-Habig-Strabe 1 Oelde/Westphalia 4740 WEST GERMANY - (2522) 771

LIST OF POTENTIAL SUPPLIERS

Supplier No.	
11	A. L. Robins and Company, Incorporated 713 - 729 East Lombard Street Baltimore, Maryland 21202 U.S.A.
12.	Simplex Filler Company 3490 Investment Blvd., Hollywood, California U.S.A. 94545
13.	Buffalo Forge P. O. Box 985 Buffalo, New York 14240
14.	Nash 1440 W. Taft Avenue P. O. Box 6126 Orange, California 92667
15.	Allen Bradley Company Industrial Controls 1201 South Second Street Milwaukee, Wisconsin 53204
16.	Magnolia Electric Motors Company, Incorporated 5535 Vineland Avenue North Hollywood, California 91601
17.	Yale Industrial Trucks of Southern California, Inc. 2615 Pellissier Place - Box 1231 City of Industry, California 91749
18.	Mateer-Burt Co, Division of Berwind Corporation Labelers/Fillers/Packers 436 Devon Park Drive Wayne, Pennsylvania 19087
19.	Elliott Manufacturing Company, Inc. P. O. Box 11277 Fresno, California 93772
20.	Hugh Dean and Company, Inc. P. O. Box 5125 Glendale, California 91201

APPENDIX H. SEVEN MAJOR PRODUCTS DERIVED FROM THE PINEAPPLE FRUIT



APPENDIX H

PINEAPPLE
MANDATORY TERMS

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*Shall immediately precede or follow product name except specific varietal name may intervene.

Common or Usual Name	PINEAPPLE (in bold type on Principal Display Panel in size reasonably related to the most prominent printed matter on such panel.)

Style

*Sliced	Whole circular slices cut across the core axis of the peeled, cored fruit cylinders.
*Half Slices	Semicircular halves of slices.
*Broken Slices	Arc-shaped portions cut or broken from slices, which portions are not uniform in size or shape.
*Tidbits	Sectors cut from slices. Tidbits are reasonably uniform in size and shape; they are predominantly from 5/16 to 1/2 inch thick and, except for an occasional unit, each sector is not larger than 1/6 of the slice from which cut.

*Chunks — Short, thick pieces cut from thick slices or from peeled, cored fruit. Chunks may or may not be symmetrical or uniform in shape and size. Predominantly, the units have a thickness greater than 1/2 inch, a width greater than 9/16 inch but a longest dimension (along any edge) not greater than 1-1/2 inches.

*Diced — Cube-shaped pieces cut from slices or from peeled, cored fruit. Except for an occasional unit, the longest dimension (along any edge) of each unit is not greater than 9/16 of the cylinder from which they are cut and they are not less than 2-1/2 inches long.

*Crushed — Shredded or finely cut pieces of fruit flesh.

Note: If the crushed pineapple, when drained, yields not less than 73 percent but less than 78 percent by weight of the net contents as drained material, the word CRUSHED or the words CRUSHED PINEAPPLE may be preceded or followed by the words HEAVY PACK.

If the crushed pineapple, when drained, yields 78 percent or more by weight of the net contents as drained material the word CRUSHED or the words CRUSHED PINEAPPLE may be preceded or followed by the words SOLID PACK.

<u>Packing Medium (in)</u>:

*Water — May not be used as packing medium for crushed pineapple.

*Pineapple Juice	Conforms to the definition and standard of identity for unsweetened pineapple juice. May be preceded by UNSWEETENED when appropriate.
*Clarified Juice	Clarified liquid collected from cutting operations or expressed from parts of the fruit. If concentrated to a density within the range specified for one of the syrups, the concentrated liquid is considered to be such syrup.

	Brix
*Light Syrup or Lightly Sweetened	14 percent or more but less than 18 percent
*Heavy Syrup or Heavily Sweetened	18 percent or more but less than 22 percent
*Extra Heavy Syrup or Extra Heavily Sweetened	22 percent or more but not more than 35 percent

NOTE: In lieu of the above terms, crushed pineapple canned with unsweetened pineapple juice may labeled *UNSWEETENED

Optional Ingredients

*Spiced

*Flavoring Added	Other than artificial. The common name of the flavoring may be used, e.g. *MINT ADDED.

*Seasoned with Vinegar

NOTE: When two or all of the optional ingredients are used, such words may be combined, e.g. SEASONED WITH VINEGAR, CLOVES, AND CINNAMON OIL.

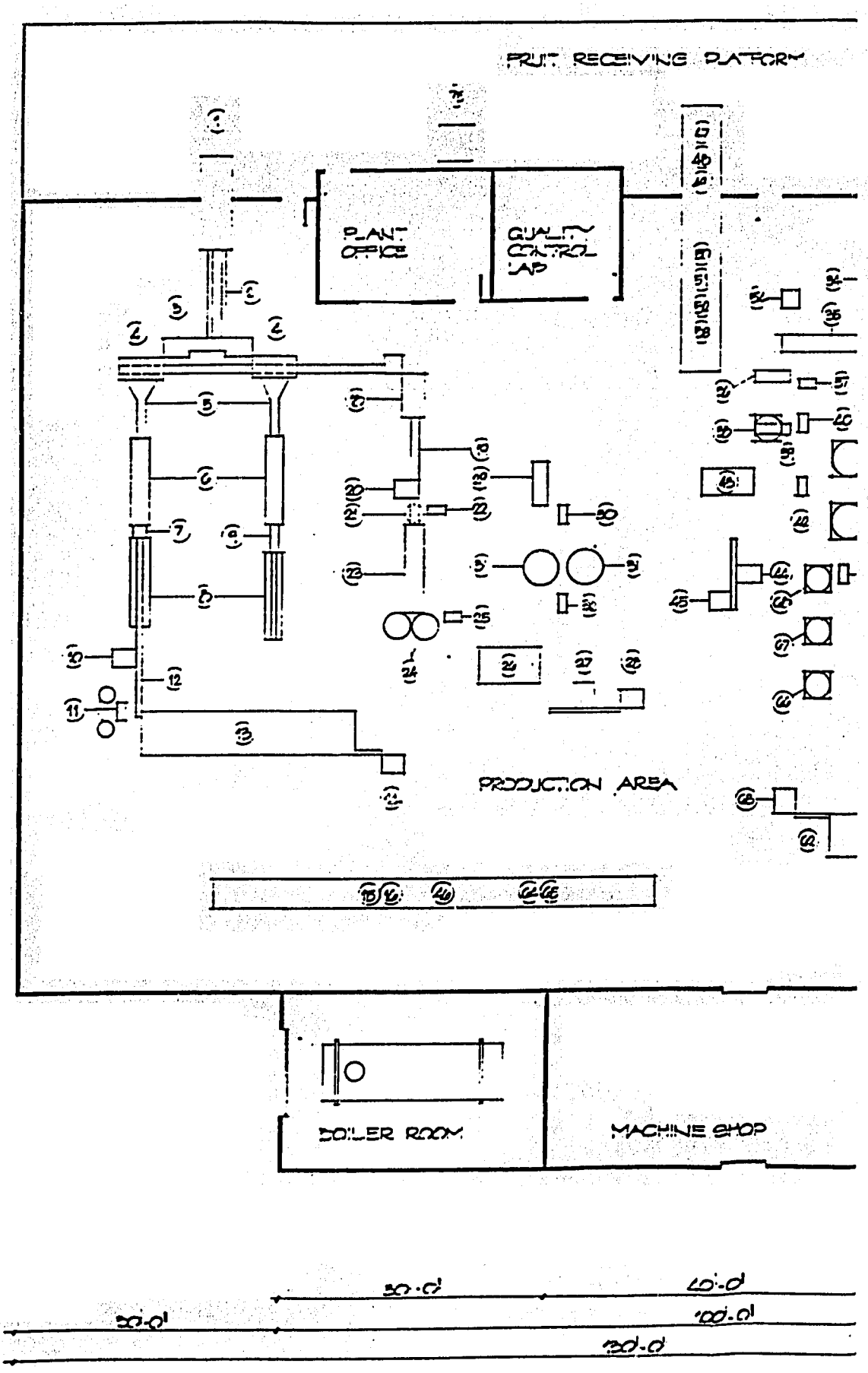
Sources:

(1) 21 CFR 27.50 Standard Identity
(2) 21 CFR 27.51 Standard of Quality
(3) 21 CFR 27.52 Standard of Fill - Crushed

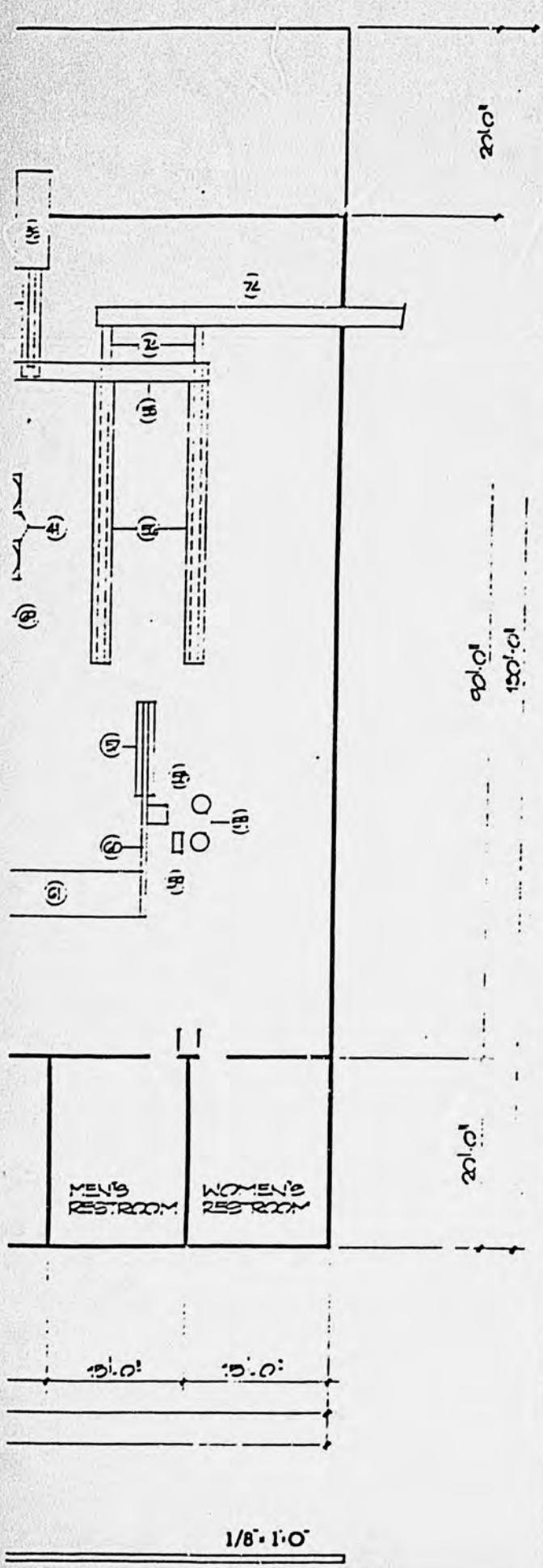
4265A

APPENDIX I

TROPICAL FRUIT PROCESSING FACILITY
SITE AND FLOOR PLAN


FRUIT RECEIVING PLATFORM
PLANT OFFICE
QUALITY CONTROL LAB
PRODUCTION AREA
BOILER ROOM
MACHINE SHOP
30'-0'
20'-0'
100'-0'
30'-0'
30'-0'

floor plan



equipment

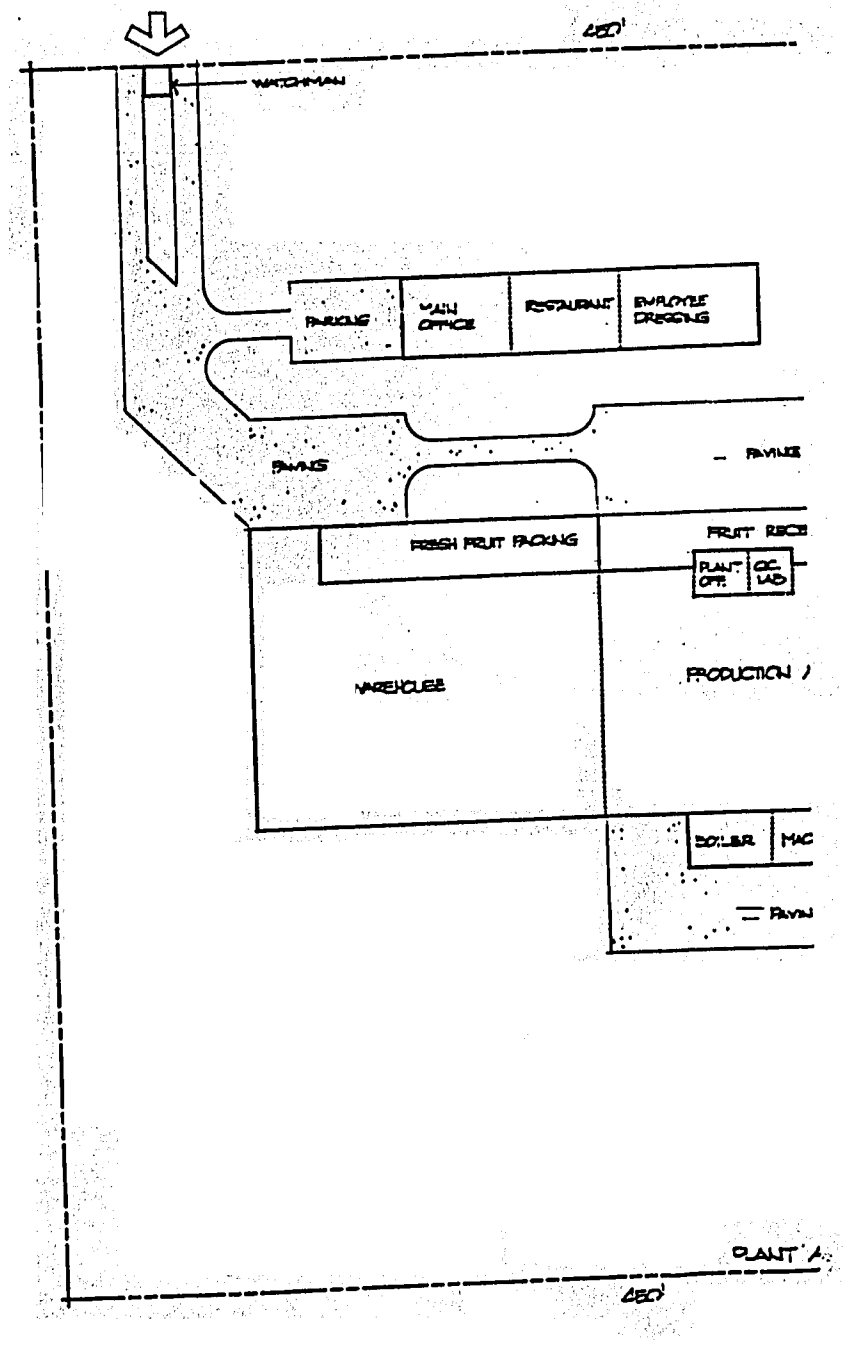
1. SOAK TANK WASHER
2. INSPECTION & SIZE GRADING CONVEYOR
3. CONVEYORS & HOLDING TABLES
4. SIZER & CORER
5. CYLINDER CONVEYOR & ELEVATOR
6. INSPECTION & TRIMMING CONVEYOR
7. SLICER
8. INSPECTION & CAN FILLING CONVEYOR
9. TIDBIT & SEGMENT CUTTER
10. SEMI-AUTOMATIC SYRUPER
11. SYRUP TANKS & PUMP
12. CAN CONVEYOR
13. EXHAUST BOX
14. CLOSING MACHINE
15. COOKING TANK
16. COOLING TANK
17. PEEL CONVEYOR
18. HEAT ERADICATOR
19. SCREW ELEVATOR
20. DISINTEGRATOR
21. DRAIN CHUTE & HOLDING TANK
22. CENTRIFUGAL PUMP
23. INSPECTION BELT
24. JACKETED MIXING KETTLES
25. POSITIVE DISPLACEMENT PUMP
26. DEAERATOR PASTEURIZER
27. PISTON FILLER
28. CLOSING MACHINE
29. JUICE EXTRACTOR
30. CENTRIFUGAL PUMP
31. HOLDING TANKS
32. CENTRIFUGAL PUMP
33. SOAK TANK WASHER
34. ROLLER INSPECTION CONVEYOR
35. CONVEYOR
36. PULPER
37. CENTRIFUGAL PUMP
38. HOLDING TANK
39. FINISHER
40. CENTRIFUGAL PUMP
41. HOLDING TANK
42. CENTRIFUGAL PUMP
43. HEAT EXCHANGER
44. FILLER
45. CLOSING MACHINE
46. WATER COOLER
47. SOAK TANK
48. ELEVATOR
49. DRUM WASHER
50. INSPECTION PAN
51. ELEVATOR
52. CUTTER
53. CENTRIFUGAL EXTRACTOR
54. GUAVA SLICER
55. PEELING & TRIMMING CONVEYOR
57. MANUAL CAN FILLING CONVEYOR
58. SEMI AUTOMATIC SYRUPER
59. SYRUP MIXING TANKS & PUMP
60. CAN CONVEYOR
61. EXHAUST BOX
62. CAN CONVEYOR
63. CLOSING MACHINE
64. ATMOSPHERIC COOKERS
65. WATER COOLER
66. MIXING KETTLE
67. VACUUM PAN
68. HEATING KETTLE
69. POSITIVE DISPLACEMENT PUMP
70. LABELLER
71. CASE PACKER
72. GLUE SEALER
73. FORK LIFT TRUCK
74. WASTE CONVEYORS

areas

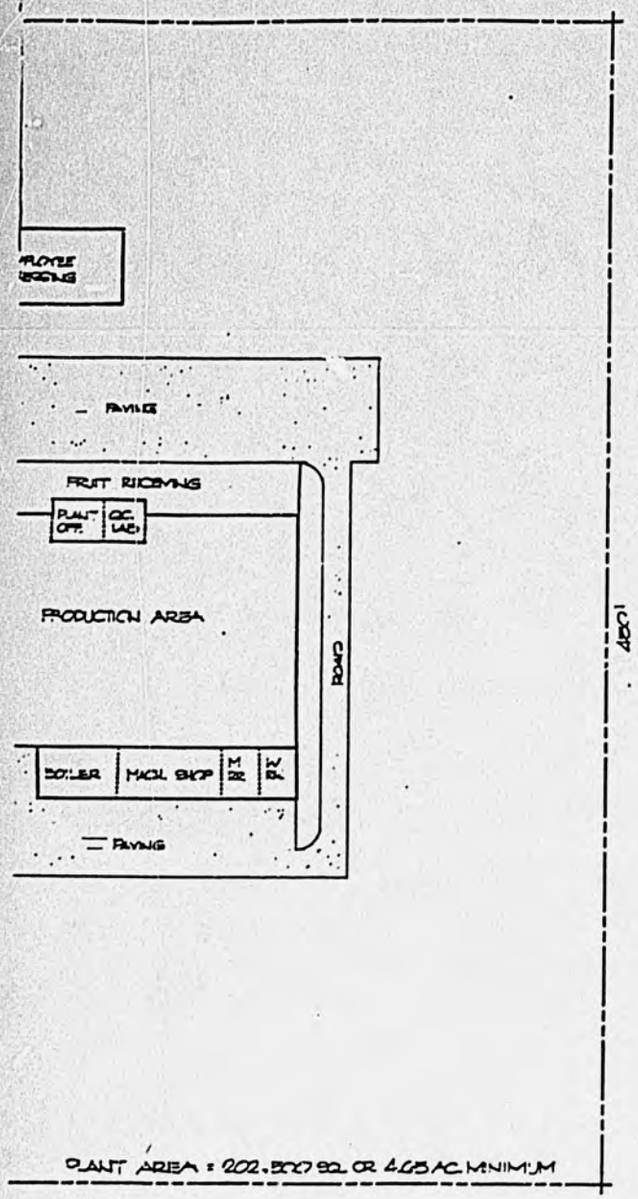
1.	FRUIT RECEIVING PLATFORM	2,495 S.F.
2.	PRODUCTION AREA	11,280 S.F.
3.	PLANT OFFICE	300 S.F.
4.	QUALITY CONTROL LABORATORY	225 S.F.
5.	TOILETS	600 S.F.
6.	MACHINE SHOP	800 S.F.
7.	BOILER ROOM	600 S.F.
8.	WAREHOUSE	11,750 S.F.
9.	FRESH FRUIT PACKING	2,000 S.F.
10.	MAIN OFFICE	1,200 S.F.
11.	RESTAURANT	1,200 S.F.
12.	DRESSING ROOM	1,500 S.F.
13.	WATCHMEN'S ROOM	100 S.F.
	TOTAL	34,050 S.F.

project
TROPICAL FRUIT PROCESSING PLANT BURMA

EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231


WATCHMAN
PARKING
MAIN OFFICE
RESTAURANT
EMPLOYEE DRESSING
RAMPS
RAVINE
FRESH FRUIT PACKING
FRUIT RECE
PLANT OFF.
QC LAB
WAREHOUSE
PRODUCTION
BOILER
MAC
RAVIN
PLANT A
460'

site plan



PLANT AREA = 202,500 SQ. OR 4.65 AC. MINIMUM

1" = 30'

areas

1.	FRUIT RECEIVING PLATFORM	2,495 S.F.
2.	PRODUCTION AREA	11,250 S.F.
3.	PLANT OFFICE	300 S.F.
4.	QUALITY CONTROL LABORATORY	225 S.F.
5.	TOILETS	100 S.F.
6.	MACHINE SHOP	800 S.F.
7.	BOILER ROOM	600 S.F.
8.	WAREHOUSE	11,750 S.F.
9.	FRESH FRUIT PACKING	2,000 S.F.
10.	MAIN OFFICE	1,200 S.F.
11.	RESTAURANT	1,200 S.F.
12.	DRESSING ROOM	1,500 S.F.
13.	WATCHMEN'S ROOM	100 S.F.
	TOTAL	34,050 S.F.

project
TROPICAL FRUIT PROCESSING PLANT BURMA

client
EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231

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APPENDIX J. ESTIMATED ELECTRICAL REQUIREMENTS FOR TROPICAL FRUIT PLANT, MUDON, BURMA

	Motor HP
Truck Dump	30.00
Water Dump & Storage	10.00
Elevator	5.00
Graders	3.00
Distribution System	10.00
Pineapple Chutes	-
Small Pineapple Chute	-
Sizing Machines	9.00
Chutes	-
#2½ Size Line	13.00
#2 Size Line	13.00
#10 Size Line	6.00
Conveyor	5.00
Conveyor	5.00
Filled Can Conveyors	3.00
Empty Can System	10.00
Vacuum Syruper	-
Closing Machine	5.00
Vacuum Syruper	-
Closing Machine	5.00
Vacuum Syruper	-
Closing Machine	3.00
Cooker	3.00
Cooler	3.00
Cooker	3.00
Cooler	3.00
Cooker	3.00
Cooler	3.00
Can Dryer	10.00
Can Dryer	10.00
Disintegrator	20.00
Positive Pump	5.00

APPENDIX J. ESTIMATED ELECTRICAL REQUIREMENTS FOR TROPICAL FRUIT PLANT, MUDON, BURMA

	Motor HP	
Tubing and Fittings	-	
500 Fal Tank	-	
Screw Press	15.00	
Holding Tanks and Pump	5.00	
Centrifugal Desludger	40.00	
Screw Conveyor	1.00	
Heat Exchanger	5,00	
3/200 gal Tanks	-	
Juice Filler and Closer	5.00	
Can Cooler	2.00	
Juice Filler and Closer	5.00	
Can Cooler	3.00	
Juice Filler and Closer	5.00	
Can Cooler	3.00	
Belt Elevator	1.00	
Pineapple Crusher	3.00	
Inspection Conveyor	1.00	
Screw Elevator	1.00	
Crushed Heater	2.00	
200 gal Kettle	3.00	
Can Filler	2.00	
Can Closer	1.50	
Can Cooler	2.00	
Syrup Mixing System	2.00	
Empty Can Handling	20.00	
Low Pressure Blower	5.00	50 cu ft/min
Low Pressure Piping	-	
Vacuum Pump	20.00	
Motor Control Equipment	-	
Sodium Hypochlorite	-	
Air Compressors	6.00	

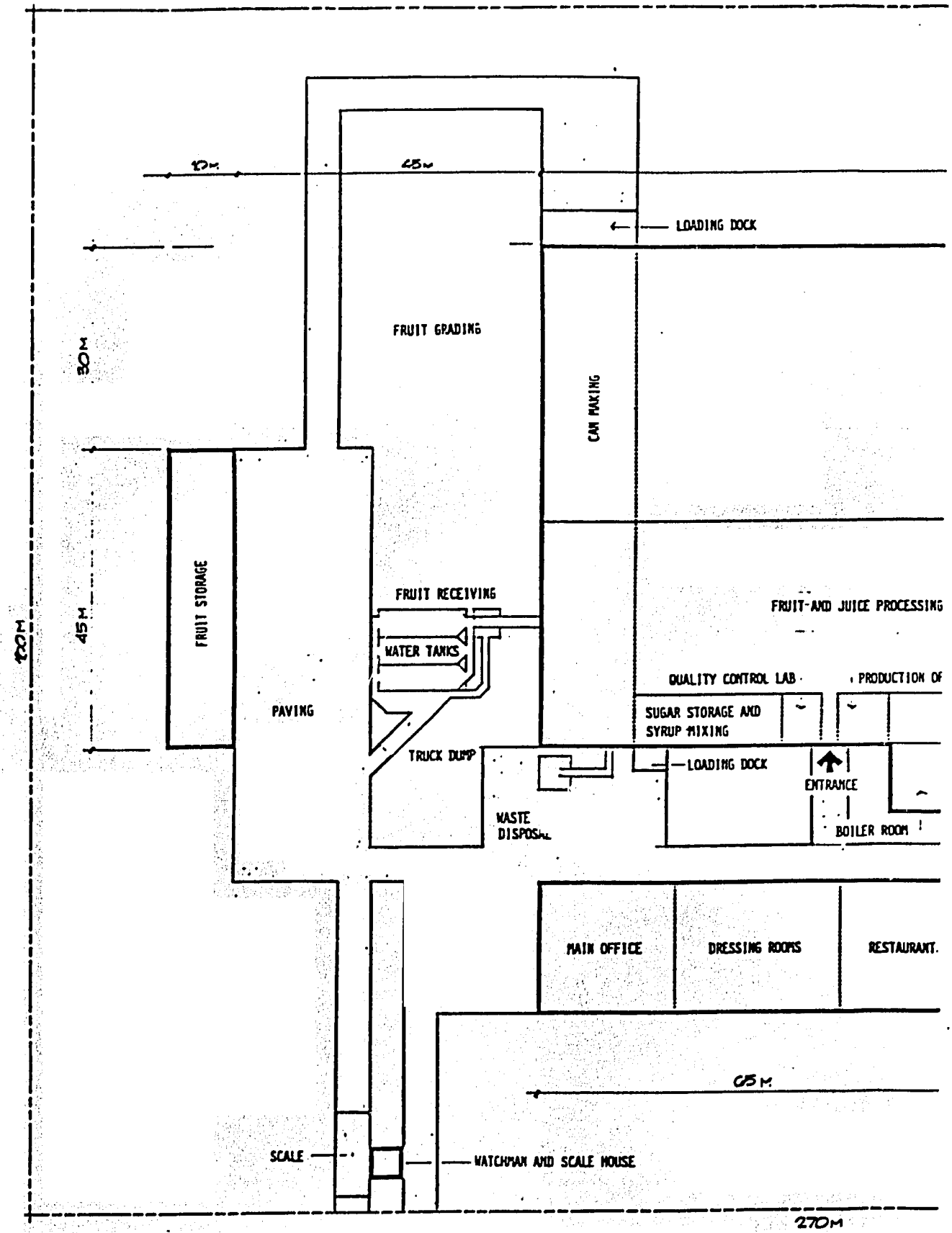
APPENDIX J. ESTIMATED ELECTRICAL REQUIREMENTS FOR TROPICAL FRUIT PLANT, MUDON, BURMA

	Motor HP
Lift Trucks	-
Aluminum Trays	-
Labeller	0.75
Labeller	0.75
Caser	0.50
Caser	0.50
Case Sealer	1.50
Case Sealer	1.50
Bright Can Palletizers	10.50
Bright Can Palletizers	12.00
Empty Can Handling	10.00
Boiler	23.50
Oil Storage Tank	-
Steam Piping	-
Stainless Steel Piping	-
Waste Elevator	5.00
Waste Storage	-
Truck Scale	-
	420. HP

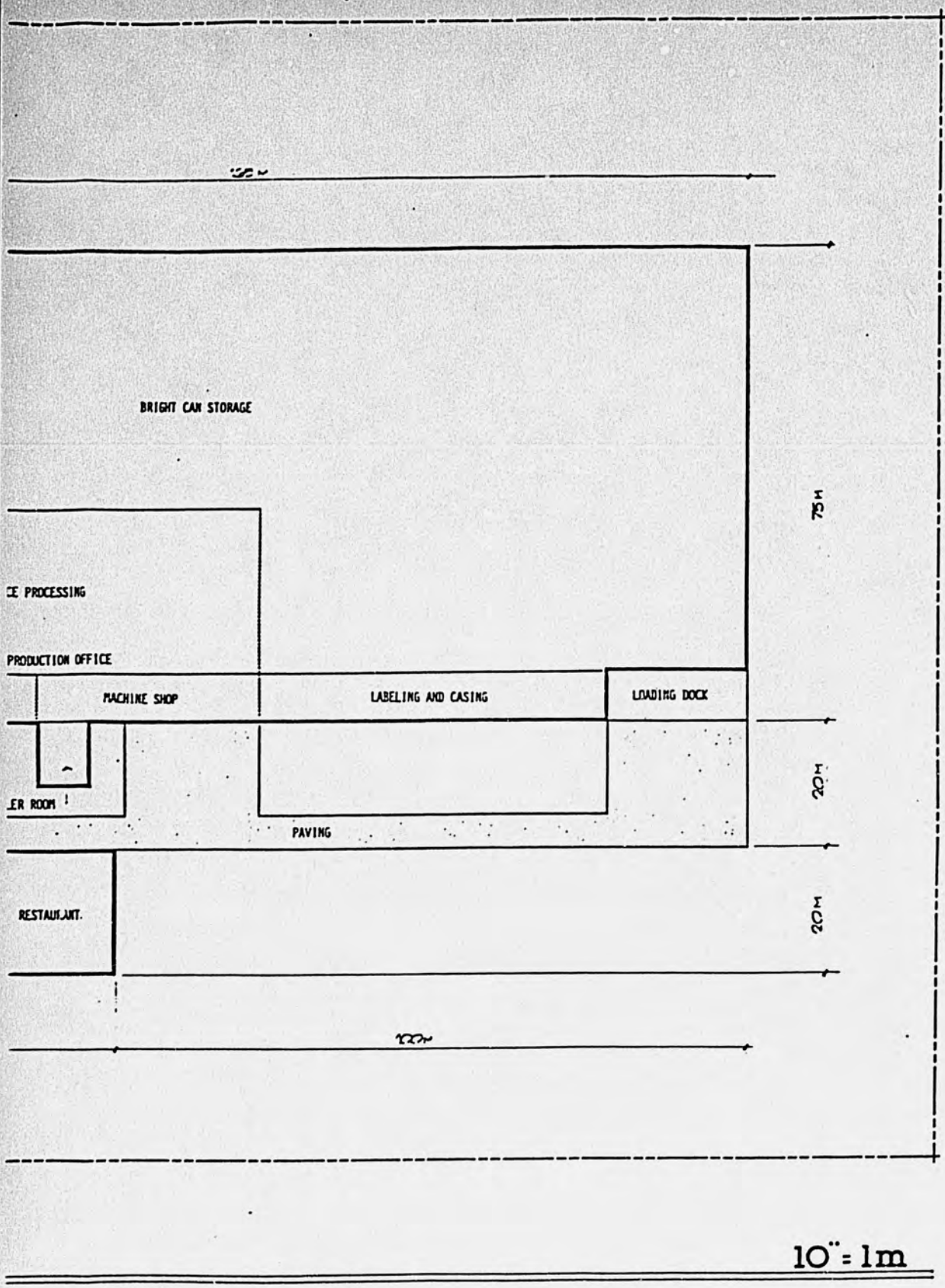
SOURCE: Experience, Incorporated

APPENDIX K

PINEAPPLE PROCESSING PLANT SITE AND FLOOR PLAN


10M
45M
LOADING DOCK
FRUIT GRADING
30M
CAN MAKING
FRUIT STORAGE
45M
100M
FRUIT RECEIVING
WATER TANKS
FRUIT-AND JUICE PROCESSING
QUALITY CONTROL LAB
PRODUCTION OF
SUGAR STORAGE AND SYRUP MIXING
PAVING
TRUCK DUMP
LOADING DOCK
ENTRANCE
WASTE DISPOSAL
BOILER ROOM
MAIN OFFICE
DRESSING ROOMS
RESTAURANT.
65M
SCALE
WATCHMAN AND SCALE HOUSE
270M

SITE PLAN



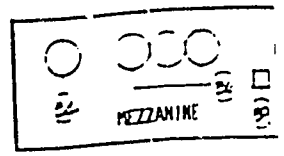
10" = 1m

project
PINEAPPLE PROCESSING PLANT BURMA

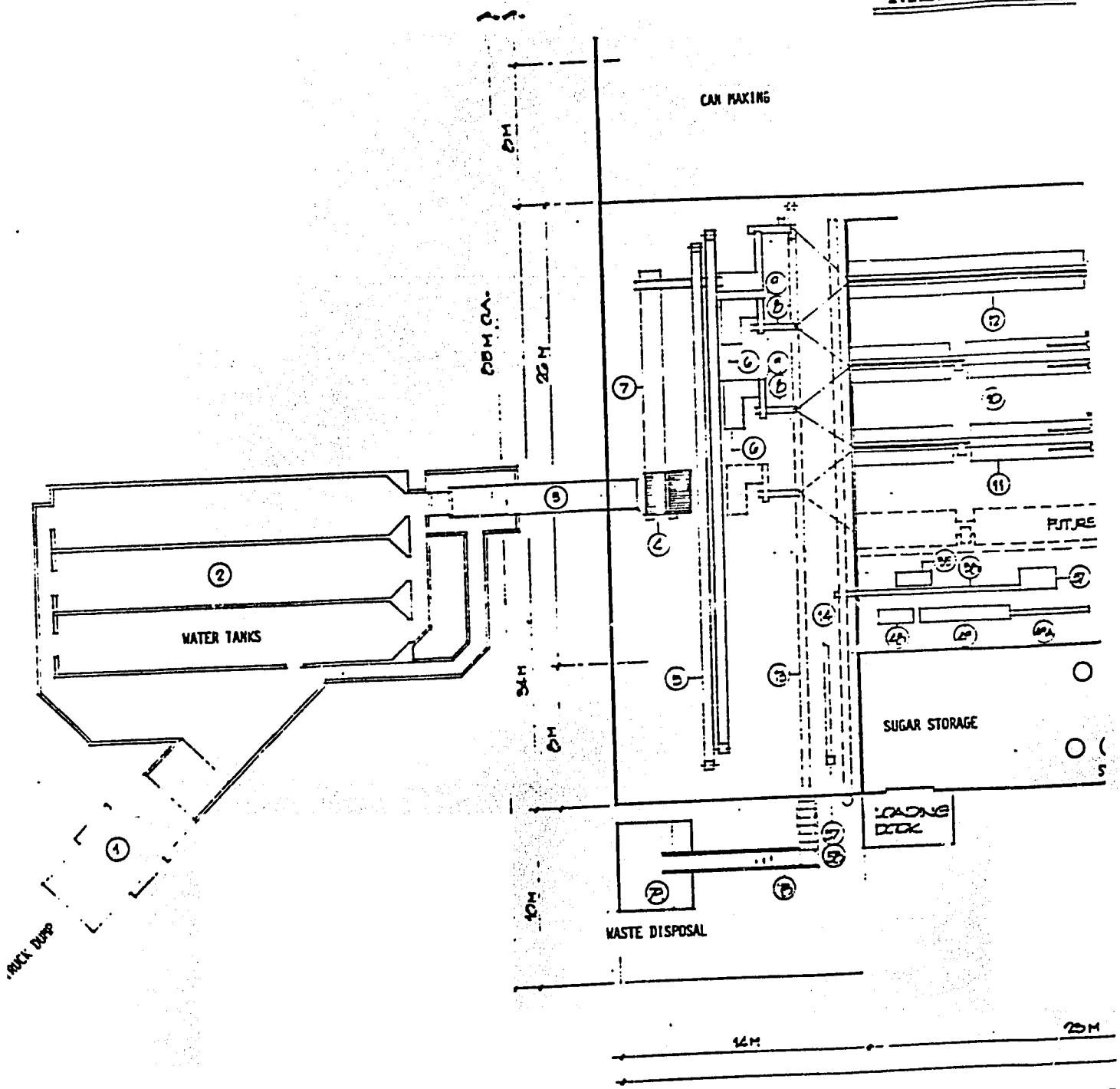
client
EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231

465

465



MEZZANINE



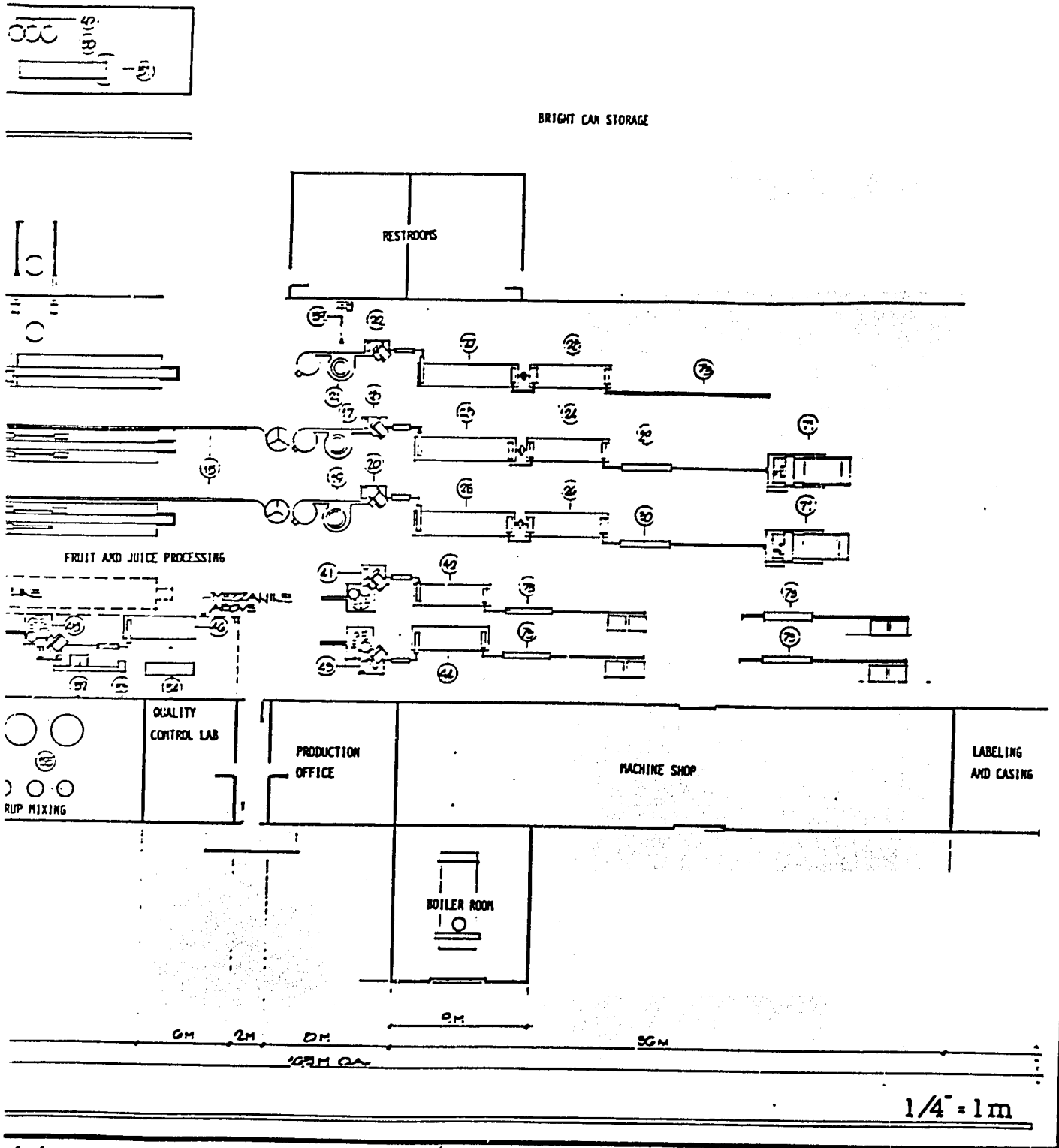
PARTIAL LOWER FLOOR PLAN

BRIGHT CAN STORAGE	5625 M2
FRUIT AND JUICE PROCESSING	1950 M2
FRUIT CRUSHING	364 M2
CAN MAKING	800 M2
BOILER ROOM	90 M2
LABELING AND CASING	440 M2
MACHINE SHOP	288 M2
PRODUCTION OFFICE	64 M2
QUALITY CONTROL LAB	48 M2
SUGAR STORAGE AND SYRUP MIXING	184 M2
MEZZANINE	184 M2

EQUIPMENT

1. Truck Dump
2. Water Dump & Storage
3. Elevator
4. Graders
5. Distribution System
6. Pineapple Chutes
7. Small Pineapple Chute
8. Sizing Machines
9. Chutes
10. #2½ Size Line
11. #2 Size Line
12. #10 Size Line
13. Conveyor
14. Conveyor
15. Filled Can Conveyors
16. Emp
17. Vac
18. Clo
19. Vac
20. Clo
21. Vac
22. Clo
23. Coo
24. Coo
25. Coo
26. Coo
27. Coo
28. Coo
29. Can
30. Can

4406



Y CAN SYSTEM
SYRUPER
ING MACHINE
SYRUPER
ING MACHINE
SYRUPER
ING MACHINE
R
R
R
R
R
R
NYER
NYER

31. DISINTEGRATOR
32. POSITIVE PUMP
33. TUBING & FITTINGS
34. 500 GAL. TANK
35. SCREW PRESS
36. HOLDING TANKS & PUMP
37. CENTRIFUGAL DESLUDGER
38. SCREW CONVEYOR
39. HEAT EXCHANGER
40. 3 - 200 GAL. TANKS
41. JUICE FILLER & CLOSER
42. CAN COOLER
43. JUICE FILLER & CLOSER
44. CAN COOLER
45. JUICE FILLER & CLOSER
46. CAN COOLER
47. BELT ELEVATOR
48. PINEAPPLE CRUSHER
49. INSPECTION CONVEYOR
49A. SCREW ELEVATOR
50. CRUSHED HEATER
51. 200 GAL. KETTLE
52. CAN FILLER
53. CAN CLOSER
54. CAN COOLER
55. SYRUP MIXING SYSTEM
56. EMPTY CAN HANDLING
57. LOW PRESSURE BLOWER
58. LOW PRESSURE PIPING
59. VACUUM PUMP
60. [illegible]
61. SODIUM HYPOCHLORITE
62. AIR COMPRESSORS
63. LIFT TRUCKS
64. ALUMINUM TRAYS
65. LABELLER
66. LABELLER
67. CASER
68. CASER
69. CASE SEALER
70. CASE SEALER
71. BRIGHT CAN PALLETIZERS
72. BRIGHT CAN PALLETIZERS
73. EMPTY CAN HANDLING
74. BOILER
75. OIL STORAGE TANK
76. STEAM PIPING
77. SS. SANITARY PIPING
78. WASTE ELEVATOR
79. WASTE STORAGE
80. TRUCK SCALE

Project
PINEAPPLE PROCESSING PLANT BURMA

Client
EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231

467

467

APPENDIX L

CAN MANUFACTURING PLANT INFORMATION
TIN PLATE MANUFACTURING COSTS,
EQUIPMENT LIST, PRICE AND
MANUFACTURERS

Estimated Production Costs for a 307 x 409 (87.3 mm x 115.5 mm) Can - Capacity 20 oz. = 567 grams

A. Production Volume - 4.900.000 cans

B. Products - Fruits - Jams - Juice - Meats - Vegetables

C. Estimated Production Costs

1. Tin Plate Cost for Bodies Using Ideal Base Box Yield with 1% Waste and Spoilage Allowance

Sheet Size Inches	Sheet Size mm	Bodies/ Sheet	Thickness Inches	Thickness mm	Base Weight Pounds	Base Weight Kilos	Specifications	Number of Base Boxes	Cost Base Boxes	Cost C&F Rangoon K
31.782 x 32.809	807.2 x 833.3	21	0.0094	0.2387	85	38.55	100/25 Differential Plate	7.865	40.00	2,202,200

2. Ends - Two per can 4.900.000 cans x 2 = 9.800.000 ends

Cost M/ends $ 28.00 C & F Rangoon

9.800.000 ends x R 28.00/M = $ 274.400 — 1,920,800

3. Wire for Welding

20.200 lbs x $ 0.9938/lb C & F Rangoon = $ 20.074 = $ 20.100 — 140,700

4. Inside Side Seam Laquer

$ 0.3514 M/cans x 4.900.000 cans = $ 1.722 — 12,100

Total Raw Material Cost — 4,275,800

5. Carton Cost

4.900.000 cans ./. 24 cans/case = 204.167 = 204.200 cases

204.200 cases x K 2.170 M/cases = K 443.114 Use K 443.100 — 443,100

6. Pro-Rata Variable and Fixed Costs — 1,079,750

Total Estimated Production Cost F.O.B. Plant — K 5,798,650

Estimated Cost per 1.000 Cans F.O.B. Plant — US$ 169.06 — K 1,183,40

469

Estimated Production Costs for a 300 x 304 (73 mm x 82 mm) Can - Capacity 14 oz. = 397 grams

A. Production Volume - 10.000.000 cans

B. Products - Evaporated Milk

C. Estimated Production Costs

1. Tin Plate Cost for Bodies Using Ideal Base Box Yield with 1% Waste and Spoilage Allowance

Sheet Size Inches	Sheet Size mm	Bodies/ Sheet	Thickness Inches	Thickness mm	Base Weight Pounds	Base Weight Kilos	Specifications	Number of Base Boxes	Cost Base Boxes	Cost C&F Rangoon K
33.750 x 36.184	857.2 x 919.1	40	0.0083	0.2108	75	34 oz.	75 Electrolytic Plate	11.145	$36.90	2,878,800

2. Ends - Two per Can = 10.000.000 x 2 = 20.000.000 ends

   Cost m/ends $21.00 C & F Rangoon

   20.000.000 ends x $21.00 = $420.000 — 2,940,000

3. Wire for Welding

   29.600 lbs/wire x $ 0.9938/lb C & F Rangoon = $29.416 Use $ 29.400 — 205,800

4. Inside Side Seam Laquer

   $ 0.2348 m/cans x 10.000.000 cans = $ 2.348 — 16,400

Total Raw Material Cost — 6,041,000

5. Carton Cost

   10.000.000 cans ./. 24 cans/case = 416.667 cases Use 416.700 cases

   416.700 cases x K 14.25 M/cases = K 593.797 Use K 593.800 — 593,800

6. Pro-Rata Variable and Fixed Costs — 1,843,490

Total Estimated Production Cost F.O.B. Plant — K 8,478,290

Estimated Cost per 1.000 Cans F.O.B. Plant — US$ 121.12 K 847.83

470

Estimated Production Costs for a 300 x 304 (73 mm x 82 mm) Can - Capacity 14 oz. = 397 grams

A. Production Volume - 10.000.000 cans

B. Products - Evaporated Milk

C. Estimated Production Costs

1. Tin Plate Cost for Bodies Using Ideal Base Box Yield with 1% Waste and Spoilage Allowance

Sheet Size Inches	Sheet Size mm	Bodies/ Sheet	Thickness Inches	Thickness mm	Base Weight Pounds	Base Weight Kilos	Specifications	Number of Base Boxes	Cost Base Boxes	Cost C&F Rangoon K
33.750 x 36.184	857.2 x 919.1	40	0.0083	0.2108	75	34 oz.	75 Electrolytic Plate	11.145	$36.90	2,878,800

2. Ends - Two per Can = 10.000.000 x 2 = 20.000.000 ends

Cost m/ends $21.00 C & F Rangoon

20.000.000 ends x $21.00 = $420.000 — 2,940,000

3. Wire for Welding

29.600 lbs/wire x $ 0.9938/lb C & F Rangoon = $29.416 Use $ 29.400 — 205,800

4. Inside Side Seam Laquer

$ 0.2348 m/cans x 10.000.000 cans = $ 2.348 — 16,400

Total Raw Material Cost — 6,041,000

5. Carton Cost

10.000.000 cans ./. 24 cans/case = 416.667 cases Use 416.700 cases

416.700 cases x K 14.25 M/cases = K 593.797 Use K 593.800 — 593,800

6. Pro-Rata Variable and Fixed Costs — 1,843,490

Total Estimated Production Cost F.O.B. Plant — K 8,478,290

Estimated Cost per 1.000 Cans F.O.B. Plant — US$ 121.12 K 847.83

67

Estimated Production Costs for a 300 x 407 (73 mm x 113 mm) Can - Capacity 15 oz. = 425 grams

A. Production Volume 4.800.000

B. Products - Fish - Fruit - Jams - Juices - Meats - Nectars - Tomato Paste - Vegetables

C. Estimated Production Costs

1. Tin Plate Cost for Bodies Using Ideal Base Box Yield with 1% Waste and Spoilage Allowance

Sheet Size Inches	Sheet Size mm	Bodies/ Sheet	Thickness Inches	Thickness mm	Base Weight Pounds	Base Weight Kilos	Specifications	Number of Base Boxes	Cost Base Boxes	Cost C&F Rangoon K
31.934 x 36.184	811.1 x 919.1	28	0.0083	0.2108	75	34 oz.	100/25 Differential Plate	6.570	$34.80	1,600,500

2. Ends - Two per can 4.800.000 x 2 = 9.600.000 ends
   Cost M/ends $ 21.00/M C & F Rangoon
   9.600.000 ends x $ 21.00/M = $201.600 — 1,411,200

3. Wire for Welding
   19.220 lbs x $ 0.9938/lb C & F Rangoon = $ 19.100 — 133,700

4. Inside Side Seam Laquer
   $ 0.3514 M/cans x 4.800.000 cans = $ 1.687 — 11,800

Total Raw Material Cost — 3,157,200

5. Carton Cost
   4.800.000 cans ./. 24 cans/case = 200.000 cases
   200.000 cases x K 1.750/M cases = K 350.000 — 350,000

6. Pro-Rata Variable and Fixed Costs — 901,630

Total Estimated Production Cost F.O.B. Plant — K 4,408,830

Estimated Cost per 1.000 Cans F.O.B. Plant — US$ 131.22 — K 918.51

APPENDIX L. EQUIPMENT LIST AND ESTIMATED PRICES FOR THE CAN MAKING LINE

Equipment List and Estimated Prices for the Can Making Line

Item No.	Quantity		Motor HP	KW	Supplier	Price FAS Port USA $
1.	1	Dexter Feeder with Conveyor	3.00	2.2	1	36.600
2.	1	United Can Model 405-3 Duplex Slitter	3.25	2.4	1	121.300
3.	1	Soudronic Model FBB-400 Body former and Welder	90.00	67.0	1	330.000
4.	1	Side Seam Stripe Applicator, Oven, Water chiller and Track System	10.00	7.5	1	176.350
5.	1	United Can Model 402-2 Automatic Flanger	2.25	1.6	1	53.400
6.	1	United Can Model 609-1 Beader	7.50	5.6	1	151.375
7.	1	Angelus Model 60L Double Seamer	7.50	5.6	1	59.800
8.	1	Borden 36 Pocket Air Tester	3.00	2.2	1	113.250
9.	1	Can Conveyor Track System and Controls	5.00	3.7	1	73.650
10.	2	Sets of Additional Change Parts	-		1	125.000
11.	2	Can Casers	3.00	2.2	2	52.000
12.	1	Bottom Case Glue Sealer	1.50	1.1	3	17.600
13.	2	Air Compressors	6.00	4.5	4	4.800
14.	2	Nash Model MUF-15 Vacuum Pumps	2.00	1.5	5	2.200
15.	1	Eaton-Yale 4000 lb Fork Lift Truck	1.00	0.7	6	17.500
		Total Estimated Prices	145.00	107.8		
		F.A.S. Port U.S.A.	145.00	107.8		$ 1.334.825
		Estimated Ocean Freight Charges				44.675
		Total Estimated C & F Rangoon, Burma				$ 1.379.500
		Total Estimated C & F Rangoon, Burma				K 9.656.500

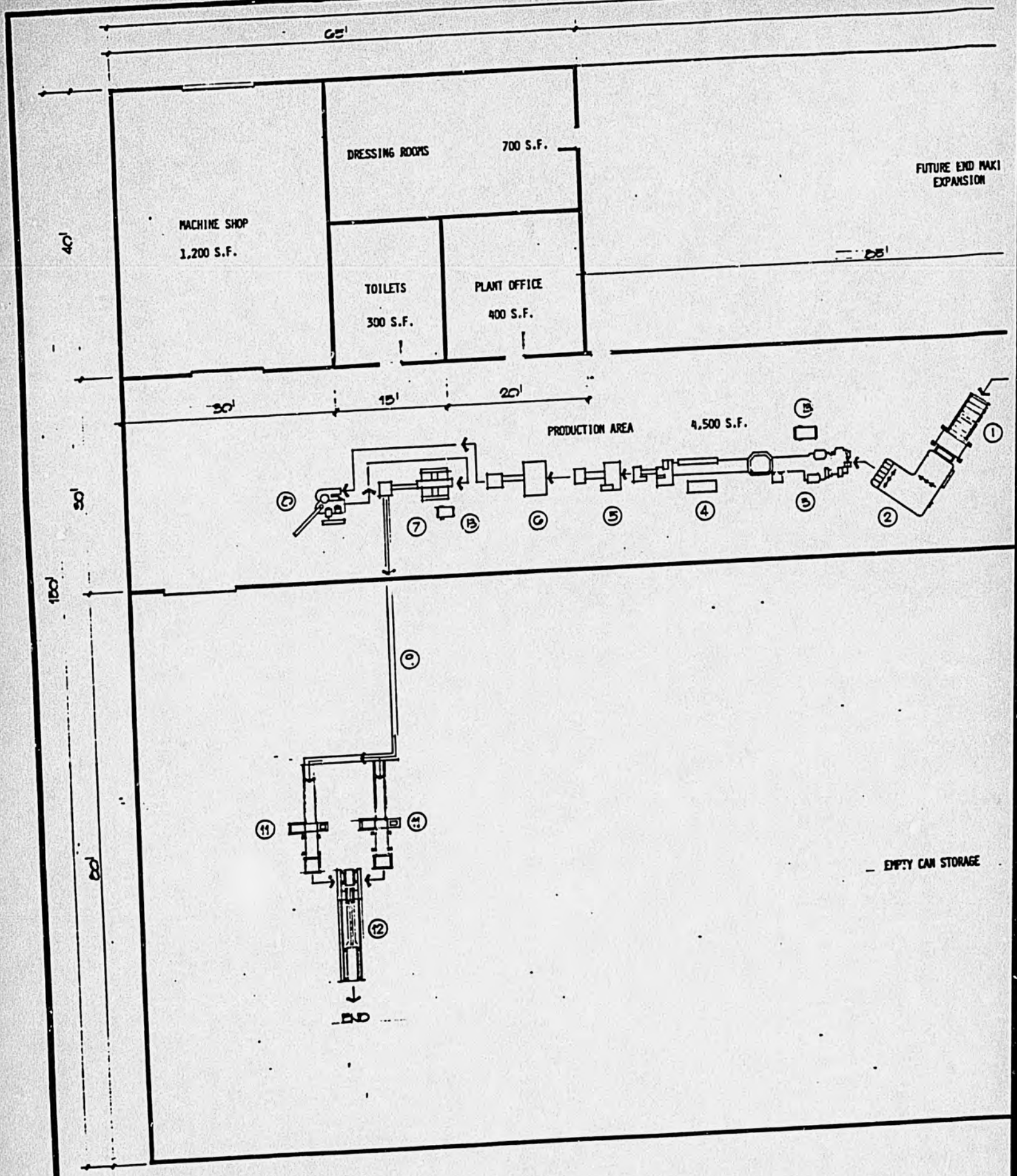
APPENDIX L. LIST OF POTENTIAL SUPPLIERS FOR CAN MAKING LINE

LIST OF POTENTIAL SUPPLIERS

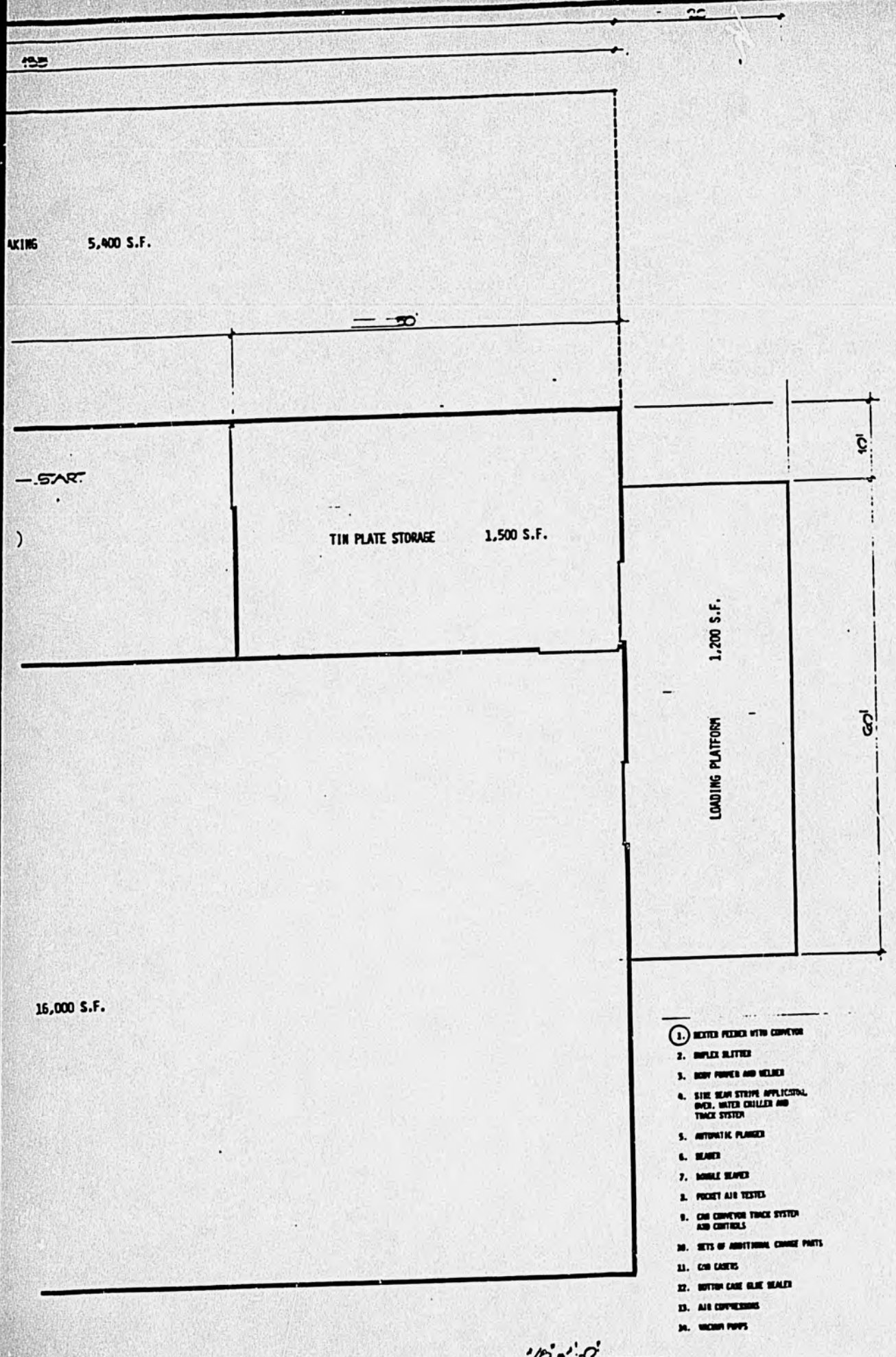
Supplier No.	
1.	United Can Company P. O. Box 3457 - Corner of Burbank and "C" Street Hayward, California 94540
2.	Mateer-Burt Co., Division of Berwind Corporation Labelers/Fillers/Packers 436 Devon Park Drive Wayne, Pennsylvania 19087
3.	Elliott Manufacturing Company, Incorporated P. O. Box 11277 Fresno, California 93772
4.	Magnolia Electric Motors Company, Incorporated 5535 Vineland Avenue North Hollywood, California 91601
5.	Nash 1440 W. Taft Avenue P. O. Box 6126 Orange, California 92667
6.	Yale Industrial Trucks of Southern California, Inc., 2615 Pellissier Place - Box 1231 City of Industry, California 91749

APPENDIX M

CAN MANUFACTURING PLANT FLOOR PLAN


65'
DRESSING ROOMS
700 S.F.
FUTURE END MAKI EXPANSION
MACHINE SHOP
1,200 S.F.
40'
TOILETS
300 S.F.
PLANT OFFICE
400 S.F.
85'
30'
15'
20'
PRODUCTION AREA
4,500 S.F.
50'
150'
80'
EMPTY CAN STORAGE
END

FLOOR PLAN



CAN MAKING PLANT

BURMA

project

EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231

client

477

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT -

Item	Quantity	Description	HP	Supplier	Supplier Cost F.O.B. British Port
A. Grading - Module					
1.	1 only	Dump hopper complete with support		1	
2.	1 only	Vibrating feeder complete with variable speed controller		1	
3.	1 only	Five-stage grader complete with motor and drive.		1	
4.	1 only	Starter		1	
		Cost			£ 13.383
			1.5		
B. Roasting and Decortication - Module					
5.	1 only	No. 6 Underfired Stoker modified for cashew shell burning complete with motors, drives and feed hopper.		1	
6.	1 only	Steel casing for furnace and flue.		1	
7.	1 only	Set of refractory linings for furnace and flue.		1	
8.	1 only	Pyrometer probe and temperature indicator for furnace, complete with compensating cable.		1	
9.	1 only	Control Panel for furnace.		1	
10.	1 only	MK 300/76 Roaster, complete with internal conveyor, variable speed drives, feeder drum with hopper, fume exhaust fan and stack, main stack, internal recirculation pipes scraper gear, thermometers, warning bell, and recording thermograph.		1	

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT -

Item	Quantity	Description	HP	Supplier	Supplier Cost F.O.B. British Port
B. Roasting and Decortication - Module (cont.)					
11.	1 only	C.N.S.L. Recirculation system comprising tank with removable filter panels, recirculation pump with motor and drive, twin bowl filter, set of valves, gauges and piping.			1
12.	1 only	Screw conveyor to Drum cleaner complete with motor and drive.			1
13	1 only	Drum cleaning unit comprising sawdust hopper, cleaning drum with sawdust removal sections, unit support frame, drive and guards.			1
14.	1 only	Vibratory feeder complete with variable speed controller.			1
15.	1 only	Pneumatic conveying system to decorticator comprising:- fan with motor and drive, feed hopper and Venturi, set of ducting, collecting cyclone with supports.			1
16.	1 only	Single decorticator complete with variable speed drive and tachometer.			1
17.	1 only	Support structure for decorticator and screen, complete with handrails and cat ladder.			1
18.	1 only	Two-deck vibrating screen complete with five alternative top decks.			1
19.	1 only	Wire mesh belt conveyor for recirculation, complete with motor and drive.			1

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT -

Item	Quantity	Description	HP	Supplier	Supplier Cost F.O.B. British Port
B. Roasting and Decortication - Module (cont.)					
20.	2 only	Pneumatic shell and Kernel aspirators, complete with remote controls.		1	
21.	1 only	Support frame for Item 20.		1	
22.	1 only	Set of inter-connecting chutes.		1	
23.	1 only	Set of motor starters.		1	
		Cost			£ 146.407
			29.0		
C. Continuous Drying System - Module					
24.	1 only	Belt conveyor complete with motor, drive and guard.		1	
25.	1 only	Belt conveyor, inclined, complete with motor, drive and guard.		1	
26.	1 only	No.6 Underfired Stoker complete with motors, drives and feed hoppers.		1	
27.	1 only	Steel casing for furnace and flue.		1	
28.	1 only	Set of refractory linings for furnace and flue.		1	
29.	1 only	Set of temperature controls comprising thermocouple, temperature indicator, compensating cable and control panel.		1	

ESTIMATED COST OF PROCESSING AND SUPPORTING EQUIPMENT -

Item	Quantity	Description	HP	Supplier	Supplier Cost F.O.B. British Port
C. Continuous Drying System - Module					
30.	1 only	Vertical heat exchanger and stack.		1	
31.	1 only	Hot air connection duct to dryer.		1	
32.	1 only	Continuous Kernel dryer, having variable speed and residence time, hot air fan, motor and drive.		1	
33.	1 only	Exhaust duct for dryer.		1	
34.	1 only	Set of inter-connecting chutes.		1	
35.	1 only	Set of starters.		1	
		Cost.....			£ 48.155
			4.5		
D. Kernel Selection System - Module					
36.	1 only	Feed hopper and support frame.		1	
37.	1 only	Vibratory feeder complete with variable speed controller.		1	
38.	1 only	Multi-channel belt conveyor, complete with motor and drive.		1	
39.	1 only	Set of connecting chutes.		1	
40.	1 only	Set of starters.		1	
		Cost			£ 9.641
			1.6		

E. Peeling and Packaging Equipment

41	12 only	Peeling and Grading Stainless Steel Tables	- 2	US$	12,000
42	1 only	Digital Scale - 50 lbs x 0.01 lb	- 3		2,400
43	1 only	Platform Scale	- 3		8,100
44	1 only	Container Sealer and Vacuum Unit	- 4		27,000

Cost	Total HP 36.6	US$	49,500
(English Equipment Cost £ 217.586 x US$ 1.706/£)		=	371,200

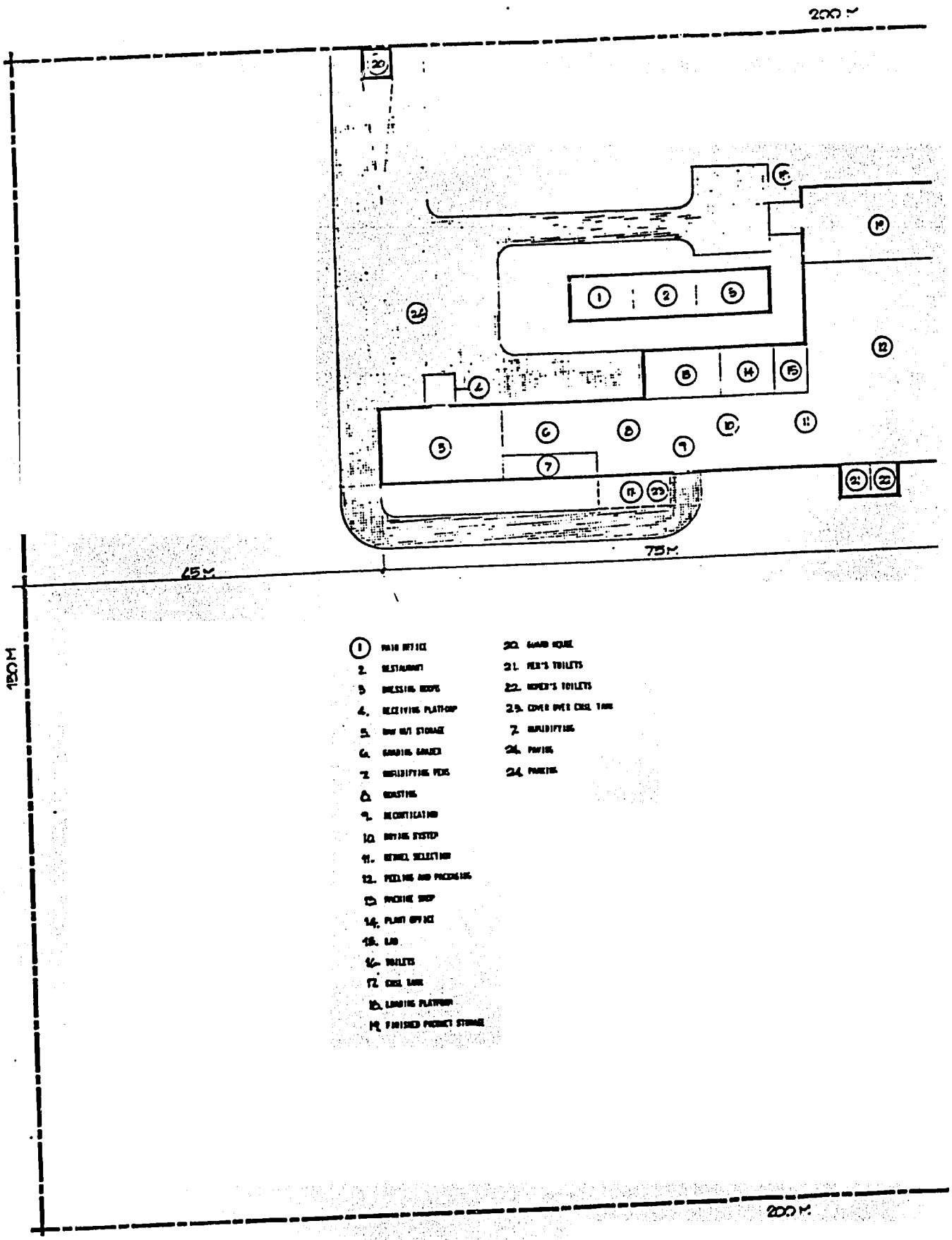
Total Estimated Cost F.A.S. Port		420,700
Estimated Ocean Freight at US$ 192.50/m^3	US$	38,300

Total Estimated Cost C & F Rangoon, Burma	US$	459,000

Total Estimated Cost C & F Rangoon, Burma	K	3,213,000

LIST OF POTENTIAL SUPPLIERS

Supplier No.	
1.	Fletcher and Stewart Limited Process Systems Division, Devonshire House, White Hart Lane London, N 17-7RG, United Kingdom
2.	Dixie Canner Equipment Company P. O. Box 1348 Athens, Georgia, 30603
3.	Toledo Scale, Reliance Electric, 5400 Orange Avenue Cypress, California 90630
4.	CORVAC, c/o Mitchell Beck Company, .ncorporated 300 East 42nd Street New York, New York, 10015



SITE PLAN

484

50M

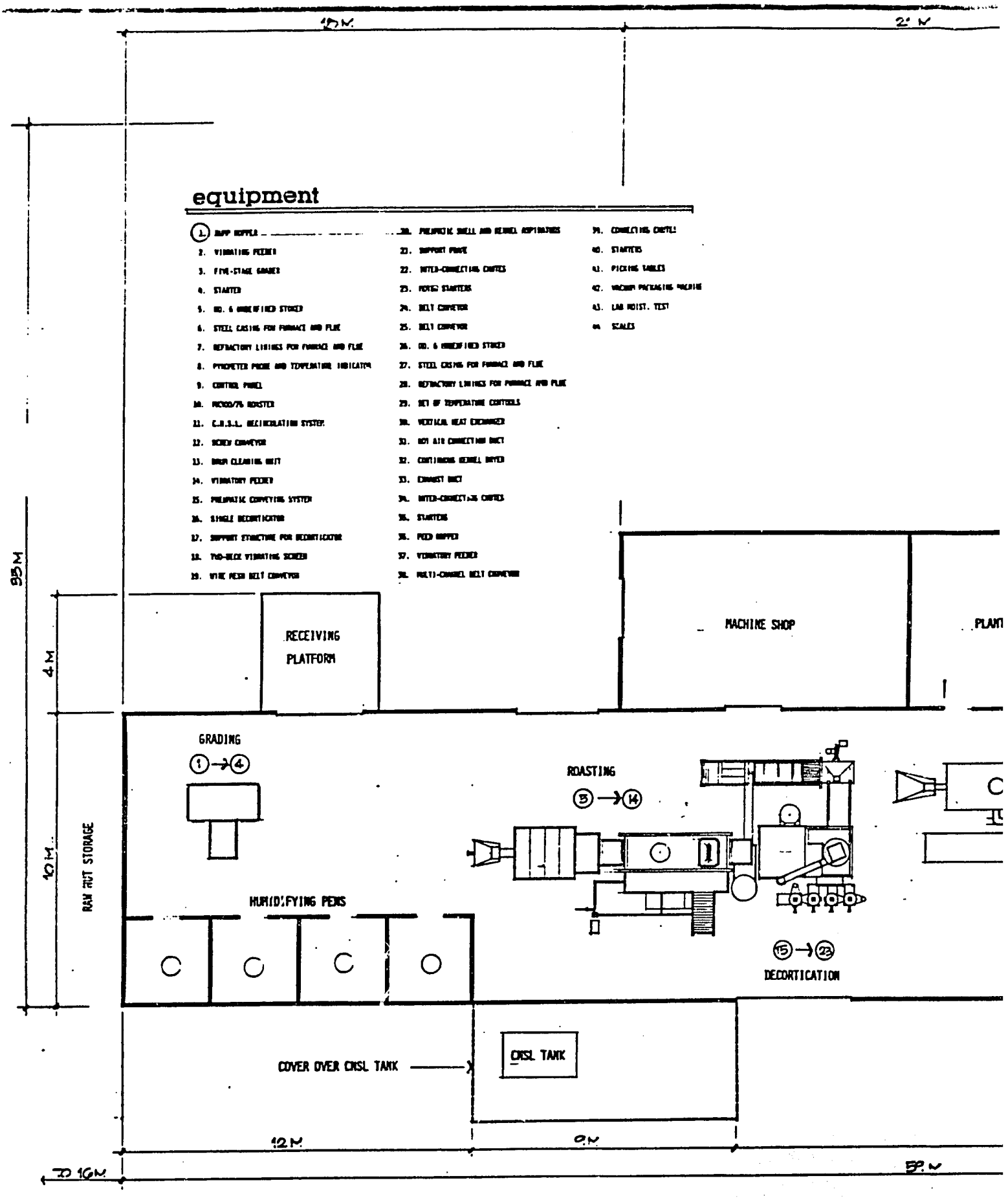
20M

1/8" = 1 MASTER

150M

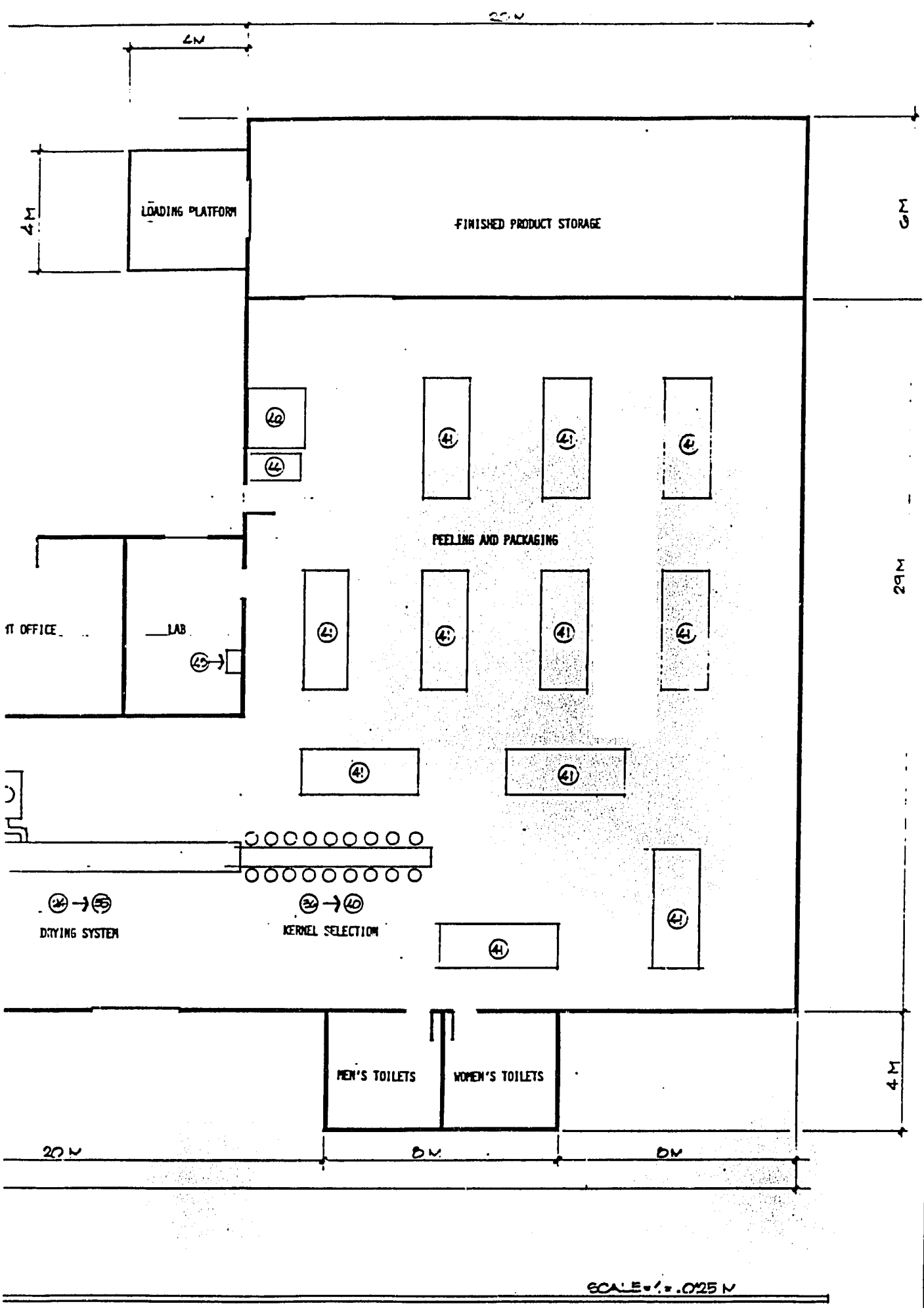
client	EXPERIENCE, INC. 1930 Dain Tower Minneapolis, MN 55402 (612) 333-5231	
project	CASHEW NUT PLANT BURMA	

58h



FLOOR PLAN

486



project

CASHEW NUT
PLANT
BURMA

client

EXPERIENCE, INC.
1930 Dain Tower
Minneapolis, MN 55402
(612) 333-5231

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APPENDIX O

LIST OF NON-IMPORTABLE ITEMS UNDER THE PLANT PROTECTION LAW OF JAPAN, (AS OF 1978).

Prohibited District	Prohibited Plant	Remark (injurious plants or animals as an object)
(1)		
Syria, Israel, Jordan, Lebanon, Turkey, Cyprus, Greece, Albania, Yugoslavia, Hungary, Austria, Italy, Malta, Switzerland, France, Spain, Portugal, Belgium, Netherlands, Germany, United Kingdom (Great Britain, and Northern Ireland), Africa, El Salvador, Nicaragua, Panama, Costa Rica, Brazil, Peru, Bolivia, Chie, Uruguay, Argentine, Bermuda, West Indies except Cuba, Hawaiian Islands, Australia	Fresh fruits including vegetable fruits (excluding pineapple, coconut, immature banana, papaya, of Solo type which is shipped from Hawaiian Island directly to Japan without calling at any port and which come up to the Minister of Agriculture and Forestry and Valencia variety, Washington Navel variety, Tomango Variety and Protea variety of sweet orange, lemon and grapefruit which are shipped from the Republic of South Africa directly to Japan without calling at any port and which come up to the standards established by the Minister of Agriculture and Forestry and Valencia variety, Washington Navel variety, Tomango variety and Protea variety are shipped through the Republic of South Africa from the Kingdom of Swaziland to Japan witnout calling at any port and which come up to the standards established by the Minister of Agriculture and Forestry and Shamouti variety, Valencia variety and Washington variety of sweet orange, lemon and grapefruit which are shipped from Israel directly to Japan without calling at any port and which come up to the standards established by the Minister of Agriculture and Forestry)	Mediterranean fruit fly (Ceratitis capitata)

Continued . . .

Pronibited District	Prohibited Plant	Remark (injurious plants or animals as an object)
(2)		
Formosa, China, Hong Kong, Laos, Khmer, Viet-Nam, Burma, Thailand, Malaysia, Brunei, Indonesia, Portuguese Timor, Philippines, India, Sri Lanka, Pakistan, Micronesia, Hawaiian Islands, Australia	Fresh fruits of citrus (excluding ponkan orange which is shipped from Formosa directly to Japan without calling at any port and which comes up to the standards established by the Minister of Agriculture and Forestry), wampi, loquat, plum, peach, pomegranate, fig, papaya (excluding papaya of Solo type which is shipped from the Hawaiian Islands directly to Japan without calling at any port and which come up to the standards established by the Minister of Agriculture and Forestry, and papaya of Solo type which is shipped from Formosa directly to Japan and which comes up to the standards established by the Minister of Agriculture and Forestry. The same shall apply for Item 3.), longan, litchi, caranbola, guava, avocado, rambutan, Arenga englei, betel nut, santol, tomato, mature banana, plants of genera Mangifera, (excluding mangoes of Manila super type which are shipped from Philippines directly to Japan and which come up to the standards established by the Minister of Agriculture and Forestry, and mangoes of Erwin and Harden types which are shipped from Formosa directly to Japan and which come up to the standards established by the Minister of Agriculture and Forestry), Diospyros, Solanum (eggplant, S. Vergascifolium, etc.),	Mango Fly (Chaetodacus ferrugineus)

Continued . .

APPENDIX O. LIST OF NON-IMPORTABLE ITEMS - Continued

Prohibited District	Prohibited Plant	Remark (injurious plants or animals as an object)
	Artocarpus (breadfruit, jackfruit, etc.), Zizyphus, Passiflora, Eugenia (Roseapple, malaya-apple, etc.), Anona, garcinia (G. Spicata, mangosteen, etc.), Cappicum and of the family Sapotaceae (star apple, sapodilla, etc.)	
(3)		
Formosa, China, Hong Kong, Viet-Nam, Burma, Thailand, malaysia, Brunei, Indonesia, Portuguese Timor, Philippines, India, Pakistan, Sri Lanka, Kenya, Tanzania, Micronesia, Hawaiian Islands, Australia	Live vines, leaves, and fresh fruits of cucumber, water melon, muskmelon, pumpkin and other Cucurbitaceous plants. Fresh fruits of kidney bean, cowpea, pigeon pea, tomato, eggplant, bell pepper, papaya, and plants of the genus Mangifera	Melon fly (Chaetodacus cucurbitae)
(4)		
China, Burma, India, Pakistan, Afganistan, Iraq, Syria, Israel, Jordan, Iran, Turkey, Cyprus, Europe, Soviet Union, Africa, Canada, United States, (excluding Hawaiian Islands. Hereinafter referred to as "United States of America"), Brazil, Peru, Chile, Uruguay, Argentine, Australia, New Zealand	Fresh fruits of apple, pear, quince, peach, plum, apricot, cherry (excluding cherries of Bing type, Lambert type and Van type which are shipped from the United States directly to Japan and which come up to the standard established by the Miniester of Agriculture and Forestry), walnut and walnut in shell	Coddling moth (Carpocapsa pomonella)

SOURCE:

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APPENDIX P-1

ELEASED ITEMS OF IMPORT PROHIBITION AND THEIR CONDITIONS JAPAN, AS OF DECEMBER 1979

ountry or istrict	Item	Date of Release	Injurious Insect	Conditions for Inspection: Disinfection Method	Conditions for Inspection: Others
tate of awaii, SA	Papaya (Solo type)	April 1, 1969	Mediterranean fruit fly, Mango fly, and Melon fly	1. EDB fumigation 8 g/m ^{3}, 2 hours (above 22° C)	1. To be produced in the designated district
				2. Treatment by steam heat. Disinfection by saturated vapor; until a center part of fresh fruits becomes 47.2° C	2. To attach the Plant Quarantine Inspection Certificate issued by an export country with the product
aiwan	Ponkan Orange	Nov. 25, 1969	Mango fly	EDB Solution (measurement ratio 0.1%), 3 minutes preserving (25° C)	3. The inspection should be carried out prior to an export by the Plant Quarantine Inspector despatched from Japan
	Tankan Orange	Dec. 5, 1975			
	Papaya (Solo type)	June 16, 1976	Mango fly and Melon fly	After 20 minutes preserving in hot water (46 - 50° C), EDB fumigation, 72 g/m ^{3} 2 hours (above 20° C)	4. The Plant Quarantine Label should be put on fresh fruits

Continued . . .

/4265A

APPENDIX P-2

Names and Addresses of Principal Importers of Tropical Fruits into Japan and Names of Tropical Fruits in the Japanese and English Languages

A. Principal Importers

Company's Name	Telephone	Address
Tokyo Seika Co., Ltd.	(03) 251-1544	14, Sotokanda 4-chome, Chiyoda-ku, Tokyo 101
Mitsubishi Corporation	(03) 210-2121	6, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
C. Itoh & Co., Ltd.	(03) 639-5111	4, Nihonbashi 2-chome, Chuo-ku, Tokyo 103
Marubeni Corporation	(03) 282-2111	4, Otemachi 1-chome, Chiyoda-ku, Tokyo 100
Sumairu Boeki	(03) 832-7221	7, Yushima 3-chome, Bunkyo-ku, Tokyo 113
	(PAPAYA)	
Marubeni Corporation	(03) 282-2111	4, Otemachi 1-chome, Chiyoda-ku, Tokyo 100
Tokyo Seika Co., Ltd.	(03) 251-1544	14, Sotokanda 4-chome, Chiyoda-ku, Tokyo 101
Mitsubishi Corporation	(03) 210-2121	6, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
	(MANGO)	
Sintoa Koeki Kaisha, Ltd.	(03) 212-8411	New Tokyo Bldg., 3-1, Marunouchi 3-chome, Chiyoda-ku, Tokyo 100
Japan Fruits Trading Co., Ltd.	(03) 255-8776	Sadatei Bldg., 4-9, Sotokanda 4-chome, Chiyoda-ku, Tokyo 101

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TABLE P-3 CUSTOMS TARIFF SCHEDULE AND IMPORT SYSTEM OF MAIN VEGETABLES AND FRUITS, JAPAN

Heading Number	Description	Date of Release	Rate of Duty: General	GATT	Preferential	Temporary
			----------percent----------			
08.01	Dates, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas and mangosteens, fresh or dried, shelled or not:					
	1. Bananas					
	(1) Fresh	April 1963				
	*(1) If imported during the period from 1st April to 30th September		(30)			(40)
	*(2) If imported during the period from 1st October to 31st March		(30)		45	50
	(2) Dried	Oct. 1961	(20)	(10	Free	10
	2. Pineapples					
	Fresh	Oct. 1961	20			
	Dried	Oct. 1961	20		10	
	3. Dates					
	Fresh	Oct. 1960	(20			Free
	Other	April 1970	(20			Free
	4. Other					
	Coconuts	Fresh Oct. 1960	(20)	(10)	Free	10

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Continued . . .

TABLE P-3 CUSTOMS TARIFF SCHEDULE AND IMPORT SYSTEM -- Continued

Heading Number	Description	Date of Release	Rate of Duty General	GATT	Preferential	Temporary
			----------percent----------			
08.02 Continued						
	*(2) If imported during the period from 1st December to 31st May		(20)			40
	4. Other					
	Tangerines and mandarins	Oct. 1961	20			
	Other	Oct. 1961	20			
08.03	Figs, fresh or dried:					
	1. Fresh	Oct. 1960	(20)			10
	2. Dried	Apr. 1960	(20)	10	5	
08.04	Grapes, fresh or dried:					
	1. Fresh	European Jan. 1971 Others Apr. 1962 Jan. 1961	20			
	2. Dried					
	*(1) In can, bottle or pot, not more than 10 kilograms each including container		(20)	(10)	5	10
	*(2) Other		(20)	(5)		

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Continued . . .

TABLE P-3 CUSTOMS TARIFF SCHEDULE AND IMPORT SYSTEM - Continued

Heading Number	Description	Date of Release	Rate of Duty General	GATT	Preferential	Temporary
			----------percent----------			
08.05	Nuts other than those falling within heading No. 08-01, fresh or dried, shelled or not:					
	1. Chestnuts	Oct. 1961	20			
	2. Walnuts	Oct. 1962	30			
	3. Bitter almond oil and betel nuts	Oct. 1961	Free	(Free)		
	Bitter Almonds					
	Betel nuts					
	4. Other					
	*(1) Sweet almonds	Oct. 1960	(20)	(9)	5	9
	*(2) Hazel nuts	Oct. 1961	(20)	(10)	5	10
	Other		20			

SOURCE: JETRO, 1982.

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TABLE P-3 CUSTOMS TARIFF SCHEDULE AND IMPORT SYSTEM - Continued

Heading Number	Description	Date of Release	Rate of Duty General	GATT	Preferential	Temporary
			----------percent----------			
08.01 Continued						
		Dry				
	Brazil Nuts	Oct. 1959	(20)	(10)	Free	10
	Cashew Nuts	Oct. 1959	20	5		
	Other, fresh	Oct. 1959	(20)	(10)		10
	Other, dried	Oct. 1959	(20)	910)	Free	10
	Mango, Avocado, Guava, Mangonsteen					
08.02	Citrus fruit, fresh or dried:					
	1. Lemons and limes		20	10		
	2. Oranges:					
	(1) If imported during the period from 1st June to 30th November		20			
	(2) If imported during the period from 1st December to 31st May		40			
	3. Grapefruit	Jun. 1971				
	*(1) If imported during the period from 1st June to 30th November		(20)			20

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Continued . . .

B. Principal Tropical Fruits

Japanese Name	English Name	Scientific Name
Aigyokushi	Lelly fig	Ficus awkeotsang
Abogado	Avocado	Persea americana
Orenji	Orange	Citrus sinensis
Karamanshi	Calamansi	Citrus mandurens
Kiwi-furutsu	Kiwi fruit	Actinidia chinensis
Kidachi-tomato	Tree tomato	Cyphomandra batacea
Guava	Guava	Psidium guayava
Guyabano	Guanabana	Annona muricata
Grepu-furutsu	Grapefruit	Citrus paradisi
Kokonatsu	Coconut	Cocos nucifera
Gorenshi	Carambola	Averrhoa carambola
Sapojira	Sapodilla	Achras zapota
Zabon	Shaddock	Citrus grandis
Santoru	Santol	Sandoricum indicum
Jyaboran	jambolan	Eugenia cumini
Suika	Watermelon	Citrullus lanatus
Suishogaki	Star-apple	Chrysophyllum cainito
Tamarindo	Tamarind	Tamarindus indica
Detsu	Date	Phoenix dactylifera
Dorian	Durian	Durio zibethinus
Nanka	Jackfruit	Artocarpus heterophyllus
Painappru	Pineapple	Ananas comosus
Pashion-furutsu	Passion fruit	Passiflora edulis
Banana	Banana	Musa sapientum
Papaiya	Papaya	Carica papaya
Banreishi	Sweet sop	Annona squamosa
Pan-no-mi	Bread fruit	Artocarpus incisa
Bilinbi	Bilmbi	Averrhoa bilimbi
Belu	Bael	Aegle marmelos
Maran	Marang	Artocarpus odoratissimo
Mango	Mango	Mangifera indica
Mangosuchin	Mangosteen	Garcinia mangostana
Melon	Melon	Cucumis melo
Raimu	Lime	Citrus aurantifolia
Ransa	Langsat	Lansium domesticum
Ranbutan	Rambutan	Nephelium lappaceium
Ryugan	Longan	Euphoria
Reishi	Litchi	Litchi chinensis
Remon	Lemon	Citrus Limon
Rozeru	Roselle	Hibiscus
Cherimoa	Cherimova	A. cherimola

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RELEASED ITEMS OF IMPORT PROHIBITION - Continued

Country or District	Item	Date of Release	Injurious Insect	Conditions for Inspection: Disinfection Method	Conditions for Inspection: Others
Taiwan - Continued	Mango (Irving type,	June 16, 1976	Mango fly and Melon fly	After 20 minutes preserving in hot water (48-50° C), EDB fumigations, 72 g/m^3, 2 hours (above 25° C), 4 days storage under low temperature (7-0° C)	5. On the package, the designation to Japan should be indicated and the sealing should also be done
Israel	Lemon Orange	June 15, 1972	Mediterranean fruit fly	EDB fumigation, 14 g/m^3, 2 hours (15-21° C)	6. Importation should be handled as a cargo. (Importation of papaya of Hawaii, Ponk orange, tank orange of Taiwan as th case of a pa senger's car ing (his) lu gage can be approved
	Grapefruit	June 15, 1972	Mediterranean fruit fly	EDB fumigation, 16 g/m^3, 2.5 hours (15-21° C)	
South Africa	Orange	June 15, 1970	Mediterranean fruit fly	Storage under low temperature, -0.6° C, 12 days	7. Others
	Lemon Grapefruit	April 20, 1971	Mediterranean fruit fly	Storage under low temperature, -0.6° C, 12 days	
Swaziland	Lemon Orange Grapefruit	June 4, 1973	Mediterranean fruit fly	Storage under low temperature, -0.6° C, 12 days	
Philippines	Mango (Manila-super)	July 10, 1975	Mango fly, Melon fly	EDB fumigation, 16 g/m^3, 2 hours (above 26° C)	
United	Cherry	Jan. 10, 1978	Codling moth	CH, BR fumigation, 32 g/m^3, 2 hours (above 27° C)	

SOURCE:
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APPENDIX Q

COUNTRY REGULATIONS, TRADE ORGANIZATIONS AND IMPORTERS FOR SINGAPORE, SAUDI ARABI, HONG KONG, UNITED ARAB EMIRATES, UNITED KINGDOM, FRANCE, FEDERAL REPUBLIC OF GERMANY, NETHERLANDS, BELGIUM, SWITZERLAND, AUSTRIA, DENMARK AND NORWAY

APPENDIX Q-1

Sources of Economic and Commercial Information, Singapore, 0106

Singapore Government Representation

MINISTRY OF FINANCE
29th-40th Bloor
CPF Building
79 Robinson Road
Singapore 0106
Tel: 222-9666

MINISTRY OF TRADE AND INDUSTRY
Department of Trade
Suite 201, Second Floor
World Trade Center
Telok Blangah Road
Singapore 0409
Tel: 271-9388

ECONOMIC DEVELOPMENT BOARD
Ninth Floor
World Trade Center
Telok Blangah Road
Singapore 0409
Tel: 271-0844

SINGAPORE INSTITUTE OF STANDARDS AND INDUSTRIAL RESEARCH (SISIR)
179 River Valley Road
Singapore 0617
Tel: 360-933

NATIONAL PRODUCTIVITY BOARD
Sixth Floor
Jurong Flatted Factory
(off Corporation Road)
Jurong Town
Singapore 2260
Tel: 652-555

INDUSTRIAL TRAINING BOARD
Annex Building
Ministry of Education Building
Kay Siang Road
Singapore 1024
Tel: 623-344

MINISTRY OF LAW
Second Floor, City Hall
St. Andrew's Road
Singapore 0617
Tel: 361-477

MINISTRY OF NATIONAL DEVELOPMENT
National Development Building
Maxwell Road
Singapore 0106
Tel: 222-1211

SENTOSA DEVELOPMENT CORPORATION
Block 10, Carlton Hill Road
Singapore 0208
Tel: 634-388

REGISTRY OF COMPANIES AND REGISTRY OF BUSINESSES
Third Floor
Colombo Court
Singapore 0617
Tel: ROC 361-203, ROB 361-282

THE MONETARY AUTHORITY OF SINGAPORE
SIA Building
77 Robinson Road
Singapore 0106
Tel: 222-5511

MINISTRY OF SCIENCE AND TECHNOLOGY
Kay Siang Road
Singapore 1024
Tel: 649-367

METRICATION BOARD
One Anson Road
Singapore 0207
Tel: 222-7755

STATISTICS DEPARTMENT
Fullerton Building
Singapore 0104
Tel: 436-121

UNITED STATES GOVERNMENT PUBLICATIONS

Foreign Economic Trends. Prepared on a semi-annual basis by the United States Embassy, Singapore, and distributed by the United States Department of Commerce

Trade USA. A bimonthly magazine, published by and on behalf of the United States commercial officers in the region to promote trade between Southeast Asia and the United States.

Commercial Newsletter. Published periodically by the United States Embassy in Singapore.

OTHER PUBLICATIONS

Singapore International Chamber of Commerce Economic Bulletin. Published monthly by the Singapore International Chamber of Commerce.

Singapore International Chamber of Commerce Report. Annual.

Singapore International Chamber of Commerce Investor's Guide. Annual.

Singapore. Published annually by the Singapore Ministry of Culture.

The Straits Times Directory of Singapore. Published yearly by Times Periodicals Pte. Ltd., Singapore.

Far Eastern Economic Review. Weekly magazine published in Hong Kong.

Asian Research Bulletin. A monthly economic report with political supplement, published by Asia Research Pte. Ltd., Singapore.

Singapore Business. Monthly magazine published by Times Periodicals Pte. Ltd., Singapore.

Asia Yearbook. Published annually by the Far Eastern Economic Review Ltd., Hong Kong.

South East Asia Oil Directory. Published annually by J.S. Metes & Co. (Pte.) Ltd., Singapore.

Singapore Manufacturer's Association Directory. Published by the Singapore Manufacturer's Association.

Shipbuilding & Repairing in Singapore Directory. Published by Singapore Association of Shipbuilders and Repairers.

Insight. Asia's monthly business magazine published by Pacific Magazines Ltd., Hong Kong.

Petroleum News. A monthly journal published by Petroleum News Southeast Asia Ltd., Hong Kong.

Companies Handbook of the Stock Exchange of Singapore Limited. Annual.

Singapore Banking and Finance. Published by the Institute of Banking and Finance.

The Singapore Manufacturer. A bimonthly newsletter, published by the Singapore Manufacturers' Association.

APPENDIX Q-2

Hong Kong Fresh Fruit and Vegetable Imports Association, Limited

Name of Firm	Representative	Address	Tele.
Hing Lee & Company	Patrick Kam	9th Fl., Tack Bldg., 48 Gilman Street	5-432181
Cathay Traders, Ltd.	Y.K. Leung	1609 International Bldg., HK	5-452046
Manetta (H.K.) Ltd.	Fung King Sun	7/F - On Lan Centre, 11 On Lan St., H.K.	5-226763
Reliance Commercial Enterprises	Newman Wu	1619 Prince's Bldg (HK)	5-224451
Thai-Union Tdg Co.	Cheumg Yuk Tong	1903 Loong Kee Bldg.	5-450101
Wai Ming Co.	Lai Kan	Lot 1, Reclamation St. Yaumati, Kowloon	3-845862
Wang Fat Hong	C.B. Cheung	K.I.L. 6 Recl. St. Kowloon	3-844861
Cheong Tai Co.	Hung Yim	Rm 1102 Yau Sing Bldg.	5-439069
Four Seas Tdg Co.	Lam Hing Nam	Yau Sing Bldg.	5430969
Sincere Comm. Co.	Nam Chei Yu	1428-1431 Swire House	5-242-31-
Utak International	Dwight A. Cookins	111 Hutchison House HK	5-262371
Hoi Sang Loong Fat Kee	T.C. Chan	Rm 704 Harvest Bldg.	5-458382
Grand Union Tdg Co., Ltd.	Sim Bak Hion Tsang Kwok Hing Ho Yok Chuen	Sun House, 7/F, GPO Box 208	5-44702
Sheraton (Hong Kong)	Alex Tse	421 Tung Ying Bldg., Kowloon	3-665511

(Above is only a partial listing--if complete listing is desired, write Hong Kong Trade & Development Council, Attn. Mr. Yim Fong, Swire House, Connaught Road, Hong Kong)

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SAUDI GOVERNMENT AGENCIES*

MINISTRIES	FUNCTIONAL RESPONSIBILITIES
Ministry of Agriculture and Water, Riyadh Phones: 401-2777, 401-1699 Telex: 201108 AGRWAP SJ	Agriculture, irrigation, desalination, fisheries, animal resources, locust control.
Ministry of Commerce, Riyadh Phones: 401-2229, 40-4708 Telex: 201057 TIJARA SJ	Foodstuff quality control, consumer protection, companies' registration, labeling regulations, standards.
Ministry of Communications, Riyadh Phones: 404-3000, 404-3440 Telex: 201020 GENTEL SJ	Roads, railroads, bus systems.
Ministry of Defense and Aviation, Riyadh Phone: 404-0524 Telex: 201071 MILFAC SJ	Construction of military bases, civilian airports, meteorology.

* All Saudi telephones are being changed to seven digits.

United States Foreign Service Officers in Economic/Commercial Sections are avaailable to assist American business visitors to Saudi Arabia. A booklet, Key to Officers of Foreign Service Posts, is published quarterly by the United States Department of State. Copies can be purchased from the Government PRinting Office. Washington, D.C. 20402

Percival, John. Oil Wealth-Middle East Spending and Investment Patterns. New York: Financial Times Publications, Ltd., 1975

Mideast Markets (bi-weekly), published by Financial Times, London. Available in United States from F.T. Publications, 75 Rockefeller Plaza, New York, NY 10019

Middle East Economic Digest (weekly). London. Available in United States from MABCO, Inc., 61 Broadway Suite 1400, New York, NY 10006

Quarterly Economic Review of Saudi Arabia, published by The Economist Intelligence Unit, London (quarterly)

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Electricity and Water Resources, Humaid Nasser al-Owais

Justice, Islamic Affairs and Awqaf, Mohammad Abdel-Rahman al-Bakr

Health, Hamad Abdel-Rahman al-Madfa

Agriculture and Fisheries, Said al-Raqbani

Planning, Said al-Ghobash

Labor and Social Affairs, Said al-Jarwan

Ministers of State
Without Portfolio, Sheikh Ahmad Bin-Sultan al-Qasimi

Cabinet Affairs, Said al-Ghaith

Supreme Council Affairs, Sheikh Abdel-Aziz al-Qasimi

Foreign Affairs, Rashid Bin-Abdullah al-Nuaimi

Interior Affairs, Hamuda Bin-Ali Dhariri

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APPENDIX Q-3

Additional Sources of Information for the Saudi Arabia Market

Commerce Action Group for
the Near East
Room 3203
U.S. Department of Commerce
Washington, D.C. 20230
Phone: 202-377-5341

Office of Saudi Arabian Affairs
Room 1446
U.S. Department of Treasury
Washington, D.C. 20220
Phone: 202-566-8371

U.S. Army Corps of Engineers
Middle East Division (Rear)
P.O. Box 2250
Winchester, VA 22601
Phone: 703-667-2295, ext. 2179
Telex: 89-584

American Embassy
P.O. Box 149, Palestine Road
Jidda
(Mailing address from U.S.:
APO New York 09697)
Phone: 67-0080
Telex: 401459 AMEMB SJ

SAUDI CHAMBERS OF COMMERCE

Eastern Province Chamber
of Commerce and Industry
P.O. Box 719
Dammam, Saudi Arabia
Phone: 21134
Cable: ALGHURFA
Telex: 601086 GHABR SJ

Jidda Chamber of Commerce
and Industry
P.O. Box 1264
Jidda, Saudi Arabia
Phone: 31059
Cable: ALGHURFA
Telex: 401069 GHURFA SJ

Riyadh Chamber of Commerce
and Industry
P.O. Box 596
Riyadh, Saudi Arabia
Phone: 22600
Cable: TAJARIAH
Telex: 201054 TJARYH SJ

Mecca Chamber of Commerce
and Industry
P.O. Box 866
Mecca, Saudi Arabia
Phone: 25775
Cable: ALGHURFA
Telex: 440011 CHAMEC SJ

Medina Chamber of Commerce
and Industry
P.O. Box 442
Medina, Saudi Arabia
Phone: 1037
Telex: 470009 ICCMED SJ

Qasim Chamber of Commerce
and Industry
P.O. Box 444
Buraidah, Saudi Arabia

Asia Business & Industry. A monthly magazine, published by Far East Trade Press Ltd., Hong Kong.

The Singapore Stock Exchange Journal. Monthly magazine published by the Stock Exchange of Singapore Limited, Singapore.

Economic Bulletin. Monthly newsletter published by the Indian Chamber of Commerce, Singapore.

Modern Asia. Monthly magazine, published by Business Publication Audit of Circulation, Inc., Hong Kong.

Foreign Investment in Singapore. A report compiled by the Bank of America.

Doing Business in Singapore. Prepared by SGV-Goh Tan Pte. Ltd., Singapore.

Economic Profile. Prepared annually by SGV-Goh Tan Pte. Ltd., Singapore.

Singapore Banking, Finance, and Insurance. Published by Times Directories (Pte.) Ltd. on an annual basis.

SINGAPORE GOVERNMENT PUBLICATIONS

Singapore Yearbook. Government Printing Office, Singapore.

Monthly Digest of Statistics. Department of Statistics, Singapore.

Singapore Trade Statistics-Imports and Exports. A monthly publication published by the Department of Statistics.

Singapore Half-Yearly Trade Statistics. Department of Statistics, Singapore.

Singapore Investment News. Published monthly by the Singapore Economic Development Board.

Commercial Bulletin. Monthly newsletter published by the Department of Trade, Singapore.

The Statutes of the Republic of Singapore, Volume 1-8. Revised Edition of Acts 1970 and Supplements.

Report on the Census of Industrial Production. Annual publication by the Department of Statistics, Singapore.

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MARINE DEPARTMENT
Fullerton Building
Singapore 0104
Tel: 910-511

PORT OF SINGAPORE AUTHORITY
PSA Towers, Maritime Square
Telok Blangah Road
Singapore 0409
Tel: 271-2211

JURONG TOWN CORPORATION
Jurong Town Hall
Singapore 2260
Tel: 650-133

MINISTRY OF CULTURE
Third Floor, City Hall
St. Andrew's Road
Singapore 0617

PRIME MINISTER'S OFFICE
Istana Annex
Singapore 0922
Tel: 375-133

MINISTRY OF THE ENVIRONMENT
Princess House
Alexandra Road
Singapore 0315
Tel: 635-111

THE TIMBER INDUSTRY BOARD
Fourth Floor, Realty Centre
15-16 Enggor Street
Singapore 0207
Tel: 220-5011

SINGAPORE TOURIST PROMOTION BOARD
131-133 Tanglin Road
Singapore 1024
Tel: 235-6611

MINISTRY OF LABOUR
Havelock Road
Singapore 0316
Tel: 436-141

SINGAPORE NATIONAL PRINTERS
(PTE) LTD.
303 Upper Serangoon Road
Singapore 1334
Tel: 282-0611

CUSTOMS AND EXCISE DEPARTMENT
Customs House
Maxwell Road
Singapore 0106
Tel: 222-3511

INLAND REVENUE DEPARTMENT
Income Tax Division
Fullerton Building
Singapore 0104
Tel: 914-244

Chambers and Associations

THE SINGAPORE MANUFACTURER'S
ASSOCIATION
Unit 118, First Floor
World Trade Center
Telok Blangah Road
Singapore 0409
Tel: 275-1211

SINGAPORE INTERNATIONAL
CHAMBER OF COMMERCE
Denmark House
Collyer Quay
Singapore 0104
Tel: 981-255

SINGAPORE CHINESE CHAMBER
OF COMMERCE AND INDUSTRY
47 Hill Street
Singapore 0617
Tel: 328-381

SINGAPORE INDIAN CHAMBER
OF COMMERCE
55A Robinson Road
Singapore 0106
Tel: 222-2855

SINGAPORE MALAY CHAMBER
OF COMMERCE
1901 International Plaza
Singapore 0207
Tel: 221-1066

SINGAPORE EMPLOYERS FEDERATION
23A Amber Mansion
Singapore 0923
Tel: 361-211

Additional Information Sources for
the United Arab Emirates

GOVERNMENT OF THE UAE

Head of State
President Sheikh Zayed Bin-Sultan al-Nuhayan

Supreme Council of Rulers
President Sheikh Zayed Bin-Sultan al Nahayyan, Ruler of Abu Dhabi

Vice-President Sheikh Rashid Bin-Said al-Maktoum, Ruler of Dubai

Members
Sheikh Sultan Bin-Mohammad al-Qasimi, Ruler of Sharjah

Sheikh Saqr-Bin-Mohammad al-Qasimi, Ruler of Ras al-Khaimah

Sheikh Rashid Bin-Ahmed al-Mulla, Ruler of Umm al-Qaiwain

Sheikh Hamad Bin-Mohammad al-Sharqi, Ruler of Fujairah

Sheikh Rashid Bin-Humaid al-Nuaimi, Ruler of Ajman

Council of Ministers (formed on July 1, 1979)
Prime Minister, Sheikh Rashid Bin-Said al-Maktoum

Deputy Prime Minister, Sheikh Maktoum Bin-Rashid al-Maktoum

Deputy Prime Minister, Sheikh Hamdan Bin-Mohammad al-Nahayyan

Finance and Industry, Sheikh Hamdan Bin-Rashid al-Maktoum

Interior, Sheikh Mubarak Bin-Mohammad al-Nahayyan

Defense, Sheikh Mohammad Bin-Rashid al-Maktoum

Foreign Affairs portfolio vacant

Economy and Trade, Sheikh Sultan Bin-Ahmad al-Mualla

Information, Sheikh Ahmad Bin-Hamed

Communications, Mohammad Said al-Mualla

Public Works and Housing, Mohammad Khalifah al-Kindi

Education, Youth, and Sports, Said Salman

Petroleum and Mineral Resources, Manaa Bin-Said al-Otaibah

PUBLICATIONS

United States Government
(Available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402)

Area Handbook for Saudi Arabia. Government Printing Office, Washington, D.C., 1977.

Foreign Economic Trends and Their Implications for the United States-Saudi Arabia. (semi-annual)

Background Notes-Saudi Arabia. January 1978.

Saudi Arabian Five Year Development Plan. (1975-80-National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. $19.

Other

Arabian American Oil Company (ARAMCO). Handbook-Oil and Middle East. Dhahran, Saudi Arabia: 1968.

Business International S.A. Business Prospects in Arab Middle East. Geneva, Switzerland: 1975.

Citibank: Investment Guide: Saudi Arabia, 1977.

Doing Business in Saudi Arabia, N.A. Shilling, 1975.

Doing Business in Saudi Arabia. February 1979 Price, Waterhouse and Co., New York.

A Hundred Million Dollars a Day: Inside the World of Middle East Money, Michael Field, London: Sedgweck & Jackson, 1975.

Guide to Industrial Investments in Saudi Arabia: Industrial Studies and Development Center, Riyadh, 1977.

Jeddah, 68/69, University Press of Arabia, Nairobi, Kenya, 1968.

Khoja, Ibrahim F. A Short Guide to Doing Business in Saudi Arabia. Washington, D.C.: World Wide Enterprises, Ltd. 1975.

Saudi Arabia, Samir Ahmed, New York: Chase World Information Service, 1976

Saudi Arabia: A Case Study in Development, Dr. Fouad al-Farsy, London, Stacey Int'l 1978.

Saudi Arabia Today, Peter Hobaday, New York: St. Martin's Press 1978

Saudi Business (weekly) published by Arab News, P.O. Box 4556, Jidda, Saudi Arabia

Saudi Economic Survey (weekly), Ashoor Public Relations, P.O. Box 1989, Jidda, Saudi Arabia

Saudi Introspect (monthly) P.O. Box 659, Southington, CT 06489

Statistical Summary (annual), Saudi Arabian Monetary Agency, Research and Statistic Department, Riyadh, Saudi Arabia

Winning Business in Saudi Arabia, Nicolas Fallon, London, Graham 1976.

Who's Who in Saudi Arabia, 2nd Edition, 1978 Tihama, Jidda, Saudi Arabia.

APPENDIX Q-5

Selected Listing of Major Importers of Tropical Fruits in the United Kingdom

Pyffes Group, Ltd.
Central Produce & Supply
231-235 Suite F
New Covent Garden, London SW8 5EW
Tel: 01-720-8881

R.E. Jenkinson
B25-31 Fruit & Vegetable Market
New Covent Garden, London SW8 5LL
Tel: 01-720-9221

J.P. Fruit Distributors, Ltd
T/as Broome & Green
H291 Earlbridge
Fruit and Vegetable Market
New Covent Garden, London SW8 5EW

Louis Konyn & Sons Ltd
D103/104 New Covent Garden Mkt.
London SW8 5LL
Tel: 01-720-8644

Francis Nicholls Ltd
London Fruit Exchange
Brushfield St, London E1 6HG
Tel: 01-377-0066

Louis Reece, Ltd
99 Commercial St
London, E1
Tel: 01-247-0201

J.O. Sims Ltd
Winchester Square
Borough Market
London SE1 9AQ
Tel: 01-407-0756

Wealmoor Ltd
15 Westfield Lane
Kenton, Middlesex
Tel: 01-907-0312

T.J. Poupart
D153-162 Fruit & Veg Mkt
New Covent Gardens
London SW8 5LL
Tel: 01-720-2288

Ridley & Houlding Ltd
Eden House
Spitalfields Market, London E1
Tel: 01-247-1822

F.T.K. Ltd
58-59 London Fruit Exchange
Spitalfields market, London E1 6E
Tel: 01-247-0661

P. Weiser (London) Ltd
D101-102 Fruit & Vegetable Mkt.
New Covent Garden, London
SW8 5LL
Tel: 01-720-9474

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APPENDIX Q-6

Major Importers of Tropical Produce in France

Agrunord, S.A.
2 rue de Provence
94619 Rungis CEDEX
Tel: 687 3635

E. Azoulay & Cia.
2 rue des Tropiques
94538 Rungis CEDEX
Tel: 687 2540

Compagnie Fruitiere
33 Blvd Ferdinand de Lesseps
13014 Marseille
Tel: 959046

Compacto S.A.
38 rue Manin
75019 Paris
Tel: 208 7382

Georges Helfer S.A.
Rue de la Tour
Centra 221
94576 Rungis CEDEX
Tel: 687 2517

Ets Klein et SPPM reunis
8 rue des Tropiques
94538 Rungis CEDEX
Tel: 687 2500/2620

Roland Lacour S.A.
106 rue de Montpellier, Bat C2
Fruleg 375
94622 Rungis CEDEX
Tel: 687 2427

Societe Pomona
21 reu du Pont-Neuf
75039 Paris CEDEX 01
Tel: 233 4464

Supergros, S.A.
14A Ave de Bretagne
Fruleg 152
94522 Rungis CEDEX
Tel 687 2309
686 0276

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APPENDIX Q-7

Selected Listing of Major Importers of Tropical Fruits and Nuts in the Federal Republic of Germany

International Fruchtimport Gesellschaft
Weichert & Co.
Oberhofenstrasse 1
2000 Hamburg 1
Tel: (040) 331241

J.A. Kahl GmbH & Co.
Fruchthof
2000 Hamburg 1
Tel (040) 2161382

J.A. Kahl GmbH & Co.
Bauernbravweg 1
8000 Munchen 70
Tel: (089) 782071

Scipio Fruchtvertrieb KG
Breitenweg 29/33
2800 Bremen 1
Tel: (0421) 36321

Afrikanische Frucht-Compagnie GmBH & Co.
Trostbrucke 1
D-2000 Hamburg 11
Tel: (040) 36881

Anton Durbeck
Grossmarkthalie
6000 Frankfurt am Main 1
Tel: (06011) 490461

Fruchthansa GmbH & Co. KG
Grossmarkt
5000 Koln 51
Tel: (022) 380601

F.A. Paul Grassnick
Grossmarkthalle
6000 Frankfurt
Tel: (0611) 439725/435488

T. Port
Lippelstrasse 1
2000 Hamburg 1
Tel: (040) 331268

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APPENDIX Q-8

Selected List of Major Importers of Tropical Fruits and Vegetables in the Netherlands

Jac van den Berg BV
Rochussenstraat 209A
3021 NS Rotterdam
Tel: (010) 767377

Jos van den Berg BV
8S-Gravendijkwal 95
P.O. Box 25006, Rotterdam
(010) 764166

Van Dijk Delft BV
Hoornseweg 26
Den Hoorn post Delft
Tel: (015) 611261

Fruit Transitokantoor BV (FTK)
Industrieweg 40
P.O. Box 11080, 3044 CB Rotterdam
Tel: (010) 371544

Citronas, P.V.
Keilweg 80
P.O. Box 6094, Rotterdam
Tel: 010 - 766544

Windig BV
Centrale Markthal 16-20
Jan van Galenstrast 14
1051 KL Amsterdam

BUD-Holland BV
Hoornseweg 15
P.O. Box 8
2600 AA Delft
Tel: (015) 231940

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APPENDIX Q-9

Selected List of Major Importers of Tropical Fruits and Vegetables in Belgium

A.V.M. Fruits
182 Brusselsesteenweg
B-9380 Lebbeke
Tel: (052) 212181

Fruitbrokers Co. N.V.
Ankerrui 3
2000 Antwerp
Tel: (031) 321870

Agrofruit Co. (Belgium) Sprl.
Frankrijklei 78 bus 3
2000 Antwerp
Tel: (031) 323545

Ets Parmin S.A.
Quai des Usines 112-154
Magasins 21-26
1020 Brussels
Tel: (02) 2426520

Ets. A. de Ridder & Fils
Quai des Usines 112-154
Magasins 1-2
1020 Brussels
Tel: (02) 2426414

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APPENDIX Q-10

List of Selected Importers of Tropical Fruits and Vegetables in Switzerland

J. Berri Ltd
Engrosmarkt Herdern
Aargauerstrasse 1
8048 Zurich
Tel: 01-424155

Bettio AG
Fuchsenstrasse 9
87840 Einsiedeln
Tel: 055 584253

Coop Suisse
Thiersteinerallee 14
Case Postale 1285
4002 Basel

Migros
152 Limmatstrasse
Case Postale 226
8031 Zurich

George Helfer SA
Rue des Fosses 45
1110 Morges
Tel: 021 715634

Lieblich AG
Solothurnerstrasse 50
Case Postale
CH-4008 Basel
Tel: 061 354500

Trembley & Burgermeister SA
49 route des Jeunes
Case Postale 287
1211 Geneva 26

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APPENDIX Q-11

List of Selected Importers of Tropical Fruits and Vegetables in Austria, Denmark, and Norway

Austria

Fruchtunion G.m.b.H & Co. KE
Laxenburgerstrasse 365
A-1232 Vienna-Inzersdorf
Tel: (022) 673501

E. Grossman
Waldmeistergasse 9
A-1140 Vienna
Tel: (022) 948374

Fruchtimex G.m.b.H. Grossmarkt
Laxenburgerstrasse 365
A-1232 Vienna-Inzersdorf
Tel: (022) 677341

Denmark

FDP (COOP-DENMARK)
Roskildevej 65
DK-2620 Albertslund
Tel: (02) 648811

Interfrugt A/S
Grohttorvet 6
DK-2500 Copenhagen-Valby
Tel: (01) 303322

SAMI-frugt A/S
Gronttorvet 6
DK-2500 Copenhagen-Valby
Tel: (01) 304646

IRMA A/S
Gronttorvet 244
DK-2500 Copenhagen-Valby
Tel: (01) 3032332

Norway

Norwegian Cooperative Union and Wholesale Society
Revierstredet 2
POB 451 Sentrum
Oslo 1
Tel: (02) 206290

A/L Gertnerhallen
Okern Torgvei 5
Oslo 5
Tel: (02) 224650

Chr. Matthiessen A/S
Filipstadvein 2B
POB 2431 Solli
Oslo 2
Tel: (02) 411350

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APPENDIX R
COUNTRY TARIFF ON SELECTED FRUITS AND VEGETABLES

APPENDIX R. EEC COMMON EXTERNAL TARIFF (CET) ON SELECTED FRESH FRUIT AND VEGETABLES AS OF JANUARY 1, 1980 (RATES IN PERCENTAGE AD VALOREM)

	CET a/	Cyprus	Spain	Israel	Maghreb b/	Mashraq c/	Greece	Turkey	ACP d/	GSP e/
FRUIT										
Avocados (all year)	8	6 (GSP)	4	1.6	1.6 f/	6 (GSP)	5	Free	Free	6
Melons (all year)	11	11	11	11	11	11	Free	11	Free	11
Watermelons	11	5.5	11	5.5	5.5	11	Free	5.5	Free	11
Mangoes (all year)	6	6	3	3.6	6	3.6 g/	5	Free	Free	6
Pineapples	9	9	9	9	9	9	9	9	Free	9
Strawberries (1 May-31 July)	16 Subject to a minimum of 3 EUA h/ per 100 kilograms	16	16	16	16	16	Free	16	16	16
(1 Aug-30 April)	14	14	14	14 (5.6 from 1.11 -31.3)	14 (5.6 from 1.11 -31.3)	14	Free	14	14	14
Coconuts	2	2	1	2	2	2	Free	Free	Free	Free
Passion Fruit	6	6	3	3.6	6	3.6 c/	5	Free	Free	5
VEGETABLES										
Capsicums (sweet peppers) (all year)	9	5.4 i/	6.3	5.4	5.4 (not Algeria)	9	Free	4.5	Free	9

Continued . . .

APPENDIX R. EEC COMMON EXTERNAL TARIFF - Continued

	CET a/	Cyprus	Spain	Israel	Maghreb b/	Mashraq c/	Greece	Turkey	ACP d/	GSP e/
Capsicums - Continued										
(15 Nov-30 April)	9	5.4 d/	6.3	5.4	5.4 (not Algeria)	5.4 c/	Free	4.5	Free	9
Green Beans										
(1 Oct-30 June)	13 with a minimum of 2 EUA per 100 kilograms	13	13	13	13	13	Free	13	Free	13
(1 Nov-30 April)	13 with a minimum of 2 EAU per 100 kilograms	5.2 with a minimum of 0.8 EUA per 100 kilograms	13	13	5.2	5.2 (Egypt and Jordan only)	Free	5.2	Free	13
(1 July-30 Sept)	17 with a minimum of 2 EUA per 100 kilograms	17	17	17	17	17	Free	17	Free	17
Aubergines (eggplant)										
(all year)	16	16	16	16	16	16	Free	16	Free	16
(1 Dec-30 April)	16	6.4	16	6.4	6.4	6.4 (Jordan only 15/1-30/4)	Free	8 1/12-14/1) 6.4 (for 15.1-30.4)	Free	9 1/1-31/3)

APPENDIX K. EEC COMMON EXTERNAL TARIFF - Continued

	CET a/	Cyprus	Spain	Israel	Maghreb b/	Mashraq c/	Greece	Turkey	ACP d/	GSP e/
Courgettes (Zucchini squash) (all year)	16	16	16	16	16	16	Free	16	Free	16
(1 Dec-30 April)	16	6.4 (1/12-1/1-end Feb)	16	6.4	6.4	6.4 (Jordan only 1/12-end Feb)	Free	6.4	Free	9 end Feb)
Asparagus (all year)	16	16	16	16	16	16	Free	16	16	16
15 Aug-31 Jan)	16	16	16	16	16	16	Free	16	9.6	16
Chillies	16	16	16	16	16	16	10	16 (1/4-31/12)	Free	16 (1/4-31/12)
								9 (1/1-31/30		9 (1/1-31/3)

a/ CET = Common External Tariff
b/ Maghreb formed in 1964 (Algeria, Tunisia, Mauritania, Morocco)
c/ Lebanon, Jordan, Egypt, Syrian Arab Republic.
d/ ACP = African, Caribbean and Pacific (members of the Lome Convention; developing countries; former colonies).
e/ GSP = Generalized System of Preferences.
f/ Algeria and Morocco only.
g/ Excludes Syrian Arab Republic.
h/ EUA = Common Market Monetary United used with agriculture.
i/ Quota system also in operation reducing tariff further.

SOURCE: UNCTAD/GATT Publication: "Selected Markets...." op.cit.

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APPENDIX R. SWISS IMPORT DUTIES ON SELECTED FRESH HORTICULTURAL PRODUCTS

BTN Heading	Product	General Tariff	M.f.n. Rate a/	Concession EEC	Concession EFTA	Rate Applicable to Developing Countries a/	Rate Applicable to Spain and Greece	Import Permit b/
07.01.50	Asparagus	10.00	7.00	7.00	7.00	7.00	7.00	--
01.01.52	Capsicums	18.00	10.00 c/	10.00	exempted d/	exempted d/e/	7.00 d/	SEA
07.01.54	Aubergines	18.00	10.00 c/	10.00	10.00	exempted d/e/	7.00 d/	SEA
07.01.80	Green beans	10.00	10.00	10.00	10.00	10.00	10.00	SEA
07.01.90	Courgettes	10.00	10.00	10.00	10.00	10.00	10.00	SEA
08.01.28	Pineapples	15.00	15.00	15.00	exempted	11.00	11.00	--
08.01.30	Avocados							
		15.00	7.50	7.50	7.50	exempted	7.50	--
	Mangoes							
08.01.30	Coconuts	15.00	7.50	7.50	7.50	exempted	7.50	--
08.08.10	Strawberries f/	3.00	3.00	3.00	exempted d/	exempted d/e/	2.10 d/	--
08.09.10	Melons	10.00	10.00	10.00	10.00 g/	7.50	7.50	--

a/ The list of developing countries and territories eligible for customs tariff preferences includes seven European countries and almost all African, Asian and Latin American countries, and can be obtained from the Swiss Customs Authorities in Bern. The m.f.n. rate is applicable to GATT signatory countries but the rate is currently also applied to non-GATT countries.

b/ Import permit to be obtained from the Services des importations et exportations du departement federal d'economie (SEA). It is usually granted automatically.

c/ This duty is operative only as long as imports are subject to quantitative restrictions or compulsory government purchase schemes for home-grown vegetables; otherwise only the general tariff is applied.

d/ From 1 November to 31 March.

e/ Exemption not applicable to produce from Romania and Bulgaria.

f/ See the section on strawberries for details of summertime import restrictions.

g/ Melons of the honeydew, Ogen and Tendral types from Portugal are free of duty.

SOURCE: Bulletin International des Douanes Suisses, Bern.

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TABLE 5. CASH FLOW ANALYSES: PINEAPPLE GROWING OPERATION, MUDON PROJECT

	DOLLARS PER ACRE											
	20P	206	20H 80P	80GC 80P	80H 80GC 320P	80H 320G 640P	320H 640GC 1235P	640H 1235GC 1235P	1235H 1235GC 1235P	1235H 1235GC 1235P	1235H 1235GC 1235P	1235H 1235GC 1235P
Land Preparation												
First Ploughing	813	--	3,252	3,252	13,009	26,017	50,205	50,205	50,205	50,205	50,205	50,205
2nd & 3rd Ploughing	585	--	2,339	2,339	9,357	18,713	36,110	36,110	36,110	36,110	36,110	36,110
Neck Bells	291	--	1,165	1,165	4,661	9,322	17,988	17,988	17,988	17,988	17,988	17,988
Crowns	100,000	--	--	--	--	--	--	--	--	--	--	--
Transport Crowns	778	--	3,113	3,113	12,452	24,904	48,058	48,058	48,058	48,058	48,058	48,058
Plant Crowns	315	--	1,261	1,261	5,043	10,087	19,473	19,473	19,473	19,473	19,473	19,473
Labor Cost for Caring												
Fertilizer	149	73	594	887	2,654	5,925	11,515	13,692	13,692	13,692	13,692	13,692
Weed Spray Killer	80	80	399	638	1,913	4,145	8,749	12,395	14,767	14,767	14,767	14,767
Forcing Agent Labor	124	124	620	991	2,974	6,443	13,599	19,368	22,955	22,955	22,955	22,955
Labor Cutting Leaves	--	40	40	161	322	804	1,930	3,770	4,967	4,967	4,967	4,967
Ratoon Treating	--	--	246	--	983	983	3,930	7,861	15,169	15,169	15,169	15,169
Crown Treating	98	--	391	391	1,565	3,130	6,041	6,041	6,041	6,041	6,041	6,041
Handling from Planting Area	--	1,049	517	4,195	6,261	18,845	41,948	81,538	97,189	97,189	97,189	97,189
Laying Plastic	217	--	870	870	3,478	6,957	13,424	13,424	13,424	13,424	13,424	13,424
Irrigation	100	100	500	2,400	5,200	10,550	10,975	15,550	18,525	18,525	18,525	18,525
Material Cost												
Fertilizer	4,702	2,316	18,807	28,070	84,489	187,505	363,998	433,324	433,324	433,324	433,324	433,324
Weed Killer	483	483	2,417	3,867	11,600	25,133	53,046	75,158	89,537	89,537	89,537	89,537
32" Plastic	3,000	--	12,000	12,000	48,000	96,000	185,250	185,250	185,250	185,250	185,250	185,250
Leaf Treating Material	30	30	152	243	730	1,583	3,340	4,733	5,638	5,638	5,638	5,638
Forcing Agent	98	98	391	783	1,957	4,696	9,171	12,082	12,082	12,082	12,082	12,082
Diazme Insert Control	180	180	899	1,438	4,313	9,345	19,723	27,944	33,290	33,290	33,290	33,290
Sundries	45	45	223	357	1,070	2,317	4,891	6,930	8,256	8,256	8,256	8,256
Equipment Maintenance	116	116	580	1,145	2,783	6,030	12,724	18,029	21,478	21,478	21,478	21,478
Irrigation Fuel	83	83	417	667	2,000	4,333	9,146	12,958	15,437	15,437	15,437	15,437
Tractor Fuel	40	40	199	319	956	2,072	4,374	6,197	7,383	7,383	7,383	7,383
Land-246	9	9	44	70	209	452	954	1,352	1,611	1,611	1,611	1,611
Interest on Equipment	297	297	1,485	2,377	7,130	15,449	32,606	46,198	55,037	55,037	55,037	55,037
Interest on Working Capital	299	299	1,493	2,388	7,165	15,524	32,766	46,424	55,306	55,306	55,306	55,306
TOTAL COST	112,931	5,461	54,412	75,384	242,273	517,263	1,015,935	1,221,953	1,302,191	1,302,191	1,302,191	1,302,191
Increased cost at 54 MT per acre	60	489	530	1,955	3,835	9,940	22,062	38,443	48,053	48,053	48,053	48,053
Total cost at 54 MT per acre	112,991	5,950	54,952	77,339	246,108	527,203	1,037,997	1,260,396	1,350,244	1,350,244	1,350,244	1,350,244

NOTE: H = Harvested
GC = Growing Crop
P = Planted

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