DEVELOPMENT PLAN

FOR

A TROPICAL FRUIT INDUSTRY

IN

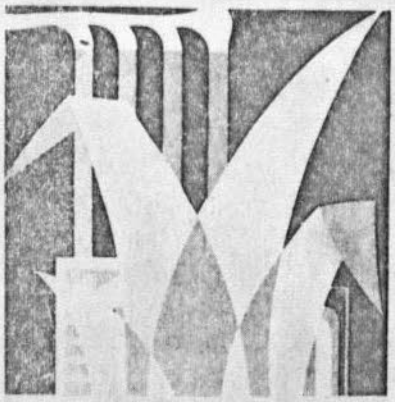
JOHORE, MALAYSIA

December 1970

Agro Industrial Associates, Inc.
Honolulu, Hawaii

DEVELOPMENT PLAN
FOR
A TROPICAL FRUIT INDUSTRY
IN
JOHORE, MALAYSIA

DECEMBER 1970



AGRO
INDUSTRIAL
ASSOCIATES
INC.
Honolulu, Hawaii

Dr. Sabaratnam
Faculty of Agriculture

DEVELOPMENT PLAN

FOR

A TROPICAL FRUIT INDUSTRY

IN

JOHORE, MALAYSIA

December, 1970

Agro Industrial Associates, Inc.
Honolulu, Hawaii

TABLE OF CONTENTS

I. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1.1 Summary and Description of the Project

A tropical fruit industry will be established in the State of Johore, Malaysia, to meet the growing demand for papaya and guava products in the Japanese market and elsewhere. Initial plantings will be 2,000 acres of papaya and 1,500 acres of guava on an area west of the Muar River approximately three miles north of Kundang Ulu.

The papaya plantings will be of the Solo variety, a small superior fruit developed in Hawaii and market proven in the U.S. and Japan. It will be sold as fresh fruit, mainly in Japan. The guava orchard will be of grafted superior varieties, also market proven. A frozen guava puree will be produced, mostly for export, to be used in making fruit juice, jams, and jellies.

Papaya trees start bearing about one year after planting. The papaya orchard will produce about 14 million pounds of fruit the third year, 27 million pounds the fourth year and will level off at about 37 million pounds from the fifth year onward. Guava trees start bearing the third year, but do not reach full production for about five years. The guava orchard development will proceed more slowly, reaching 14 million pounds by the sixth year, and levelling off at 42 million pounds per year from the ninth year onwards.

Modern fruit processing and packing facilities will be constructed at the project site. The papayas will be shipped by air to Japan, and the guavas by refrigerated ships.

1.2 Conclusions

1. The project is technically and agriculturally feasible. Climate and soils in the project area are suitable for commercial papaya and guava production. Proven superior varieties are available, together with the latest technical knowledge and operational experience.

2. The forecasted financial results are extremely favorable. Income starts the second year, and

the project shows a profit of M$4.5 million the third year. Profits increase to about M$ 9 million per year after taxes in the sixth year, and level off at about M$11 million from the ninth year on when the entire orchard is in full production. Total cash investment will be about M$4.8 million, of which only about $1.5 million will be needed the first two years. From the third year onwards capital investments will be financed from operating cash flow.

Because of the rapid payback (3rd year) and cash flow generation, no long term financing will be required.

3. The project will serve the national interest.

Foreign exchange earnings of approximately M$45 million will be generated. Approximately 800 new jobs will be created. The economy of Johore will be stimulated directly by the project and indirectly by the various support services and industries that will be created.

4. There are strong market demands for papaya and guava. A ready market exists for fresh papaya in Japan, and a smaller market in Malaysia. The market for guava puree should be well established by the time guavas are in full commercial production.

1.3. Recommendations

1. Negotiate with the Johore State Government to make available the recommended land area.

2. Contract with Hawaiian experts to plan, organize and manage the production during the initial stages, and to train local personnel to take over.

3. Start clearing the initial nursery area immediately. Import selected Solo papaya seeds from Hawaii. Import young budded guava trees from Hawaii to serve as a source of bud wood to be grafted on seedlings in the nursery.

4. Plant the first 100 acres of papayas to test and study the performance of the newly introduced varieties in comparison with varieties that have been well established in Malaysia.

5. Proceed with commercial development of the project as recommended in the report.

1.4 Statistical and Financial Summary

For quick reference, the chart on the following page summarizes key production and financial data.

SUMMARY OF KEY PRODUCTION

AND FINANCIAL STATISTICS

Year	1	2	3	4	5	6	7	8	9
PRODUCTION (000 lbs)									
Fruit Production									
Papaya		3,000	14,500	27,500	37,500	37,500	37,500	37,500	37,500
Guava			200	1,400	5,200	14,000	26,000	37,000	42,000
Fruit Sold									
Fresh Papaya	-	2,700	13,050	24,750	33,750	33,750	33,750	33,750	33,750
Guava Puree	-	-	135	945	3,510	9,450	17,550	24,975	28,388
FINANCIAL (000 M$)									
Sales Revenue	-	2,997	14,544	27,885	38,894	41,586	45,123	48,364	49,853
Net Operating Profit	(479)	20	4,564	9,963	14,641	15,892	17,514	19,108	19,816
Income Tax	-	-	Pioneer Status		-	7,151	7,881	8,599	8,917
Net Profit After Tax	(479)	20	4,564	9,963	14,641	8,741	9,633	10,509	10,899
Cash Flow									
Annual	442	(186)	4,087	9,849	13,902	8,874	9,517	10,872	11,262
Cumulative	442	256	4,343	14,192	28,094	36,968	46,485	57,357	68,619

II. INTRODUCTION

II. INTRODUCTION

2.1 Background of the Project

Representatives of two Japanese trading companies have approached producers and processors of papaya and guava in Hawaii with a request for large, reliable supplies of these fruits for the Japanese market. Initial shipments of fresh papaya to Japan have met with good market acceptance, although the supply is limited and the price extremely high. The supply of guavas and papaya in Hawaii is not sufficient to supply present demands. Therefore, any substantial expansion of these tropical fruits into new markets from Hawaii would be impossible.

Agro Industrial Associates, Inc. was asked to investigate and help develop a source of supply of fresh papaya and guava from other areas. The papaya would be used primarily as fresh fruit in Japan. The guava would be imported to Japan in the form of puree, for processing there into juices for mixing with mandarin orange juice and other juices, and for preparation of jams and jellies.

The Associated Development Corporation, a Malaysian company, together with the Johore State Government, has selected an area of 4,000 acres as a tentative site for the first phase of a commercial guava and papaya production project. Agro Industrial Associates, Inc. was engaged to conduct a survey to determine the feasibility of commercial guava and papaya production at the project area and to evaluate the economic feasibility of establishing the industry.

Experts from Agro Industrial Associates, Inc. in collaboration with tropical fruit scientists from the University of Hawaii School of Tropical Agriculture have carried out the required field work, market investigations and laboratory tests, the results of which are presented in this report.

2.2 Principle Objectives

Principle objectives of the proposed project are:

1. To provide a supply of choice quality fresh

papaya for the Japanese fresh fruit market, and for the local Malaysian market.

2. To provide a source of high quality guava concentrate to be produced in the form of a puree, for export to Japan, and for use in Malaysia for producing guava juice, jams and jellies, and syrup for the local market.

3. To further diversify Malaysia's agricultural economy.

4. Provide additional employment opportunities.

5. Provide the opportunity for small holder participation in future expansion of the tropical fruit industry.

6. Increase Malaysia's foreign exchange earnings through the exports of papaya and guava products.

2.3 Guava and Papaya - General Information

Guava and papaya are presently grown in Malaysia, mostly in backyard plantings. Some guava is processed into syrups, juice and preserves. Papaya is sold locally as a fresh fruit and has good acceptance. Although these fruits are available in Malaysia, the new industry will be based on new imported varieties, of proven superior quality, which have known market acceptance. In marketing a new product, it is essential that uniform high quality standards be maintained, and that the customer be given a superior product. The local Malaysian varieties of both papaya and guava vary widely in flavor, color, size and taste. It would be risky to base an export business on these fruits, and the new industry will therefore be based on varieities imported from Hawaii.

A. Papaya - General Information

The Papaya (Carica papaya) is widely distributed in tropical regions and is commonly eaten as a fresh fruit. In Hawaii the papaya is one of the most popular breakfast fruits. It is being exported to the West Coast of the U.S.A., and to Japan, where the supply cannot keep up with the increasing demands.

The fruit is an excellent source of Vitamins C and A, contains some Vitamin B and has a sugar content of 10 to 15 percent. Papayas can be cooked when green like summer squash or used as preserves, sauces or in pies. Acceptable products have been made by dehydration, canning, pickling and preserving. Papaya puree is used as an additive to tropical fruit drinks. Papain produced from the skin of the green papaya is used as a meat tenderizer.

This remarkable fruit is not closely related to any other familiar fruit. It is grown on a semi-woody evergreen tree which attains a height of 10 to 25 or more feet if allowed to grow. It can produce fruit continuously for 25 years or longer. In commercial production, however, because of the reduced yield obtained and the difficulties and hazards involved in harvesting fruit from tall old trees, the trees are generally replaced after three or four years of production.

The original home of the papaya was tropical America, probably Mexico and Central America. Its culture gradually spread along tropical trade routes throughout the world after the discovery of America.

The papaya grows in native gardens and in the wild state throughout Malaysia. It is used as a breakfast fruit, although the quality of the fruit is quite variable. There are no large scale commercial papapa groves in Malaysia at the present time.

For many decades, papaya has been the most popular fresh fruit consumed in Hawaii. As a result of intensive experimentation and selection, improved high yielding, tasty varieties have been developed. Among the several varieties grown in the Islands, the medium sized Solo variety is the most popular. It bears unisexual (imperfect) and bisexual (perfect) flowers on different plants. The bisexual type of Solo, selected for its tasty, thick, orange colored flesh, fruitfulness, and oblong or pear-shaped form, is most commonly

found on Island markets. Commercial growers plant two or three seedlings in a place and select the bisexual one at flowering time, destroying the others. On the average two out of three plants have bisexual flowers. The third produces round fruits from flowers that have no stamens and frequently produces fewer fruits because of the lack of pollination.

Fruits begin to mature about one year after the seed is planted. Under favorable climatic conditions, an almost continuous supply of fruit can be harvested for several years thereafter. Because fruits are borne so high on older trees, making picking difficult, new plantings are often made each year and the tall older trees are cut down. In Malaysia, it may be possible to grow the trees much longer, depending on the economics of harvesting.

The Solo variety has several types of trees. The two most important types are:

1. Hermaphrodite and, 2. Female.

1. Hermaphrodite (bisexual) Solo papaya trees produce large "perfect" flowers close to the trunk. Perfect flowers have both stamens and a pistil. The fruit is elongated, pear-shaped and slightly ridged. (See Figure 1a on the following page)

2. Female (unisexual) Solo papaya trees produce very large "imperfect" flowers close to the trunk. Imperfect flowers have a pistil but no stamens and they must receive pollen from some hermaphrodite tree in order to produce fruit. The fruit is round, sometimes irregularly shaped. It is not as marketable as the pear-shaped fruit. (See Figure 2a on the following page)

Occasionally male trees appear. They are undesirable for many reasons and should be removed immediately. They produce small imperfect flowers, usually having stamens only, at the end of very long stems.

EXHIBIT 1

Figure 1
Hermaphrodite
flower

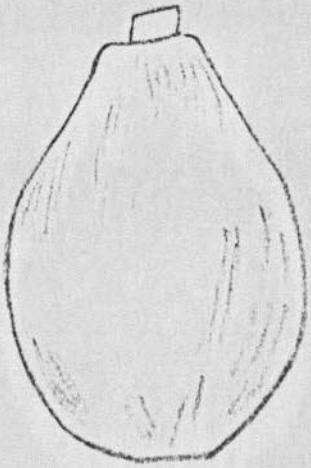


Figure 1A
Hermaphrodite
fruit

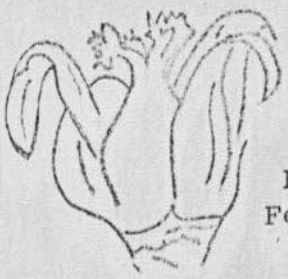


Figure 2
Female flower

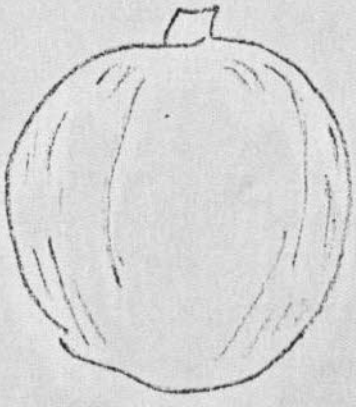


Figure 2A
Female fruit

PAPAYA FRUIT TYPES

B. Guava - General Information

The common guava, known botanically as Psidium guajava is the most widely known and important fruit plant of the Myrtle family. This family contains a number of other fairly well-known fruits grown in the tropics. These related fruits include the strawberry guava, the rose apple, the Surinam cherry, the mountain apple and the Java plum.

The guava is native to tropical America, and has been distributed to nearly all the tropical and sub-tropical areas of the world.

The fruit commonly is used for making jelly, puree, jam or guava nectar or it may be eaten as fresh fruit. Much of the recent interest in the guava has been due to its extremely high Vitamin C content and nutritional qualities, and its distinctive flavor. Guavas contain more than five times as much Vitamin C as fresh orange juice, and up to ten times as much as the best tomato varieties. Guavas are also a relatively good source of Vitamins A and B and a fairly good source of iron, calcium and phosphorus. In addition to possessing valuable nutritional qualities, the guava blends exceptionally well in various processed fruit preparations. For these reasons a demand has risen for uniform types of high quality fruit.

Under favorable growing conditions the guava plant develops into a small tree. Well grown trees on fertile soil often reach a height of 30 feet or more with about an equal spread. The trunk which is usually short, branches freely near the ground and may reach a diameter of about 12 inches in larger specimens. The bark is scaly and greenish brown to brown in color. The oblong leaves arranged in pairs are from four to seven inches in length. They are smooth on the upper surface but have numerous small hairs on the underside of the leaf.

The bisexual or perfect flowers are white in color and from one inch to about one and a half

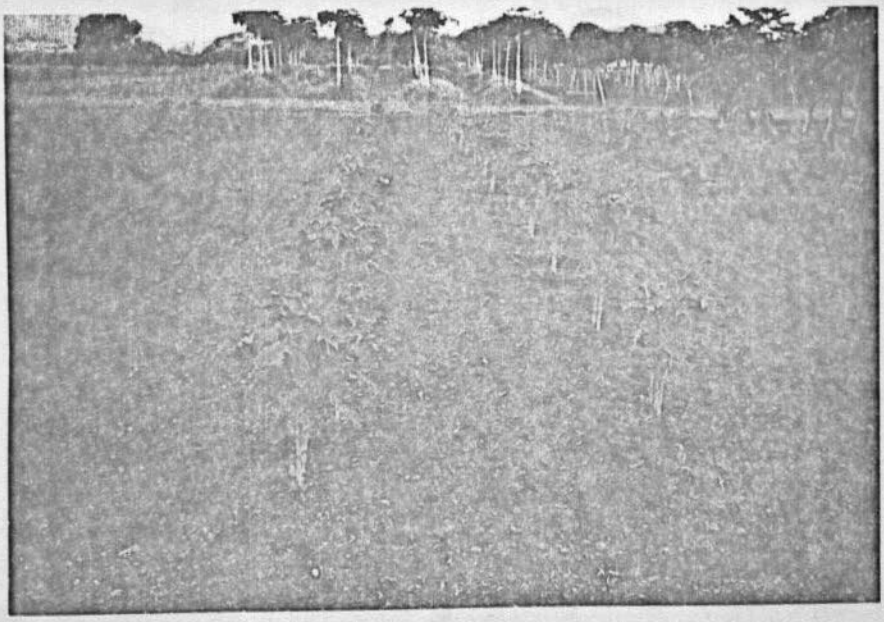
inches in diameter. They usually occur singly or in clusters of two or three. The stamens are numerous and pollen plentiful. Cross pollination is frequently aided by bees and other pollen carrying insects. Self pollination is possible, and isolated trees often set satisfactory crops of fruit without cross pollination.

Botanically the fruit is a berry which may be round, ovate or pear-shaped. The fruits vary from one to four inches in diameter and from two ounces to about one pound in weight. The skin color of the ripe fruit is usually yellow and the flesh color may be white, pink, yellow, salmon or carmine. Guavas vary from thick-fleshed fruits with only a few seeds in a small center cavity to thin-fleshed fruit with numerous seeds imbedded in a large mass of pulp. The fruits range in flavor from quite sweet in some types to sour and highly acid in others. The characteristic musky guava aroma and flavor are quite evident in most forms, but in some types they are mild and pleasant. In others, the aroma and flavor are almost too strong and penetrating for most tastes. The fruits usually occur singly but clusters of two or three are not uncommon. The main guava crop usually ripens from May through August, although a few ripe fruits can be found any month of the year. A small fairly distinct second crop is often produced during the winter season. Trees which have been propogated by budding, air-layering or other vegetative means usually begin to bear within two years after transplanting. Seedlings usually begin to bear lightly the second or third year after transplanting, with full commercial production by the fifth year.

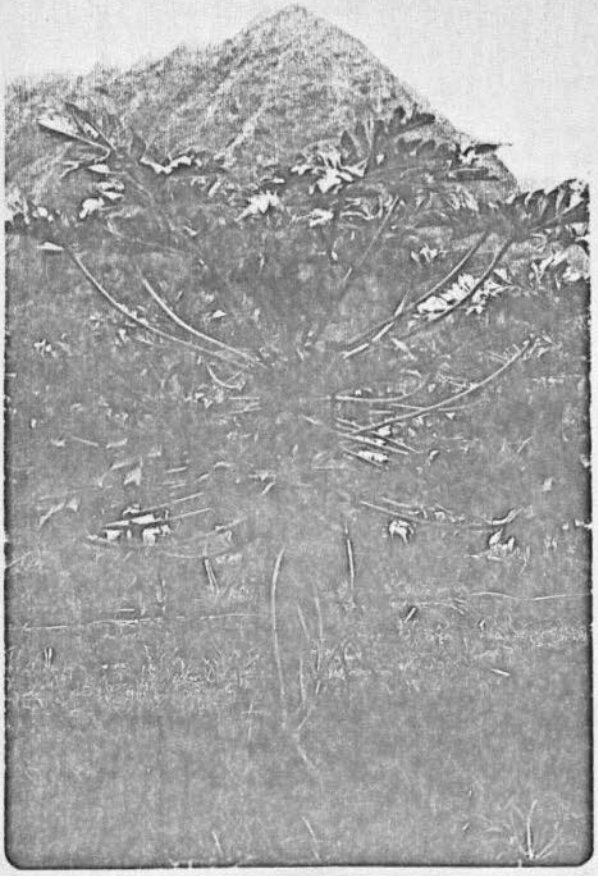
Photographs

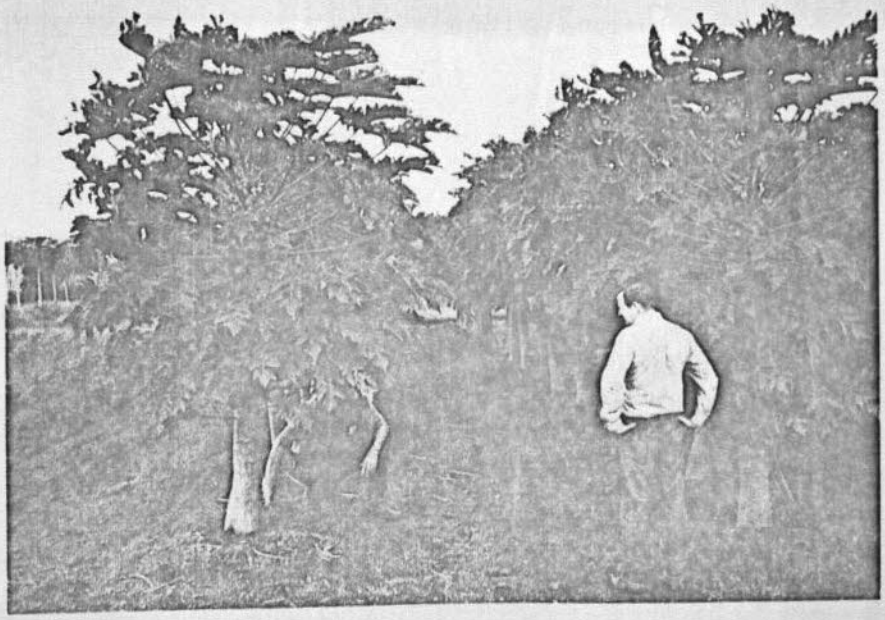
The photographs on the following pages show solo papaya trees and fruit in commercial production in Hawaii

Young Solo Papaya tree showing good fruit set and low bearing characteristics

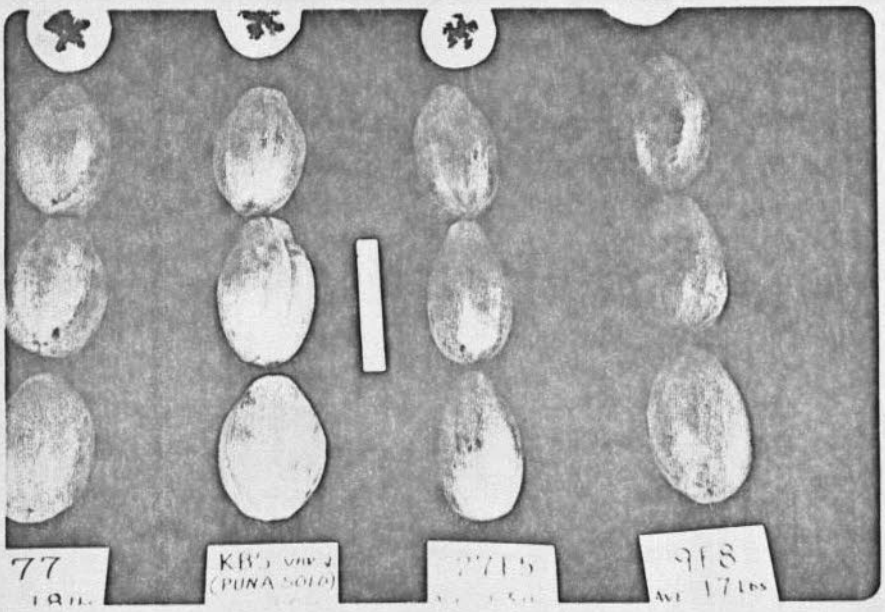


Papaya seedlings after transplant





Young Solo Papaya Trees Showing
Desirable Low-bearing Characteristic



Standard Puna Solo Papaya (second from left) compared with new selected University of Hawaii varieties

Harvesting from a tractor from tall three year old papaya trees

III. AGRICULTURAL ASPECTS OF PAPAYA AND GUAVA PRODUCTION

III. AGRICULTURAL ASPECTS OF PAPAYA AND GUAVA PRODUCTION

3.1 Papaya Culture

A. Site Selection and Soil Preparation

The criteria required for growing papaya are discussed in Section IV, Project Area. The site chosen for the project meets these criteria, and is capable of heavy yields of high quality papaya.

The land will be cleared of existing stand of trees and shrubbery, harrowed and then sub-soiled. The soils have adequate organic matter, and no additives will be required except for normal fertilization at planting.

B. Orchard Development and Layout

The orchard layout and planting distances vary according to the contour of the land, location, climate, degree of mechanization in the orchard and size of ruit desired. Close spacing results in smaller fruit. In most instances the spacing in rows is closer than between rows.

For the proposed papaya plantings in Malaysia, it is recommended that the plants be set out at a distance of seven feet between plants in the rows, and ten feet between rows. This would allow 622 trees per acre. The trees will be planted in blocks with 12 foot roadways between the blocks or sections to facilitiate the movement of equipment and personnel.

The papaya trees in each location will be grown for four years (three production years) after which they will be cut down, leaving the area exclusively to guavas. New papaya plantings will be made each year to make up for the trees that are removed.

C. Papaya Varieties

As described earlier, the Solo papaya variety developed in Hawaii has gained wide market acceptance, and is superior in flavor and quality of fruit to other commercial varieties. This type of fruit is in demand for the Japanese market, where the housewife wants a small fruit that can be purchased at a reasonable price and consumed at one sitting.

The two principle Solo papaya varieties that will be planted in Malaysia are the Puna and Waimanalo varieties, and several new University of Hawaii varieties. The Puna variety will be planted semi-commercially as quickly as possible, and then further selections made from existing plantings. There is considerable variation within strains of the same Puna variety, and local selection should be made as quickly as possible for the specific area in Malaysia. It is also intended to gather the best Malaysian varieties and use them in trials, to compare with the Hawaiian varieties.

The Puna variety is most popular because of its small size and uniform good quality. It averages about 1½ pounds per fruit. The Waimanalo is a heavy yielder and good quality, but somewhat larger, running up to three pounds per fruit.

Average yields of the Puna variety in Hawaii has been 63,000 pounds per acre for the three year cycle, which consists of only two harvest years, 38,000 pounds the first year of production and 25,000 pounds the second year.

Experimental yields show that 50,000 pounds or more can be harvested during the first year of production under suitable climatic conditions and good cultural practices. Papaya trees begin to produce marketable fruit by the end of the first year after the planting of the seed. In commercial production the papaya tree is normally cultivated for three years, the main reason for this being that the tree grows too tall and harvesting the fruit becomes uneconomical.

In Malaysia, with lower labor costs, this will not be true, and we anticipate that the trees will be grown for at least four years. The development of new harvesting methods can extend the production cycle even longer, thereby increasing the total yield of an orchard.

D. Papaya Cultural Practices

1. Papaya Seed

Papaya plants are started from seeds. The seeds are taken directly from a good Solo papaya fruit, which has been selected for its shape, yielding ability, and fruit quality. Seeds removed from fresh solo papaya may be planted directly without removing the gelatin-like coating about the seed. Each papaya contains about 500 to 600 seeds, and an estimated 200 trees may be obtained from each papaya. Fresh seeds germinate within 10 to 14 days.

If seeds are to be kept and stored, the gelatin-like coating must be removed. The seeds are then washed in clean water to separate them from the pulp, and kept in a cool dry room in an air-tight container.

Initial supplies of seeds of selected Solo papaya varieties will be imported from Hawaii and planted in a specially prepared propagation area at the project site.

2. Planting Methods

The papaya may be planted directly in the field, or seedling plants may be grown in seed flats, tin cans or paper bags to be transplanted into the fields.

For direct seeding in the orchard, a small hole is dug and 8 to 10 seedlings are placed in the hole and covered with ¼ inch or more of dirt. Seedlings are thinned to two or three plants about two months after sprouting.

For this project, seedlings will be grown in seed flats and transplanted to the orchard.

3. Growing Seedlings for Transplanting

The seedling flat is filled with clean soil to about one inch from the top. The seeds are spread out over the soil and covered with ¼ inch or more of soil.

A week after the seeds have germinated, the seedlings are transplanted into individual pots or cups. The soil that is used for germinating seeds should be steam sterilized or treated with a chemical such as methyl-bromide to destroy any organism which may effect the growth of the seedling. Care should be taken that no crops which suffered from nematode infestation were previously grown on soils used for growing seedlings. Precautions must be taken that young seedlings are not damaged by damping off, powdery mildrew, or mites. The control of these pests is discussed later under Diseases and Insects.

4. Transplanting

Transplanting occurs when seedlings are transplanted from the seed flat to individual containers and to the field. When transplanting from the seed flat to individual pots, the seedling should be at the two-leaf stage or about one week old. Young seedlings that are transplanted are less likely to be set back in growth than the larger seedlings. Fifty percent or more shade is provided to keep the newly transplanted seedlings from wilting before becoming established in the pots. The shade may be removed in two weeks after transplanting. Two or three weeks after the shade is removed, the seedlings should be ready for field planting. They would then be approximately four inches high.

If the soil is dry, it should be irrigated or moistened prior to transplanting in the

field. Two or three plants are set in each location approximately six inches apart to make sure that there will be at least one hermaphrodite (perfect flower) tree in each location. The soil at the bottom of the hole is mixed with a fertilizer high in phosphate such as super-phosphate. The seedlings are then set in the hole and placed at a level that is slightly deeper than they were in the pots. The seedlings should be set in the soil as firmly as possible. After the seedlings are set, a small handfull of a general fertilizer is spread in a circle about four to five inches from the trunk. The newly set seedlings are irrigated as soon as transplanting of the orchard is completed.

5. Thinning

Thinning in the field occurs as soon as the papaya flowers are visible and large enough to determine whether it is a hermaphroditic or a female tree. Trees in this stage are about five months old. Only one hermaphroditic papaya tree is selected and allowed to grow in a spot. In the event that all of the papaya seedlings in a spot develop into female trees, they are removed and another hermaphroditic tree or seedling is planted in the same general area.

6. Weed Control

Shallow cultivation with a spring-tine cultivator is recommended to destroy weeds growing between trees. Where cultivation is difficult and weeds are numerous, chemical weed control may be advisable. Weed killers containing 2-4-D must not be used around papaya plants. Aromatic oil or an aromatic oil emmulsion made with pentachlorophenol is a good, economical weed spray. The oil is sprayed in the rows directly upon the weeds using a knap-sack sprayer or a power sprayer. Low pressure from 20 to 40 pounds per square inch is best in applying herbicides. Since small papaya seedlings are very sen-

sitive to the oil, the weeds close to the papaya seedlings are not sprayed with the aromatic oil but are pulled out by hand or removed with a hoe. The interval between applications of aromatic oil is about two months, or as long as three months during a dry period. Alternate materials for papaya weed control would be Paraquat applied at 60 to 80 gallons per acre with 1½ quarts of Paraquat applied per acre.

7. Fertilization

Fertilization should begin with the application of one half pound of treble super-phosphate or one pound of super-phosphate in the hole at planting. This is followed with a small handful of 10-20-20 spread on the surface in a circular band around the seedling after planting. Early applications are applied close to the plant. On larger trees, fertilizer should be placed in the soil near the outer tips of the young growing roots. Papayas are heavy potash feeders.

Dry fertilizer is applied each month after planting, using a 10-20-20 formulation at the rate of one pound per tree for the first six month after the sex of the tree has been determined, and one half pound per tree per month thereafter. Total application per acre per year will be approximately 4,000 pounds of 10-20-20 fertilizer.

3.2 Papaya Diseases and Insect Pests

A. Diseases

Diseases can be very important factors in reducing yield and marketability of papaya. A systematic spraying program is essential for disease prevention and control.

Plants growing under unfavorable conditions are more subject to diseases than vigorous healthy specimens. By carefully following the described cultural practices, disease damage can be reduced.

Some of the more important diseases of papayas are:

Virus diseases

Papaya Mosaic
Papaya Ringspot

Fungus Diseases

Anthracnose
Black Spot
Damping off of seedlings
Dry Rot and Stem-end Rot
Internal Blight
Phytophthora Blight

Nematode Diseases

Root-knot Nematode
Reniform Nematode

A spraying program for disease and mite control starts at six months of age and continues on a ten day interval throughout the crop. During wet weather it may be necessary to spray on a seven day interval. The fungus disease Phytophthora and Anthracnose are sprayed with Dithane M-45 at the rate of two pounds per hundred gallons of water applied at ten gallons per acre. Mite control is with elemental sulfur applied at two and a half pounds per acre with 100 gallons of water. Sulphur will also control the fungus disease powdery mildew. A spreading agent such as Triton B-1956 should be used with this Dithane M-45 and sulphur spray.

Damping off is caused by organism that live in the soil and attack young seedlings. This can be controlled by using sterilized soil for growing the seedlings, or by coating the seeds with a fungicide before planting.

Exhibit 2 following this section details the major diseases and their symptoms, causal agent, and control.

B. Insects and Other Pests

The most important insect pests found on papaya

plants are mites, thrips, aphids and fruit flies, in addition to nematodes.

Mites

These important pests multiply rapidly in dry weather. The privet mite causes callouse-like grayish scaly or cacked areas on the skin of the fruit. They are most common where the fruit touches the stem and may be sunken below the normal surface level. The broad or white mite which occurs on the under sides of the leaves is extremely small and hard to see. When young leaves are attacked, they are reduced in size and become yellow or yellowish green. The leaf blades become misshapen and leathery, and the tips often curve downward. If unchecked, the leaves become smaller and much distorted and finally the top dies. Several new branches may sprout lower down on the trunk or the tree may die. Mites multiply rapidly in warm weather. They move into a papaya plot from other trees and come from vegetables growing in the vicinity.

Red Spiders, which occur in whitish,orange,red and scarlet forms are also papaya pests, occurring generally on the under side of the leaves and on the fruits.

Sulphur will usually control most mites. Sprays are preferred to dust because leaves are smooth and winds blow away much of the dust. Wetable sulphur powder applied at the rate of two and a half pounds per hundred gallons of water with a good spreading and sticking agent such as Triton B-1956 is recommended.

Aphids and Thrips

These insects sometimes cause serious damage in the first few weeks after papaya trees are planted in the field, especially if unfavorable growing conditions slow up normal growth. When these little sucking insects are abundant, the leaf curls at the edge, and the leaf stems droop down.

Nicotine sulfate applied at the rate of one quart

to 100 gallons of water with soap as a wetting agent, will usually control aphids. DDT applied at the rate of two pounds 50 percent wetable powder in 200 gallons of water combined with sulfur can be used to control thrips.

Fruit Flies

The Oriental fruit fly may lay eggs in soft or mature papayas, causing them to become wormy and decayed. Harvesting the fruit as soon as a trace of yellow appears near the blossom end greatly reduces the possibility of infestation. Chemical control is discussed in detail in the Guava section.

Nematodes or Root Knots

Root knots are often found on papaya plants in sandy soil. They are usually caused by nematodes which are too small to be seen by the naked eye. Nematodes live in the soil and enter the roots of plants causing root swellings which interfere with normal root functions. They may cause a plant to develop very slowly and to produce very few fruit even if fertilizer is plentiful. It is unwise to try to grow papayas in soils which are heavily infested with nematodes. It is especially important to grow seedling plants in soil that is free of nematodes.

3.3 Guava Culture

Most guavas now processed come from seedling trees grown on wasteland or in backyard plots. Fruit from this source is variable in quality and supply. A substantial guava industry cannot be developed unless a more reliable and uniformly high quality fruit supply can be developed. Wild fruits vary extensively in all of the quality factors which processors would like to control in the raw product, such as color, flavor, yield of puree, acidity, soluble acids and vitamin content. In order to manufacture a finished product of uniformly high quality, it would be necessary for the processor to analyse each separate lot brought to him by pickers and to blend skillfully the different lots. This is impractical unless the processor is willing

to grade out or discard those fruits which are below minimum standards of raw fruit quality. Therefore, selected guava seedlings or varieties grown in orchards will assure the processor of uniform quality fruit. High yields of excellent quality fruit could be expected where good orchard management is practiced with irrigation, fertilizer, weed control and disease and insect control.

A. Standards for Selecting Desirable Processing Guavas

Commercial processing and competition among manufacturers of guava products has resulted in the urgent necessity of improving and maintaining the quality in yield of fruit. Recognition of this necessity brought about the development of several outstanding commercial varieties in Hawaii. Experience of commercial processors have shown that there are certain characteristics desired in an ideal processing guava. These characteristics as listed below are the goal or standard for use in selecting a suitable processing type guava to propogate vegetatively for orchard plantings.

STANDARDS FOR SELECTING DESIRABLE GUAVA VARIETIES TO USE FOR COMMERCIAL PROCESSING

Fruit Diameter	Diameter of Cavity	Fruit Weight	Seeds	Color	Flavor	Soluble Solids	Vitamin C	Stone Cells
Inches	Inches	Ozs.	%			%		Quantity
3	1.5	7-10	1-2	Strong Pink	Pleasant Palatable characteristic guava flavor	9-12	300 or more	Few

production is anticipated. The land will have already been cleared and prepared for the papayas, and no further land preparation will be required prior to transplanting of the guavas.

D. Orchard Development and Layout

The guavas will be planted between the rows of papayas in the same orchard, spaced twenty feet between plants in the row, and twenty-five feet between rows. This arrangement of intercropping should not unduly hamper cultural and harvesting operations while the guava trees are small.

The guavas will be planted at the same time as the papayas. They will start producing the third year, and yields will increase rapidly from the fourth year on. After the fourth year, the papaya trees would be removed and the orchard would remain exclusively in guavas. New papaya planting would meanwhile have been made elsewhere.

E. Cultural Practices

1. Propagation

The first step is to produce vigorous young seedlings to be grown in the nursery, on which bud wood will be bud-grafted from improved varieties.

Seeds are first planted in flats of sandy soil and covered to a depth of about ¼ inch. When sterilized soil is not available, seeds should be treated with a fungicide to control damping-off. When the young seedlings are about 1½ inches high, they are transplanted into the nursery about 12 inches apart. Well grown plants will be approximately 12 inches high in five to seven months, at which time they will be ready for grafting or budding.

2. Budding

The most satisfactory method of propagating a large number of guava plants true to variety is by bud-grafting the selected variety on seedling stock. Seedling stock plants for the budding operation should be from ½ inch to 1 inch in diameter and growing vigorously in a nursery row or in large containers. Either the patch bud technique or the simple modification known as the Forkert budding may be used. Both succeed well when the piece of bark containing a large well-developed bud is covered with a somewhat larger plastic patch which is bound and placed over the bud by wrapping with a plastic budding band. A skilled propagator can usually get 90 percent take. Bud wood with about the same diameter as the root stock plant should be prepared by cutting off the leaves of selected branches 10 days to 2 weeks before the removal of branches for bud wood. The buds become enlarged during this period and therefore grow more readily when budded. The budded three should be ready for orchard planting about one year after planting of wild seed.

3. Transplanting

Transplanting holes will be dug twenty feet apart, with the holes somewhat larger than are needed to accommodate the roots and the soil mass contained in the root. About one-half pound of a general fertilizer such as 10-10-10 should be mixed into the soil at the bottom of the hole before planting. In transplanting, hold the plant upright in the planting hole and plant it at about the same depth as the tree grew in the nursery row. Use as much top soil as possible to fill in around the roots. Pack the soil down firmly around the roots with the hand. Plants should be watered immediately after transplanting unless the soil is quite

damp, and the transplanting done on a rainy or cloudy day.

4. Weed Control

Clean culture is the most satisfactory practice in young orchard plantings. The weed control operations will be coordinated with the weeding of the papaya plants. The alternate open rows can be cultivated with a shallow mechanical cultivator. The interplanted rows will require hand weeding or spraying with an aromatic oil or other non-hormone spray. Hormone weed sprays such as 2-4-D will kill or seriously injure guava trees and should not be used in the orchards.

5. Pruning

Young trees should be trained to a single trunk branching about two feet above the ground, rather than allowing several smaller trunks to arise from the same root. This means that suckers coming up around the trunk should be removed whenever they appear. Generally, very little additional pruning is needed to form a good tree other than to leave five to eight strong well spaced main branches on a single trunk or leader. Guava trees have a tendency to branch low and all low hanging branches which touch the ground should be removed.

Guava trees often grow to be 25 or 30 feet tall in a few years. Such trees can be trimmed back by cutting back leader and upper limbs severely to wood that is 3/4 of an inch or more in diameter. If judiciously done, this type of pruning will force out desireable new fruiting wood and at the same time keep the tree low enough so that most of the fruit can be picked from the tree without using a ladder.

6. Fertilization

During the first year after planting, about 1/3 pound 10-20-20 formula fertilizer should be applied around the base of the tree, four or five times a year. The

guava is a heavy potash user. The rate of application should be increased to 1/2 pound per application the second year and up to one pound the third year. Older bearing trees require heavier fertilizer applications. Relatively heavy applications of high nitrogen fertilizer a month or more before the main flowering season tend to increase the amount of new fruiting wood as well as a percentage of flowers which set fruit. For this reason, it is recommended that the bearing guava trees be fertilized with a high nitrogen fertilizer such as 16-20 ammonium phosphate a month or more before the main flowering season starts, as this would result in larger crops.

3.4 Guava Diseases and Insect Pests

The most serious insect pest of guava is the Oriental fruit fly, Dacusdorsalis Hendel. This fly lays eggs within the maturing fruit where they hatch into small maggots. The maggots burrow through the ripe fruit making it unsuitable for human consumption. Parasites can reduce the population of the fruit fly considerably but at times a large proportion of fruit are stung by this pest. Stung fruits can be utilized if they are picked slightly on the green side just as they begin to ripen. At this stage few of the eggs will have hatched. Under orchard conditions it is extremely important that unused fruits in which the flies have laid eggs are removed from the orchard and disposed of promptly.

The Mediterranean fruit fly, Ceratitis capitata may also be an important pest in some areas. Damage caused by this fruit fly and the measures for its control are similar to that of the Oriental fruit fly.

The most promising development in fruit fly control in guava is the effectiveness of bait sprays containing Malathion, a quick acting insecticide, combined with a protein hydrolysate bait material attractive to fruit flies. Relatively small amounts of this type of bait spray have given excellent control when applied at intervals of about two weeks. One of the outstanding features of this control method is that fruit flies are attracted to the poison bait material from distances of 50 feet or more,

so that thorough spraying is not necessary to secure good control.

Sucking insects such as scales and aphids sometimes become numerous enough to cause damage to guava trees. These insects injure the trees by sucking the sap and certain types of scales produce a toxic effect on some plants. Aphids and some scale insects secrete a sweet substance called "honey dew" which attracts ants who utilize it as food. Sooty mold grows and spreads on the honey dew secreted by scales and aphids. Scales can be controlled by thoroughly spraying the trees at two week intervals with an oil emulsion mixture spray consisting of about 1½ gallons of summer oil and one quart of nicotine sulfate per 100 gallons of water. This spray also controls aphids.

ANTHRACNOSE (Colletotrichum gloeosporioides)	Spots on fruit, leaves, and petiole. Spots mainly on mature, ripening fruits. Pinkish spore mass may appear on the spot surface.	Spray basic copper sulfate or Dithane M-45 at 7- to 10-day intervals. Remove cull fruit from orchard. Do not exceed 4 lbs. basic copper sulfate or 2 lbs. Dithane M-45 per acre in any single application.	Basic copper sulfate: 2 tbsp./gal. water or 2 lb./100 gal. water Dithane M-45: 1 tbsp./gal. water or 1-1/2 to 2 lb./100 gal. water
BLACK SPOT (Cercospora papayae)	Small, black, sunken spots appear on green fruit. Leafspots are small, with gray centers and dark edges.	Spray basic copper sulfate at 7- to 10-day intervals. Remove cull fruit from orchard. Do not exceed 4 lbs. basic copper sulfate per acre in any single application. Avoid planting in wet, humid areas.	Basic copper sulfate: 2 tbsp./gal. water or 2 lb./100 gal. water
PAPAYA MOSAIC (Virus)	Mild to severe chlorosis of leaves; water-soaked marks on lower side of leaf, petiole and stem; water-soaked concentric rings on fruit.	Use virus-free seedlings. Cut down diseased trees and spray them immediately with Malathion to eradicate aphids. Do not spray other fruit-bearing trees in orchard with Malathion.	Malathion: 2 lb./100 gal. water
PAPAYA RINGSPOT (Virus)	Faint to severe chlorosis in leaves; water-soaked streaks on petioles and stem; yellow spots to yellow and green rings on green-ripe fruit.	Use virus-free seedlings. Cut down diseased trees and spray them immediately with Malathion to eradicate aphids. Do not spray other fruit-bearing trees in orchard with Malathion.	Malathion: 2 lb./100 gal. water
PHYTOPHTHORA STALK AND FRUIT ROT (Phytophthora parasitica)	Blighted tree tops; stem cankers; whitish growth on fruits followed by fruit rot.	Spray basic copper sulfate at weekly intervals during wet weather.	Basic copper sulfate: 2 tsp./gal. water or 2 lb./100 gal. water
POWDERY MILDEW (Oidium papayae)	Leaf spot, grayish-white spots on lower sides of older leaves.	Apply wettable sulfur at 7- to 10-day intervals. Do not exceed 50 lbs. sulfur per acre in any single application.	Wettable sulfur: 4 tbsp./gal. water or 6 lb./100 gal. water

Quantity given is suggested amount of formulated material to mix in a spray solution. When spraying, completely wet plant surface to drip-off. Add 2-4 oz. of spreader-sticker per 100 gal. of pesticide.

IV. PROJECT AREA

IV. PROJECT AREA

4.1 Criteria for Site Selection - Soils, Climate and Other Conditions

A. Soils - Papaya

Papaya trees are able to grow well in a wide variety of soils. The most important characteristic is that the soils have good water drainage characteristics. The papaya root system is easily damaged if the soil is saturated with water. Excess moisture, resulting from heavy rains or other causes, should be drained away within a few hours to avoid root decay and even death of the trees.

The papaya is a rapid growing tree and must have a continuous supply of readily available plant food and moisture to insure satisfactory growth. Loamy soils which are well supplied with organic matter are best. Recently cleared land, which is well drained and contains an abundance of humus, is especially well suited to commercial papaya culture.

In practice commercial papayas can be raised on a wide range of different soils, providing they are well drained. In Hawaii, excellent production is obtained on rock land soil called aa, a type of soil in the lithosols group. This is primarily porous lava with a limited amount of volcanic ash and weathered rock material and some organic matter. The low humic latosols are also considered excellent for papaya production. With a good economical source or irrigation water the low humic latosols can be one of the most productive areas of high quality fruit. Sandy loams are also used for commercial production.

B. Climatic Factors - Papayas

Environmental factors conducive to good growth and good fruit quality include warm temperatures the year round, good light exposure, mild winds, and an annual well distributed rainfall in the neighborhood of 100 inches per year. The papaya plant is very sensitive to climatic change. Extremes of temperature will cause changes in the sex of the plants. Uniform warm temperatures

are the best.

High sunlight radiation is required for best quality fruit and maximum yields.

The papaya tree should have ample soil moisture at all times. The moisture requirements of the papaya plant differs in each location and depends upon the ecological factors characteristic of the area. The amount of rainfall, temperature, light, wind, soil type and elevation all play an important role in determining the amount of moisture needed to keep the papaya tree in good productive condition. The age of the tree is also important. Young papaya seedlings need more moisture than older trees to maintain normal growth. Older trees can get along with less moisture because of the slow rate of vegetative growth. The root system of older trees is more extensive, thereby enabling the tree to absorb available moisture more readily.

Annual rainfall in the neighborhood of 80 to 100 inches, well distributed throughout the year, is considered ideal. Lack of moisture over any prolonged period will slow down growth and will encourage the production of a greater number of male or sterile flowers. Subsequently there is a reduction in yield because of the lower number of fruits setting on the tree.

C. Soils and Climatic Factors - Guavas

The guava is adaptable over a wide range of soil and climatic conditions. It often grows wild in places where other fruit trees would fail entirely. It will survive flooding and continue to grow on soils that are temporarily water logged. Guava trees growing on infertile soils without much care often show little apparent signs of distress, although yields may be low. They grow satisfactorily on moderately acid soils and also do well under slight alkaline soil conditions. Although the guava may be tolerant to rather poor soil conditions, it responds well to good soils and climate and surprisingly well to both organic and chemical fertilizers. Since flowers are produced on new

wood, there seems to be little danger of the plant becoming over-vegetative and apparently there are few soils that would be too fertile for guava.

Guavas are sensitive to low temperatures. Mature trees may withstand 26°F for a short duration, but for optimum yields, uniformly high temperatures are required. Guavas are grown between sea level and about 3,000 foot elevation. Annual rainfall between 40 and 150 inches appears to permit satisfactory growth. Windy slopes and ridges exposed to the winds produce small stunted plants and are obviously not suitable orchard sites. Areas selected for papaya production would be suitable for guavas.

D. Other Criteria

Other factors to be considered in selecting the project area include (1) terrain, (2) cost of clearing and site preparation, (3) nearness to a port and airfield, (4) accessability by road, (5) availability of electric power and water, (6) labor supply, (7) squatters problems and, (8) competition for other use of the land.

4.2 Location and Description

A. The selected site is in the State of Johore just west of the Muar River and approximately three miles north of Kundang Ulu. The new paved road from Kundang Ulu to the Durian Chondong Malay Reservation cuts through the eastern part of the property.

B. Description

The area is approximately 4,000 acres in size and is roughly square in shape. The elevation varies from 50 feet to 200 feet above sea-level with the majority of the land approximately 100 feet above sea-level. The northeast border is fairly steep, sloping down to the center of the property, which is drained by the Parit Sawah which also drains the ridge that runs through the western part of the property. The extreme

western part slopes down from this ridge to fairly low land which is drained by the Parit Bengkak. These are the two main streams that drain the area. Almost the entire project is on sloping land with the only flat land being the extreme stream bottoms. This makes it ideal for papaya where good drainage is essential. The areas selected for planting would have to be chosen with the contours and slope in mind. Most of the entire project is good for papaya growth. Therefore, the criteria for selecting the actual acreage for planting would depend upon contours of the area so that machines could be used. A detailed map of the project area is shown in Exhibit 3, following Section IV.

4.3 Terrain and Soils

The area is in native forest and jungle, most of which has never been logged. The terrain is moderately steep rolling hills with small stream beds at frequent intervals. There is almost no flat land. The land has excellent surface drainage with run-off outlets through the numerous small streams which eventually run into the Muar River.

The soil is generally a reddish color of a very coarse nature and appears to have developed from decomposed granite. The pH is in the 4.7 range and the soil is of low fertility which is typical of virgin forest area. With the addition of fertilizers this soil is capable of supporting excellent stands of papaya and other suitable fruits. Below this upper profile is a tight layer of yellow-gray clay with red blotches which is found in much of West Malaysia. The terrain has sufficient slope to permit good lateral drainage through the coarse upper profile. The only drainage problem is in the few acres of flat bottom lands which should not be planted in fruit trees.

Thin lateritic layers are present but do not appear widespread or hard.

4.4 Climate

Temperature and rainfall amounts and distributions

are favorable for papaya as well as many other tropical fruits. Mean annual rainfall is approximately 84 inches with fairly uniform distribution throughout the year. Minimum monthly rainfall in the drier part of the year from December to February averages over two inches of rain per month with the exception that on an average one month every two years will fall below two inches. The probability of two consecutive months of less than two inches of rainfall each is once every fifteen years.

Average sunlight hours per month are six with the wetter months showing an average amount of daily sunlight of over four hours. This is important for papaya as sunlight plays an important part in fruit quality.

All of the climatic factors are favorable for papaya plantings as well as guava. Weather statistics for the area are shown in Exhibit 4, following Section IV.

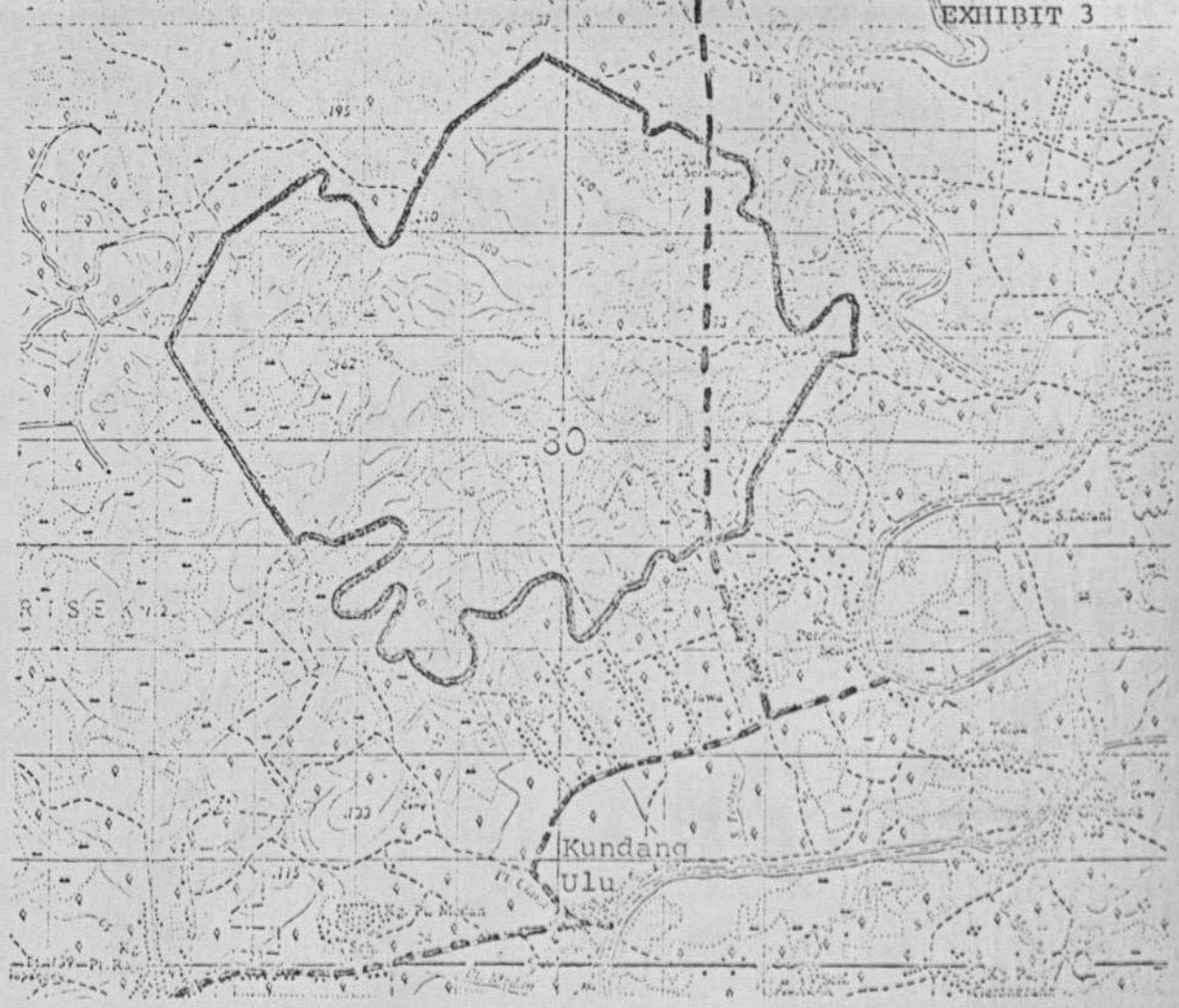
4.5 Other Factors

Shipping from the area is excellent with a variety of methods available. Within a mile of the property is the Muar River which presently has barge traffic down to the coast and on to ocean-going vessels. Twenty-three miles southwest on the coast lies the town of Muar with port facilities and a small air strip. Seventeen miles north of the area is the town of Segamat which is on the rail line between Singapore and Kuala Lumpur. Thirty-eight miles west of the area on the ocean lies the larger port of Malacca. Malaccaalso has an airport with regular service between Kuala Lumpur and Singapore.

These three methods of shipping, railroad, air and ocean-going vessels all lie within economic distance of the projected site.

An electric power line parallels the northern part of the Kundang Ulu-Durian Reservation road which could be tapped for a source of outside power if needed.

EXHIBIT 3



Scale One Inch to a Mile or 1:63,360

Mile 1 ¾ ½ ¼ 0 1 2 3 4 5

Yards 1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

LOCATION OF TROPICAL FRUIT PROJECT JOHORE, MALAYSIA

Exhibit 4

WEATHER STATISTICS

Month	Rainfall Inches	Ave. Daily Hours Sunlight	Average Temperature °F Max.	Min.
January	6.1	5.43	87.7	71.2
February	3.9	7.23	89.5	71.2
March	7.1	6.82	90.7	72.3
April	8.2	6.34	90.8	73.0
May	7.8	6.11	90.2	73.1
June	6.2	6.52	89.8	72.3
July	5.5	6.13	89.3	71.6
August	6.8	6.76	89.1	71.5
September	7.6	6.27	89.2	72.0
October	9.3	5.51	88.9	72.1
November	8.8	5.06	88.3	72.3
December	6.7	4.71	87.7	71.8
Total	84.0	Ave. 6.07		

V. ORCHARD DEVELOPMENT AND FRUIT PRODUCTION

V. ORCHARD DEVELOPMENT AND FRUIT PRODUCTION

When development is completed there will be 2,000 acres of papaya and 1,500 acres of guava in the permanent orchard, with 1,500 acres of each in production each year. During the initial stage of orchard development, both papaya and guava will be grown on the first 1,500 acres. Papayas will be planted at intervals of seven feet between trees and ten feet between rows. Guava plants from the nursery will be planted at 25 foot spacing between rows and 20 feet between plants in the row.

The papayas will start bearing in one year. At the end of the fourth year, the third production year, the heighth of the papaya trees will make harvesting uneconomical, and the papaya trees will be cut down. The guavas by that time will be four years old, and starting to bear heavily. The guava trees will be developed to the stage that shading by the papaya trees would be harmful. After the removal of the papaya trees from each block, that land unit will be devoted exclusively to guava production. By the end of the seventh year, all papaya trees will have been removed from the 1,500 acre guava orchard.

The year prior to removal of the papaya trees from each block, new papaya plantings will be made on equivalent areas of new land to compensate for the trees that are removed. Total papaya production from the orchard will therefore be kept stable. Papayas will be inter-cropped with guavas only on the first 1,500 acres. As papaya planting is extended beyond this area, that land will be devoted exclusively to papayas. There will be 2,000 acres in the permanent papaya orchard, of which 1,500 acres will be in production each year, and 500 acres replanted.

5.1 Site Development

Land clearing and preparation will be scheduled according to the planting rates projected below. Clearing will take place following logging of the area. Trees would be sheared at ground level and all logs and brush windrowed for drying and burning. Complete removal of roots will not be necessary. The cleared area will receive a heavy disking followed by deep plowing or sub-soiling as required.

The land will then be ready for planting.

Main roads will be constructed through the approximate center of each block, with lateral roads at right angles to the main road at about half-mile intervals. All roads will be laterite surfaced.

5.2 Orchard Development

Nursery

The first fifty acres cleared will be used as a nursery to propagate papaya seedlings, and to grow guava seedling stock for grafting with bud wood from superior varieties prior to being planted in the orchard. The nursery area will contain a laboratory, storage warehouse, drying sheds and will serve as project headquarters.

Planting of papaya and guava seedlings in the nursery will be scheduled to correspond with the planting program shown below.

The budded guava seedlings will be ready to be moved from the nursery to the orchard plantings approximately one year after they are started. After the first year, when budded trees will be imported, the budding of guava seedlings will be programmed so that the trees will be ready to move from the nursery and planted in the orchard at the same time as the papaya seedlings.

Planting Schedule

The proposed planting schedule for papaya and guava is shown below:

PLANTING SCHEDULE (ACRES)

Year	Papaya (1st planting)	Guava	Papaya (2nd planting)
1	100	100	-
2	400	400	-
3	500	500	-
4	500	500	-
5	-	-	500
6	-	-	500
7	-	-	500
8	-	-	500
TOTAL	1,500	1,500	2,000

A total net area of approximately 3,500 acres will be used for guava and papaya production. The first 1,500 acres will be inter-planted with both papaya and guava. Planting of this area will be completed in the fourth year. As the papaya trees get too tall for economic harvesting, they will be removed, leaving the 1,500 acres in guavas exclusively.

As the papaya trees are removed, equivalent areas will be planted in the second block. To achieve stabilized papaya production from 1,500 acres, a total of 2,000 acres of land will be required, to allow for removing and replanting 25 percent of the area each year as the trees get too tall.

The projections used in this report will show the production from 1,500 acres of each guavas and papayas.

5.3 Production Assumptions

1. Fruit Yields

All fruit yields used in the report will be shown as net fruit delivered to the processing plant. An additional ten percent allowance is made for rejects during processing.

Yields per acre are projected as follows:

Yields per Acres (000 lbs)

Year	Papaya	Guava
1	-	-
2	30	-
3	25	2
4	20 (1)	6
5	-	18
6	-	28 (2)

(1) trees are removed after fourth year.
(2) yields level off at 28,000 lbs per acre after sixth year.

2. Number of Trees per Acre

Papaya - 622 Guava - 87

5.4 Production Schedule

Exhibit 5 on the following page is the ten year projection of estimated production of fresh papaya and guava.

There will be no fruit production during the first year. The first harvest of 3,000,000 pounds of papaya from the first 100 acres during the second year will provide enough fruit for testing the processing facilities, and test marketing the fruit. Following this, production rises rapidly and levels off at 37,500,000 pounds from the fifth year on.

Guava production starts during the third year, with a small harvest of 200,000 pounds from the initial 100 acres available for processing and test marketing. Guava production rises more slowly. Although maximum guava yields are achieved six years following planting, maximum total production from the orchard is not obtained until the ninth year when production will level off at approximately 42,000,000 pounds per year.

(Exhibit 5 follows)

EXHIBIT 5

FRESH FRUIT PRODUCTION SCHEDULE

PAPAYAS AND GUAVAS

Year	PAPAYAS			GUAVAS		
	Acres Harvested	Av. Yield per acre (000 lbs)	Total Production (000 lbs)	Acres Harvested	Av. yield per acre (000 lbs)	Total Production (000 lbs)
1	-	-	-	-	-	-
2	100	30.0	3,000	-	-	-
3	500	29.0	14,500	100	2.0	200
4	1,000	27.5	27,500	500	2.8	1,400
5	1,500	25.0	37,500	1,000	5.2	5,200
6	1,500	25.0	37,500	1,500	9.3	14,000
7	1,500	25.0	37,500	1,500	17.3	26,000
8	1,500	25.0	37,500	1,500	24.6	37,000
9	1,500	25.0	37,500	1,500	28	42,000
10	1,500	25.0	37,500	1,500	28	42,000

VI. HARVESTING AND PROCESSING

VI. HARVESTING AND PROCESSING

6.1 Harvesting Papayas

The papaya tree starts producing mature fruit about one year after planting. Papayas are ready to pick when the first trace of yellow appears on the skin. Such fruit, ripened off the tree, will taste just as good as those that become entirely yellow on the tree. Papayas are harvested at approximately three day intervals. During the winter months the fruit ripens slower and the picking interval may be slightly longer.

Harvesting is a simple operation when the papaya trees are short and the fruit are within reach of the individual on the ground. All fruits that show a slight tinge of yellow at the apical end of the fruit are picked and placed into a hand carried container. They are then hauled off to the packing shed. In handling picked fruit, every possible care should be taken to avoid bruising, which incurrs rapid spoilage. Padded shallow containers aid greatly in the protection of this tender fruit.

As soon as the papaya trees grow to the point that the picker cannot reach the fruit from the ground, the technique of harvesting is modified by using harvesting aids. These aids include the modified plumbers helper, the step ladder and the bin or enclosed platform.

The plumbers helper is used by most growers. The plumbers helper is modified by taking off the handle and replacing it with a bamboo pole about eight feet in length or more. The picker then places the rubber cup against the bottom of the papaya and pushes the fruit with the pole. This action causes the papaya to snap off from its stem causing the fruit to fall. The picker catches the fruit with one hand before it falls to the ground and places the fruit in the picking container. A picker can pick about 1,000 pounds per day by this method.

The bin method of harvesting is used in conjunction with a tractor. The bin is made large enough to hold one or two men and several boxes of papaya.

The tractor furnishes the power to lift the bin to the level of the papaya tree so that the harvester in the bin can pick the papaya easily. This method is used on level land only and requires a tractor driver and one or two pickers or harvesters.

The step ladder is also used to go up and down the papaya tree by some of the smaller growers. This is a tedious, time-consuming method of harvesting, and is not recommended for commercial production.

Infield Transport and Field Packing Shed

The filled picking containers are placed in a small pick-up truck or tractor drawn cart for delivery to the packing shed.

In the field packing shed, papayas are hand sorted by size, shape and ripeness, and spoiled and mis-shapen fruit are removed. After sorting, the papayas are ready for processing.

6.2 Harvesting Guavas

Guavas used for processing should be picked when they develop a yellow skin color but are still quite firm. Soft, over-ripe or mouldy fruit should be avoided. The fruit should be harvested by picking it from the tree. Fruit that has fallen to the ground should not be used. Partly green fruit which has developed about one half of the yellow color of mature fruit can also be harvested and utilized. However, it should be stored at room temperature for proper ripening.

The first harvest would take place in the third year after the orchard is started. Although the yield would be small at first, picking is desirable to establish harvesting methods and train personnel.

In the third year, fruit yield is estimated at only about 2,000 pounds per acre. By the sixth year, yields of 28,000 pounds per acre should be expected. The yield estimates for the guava orchards are based on experience obtained in Hawaii. It is anticipated that the yield will level off after the sixth year and that the tree will continue to bear for at least

twenty-five years. Actual yields could exceed 40,000 pounds per acre by the tenth year of the orchard.

To avoid bruising fruit during transportation from the field to the processing plant, shallow containers should be used so that the bottom layer of fruit bears less weight and is less likely to become crushed or bruised. The fruit should be transported to the processing plant without unnecessary delays soon after harvesting. Upon arrival at the plant the fruit should be stored in a cool location until processed.

Storage of Fruit

All green and partly green fruit should be set aside in boxes and allowed to ripen in ripening bins well protected from dust, rodents and insects. These bins should be constructed to permit good ventilation and protection from sun and rain.

Ripe fruit that is not being processed immediately may be stored at about 36°F for as long as two weeks without any injury. Storage at 45°F allows fruit to be stored for about one week without appreciable damage. At temperatures below 0°F ripe fruit can be stored for four weeks and probably longer without injury to the fruit or excessive loss of Vitamin C.

6.3 Processing of Fresh Papaya

The flow sheet for preparing fresh papaya for export shipment is shown in Exhibit 6 following.

Sorting will be done manually; it serves to divide the fruit into different degrees of ripeness at harvest so that quality at destination can be controlled

Hot water treatment is used to control fungi decay, such as stem-end rot. It is not a complete elimination of decay because the degree of control depends on a number of other factors such as orchard conditions, rainfall and climate, harvesting technique and post-harvest handling. At present, a 20-minute immersion in 120°F water is recommended. Improvement through experimentation is being studied at the University of Hawaii.

Disinfestation will be needed for import into Japan. Fumigation with ethylene dibromide is the preferred method at present. Gamma irradiation treatment, once approved by the U.S. Food & Drug Administration, should be considered later because it greatly increases the efficiency of the processing line, and will result in higher percentage of marketable fruit due to shelf life extension from the radiation treatment. Sanction by the local authority on the use of irradiation treatment is expected.

Aeration is part of the needed step after fumigation so as to assure the fruit being quite free of residual chemicals. It is also for the safety of the workers and the handlers.

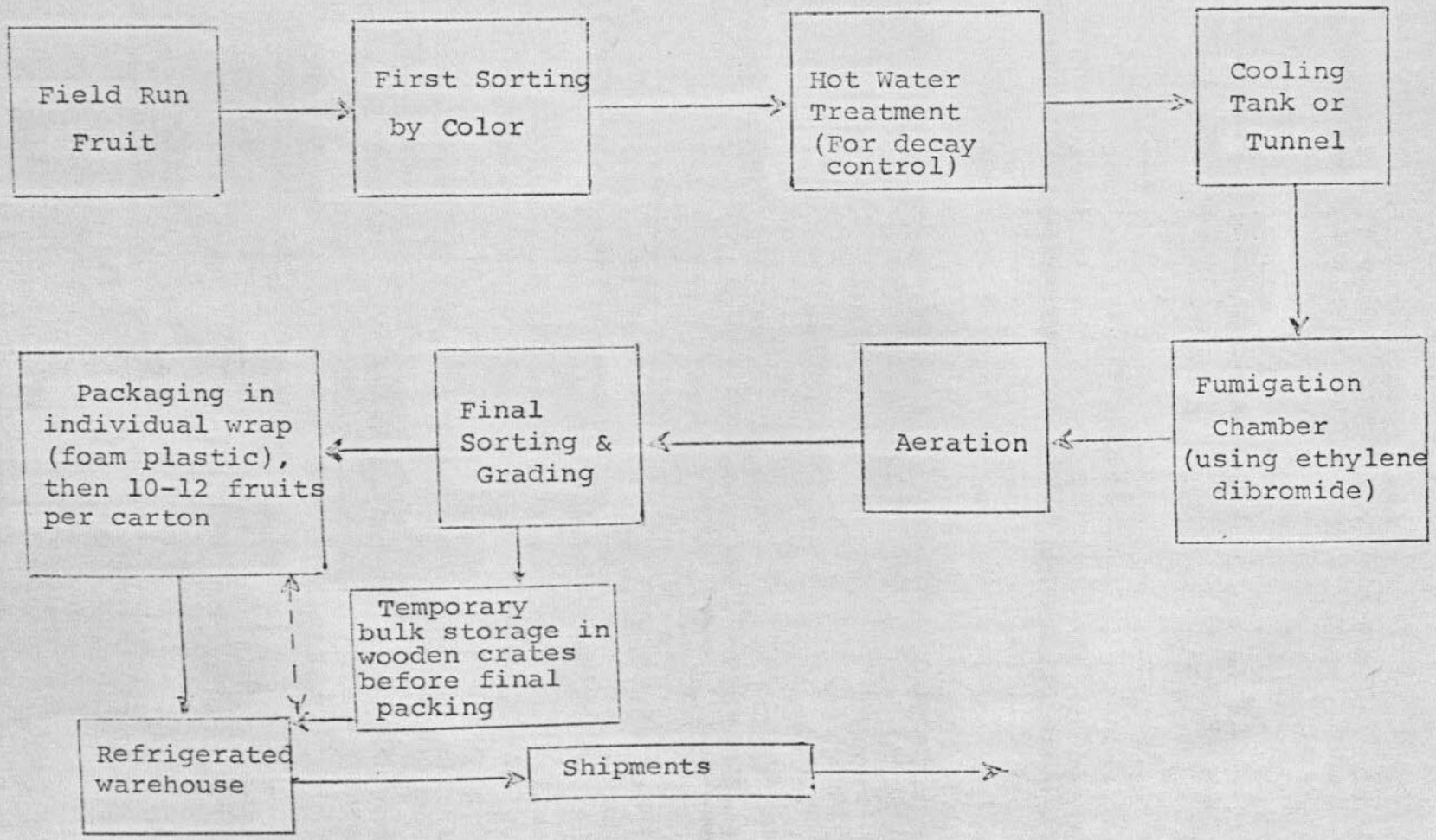
Final sorting and grading will allow better control of product uniformity. Individual foam wrappings such as those used on the Japanese 20-century pear will be used and will be incorporated at this point. With individual protective wrappings, higher quality and better sales appeal will undoubtedly result.

Refrigerated warehouse should be set at 55°- 60°F with allowance to go 10°F lower if necessary because of handling time and climate conditions.

Cost details are given in Section VIII. together with a list of equipment.

(Exhibit 6 follows)

FLOW DIAGRAM FOR THE PROCESSING OF FRESH PAPAYA EXHIBIT 6



6.4 Manufacturing of Guava Puree

The flow sheet for making guava puree is shown in Exhibit 7 following.

The process is not a complicated one, as long as all the machinery is connected in a coordinated manner.

Two things which are not considered here can be decided later. One, the puree made will be a single strength puree with no sugar added. This allows the buyer to have much flexibility in his choice of re-manufacturing such as making into a tropical fruit nectar. Nectar is the term used for a mixture of fruit puree (or juice) with sugar and water added to suit general taste. If desired, some of the puree can be made into a nectar base in the future if the price of sugar is favorable.

Another point is that pasteurization is not considered here because if the puree can be frozen quickly, then pasteurization is not necessary. This is based on experience obtained in Hawaii. However, if papaya puree is to be made in the same processing line during the guava off-season, then a pasteurization step has to be added.

Packaging into polyethylene-lined fiberboard cartons or 30 pound tins should be very satisfactory. The choice of the two will depend on the cost, and perhaps preference of the buyers.

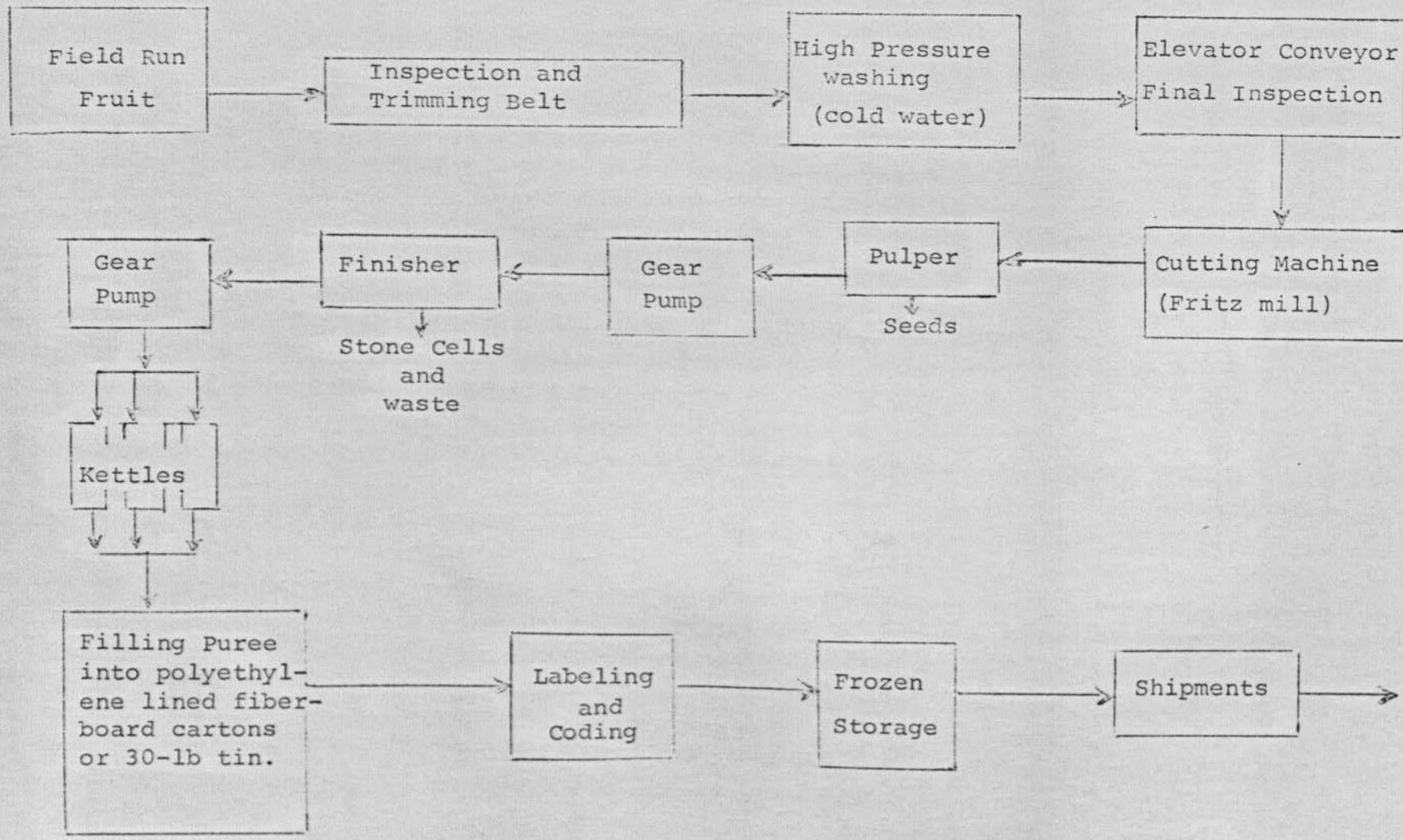
Packing, labeling, coding and moving into frozen storage are all manual. Inexpensive mobile wooden racks will be built and utilized.

Cost details are presented in Section VIII, together with a list of equipment.

(Exhibit 7 follows)

EXHIBIT 7

FLOW DIAGRAM FOR PROCESSING OF GUAVA PUREE



6.5 Handling, Transportation and Storage

- Papaya

The processed papayas, packed in the export cartons, are stored in the refrigerated warehouse at the project site until just prior to shipment. They are then trucked to the airport at Malacca, and transported by air freight to Tokyo.

Air freight charges from Malacca to Tokyo are estimated at M$.45 per pound. Cost of transportation from warehouse to the airfield will be M$20.00 per ton.

In the future, it is quite probable that shipments of fresh fruit will be made by ocean freight in refrigerated containers. Such containers are presently available. Cost of ocean transportation would be approximately M$.18 per pound, which would considerably reduce the cost of fresh papayas landed in Japan. For the forecast in this report however, we are estimating all fruit to be transported by air.

- Guava Puree

Guava puree will be packed in polyethylene-lined fiberboard cartons or tins and stored under refrigerated cargo containers which are provided by the steamship company, and transported by barge to Singapore. From Singapore they will be trans-loaded into refrigerated ships and transported directly to Japan. Estimated cost of storage and barge transport to Singapore is M$.03 per pound.

VII. MARKETS AND MARKETING

VII. MARKETS AND MARKETING

7.1 Types of Products

Types of products for which papaya and guava are used include the following:

Papaya Products

Fresh fruit.

Fruit juice - papaya nectar.

Papaya pickles and preserves.

Papaya puree for use in tropical fruit drinks.

Baby food.

Papain as a meat tenderizer or a stomach powder to aid digestion.

Puree as an ingredient in fruit jams.

Guava Products

Fresh fruit.

Jams and jellies.

Fruit juice - guava nectar.

For mixing with other tropical fruit juices.

Flavoring for ice cream pies, cake fillings, etc.

Jams and jellies.

The proposed Malaysian product will produce only the following:

1. Fresh fruit for export and for selected local markets.

2. A guava puree to be frozen and exported to Japan, or used locally in the manufacture of any or all of the products listed above.

7.2 Markets

The principal market for fresh papaya and guava puree will be Japan. For projections in this report, it is assumed that 85 percent of each product will be exported to Japan, and 15 percent sold locally.

The Japanese market for fresh fruit is growing rapidly. Papayas have been on the Japanese market for several years, but the cost is too high for wide-spread distribution. At present, the Japanese market is supplied by air shipments of papayas from Hawaii. According to market specialists from the Japanese trading companies, the Japanese market has just begun to be developed.

The most important factor in selling papayas on the Japanese market is the exposure of customers to papayas. This exposure is most effectively done by displaying papayas prominently and having a good supply always available. The market specialists believe the best way to increase Japanese sales is to work with individual market outlets to insure that papayas are properly displayed and that spoiled fruit is discarded. Markets must be assured that a continuing supply will always be available to meet rising demands.

Product quality is very important if repeat sales are to be made. Product quality depends on quality control in growing, treating and packing. Packaging will become very important. Ideally, each papaya should be well displayed but at the same time well protected by its individual package. The papaya will be competing with other fresh fruit such as cantaloupe and fresh pineapples. Competition with other papayas should not be a factor, as very little quality fruit is produced elsewhere. The major expansion in papayas will be in the fresh fruit market rather than in canned or frozen papayas.

Guava Puree

The guava puree will be used as guava nectar, a straight guava juice drink; for mixing with Mandarin orange juice and other fruit juices available in Japan; and for making guava jam and guava jelly in Japan for the Japanese market. There are presently import restrictions on bringing fruit juices into Japan, but these are expected to be lifted within about one year.

Price

The price of fresh papaya in Japan on the retail

market runs between U.S. $1 and $2 per pound (M$3 to M$6 per pound). On the Mainland U.S.A., the average wholesale papaya price at two West Coast cities was U.S.$.34 to U.S.$.36 per pound in San Francisco and U.S.$.27 to U.S.$.36 per pound in Los Angeles. For the projections in this report, we are assuming that the wholesale price of papayas in Japan delivered to the wholesaler will be U.S.$.40 per pound, or M$1.20 per pound. A reasonably priced, high quality papaya should have wide acceptance in a growing Japanese market.

The guava puree will be sold at M$.45 per pound F.O.B. Malaysia in containers, frozen and stored in refrigerated shipping compartments.

7.3 Sales Forecast

Exhibit 8 on the following page shows the volume of fresh fruit and frozen puree to be marketed each year in the Japanese and local markets, and the gross sales income.

Price assumptions are as follows:

Papaya - Japanese market, M$1.20 per pound.

- Local market, M$.60 per pound.

Guava Puree - Japanese market, M$.45 per pound F.O.B. Malaysia

- Local market, M$.36 per pound at plant.

Market distribution will be 85 percent of both products sold in Japan and 15 percent in Malaysia.

Yield of puree from fresh guavas will be 75 percent. Assume 10 percent loss of both papaya and guava as rejects during processing.

Exhibit 8 follows

SALES FORECASTS EXHIBIT 8

	Price Per pound (M$)	YEARS 1	2	3	4	5	6	7	8	9	10
RESH FRUIT SALES BASIS (Adjusted for 10 per-cent rejects)											
Papaya (000 lbs)		-	2,700	13,050	24,750	33,750	33,750	33,750	33,750	33,750	33,750
Guava		-	-	180	1,260	4,680	12,600	23,400	33,300	37,800	37,800
RESH FRUIT SALES (000 lbs)											
Papaya Ex-port (85%)	M$1.20	-	2,295	11,093	21,038	28,688	28,688	28,688	28,688	28,688	28,688
Papaya lo-cal (15%)	.60	-	405	1,957	3,712	5,062	5,062	5,062	5,062	5,062	5,062
Puree -Total (75% yield on fruit)		-	-	135	945	3,510	9,450	17,550	24,975	28,388	28,388
Guava Puree (export 85%)	.45	-	-	115	803	2,984	8,032	14,918	21,229	24,129	24,129
Guava Puree-local (15%)	.36	-	-	20	142	526	1,418	2,632	3,746	4,259	4,259
ALES REVENUE (000M$)											
Papaya Export		-	2,754	13,311	25,246	34,425	34,425	34,425	34,425	34,425	34,425
Papaya - local		-	243	1,174	2,227	3,037	3,037	3,037	3,037	3,037	3,037
Guava Puree Export		-	-	52	361	1,243	3,614	6,713	9,553	10,858	10,858
Guava Puree Local		-	-	7	51	189	510	948	1,349	1,533	1,533
TOTAL REVENUE			2,997	14,544	27,885	38,894	41,586	45,123	48,364	49,853	49,853

VIII. FINANCIAL FORECASTS

VIII. FINANCIAL FORECASTS

8.1 Basic Assumptions and Data Used in Forecasts

A. Papaya - Fruit production cost assumptions

		Cost per acre
- Clearing - Contract clearing including heavy discing		M$270
- Land preparation		33
- Labor cost @ M$1.00 per hr.		
- Papaya culture, cost per acre		
1. Planting - 60 man hours + M$15 material		75
2. Thin seedlings - 24 man hours		24
3. Thin plants - 12 man hours		12
4. Fertilizer - 10-20-20		
72 man hrs. per acre per year	M$72	
4,000 lbs/acre @ M$270 ton	540	
Total Cost Fertilizer		612
5. Weed control		
60 man days	M$ 60	
Herbicide materials	60	
Mechanical	50	
Total		170
6. Pest Control		
34 appl. Dithane @ 2 lbs acres x 2.80	190	
30 appl. Sulfur @ 2.5 lbs x .25	19	
Labor - 124 man hours	124	
Mechanical	40	
Total		373
- Harvest		
Labor - 1,000 lbs/acre per man day - 200 man hrs/acre	200	
Materials	40	
Total		240

		Cost per acre
- Infield Sorting		
100 man hours	M$100	
Materials	20	
Total		M$120
- Overhead and Miscellaneous		100

B. Guava - Fruit Production Cost Assumptions

- Clearing and land preparation. Included under papaya costs.		
- Nursery trees - M$2.00 per tree, to cover cost of budding and growing trees in nursery x 87 trees per acre		175
- Planting		70
Survey and mark	M$ 10	
Haul trees and fertilize	10	
Planting, labor and equipment	50	
- Pruning - M$1.00 per tree per yr.		87
- Weed Control - M$50 per acre. Part of weed control will be covered by papaya costs until trees close in.		50
- Fertilizer		
1st year - M$40 materials + 30 labor		70
2nd year - M$90 materials + 30 labor		120
3rd year - M$185 materials + 30 labor		215
4th year and on - M$235 materials + 30 labor		266
Use 10-20-20 fertilizer mix. approx. 20 lbs per tree per year for mature trees		
- Disease and insect control		
1st year		90

2nd year	M$150
3rd year	200
4th year	250
5th year	300

- Harvest and haul to processing plant

  1st harvest = M$60 per 1,000 lbs
  Full production = M$30 per 1,000 lbs

- Field overhead and miscellaneous
  M$30 to M$100 per acre

C. Papaya and Guava Fruit Production Costs

Exhibit 9 on the following page shows the yearly costs of production of fresh fruit for guava and papaya, through harvesting and delivery to the processing plant.

(Exhibit 9 follows)

PAPAYA FRUIT PRODUCTION COST M$ EXHIBIT 9

Operation	Cost per Acre (M$)	Year 1 Acres	Year 1 Cost	Year 2 Acres	Year 2 Cost	Year 3 Acres	Year 3 Cost	Year 4 Acres	Year 4 Cost	Year 5 and on Acres	Year 5 and on Cost
PAPAYA											
Land Clearing	270	100	27,000	400	108,000	500	135,000	500	135,000	500	135,000
Land Preparation	33	100	3,300	400	13,200	500	16,500	500	16,500	500	16,500
Planting	75	100	7,500	400	30,000	500	37,500	500	37,500	500	37,500
Thin Seedlings	24	100	2,400	400	9,600	500	12,000	500	12,000	500	12,000
Thin Plants	12	100	1,200	400	4,800	500	6,000	500	6,000	500	6,000
Fertilize	612	100	61,200	500	306,000	1,000	612,000	1,500	918,000	2,000	1,224,000
Weed Control	170	100	17,000	500	85,000	1,000	170,000	1,500	255,000	2,000	340,000
Pest Control (reduce 12 %)	373	50-100	18,000	500	186,500	1,000	373,000	1,500	559,500	2,000	746,000
Harvest	240	-	-	100	24,000	500	120,000	1,000	240,000	1,500	360,000
Infield Sorting	120	-	-	100	12,000	500	60,000	1,000	120,000	1,500	180,000
Overhead & Misc.	100	100	10,000	500	50,000	1,000	100,000	1,500	150,000	2,000	200,000
TOTAL			147,600		829,100		1,642,000		2,637,000		3,267,000
Fruit Production (000 lbs)				3,000		14,500		27,500		37,500	
Cost per 1,000 lbs					276.36		113.24		95.89		86.85 (US$2.9/1

EXHIBIT 9

GUAVA FRUIT PRODUCTION COST M$

Operation	Cost per Acre (M$)	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7		Year 8		Year 9 & subsequen years
		Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	Acres	Cost	
VA																		
learing & Land Preparation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nursery trees	175	100	17,500	400	70,000	500	87,500	500	87,500	-	-	-	-	-	-	-	-	-
Planting	70	100	7,000	400	28,000	500	35,000	500	35,000	-	-	-	-	-	-	-	-	-
Pruning	87	-	-	-	-	100	8,700	500	43,500	1,000	87,000	1,500	130,500	1,500	130,500	1,500	131,500	131,5
Weed Control	50	100	5,000	500	25,000	1,000	50,000	1,500	75,000	1,500	75,000	1,500	75,000	1,500	75,000	1,500	75,000	75,0
Fertilizer	variable	100	7,000	500	40,000	1,000	104,500	1,500	207,600	1,500	300,500	1,500	373,500	1,500	399,000	1,500	399,000	399,0
Disease & Insect Control	"	100	9,000	500	51,000	1,000	130,000	1,500	250,000	1,500	350,000	1,500	425,000	1,500	450,000	1,500	450,000	450,0
Harvest & Haul to Processing Plant	"	-	-	-	-	100	12,000	500	70,000	1,000	208,000	1,500	420,000	1,500	780,000	1,500	1,110,000	1,260,0
Field Overhead & Miscellaneous	"	100	3,000	500	25,000	1,000	70,000	1,500	90,000	1,500	100,000	1,500	120,000	1,500	140,000	1,500	150,000	150,0
TOTAL			48,500		239,000		497,700		858,600		1,120,500		1,544,000		1,974,500		2,314,500	2,464,5

D. Processing Costs

1. General Comments

The processing cost estimates are based on projected total production figures for the third production year. This year was chosen because it represents a reasonable beginning for a major endeavor. For papaya the total for processing in year 4 is 24.75 million pounds. This levels off at 33.75 million pounds from year 5 on. The inital installation will handle the full volume.

For guavas, approximately 4.7 million pounds of fruit will be processed during year 5, which year is used as the basis for unit cost calculations. The initial investment will be for enough equipment and machinery to process up to 80,000 pounds of raw fruit daily, working approximately 20 hours per day on two shifts. As production increases during subsequent years up to a maximum of over 37 million pounds of fruit to be processed by year 9, additions will be made to buildings, processing equipment and freezer storage to accommodate the additional production.

For the forecast in this report, the same unit costs will be used from year 5 on, although in practice the unit costs will be expected to decrease as maximum volume is attained.

2. Cost of Preparing Fresh Papaya for Export Market

Basis: Weekly capacity: Initial capacity, 550,000 lbs per week

Full capacity: 750,000 lbs per week by additional shift

50 weeks operating per year.

Factory Requirements	Computation	Annual Cost M$
Land - Site preparation and miscellaneous	15,000 sq.ft. @ M$9.00= $135,000	
Annual depreciation @20 year life		6,750
Building	8,000 sq.ft.@M$18.00= 144,000	
Annual depreciation @20 year life		7,200
Equipment		9,849
Machinery	M$96,000 depreciation @ 15-year life = M$6,399	
Truck, flat bed used, two (2)	M$9,000 depreciation @ 4 year remaining life=M$2,250	
Office equipment	M$12,000 depreciation @ 10 year life = M$1,200	
Salaries, Office Staff		54,000
Wages		28,800
Repairs and Maintenance		4,500
Packaging Materials		
Cardboard Cartons	12 fruit or 15 pound carton 1,835,000 @ .21¢	385,350
Individual foam wrappings	20,000,000 fruit @ 1.5¢	300,000
Chemical and Detergents		12,000
Refrigerated Storage	2 rooms, 4,000 sq.ft.= M$144,000 @ $18,10-yr life	14,400
Insurance		3,000

Factory Requirements	Computation	Annual Cost M$
Utilities		5,400
Taxes and Fees		9,000
	Total Cost	840,249

SUMMARY

Cost per 1,000 pounds fruit (M$)

		M$ per 1,000 lbs
Packaging		M$25.00
Processing		5.60
	Total	M$30.60

3. Cost of Processing Guava Puree

Basis: Daily Capacity: 40,000 lbs of raw fruit, during year 5, 75 percent yield

125 day operating season per year.

Factory Requirements	Computation	Annual Cost M$
Land - Site preparation and miscellaneous	15,000 sq.ft. M$9.00 = 135,000	
Annual depreciation @ 20 years		6,750
Buildings	8,000 sq.ft. @M$18= 144,000	
Annual depreciation @ 20 year life		7,200
Equipment		
Machinery	M$117,000 depreciation @ 15-year life= 7,800	

Factory Requirements	Computation	Annual Cost M$
Truck, flat bed, used, two (2)	M$9,000 depreciation @ 4-yr. remaining life= M$2,250	
Office Equipment	M$12,000 depreciation @10 yr life = M$1,200	M$11,250
Salaries, Office Staff		54,000
Supervisor	@M$2,400 per month	
Accountant	@M$1,200 per month	
Secretary	@M$ 900 per month	
Wages, 2 men, 12 months 10 men, 8 months 24 months @ M$300 80 months @ M$240		26,400
Repairs & Maintenance (Incl. a full time mechanic @300 per month)		6,000
Packaging Materials Fiberboard cartons (40-50 lb. capacity) 100,000 @ .60¢		60,000
Polyethylene bags (to fit cartons) 100,000 @ .15¢		15,000
Chemicals & Detergents M$90/100,000 lb. fruit		4,500
Freezer Storage	3,000 sq. ft. @M$30= M$90,000 (30'x100'x10') @ 10-year life	9,000
Insurance		3,000
Taxes		12,000
Utilities		6,000
Total Processing Cost for 3,750,000 pounds puree		221,100

Factory Requirements	Computation	Annual Cost M$

Summary:

Cost per 1,000 lbs fruit (M$)

Packaging	M$20.00
Processing (fixed plus variable)	39.00
Total	M$59.00

E. TRANSPORTATION TO MARKET

	PAPAYA				GUAVA		
	Truck To Local Market	Truck To Airport	Air Freight To Japan	Total Cost PAPAYA	Transport To Singapore	Truck To Local Mkt.	Tota Cost GUAV
Unit Cost (M$ per 1000 lbs.)	15.00	10.00	450.00	-	30.00	15.00	
Year 2 - Units	405	2,295	2,295	-	-	-	
- Cost	6,075	22,950	1,032,750	1,061,775	-	-	
Year 3 - Units	1,957				115	20	-
- Cost	29,355	110,930	4,991,850	5,123,135	3,450	300	3,75
Year 4 - Units	3,712	21,038	21,038	-	803	142	-
- Cost	55,860	210,380	9,467,100	9,733,340	24,090	2,130	29,97
Year 5 - Units	5,062	28,688	28,688	-	2,984	526	-
- Cost	75,930	286,880	12,909,600	13,272,410	89,520	7,890	97,41
Year 6 - Units	6th year on same as 5th year				8,032	1,418	-
- Costs					240,960	21,270	262,23
Year 7 - Units					14,918	2,632	-
- Cost					447,540	39,480	487,02
Year 8 - Units					21,229	3,756	-
- Cost					636,870	56,340	693,21
Year 9 - Units					24,129	4,259	-
- Cost					723,870	63,885	787,75

F. Promotion, Marketing, Destination Handling and Miscellaneous

	Papaya		Guava Puree	
	M$120/1,000 lbs		M$70/1,000 lbs	
Year	Units	Cost	Units	Cost
	1,000 lbs	(M$)	1,000 lbs	(M$)
1	-	-	-	-
2	2,700	324,000	-	-
3	13,050	1,566,000	135	9,450
4	24,750	2,970,000	945	66,150
5	33,750	4,050,000	3,510	245,700
6	33,750	4,050,000	9,450	661,500
7	Same as year 6		17,550	1,228,500
8			24,975	1,748,250
9			28,388	1,987,160

G. Administration and General

Year	1	2	3 and on
Consulting & Management	50,000	100,000	150,000
Travel Expenses	15,000	18,000	24,000
Accounting	10,000	15,000	25,000
Civil Engineering	15,000	10,000	10,000
Warehouse	10,000	20,000	30,000
Medical	10,000	30,000	40,000
Research	24,000	24,000	24,000
Road Maintenance-300 mi./yr.	6,000	12,000	12,000
Legal Fees	30,000	20,000	15,000
Others	10,000	20,000	30,000
Employee Services	20,000	30,000	45,000
	200,000	299,000	405,000

Depreciation on Common Equipment (add to Administration and General above)

Year	1	2	3	4	5
Depreciation	71,700	110,700	164,000	196,700	251,200
G & A (above)	200,000	299,000	405,000	405,000	405,000
Total - to P & L	271,700	409,700	569,000	601,700	656,200

8.2 Capital Investment and Depreciation

Capital equipment needs by year are summarized in Exhibit 10 which follows.

Capital investments are spread out over six years because of the delayed development of the guava orchards. Immediate capital needs are therefore minimized, and capital requirements from the third year on are paid for out of the operating cash flow.

The same exhibit shows the total depreciation charges by year.

Details of the equipment and costs of the guava and papaya processing plants are shown separately in Exhibits 11 and 12 which follow.

EXHIBIT 11

INVESTMENT FOR PAPAYA FUMIGATION PLANT

Basis: Weekly Capacity: 750,000 pounds - Operating 50 weeks per year

Land - Site preparation & facilities		
Buildings		M$135,600
Machinery & Equipment:		144,000
2 Inspection belts	M$7,200	
Conveyors	9,000	
2 Hot water tanks	9,000	
24 Wire Baskets (s.s.)	10,800	
2 Cooling Tanks	6,000	
1 Fumigation Chamber (with circulation fan and exhaust fan)	24,000	
1 Air Compressor	6,000	
1 Steam Boiler	9,000	
2 Temperature Controllers	9,000	
Gauges, valves, thermometers, pipings, etc.	6,000	
Refrigerated Storage		96,000
Trucks, used, two (2)		144,000
Office Equipment		9,000
Inventories		12,000
Cartons, 917,500 (6 mos. supply)		195,000
Fruit Wrappings (6 mos. supply)		150,000
Chemicals & Miscellaneous		9,000
Total Investment		894,000

EXHIBIT 12

EQUIPMENT AND INVESTMENT FOR GUAVA PUREE PROCESSING PLANT

Basis: 80,000 pounds raw fruit daily capacity, working 20 hours per day. Will be increased in increments up to maximum 270,000 pounds per day by year 9.

Land and improvements		M$135,000
Buildings		144,000
Machinery & Equipment for 80,000 pounds per day production		
1 Pulper	M$12,000	
1 Finisher	12,000	
1 Pulper stand-by	12,000	
1 Comminuting machine	24,000	
3 Gear Pumps	10,800	
Conveyors	12,000	
High Pressure Washer	9,000	
4 Kettles	12,000	
Small Equipment, (pipes, tools, knives, etc.)	7,200	
Miscellaneous	6,000	117,000
Freezer Storage		90,000
Trucks, used, two (2)		9,000
Office Equipment		12,000
Inventories		
Cartons	60,000	
Plastic Bags	15,000	
Chemicals & Detergents	4,500	
Misc. Supplies	1,500	81,000
Total Investment for initial 80,000 lbs per day production capacity		588,000

Additional investments in subsequent years will be as shown in the equipment schedule, Exhibit 10.

8.3 Financial Statements

Included in this section are:

Exhibit 13 - Profit and Loss

Exhibit 14 - Cash Flow

1. Comments on Profit and Loss

The combined operations show a profit of M$4,564,000 the third operating year. Profits increase rapidly to M$14,641,000 during year 5, the last tax free year under Pioneer Status.

Under full taxation, net profits are M$8,741,000 for year 6, increasing steadily until levelling off at M$10,899,000 from the ninth year on, when both guava and papaya are in full production.

Because of the high profitability and rapid cash flow return, the operations will be financed entirely out of investment capital. No long term loans are required.

2. Comments on Cash Flow

Equity investment will be M$3,200,000. Of this, M$1,200,000 will be an exchange of corporate stock for the capitalized value of the land owned by the State Government. The balance of M$2,000,000 will be cash from investors.

Total investment in the project will be approximately M$4,800,000, plus M$1,200,000 of capitalized land value for which no cash will be required. Cash requirements during the first two years will be only M$1,500,000. The balance is spread out over the next five years, and will be financed from cash flow income.

Exhibits 13 and 14 follow

PROFIT AND LOSS

(000 M $)

EXHIBIT 13

YEAR	1	2	3	4	5	6	7	8	9
PAPAYA									
Sales Revenue	-	2,997	14,485	27,473	37,462	37,462	37,462	37,462	37,462
Operating Expenses									
Field Operations	148	829	1,642	2,637	3,257	3,257	3,257	3,257	3,257
Processing & Packaging	-	83	399	757	1,033	1,033	1,033	1,033	1,033
Hauling of Shipping	-	1,062	5,123	9,733	13,272	13,272	13,272	13,272	13,272
Marketing, Promotion & Misc.	-	324	1,566	2,970	4,050	4,050	4,050	4,050	4,050
Administrative - Field	10	30	150	180	210	210	210	210	210
Total Operating Expenses	158	2,328	8,880	16,277	21,822	-	-	-	-
Profit From Papaya Operations	(158)	669	5,605	11,196	15,640	15,640	15,640	15,640	15,640
GUAVA									
Sales Revenue	-	-	59	412	1,432	4,124	7,661	10,902	12,391
Operating Expenses									
Field Operations	49	239	498	859	1,120	1,544	1,974	2,315	2,465
Processing & Packaging	-	-	11	73	276	743	1,381	1,947	2,230
Hauling & Shipping	-	-	4	30	97	262	487	693	787
Marketing & Promotion	-	-	9	66	246	662	1,229	1,748	1,987
Administrative - Field	-	-	9	15	36	45	60	75	90
Total Operating Expenses	49	239	531	1,043	1,775	3,216	5,131	6,778	7,559
Profit From Guava Operations	(49)	(239)	(472)	(631)	(343)	908	2,530	4,124	4,832
Administrative & General Expenses	272	410	569	602	656	656	656	656	656
Combined Operating Profit	(479)	20	4,564	9,963	14,641	15,892	17,514	19,108	19,816
Profit Before Income Tax	(479)	20	4,564	9,963	14,641	15,892	17,514	19,108	19,816
Income Tax - 45%	-	-	-	-	-	7,151	7,881	8,599	8,917
Net Profit or Loss	(479)	20	4,564	9,963	14,641	8,741	9,633	10,509	10,899

CASH FLOW (000 M$)

EXHIBIT 14

Year	1	2	3	4	5	6	7	8	9
PROFIT OR (LOSS) AFTER TAXES	(479)	20	4,564	9,963	14,641	8,741	9,633	10,509	10,89
Add:									
Depreciation	72	133	202	237	324	331	355	363	363
Stock Sales									
Cash	1,500	500	-	-	-	-	-	-	-
Land Credit	600	600	-	-	-	-	-	-	-
TOTAL	1,693	1,253	4,766	10,200	14,965	9,072	9,988	10,872	11,262
Deductions:									
CAPITAL PURCHASES									
Land Premium (capitalized)	600	600	-	-	-	-	-	-	-
Land Improvements	300	235	-	35	100	-	-	-	-
Equipment & buildings	371	289	460	216	385	-	-	-	-
Manufacturing plants	-	315	144	-	372	117	351	-	-
Inventories	-	-	75	100	206	81	120	-	-
TOTAL	1,271	1,439	679	351	1,063	198	471	-	-
CASH FLOW, NET	442	(186)	4,087	9,849	13,902	8,874	9,517	10,872	11,262
CUMULATIVE CASH FLOW	442	256	4,343	14,192	28,094	36,968	46,485	57,357	68,619