

Secretariat of the Pacific Community

Facilitating Agriculture Commodity Trade in the Pacific [FACT]



Value chain study of Tropical Dried Fruits in Fiji.

“PROMOTING HEALTHY SNACKS”

This study attempts to look at the value chain of dried fruits in Fiji with particular emphasis on the market overview in order to identify possible market and marketing opportunities of dried fruits for FRIEND (Foundation for Rural Integrated Enterprises N Development) an NGO who is interested to begin commercial production of dried fruits, including pineapples, mangos, papayas and bananas, The study encompasses dried fruits, slices, whole, fruit medley, and fruit leather in Fiji

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“ An EU Funded Project ”



Executive Summary

This study attempts to look at the value chain of dried fruits in Fiji with particular emphasis on the market overview in order to identify possible market and marketing opportunities of dried fruits for FRIEND (Foundation for Rural Integrated Enterprises N Development) an NGO who is interested to begin commercial production of dried fruits, including pineapples, mangos, papaya and bananas, The study encompasses dried fruits, slices, whole, fruit medley, and fruit leather in Fiji.

The study entailed the gathering of primary data from key informants in both the private as well as the public sectors. Informants included fruit processors/exporters and government departments in particular the Ministry of Agriculture who provided raw data on the production of various fruits and its availability. Target markets are tourists, students in all institutions, retail shops, supermarkets, hotels and motels throughout Fiji. The possible export markets are Australia, New Zealand, US, Canada, and EU markets.

The investigation showed that pineapples, Papayas and mangos are predominantly produced in the Western and Northern Divisions of the Fiji Islands whilst bananas are produced in larger quantities in the Central Division. Pineapples and Papayas also grow well in the Central Division particularly in the Dawasamu district.

A substantial quantity of Papayas, mangos and pineapples are grown in the Western Division and are exported to New Zealand, Australia and Japan. Of the fruits, Papaya is the biggest earner of income from export markets totaling 1,950 tonnes over the last five years. The total production of the major fruits in Fiji is around 12,320 tonnes. Banana pulp is exported to Korea.

Producing quality agro-produce is a matter of concern and needs to be addressed expeditiously. This would enable growers to realize the full economic benefits from the agro-industry as well as being competitive in the world market. In order to realize high quality consistent supply of produce, a well planned program to plant crops in a staggered manner coupled with the use of GAP (Good Agricultural Practices) is necessary. On Viti Levu a location near to the city of Lautoka would be a highly suitable location for solar driers for processing dried fruits since a high level of sunshine hours are available as indicated by metrological data. Seaqqa is considered the most ideal location for solar driers in the Northern Division.

The best fruit varieties for dried fruits production include both local as well as exotic varieties.

There is a preference for organically grown fruits in the local markets as indicated by study data from school canteens and tertiary educational institutes, the hotel industry where tourists are the target segment and all the retail shops and major supermarkets throughout Fiji. Organically grown dried fruits would fetch prices in the Australian, NZ, US and EU markets. There is a growing demand for healthy foods and snacks by consumers in general. All the stakeholders need to jointly work together towards organic farming. Good post- harvest handling, transportation, processing, and storage can reduce wastage and enhance quality.

People are becoming more diet conscious and prefer healthy snacks with minimum and no added sugar. Creating an increasing awareness and promoting organically grown dried fruits in Fiji and abroad would greatly enhance markets for the dried fruit industry. In order to promote Fiji dried fruits in overseas markets it is important to brand "Fiji" in every package of different sizes: labels should indicate the unique qualities of the products. The ideal sizes would be 50g, 100g or 125g or 150g, 240g or 250g and 500g to cater for the preferences of package sizes from customers. The labeling has to be colorful, striking, and attractive with the word Fiji and brand name. The labels should clearly specify the breakdown of all ingredients in the product must be compliant with CODEX standards to be suitable for export in the global marketplace.

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Background

This study forms part of the project **Value Chain Study for Dried Tropical Fruits** in Fiji. The report embodies a detailed study on market overview and to identify market opportunities for dried fruits in Fiji. This report reviews the availability and sources of fresh fruits and their relative merits.

An attempt was made to estimate the current production levels and identify gaps and opportunities in processing and marketing of dried fruits. The dried fruits fall within the fruits and vegetables category of the agriculture sector in Fiji.

In 2007, an estimated total of 46,074 tonnes valued at \$F56.4 million of fruits and vegetables were imported as opposed to only 2,681 tonnes valued at \$F4.8 million were exported (EP&S MAFF, Fiji, 2007 Annual Report).

It is estimated that 12 to 15 tonnes of various varieties of dried fruits are sold locally and around 8 to 10 tonnes are exported annually whilst growers consume their own harvest and process their home made pickles (chutneys). According to the Ministry of Agriculture's EP&S Division, a total of 12,320 tones of fruits were produced during 2006 compared to 16,487.9 tonnes in 2007 (EP&S,MAFF, 2007). See Annex I.

There are no commercial processors of dried fruits in Fiji. FRIEND (Foundation for Rural Integrated Enterprise Development) is committed to processing and supplying dried fruits in the local as well as the export markets.

Dried tropical fruits have a huge export potential in the world market. Kortbech-Olesen (1995) asserts that the largest market for dried fruits are the UK, Germany, Japan, and the Netherlands with raisins and sultanas, Papaya, mangos pineapples and apples as the most popular products in demand.

Recent global trends indicate that trade in fruits and vegetables are increasing (Agona *et al*, 2002). There are many different varieties of pineapple, Papaya, mango and banana available in Fiji. The soil is fertile and it is possible to grow organic fruits and vegetables. Organic fruits and vegetables earn premium price in the European niche markets (Uganda Chamber of Commerce viewed in *newafrica.com* 20/12/08). There is a growing demand for organically certified product that is also low in sugar (natural levels).

Organic products can reportedly sell for several times the price of regular product (ADC Commercial Bulletin # 11, 2001). According to Agona *et al*, 2002, the demand for exotic tropical and subtropical fruits by consumers in developed countries is on the increase and so is the demand for natural and organically certified products.

The Western and Northern Divisions have abundant sunshine during the dry season and solar drying facilities would be best suited for drying fruits at a central location in each of these Divisions.

Problem statement and justification

Fruits and vegetable processing in Fiji is yet to be fully exploited. In fact perishable farm produce are all too frequently wasted and/or sold at giveaway prices during peak seasons due to inadequate post harvest storage facilities and lack of effective preservation techniques and consequently there is high wastage. The potential for developing a new industry processing and exporting dried fruits in Fiji is clearly indicated by the small number of fruit processors and exporters that are currently operating. Dried fruits can be preserved even in the absence of refrigeration, and drying significantly lengthens shelf life.

When fresh fruit is unavailable, impractical, or out of season, dried fruit can provide an alternative. It is often added to baking of cakes, yoghurts, breakfast cereals and food bars. The Secretariat of the Pacific Community under the EU funded FACT Project aims at promoting the development of rural agro-processing and marketing.

Currently there are no dried fruit processors in Fiji. FRIEND (Foundation for Rural Integrated Enterprises N Developments) an NGO is interested to begin commercial production of dried fruits, including pineapple, mango, Papaya, and banana using appropriate solar driers and solar hybrid driers with production scheduled to commence in 2009.

This study therefore attempts to understand the status of the economic importance of fruit drying in Fiji and formulate appropriate interventions to successfully market dried fruits in Fiji as well as export markets. The beneficiary can then focus their production, processing and marketing to meet the demands through better access to market information.

Objectives

The objectives of this study and marketing overview were to understand the current and potential status of the dried fruit industry in Fiji.

The study had the following objectives:

1. To review the availability and sources of fresh fruits and relative merits for use in the production of dried fruit products.
2. To examine the production schedule to make best use of solar hot air drier(s) for pineapple, Papaya, mango and banana and recommend best location for drier(s).
3. To identify key factors needed to ensure consistent high quality of produce and recommend suitable management, monitoring and quality control systems.
4. To conduct desk research to identify best fruit varieties in Fiji for dried fruit production.
5. To review markets for dried fruits in both local as well as export markets in terms of size, price paid (including the price paid for certified organic dried fruits) and explore through desk research export markets for dried fruits in Australia, New Zealand and USA.
6. To find out ways and means of obtaining premium price for Fiji dried fruits in export markets.
7. To find out the best possible ways for packaging and labeling Fiji dried fruits.
8. To prepare a report of the findings and make appropriate recommendations to address the issues highlighted in objectives 1 to 7.

Methodology

The study was conducted in the Western, Central and Northern Divisions of the Fiji Islands which were purposively selected as well known areas for pineapple, mango and Papaya. The Central Division was particularly chosen to conduct the study for banana as the bulk of the banana is produced in the upper regions of the Central Division as well as Papaya and pineapples in the Dawasamu district.

In the Western Division the both government research stations (Sigatoka and Leglega) and the surrounding areas were visited and key informants were interviewed. Fruit producers were interviewed in the Sigatoka Valley as it is the major Papaya producing area for the export market. Research data on banana varieties and their performance were obtained from the Principal Research Officer Fruits/vegetables.

The private sector enterprises visited were:

- FRIEND (Foundation for Rural Integrated, Enterprises N Developments) a company who manufactures, pickles, chutney and greeting cards;
- Nature's Way Co-operative (Fiji) Ltd., a processing company who provides High Temperature Forced Air (HTFA) treatment facilities to exporters for maintaining quarantine regulations under the BQA (Bilateral Quarantine Agreement) between regional governments;
- Agrana Fruit (Fiji) Ltd., a processing company and manufacturer of fruit juices, fruit pulps and jams; and
- Nationals Exports Ltd. an exporter of fruits, vegetables and kava products. See Annex II.

The government departments visited were MAFF (Economic Planning and Statistics Division; Koronivia, Sigatoka, and Leglega Research Stations; Extension Offices in Lautoka, Nausori, Korovou, Labasa, Seaqaqa; Quarantine Division); Bureau of Statistics, the Ministry of Education, the Metrology Department, and the Fiji Visitor's Bureau were also contacted to obtain secondary data for the study.

Tools for primary research data collection included checklists for the various categories of market participants. The data collected were both qualitative and quantitative in nature.

Secondary information was also obtained through the Internet to supplement the primary data. Because of the limited product processing data and the differences of opinion expressed by different informants and information sources, this report provides a general assessments of the sector capacities rather than an exact exhaustive overview. The author of this report has not been able to reconcile or explain the difference of data from different statistical sources. The report does not explain the difference of data from different statistical sources. Rather this report explains the figures that were provided.

Findings

Main fruit production areas, size, growth, seasonality

In terms of Objective 1 of the study, surveys and face to face interviews with the Ministry of Agriculture staff indicated that fruits especially, mangoes, Papaya and pineapples can ideally be sourced from the Western Division of Fiji. This Division has suitable weather for growth and the availability of the HTFA plant to exporters for treatment of produce in compliance with sanitary and phyto-sanitary (SPS) requirements as revealed through surveys and face to face interviews with the Ministry of Agriculture staff. The Northern Division has similar favorable weather conditions as the Western Division but because of the remote location of growers from the processors, produce would be subject to high post-harvest losses because of bad road conditions as well as sustaining high transportation costs. Pineapples and mangos are seasonal in production while bananas and Papaya are available throughout the year. However with staggered planting pineapples can be harvested throughout the year using fruiting hormones (although this would negate the possibility of organic certification). Pineapples, Papaya and mangos are predominantly produced in the Western and Northern Divisions of the Fiji Islands whilst bananas are produced in larger quantities in the Central Division. Agrana Fruit (Fiji) Ltd buys the bulk of their banana requirements from the Central Division. Pineapples and Papaya also grow well in the Central Division particularly in the Dawasamu districts. See **Annex 1, Tables 1 to 5** for details of export figures for fruits and vegetables undergoing HTFA treatment provided by Natures Way Co-operative (Fiji) Ltd and the export figures for Papaya and mango are summarized below.

Table A

Annual exports of Papaya and mangos from Fiji

Product/tonnes	2004	2005	2006	2007	2008
Papaya	257	318.8	672.7	497	207.1
Mango	28.1	38	42.6	23.2	13.1

Source: Natures Way Co-operatives (Fiji) Ltd. 2008

Table 6 in **Annex 1** shows the crop production figures for 2006 and 2007. These figures indicate the production potential of various commodities grown in Fiji. Accordingly the total national production of fruits for 2006 was 12,320 tonnes compared to 16,488 tonnes in 2007.

FRIEND buys almost all of its produce from Western Viti Levu (Sigatoka to Rakiraki) and has designated growers supplying them on an as-needs basis.

The main regions and sources identified for the supply of fresh fruits are shown in Table B below whilst Table C shows the estimated quantities of fruits sold annually in local markets and roadside stalls.

Table B**The Availability and Sources of Fresh Fruits in Fiji**

Type of Fruit	Sources	Location	Availability (Season for Ripe Fruits)	Quality of Fruit	Average Price per Kilogram	Safety Standard
Pineapples	Farmers,	Western, Central and Northern Divisions	November / December, also available during off-season	Export and rejects	\$F1.20	Safe and free of contamination
	Local Markets/Roadsides			Export/Rejects		Safe with some degree of contamination
	Traders/Exporters,			Exports		Safe and free of contamination
Mango	Farmers,	Western and Northern Divisions	(Seasonal crop) October to December	Export and rejects	\$F2.00	Safe and free of contamination
	Local markets/Roadsides			Export/rejects		Safe with some degree of contamination
	Traders/Exporters			Export/rejects		Safe and free of contamination
Papaya	Farmers,	Western and Central Divisions	Available throughout the year	Export and rejects	\$F1.00	Safe and free of contamination
	Local markets/Roadsides			Export/Rejects		Safe with some degree of contamination
	Traders/Exporters,			Export/rejects		Safe
	HTFA			Rejects		Safe with some degree of contamination
Banana	Farmers,	Central, Western and Northern Divisions	Available throughout the year	Export	\$F1.50	Safe
	Local markets/Roadsides			Export/Rejects		Safe
	Traders/Exporters			Export		Safe

Source: Developed for this study 2008

Table C**Estimates of Quantities of Fruits Sold Annually in Local Markets/Roadsides (Tonnes)**

Municipal markets & roadside stalls /Commodity	Pineapples (Mt)	Papaya (Mt)	Mangos (Mt)	Bananas (Mt)
Roadside stalls (Fiji)	300	340	360	320
Korovou	100	20	15	45
Nausori	150	90	35	200
Suva	305	180	120	300
Lami	100	80	15	45
Navua	100	20	15	50
Sigatoka	100	100	100	100
Nadi	120	100	120	80
Lautoka	250	150	150	120
Ba	150	50	80	35
Tavua	100	40	50	25
Rakiraki	80	40	50	40
Labasa	120	50	50	50
Seaqaqa	60	30	200	30
Nabouwalu	80	20	10	35
Savusavu	70	40	10	35
Total	2185	1350	1330	1510

(Source: Estimated data from Divisional PAOs, Ministry of Agriculture, Fiji, 2008)

A total of 6,376 tonnes of fresh fruits ranging from green to ripening stage are estimated to be available annually in municipal markets and roadside stalls throughout the two major islands of Fiji.

Table D below shows the total production of the four major fruits for dried fruit industry in Fiji from 2003 to 2007.

Table D

Production (tonnes)	2003	2004	2005	2006	2007
Banana	2201	3400	2071	3352	2852
Papaya	2403	2757	1871	2768	9091
Pineapples	2787	3488	2985	3205	2042
Mango	227	681	210	243	not reported

Source: E P & S Ministry of Agriculture, Fiji, 2008

Production schedule, best use of solar driers, best location for solar driers, solar drier construction

According to the survey data from FRIEND, Agrana Fruit (Fiji) Ltd, Natures Way Co-Operative (Fiji) Ltd, and National Export Ltd the major issues confronting the fruit industry in Fiji are consistency of supply of produce, quality, and post-harvest losses. See **Annex II** for details.

In terms of Objective 2 of the study it is important to consider setting up an efficient solar drying complex with a well planned production schedule through a consistent supply of good quality fruits to make efficient use of the solar driers.

Food drying is a simple, ancient technique. It requires a place to spread the food where (warmed) dry air in large quantities can pass over and beside thinly cut vegetables, fruit or meat products, ideally no more than about 1 cm or 3/8 inch thick (Barbara Kerr 1998). Food is set on trays or another drying arrangement like solar driers and allowed to dry. Dry clean air from any source will dehydrate food/fruits, allowing it to be preserved for a longer period of time.

Nutritionally, the USDA ranks dried food as better than canning and slightly less nutritious than freezing (F:\Appropriate Technology Projects-Solar Fruit Dryers.mht viewed 18/12/2008). Unless stored under refrigeration, dried fruit should ideally be used within a few months, as its nutritional value gradually lessens over time. More research work needs to be done for designing the best type of solar drier required for the tropical islands of the Pacific and this work is being undertaken by John Bennett (for FACT).

The metrological data presented by the Meteorology Department of Fiji shown in **Annex III** suggest that the Western and Northern Divisions would be ideal locations for setting up solar drier panels for drying of fruits in Fiji because of the abundance of sunshine hours.

Lautoka city and Seaqaqa town being the central locations in the drier sides of the two main islands of Fiji would be ideal locations in terms of availability of sunshine and for ease of transportation of produce from either side of the dry zone.

Solar Dryer Construction

Pacific Kava Consultant, Mr. John Bennett, in consultation with FRIEND had undertaken a contract with the Secretariat of the Pacific Community's FACT project and constructed three 'Passive Dryers' in Hawaii which will be used by FRIEND for the fruit drying process. The brief on the specifications of the solar dryers are outlined below:

BRIEF ON PASSIVE SOLAR DRYERS

1) - 6' x 12' (1.828m x 3.658m) modular, 'Knock Down Dryer':

Key features:

- constructed of locally available materials (i.e.-steel, concrete, polycarbonate roofing).
- Choice of materials and rugged construction ensure longevity and optimal efficiency.
- Easily assembled anywhere.
- Multi-purpose applications: dry coconut endosperm, kava, seaweed, fruits, nuts, most botanicals, & fish, etc.
- No moving parts to break down or service and no need for electricity.
- ensures products are kept dry during the drying process to minimize degradation or contamination.
- Expandable design.

Components include:

- 14g galv. steel frame,
- Galv. supporting legs which are adjustable for orientation to the sun.
- Galv. roofing iron for drying platform base support.
- 1" rigid foam or fiber glass base insulation
- Std. concrete 40mm x 200mm x 400mm patio blocks heat sink.
- U.V. resistant 17"sq. polypropylene drying trays.
- Long lasting, durable, U.V. resistant polycarbonate roofing material.

Size:

- 10' x 6' x 12' (.254m x 1.828m x 3.658m) modular galv. steel frame

Capacity:

- 32, 17"sq. (432mm sq.) trays drying up to 90kg fresh material per charge, depending on commodity (eg.-32kg fruit, 90kg coc. flesh).

Performance:

- Dryer attains temperatures up to 80C (175F) during the day allowing two coc. Flesh drying cycles (to 5% moisture) per week under partly sunny skies. The concrete heat sink extends drying into the evening after sunset.

2) 12'sq. (3.658 meters square) Solar dryer

- Same as above dryer but twice the capacity.
- Expandable

3) 12'sq. (3.658 meters square) 'Solar Dryer Plenum'

- designed to dry commodities as with the above while at the same time providing additional heat to a drying chamber where multiple trays are shelved in a hybrid solar, biomass drying chamber. The unit is designed to work in conjunction with a solar hot water heater and biomass radiant stove fitted with a wetback. The complete hybrid system capacity would be 200-400kg depending on the commodity
(Source: John Bennett, Pacific Kava, 2009)

Identifying key factors needed to ensure consistent high quality dried fruits

According to Agona *et al.* (2002) the processing level quality is ensured through training and hygienic processing. However, presently the numbers of people trained in quality assurance in Fiji is low.

The current drying technologies available in Fiji are:

- Sun drying in open air;
- Traditional hot air driers; and
- Simple solar driers.

In terms of Objective 3 of the study the current drying methods do not ensure products with consistent quality attributes. Cereals, cocoa beans, tamarind, mangos for pickles and copra are some of the agricultural commodities which are dried using the above methods in Fiji.

According to ADC (2001) surveys of European and US tropical fruit importers, conducted in March 1998, found that importers are less interested in sun dried product and that the market was very competitive overall. The assumption is that the product will have too many foreign products (insect fragments, defects, spoilage, microbiological problems, and bacteria) and will not pass food safety regulations. ADC (2001) further asserts that some would be willing to look at the sun dried product and see whether it meets specifications however, all stressed that the market is well supplied and that new entrants must have some comparative advantage in terms of price or presentation.

During the survey work in the Western Division it was noted that the National Exports Ltd in Lautoka had bought a drier from India for drying green and half ripe mangos and star fruits for exports markets. This drying machine was operated by using electricity but was not in use at the time of the visit, and seemingly it was lying idle for a period of time and upon enquiry it was revealed that the machine was only operational during the mango season and was not used for any other purpose.



Picture 1 Front view of electric generated drier at National Exports Ltd. - Lautoka



Picture 2 Inside view of electric generated drier (tray and fan) at National Exports Ltd- Lautoka

Another such drier was located at the FRIEND complex in Lautoka and was not in use as well. This machine was donated to FRIEND by the British High Commission and upon enquiry it seemed that the user had lacked the knowledge on how to use the machine and was informed that the final dried products were not dried to the required level for making mango pickles and 'Khatai' (dried spiced green/half ripe mango used in Indian cooking to add flavor).



Picture 3 Interior view of mini drier at FRIENDS



Picture 4 Front View of mini Electric Drier at FRIEND

After undergoing initial drying using the electrical drier the partly dried mangos are then sun dried. It is reasonable to assume that processors in Fiji lack the knowledge and skills on drying of agro-produce using the appropriate methods and sun drying is the most common methods used.

In general growers of agro-produce in Fiji lack the knowledge and the will to produce and maintain good quality produce that would obtain premium price in the markets. Poor quality produce and high degree of wastage of agro-produce is largely due to post-harvest losses through poor handling, transportation, and storage problems. Poor husbandry practices and lack of knowledge to use recommended package of practices also contribute to the production of inferior quality produce.

People are now becoming health conscious and prefer safe and organically certified food. If Fiji is to compete in the world market for dried tropical fruits it needs to get farmers to grow fruits through certified organic farming practices. Because of the absence of a legal framework it was difficult to explore further organic production of fruits in this study, and compounded by a lack of local expertise and production inputs in Fiji. According to Brinza (2008), the prices of organic products are several times higher than those of the traditional products.

High quality processed dried fruits will only be realized through the use of organically grown inputs, certified and be derived through quality sorting and grading. The photographs below show typical samples of quality solar dried banana chips sliced dried mangos, dried fruit medley, dried pineapple slices, dried bananas and dried Papaya chunks supplied by Wholesale Bulk Dried Fruits in the US.

Sample photographs of processed dried fruits



Dried Mango



Dried Banana



Dried Fruit Medley



Dried pineapple slices
chunks



dried banana



dried Papaya

Source: (Wholesale bulk dried fruits, Apples, Coconut, Papaya, Pineapple, Ginger- www.bulkfoods.com)

The above photographs show the attractive and flamboyant appearance of processed dried fruits after undergoing processing through solar drying and subsequent treatment for maintaining its original colors as well its taste and quality.

The products shown do not contain added sugar and are ready for packaging. To maintain its original color the fruits are often treated with sulfur. The sulfur is added to make the color of the product more appealing. "Organic" dried fruit is produced without sulfur dioxide, which results in dark fruit and a flavor more closely resembling the fresh fruit from which it came. "The color of some fruits can also be "fixed" to some extent, with minimal impact on flavor, by treating the freshly cut fruit with a preparation rich in [Vitamin C](#) (e.g., a mixture of water and [lemon](#) juice) for a few minutes prior to drying" (F:\ Dried Fruit-wikipedia.mht viewed 24/12/2008). Also, some varieties are less susceptible to browning, for example in bananas, goldfinger (FHIA 1) and vudi types maintain better color on drying.

Small producers in the Northern and Western Divisions of the Fiji Islands grow, process, dry and supply exporters or processors with dried fruits such as sliced green mangos for spiced pickles (Khatai) and tamarind. The quantities of the dried fruit products in Fiji are small and it is difficult to obtain a specified figure as there is no information available on this from relevant authorities.

Varieties of fruits for dried fruit production in Fiji

The major fruits targeted for dried fruit production using solar driers are mangos, Papayas, pineapples and bananas. In terms of Objective 4 of the study the following information was collected from the field staff of Research and Extension Divisions of the Ministry of Agriculture during the survey:



Ripe Exotic Mango

Mango (*Mangifera indica*) – There are around 69 varieties of mangos in Fiji with 47 exotic and 22 local varieties. See Annex IV for the complete list of varieties available in Fiji.

Mango does well in the drier zones of the main islands and along the coastal areas where neither breeze nor heavy rain are present during the flowering season to affect the flowers from fruiting. Currently the bulk of the ripe mangos are consumed locally and sold in the local markets, along the roadsides and to hotels. Fresh half-ripe as well as dried green mangos are exported to New Zealand whilst processed mango juice and mango puree are exported to Australia by Agrana.

Ripe mango juice is also used in blending as flavors with other fruit juices to make fruit punch. Green mangos are also dried partially and processed with spices, chillies, salt and sugar in mustard oil to manufacture pickles. Processed ripe mangos flavors are now being commonly used in the manufacture of pulp and flavors for ice creams and flavored drinks. Of the local varieties, Fiji Mango, Peach Mango and Baramasia have good eating quality as they are fleshy and less fibrous and choicest of the lot in terms of its taste. Of the exotic varieties of mango Carabao, Tahitian, Hybrid mango and Tommy Atkins are the most favored ones because of its quality in terms of being very fleshy with very little fibers as well as being very tasty. The above varieties of mangos are likely to be well suited for drying in terms of its color and ripeness for further processing.



Local variety of Mango

Papaya (*Carica papaya*) – There are many varieties of Papaya grown locally. The local varieties are sold mainly in the local



markets whilst the hybrids are planted mainly for the export markets. The main recommended variety planted for the export markets is Sunrise Solo (known locally as Fiji Red) and Sunset (Waimanalo). This variety is commonly grown mainly in the drier zones of the Western and Northern Divisions but also do well in the Central Division as well particularly in the Dawasamu area. With good nutrition Solo Sunrise is highly productive: the flesh is bright orange reddish or dark pink in color, sweet and very tasty. They do not grow very large in size and fruits are picked as it begins to mature to avoid damage during transportation and in consideration of longer shelf life. Certified matured Papayas are mainly exported to New Zealand and Australia.



Pineapple (*Ananas comosus*) – The two most widely grown varieties of pineapples grown in Fiji are Smooth Cayenne and Ripley Queen. *Veimama* a cross with a local variety is also grown for processing. Another local variety is a maroon type pineapple and is found in Vanua Levu with grey dust (color) n leaves. The fruits weigh up to 3 kg each and are similar to Ripley Queen.

Pineapples are grown mostly for the local markets but some have been exported fresh to Canada via airfreight.

Pineapples are also used for manufacturing pineapple juice for canning and/or canned as cubes with other fruit mixes or as ringed, sliced, or crushed pineapples used in baking. The photograph shown above is a sample of Smooth Cayenne variety. It is very juicy and takes longer to dry.

Banana (*Musa nana*) – Bananas are grown widely throughout Fiji. It is grown on a bigger scale in the Sigatoka Valley and in the provinces of Naitasiri and Tailevu. The bulk of the bananas are sold in the local markets along roadsides and retail outlets including all the major supermarkets. The introduced varieties include FHIA varieties and Chavendish Dwarf. See Annex II for details on varieties and yield performance. There are around 18 varieties grown locally including *Veimama*, *Liga-ni-Marama* (Lady's finger), *Jaina Balavu*, *Jaina Leka*, and *Jaina Damu*. Plantains include *Damu Loa*, *Green Tall*, *Green Thick*, *Blue Java*, *Grey Green skin* and *Horn Type*. Ripe banana (Cavendish types or *Jaina*) are processed and packed aseptically for exports in the form as purees to Australia, New Zealand and Japan.



Other fruits

Citrus is another common fruit that is grown widely in Fiji particularly in Vanua Levu.

There are around 27 varieties of citrus in the Citrus Germplasm at the Seaqaqa Research Station and are listed as follows:

- Dancy Tangerine
- Orlando Tangelo
- Emperor Mandarin
- CumCalomondin (known locally as moli cumquat)
- Minneola Tangelo
- Murcott
- Lee Mandarin
- Satsuma Mandarin
- Page Mandarin
- Late Valencia Orange
- Washington Naval Orange
- Naval-S Orange
- Olinda Valencia
- Cutter Valencia
- Valencia S- Orange



- Jaffa-S Orange
- West Indian Lime
- Seedless Lime
- Key Lime
- Frost Lisbon Lemon
- Frost Eureka Lemon
- Meyer Lemon
- Harvey Lemon
- Marsh-S Grapefruit
- Namale Pomelo
- Ruby Red
- Duncan-S Grapefruit

Citrus orchard at Batiri, Seaqaqa



Sour varieties of citrus are used to manufacture pickles in spices and bottled for sale in local markets. Most varieties of citrus are rich sources of vitamin C. Soft drinks and juice is manufactured. Citrus Puree is also used to manufacture citrus fruit leather and might be incorporated into fruit leather blends to maintain color and give good acid/sweet balance.

Around 1000 tonnes of Late Valencia and Early Valencia varieties are produced annually at the Seaqaqa Research Station and sold in the local municipal markets throughout Fiji and along roadside stalls and in some of the major supermarket chains.

Indigenous varieties of fruits

Other indigenous and introduced varieties of fruits which are commonly sold in the municipal markets during fruiting season are listed below; however, it was not possible to gather accurate production data from the extension field staff of the Ministry of Agriculture.

List of Indigenous Varieties of Fruit:

1. Dawa (*Pometia pinnata*)
2. Kavika (*Syzygium malaccense*)
3. Avocado Pear (*Persea amerciana* - introduced)
4. Jack fruit (*Artocarpus heterophylla* - introduced)
5. Wi (*Spondius dulcis*)
6. Sour sop (*Annona muricata* - introduced)
7. Kura (*Morinda citrifolia*)



Avocado pear



Kura

Market Share, Competition and market prospects

The current market size for dried fruits produced in Fiji is approximately 12 to 15 tonnes (study data). These dried fruits are sold locally in the form of dried green/half ripe mangos or dried star fruits and small quantities are exported by individual exporters mainly to New Zealand, Australia and Canada. The annual exports of dried fruits for National Exports Ltd are about 5 tonnes. According to the Divisional Agricultural Officers a total of around 10 tonnes of dried mangos are exported by several exporters in small quantities as to cater for the demand by Fiji Indian communities living abroad. FRIEND also export value added fruits in the form of chutney and pickles to Australia, New Zealand, Samoa, and Vanuatu. Asian products, including chutneys and pickles from India, Indonesia Philippines and Malaysia, are very competitive in the local market.

Philippines are noted to be a big supplier of dried fruits and are well established in the market. Thailand is a leading supplier of dried pineapples, Papaya and mangos (ADC Bulletin # 11, 2001). The major leading supplier of dried fruits in the South Pacific region is Australia. Companies in Australia are able to meet volumes and their technology is far superior when compared to Fiji. Australian Food Innovators Pty Ltd has an annual sales turnover of US\$5million-US\$10 million in the South East Asian market (E.AUSTRALIAN FOOD INNOVATORS PTY LT5D-Dried fruits, fruit juices, fruit topping.mht. viewed 18/12/2008). It is worthy to note that even the Australian dried fruit producers are fighting a tough battle against the dumping of cheap Greek currants in the Australian markets. The Australian Dried Fruits Association and the processor Sunbeam mounted an anti-dumping case arguing Greek product was being sold in Australia at below the normal price in the home country (E:\Australian dried fruit producers fight against cheap Greek imports.mht viewed 18/12/2008).

According to Kortbech-Olesen (1995), dehydrated and tropical fruits, which are sold as fresh, dried or canned, posted large increases in exports, with total world trade reaching \$55 million in 1993. He further asserts that with the expansion of the Uruguay Round, increased demand for dried and tropical fruit is expected to open new markets in developing countries. At present, the largest markets for dried fruits are the UK, Germany, Japan and the Netherlands, with raisins and sultanas, papayas, mangos, pineapples and apples comprising the biggest market segments.

Although current demand is stable, sales could expand over the long term as new uses are developed and new markets open up.

Technologies for solar driers, marketing opportunities and constraints

Drying techniques

The technologies used in fruit drying in Fiji as discussed earlier in Section 3.3 are very simple in terms of quantity and quality of dried fruits produced. By far the most successful are the conventional copra driers through direct sunlight or hot air through heat generated from firewood etc. The use of these drying methods can result in having impurities through handling and during storage and this could affect the final product. However for the production of high quality dried fruits requires a clean place to spread the fruits where dry air in large quantities can pass over and beside thinly cut fruit or whole products. Fruits can be set on trays or another drying arrangement and allowed to dry. Dry clean air from any source will dehydrate the fruits, allowing it to be preserved for a longer period of time. It is recommended that proper solar driers should be constructed and having specific sizes to cater for the supply of fruits from the sources identified in order to satisfy the market size and demand for Fiji dried fruits. More research and expert work has to be done to construct the right sizes that suit the volumes to be handled by the potential processors.

In the USA a successful dried fruit manufacturer has installed numerous solar panels to generate adequate power to dry ripe fruits and has saved substantial costs in electricity charges. See extract below.

Commercial usage of solar energy- an extract-US: Dried Fruit plant goes solar

A packing plant that's known for its dried fruit is now harvesting the sun's rays for solar power. Mariani Packing Company installed a solar array with 5,800 panels covering seven acres at its packaging and processing facility in Vacaville. The solar panels will provide the 750,000 square

foot facility with 1.1 megawatts of electricity which is about 25 percent of the company's utility needs.

"It's going to offset about \$250,000 worth of bills we would normally pay to PG&E," said Mark Mariani, chairman and CEO of the family-owned business. The panels, which were installed by SunEdison and groSolar, will allow the packing company to purchase power at greatly reduced prices. Mariani also said that the installation of the panels is good for the environment. "It's the right thing to do because we're going to offset our utility costs down the road," he said, adding that the sun's power had been used many years ago to dry fruit.

Mariani Packing Company is the largest privately-owned, dried fruit manufacturer in the world. It moved operations from San Jose to Vacaville in 2000.

Source: news10.net (Publication date: 12/4/2008)

Dried fruit marketing

The bulk of imported dried fruits sold in Fiji are sold through Chinese shops who import the dried products in bulk packages direct from Taiwan and other Asian countries. Supermarkets, school canteens, village cooperative shops and retail shops throughout Fiji also sell these dried fruits. The larger retail supermarkets buy similar products through distributors like Asha Bhai & Co., C.J. Patel & Co. These cheap imports typically contain added colors, sugars and/or salts.



Dried Asian products in major outlets including school canteen

The survey conducted for the study revealed that marketing of local dried fruits was rated as low. In fact the only dried fruits located in some supermarkets were dried green mangos (Khatai) that had spices and salt added during the sun drying process and dried tamarind. The survey also revealed that the packages of many imported dried fruits had very poor labeling with unclear specifications on the contents of the ingredients. These dried fruits are packed in small clear plastics in the form of mango skin powder, mango skin, Papaya skin, dried ginger, etc. These small packs were labeled by using permanent markers and were sold at 50 cents per package. Some shops had loose dried mango skins, Papaya skins, and flavored dried ginger pieces

(with colorings and sugar added) in clear jars and were sold at 5 to 10 cents apiece.

Marketing of dried green mangos, dried tamarind, or star fruits is done on an individual basis where each exporter looks for markets to supply on their own in New Zealand, Australia and Canada. It was difficult to establish the quantity of such exports but it was estimated to be around 10 to 12 tonnes per year. From the survey data, National Exports Ltd exports around 3 to 5 tonnes of dried mangos to the US, Australia and New Zealand.

Marketing opportunities for dried fruits

In terms of Objective 5 of the study the biggest opportunity to market dried fruits in Fiji is to look at and penetrate the local markets. From the survey for potential market outlets throughout Fiji, the following data were obtained from the Fiji Islands Bureau of Statistics: (1).The number of supermarkets throughout Fiji was 362. (2). The number of retail shops throughout Fiji was 3,881. (3). The number of village canteens throughout Fiji was around 340, (4). The number of Hotels and Motels throughout Fiji

was 688. In addition to this there are 1539 educational institutions throughout Fiji comprising of the following:

- 559 pre-primary schools
- 720 primary schools
- 169 secondary schools
- 90 tertiary institutions

(Source: Ministry of Education, Fiji 2008)

Nearly all the retail shops, supermarkets, village canteens, educational institutions buy some forms of dried fruits or other and sell to consumers. Most of the educational institutes have canteens which sell foods, confectioneries, sweets and other dried fruits like mango skin, Papaya skin, dried flavored Chinese sweets, dried plums, tamarind, etc. with the exception of the International schools where fresh fruits are only sold as well as nutritious packs of cassava and potatoes chips are sold as snacks. However they are prepared to buy dried fruits if they are produced with organic certification.

Of the 12 education institutes and schools that were interviewed, all expressed that greater awareness programs on health issues should be promoted by the processor who supply such products to educational institutes so that students derive healthy balanced diet from the products sold in school canteens. The school authorities expressed that vigorous advertisements on the nutrition content of the



**Sun dried half ripe mango
produced locally**

dried fruits and other produce should be highlighted and its importance in terms of health of students and teachers and for everyone else in the organization.

The dried sample of half-ripe mangos shown in the photograph is sold to consumers for use as additives in cooking dhal soup or pumpkin curry for additional flavors and is a delicacy in Indian dishes. Others use dried mangos to blend with tamarind for chutney.

Heaps of such dried fruit were observed to be sold at the Labasa market and other municipal markets in Fiji. The price of a heap of dried mangos was \$2.00. Each heap weighed 100 grams and equivalent to \$10.00 per kilogram

During the survey for market outlets, of the 10 hotels/motels in the Northern Division 5 hotels in Labasa expressed low tourist occupancy therefore selling dried fruits to tourist will not be a viable venture because tourist occupancy was rated from only 3 to 5 percent annually. The main reason for low occupancy was due to:

1. Lack of resorts around Labasa
2. No international airport in Labasa
3. No port of entry for tourist cruiser liners
4. Lack of government support to improve and enhance amenities for tourists on attractive sites like the one tree island, the three sisters mountain etc.

However in the Savusavu area through desk research 5 hotels and 3 souvenir shops had reported a higher number of tourist arrivals with a possibility of tourist demand for dried certified organic fruits provided the products are well supported with creating awareness and vigorous promotional issues on health issues pertaining to the dried fruit products

A similar response was obtained from 6 resorts/hotels and duty free shops at the international airport in the Western Division. The Fiji Visitors' Bureau recorded 539,255 visitor arrivals in 2007 and 48,964 visitor arrivals (from January to October) in 2008.

As discussed earlier, opportunities exist for dried fruits in the international niche markets where health foods are in high demand. The organic growing and processing of dried fruits could open up such opportunities in the global markets. This should be explored further as the industry expands to compete in the global markets. Table E below shows the import data of dried tropical fruits in Europe and the US.

Table E
Estimated Import Market Size of Dried Tropical Fruits in Europe and the US in tonnes (MTs)

Market	Total Imports (MTs)	Comments
Belgium	300	Principal items are banana, pineapples and Papaya
France	1800-2800	Banana chips (600-800) Papaya (500-800) Pineapples (500-800) Other (299-400)
Germany	3,500	Banana chips 1500 Other (2000)
Netherlands	1600-1800	Banana chips (600-800) Other 1000
Switzerland	150	-
UK	3500	Banana chips 1500 Other 2000
USA	4500-6000	Banana chips 3000-4000 Other 1500-2000

Source: ADC Commercialization Bulletin # 11, 2001

According to Brinza (2008), the European Market offers some distinct opportunities for: 1) producers and importers of organic products; 2) processors and packers in countries of origin who are more cost effective in value-adding because of the competitive advantage of the lower labor costs. While adding value and taking advantage of the low labor costs, going organic will be a very large challenge for producers in Fiji because of the absence of legal framework and nonexistent production infrastructure of inputs and technologies.

According to Blagg (2007) there is a projected significant increase in dried fruit sales due to consumers seeking out healthier food alternatives (especially healthy snack foods). Table F below gives an indication of the quantities of dried fruits that were consumed by different countries in 2006 as specified:

Table F
2006 Major Consuming Dried Fruit Countries

United States	286,200 MT
United Kingdom	160,000 MT
Germany	105,000 MT
Scandinavia	70,000 MT
China	120,000 MT
Japan	38,000 MT
Total	779,200 MT

Source: Adobe Reader-[SOTIC_2007_LarryBlagg.pdf] viewed 28/12/2008

The European Union is a strong net importer of dried fruits (Brinza 2008).

Exporters and processors in developing countries should be aware of the requirements of their trading partners and the EU. Brinza (2008) further asserts that these requirements are established through legislation and through codes, labels and management systems. These requirements are based on environmental, consumer health and safety, social and economic concerns.

It is apparent that tropical fruits only comprise 4 to 5% of the total market for dried fruits, indicating reasonable potential for expansion, especially for brightly coloured fruits such as Fiji red papaya as a dried diced ingredient for muesli mixes.

Constraints

The constraints facing the development of a dried fruit industry in Fiji include:

- High product losses experienced during post harvest handling and during transportation
- Lack of appropriate driers for consistent quality and handling large quantities
- Unpredictable weather patterns in the wet zone that affect drying through solar driers as well as seasonal cyclone threats
- Poor infrastructure and processing facilities
- Seasonality of two key fruits, viz. mangos and pineapples
- High capital costs
- Establishing organic certification
- High freight and transportation costs
- Poor market information system
- Competition from imported fruit flavors for processing in confectionery, dairy and soft drink industry.

Steps in the production process and estimated costs of production, means of obtaining premium price, packaging and labeling of Fiji dried fruits.

Steps in the production process for dried fruits

According to ADC Commercialization Bulletin #11(2001), the steps in the production process of dried fruits (non-organic) are listed as follows:

1. Selection and purchase of fruits
2. Sorting
3. Washing- (1%-10% salt water solution; 0.1%-5% soda water solution or hot water)
4. Peeling
5. Coring , removal of stones / seeds
6. Cutting of fruits (according to buyer specifications)
7. Blanching (using a method that meets buyer specifications- boiling in acidified water or steam, placing fruits over burning sulphur, or immersing in sulphited water solution).
8. Drying either through solar or conventional means
9. Cooling
10. Sorting and grading for local and export markets, packaging and packing.
11. Storage and transportation (if the product has high moisture content and a preservative has not been used, cold storage may be required).

Estimated cost of production for one kilogram of dried fruit

In the production of one Kilogram of dried fruits the following costs have been estimated for pineapples:

Activity	Cost (\$)
Selection and purchase	0.02
sorting	0.02
Cutting of fruits (according to buyer specifications)	0.03
Washing- (1%-10% salt water solution; 0.1%-5% soda water solution or hot water)	0.02
Peeling	0.02
Coring , removal of stones / seeds	0.02
Blanching (using a method that meets buyer specifications- boiling in acidified water or steam, placing fruits over burning sulphur, or immersing in sulphited water solution)	0.03
Grading for local and export markets, packaging and packing.	0.02

Source: Developed for this study

The estimated cost of \$0.18 is based on one labor carrying out the above activities to obtain one kilogram of dried fruit. Assuming that 10 fresh ripe pineapples cost \$5.00 (and each pineapple weighing around 1 Kg) would mean that each pineapple would cost \$0.50. In order to derive 1 Kg of dried pineapples it would require around 9-10 Kg of fresh pineapples (ADC Commercialization Bulletin #11 2001). This then gives an indication that the estimated cost of drying to obtain 1 Kg of dried pineapple is around 36% (\$1.80) of the total cost of pineapples which is \$5.00.

Therefore the total cost of producing one kilogram of dried pineapples would in essence be \$5.00 (cost of pineapples) plus \$1.80 (processing cost) = \$ F 6.80 and which means that the processors need to further add other costs such as packaging, labeling, transportation, etc. before the final selling price can be determined.

4.3 Means of obtaining premium prices for Fiji dried fruits in export markets

As discussed earlier in Section 3.3 quality is one of the important issues in regards to competition in local and export markets. Some of the means of obtaining premium prices in export markets is ensure production of high quality produce and to create a competitive advantage over competitors that cannot and will not match Fiji dried fruits. According to Kotler (2003), any competitive advantage must be seen as a customer advantage. The Fiji dried fruit processor could operate at the high-quality ends of the market. Rather than being a follower in large markets, Fiji dried fruit processor can be a leader in niche markets. In this market situation it will avoid competing with giant companies by targeting small markets which will be of little or no interest to the giant companies and as a supplier of ingredients. The competitive advantage can be obtained through excellent branding, labeling, packaging and above all having the best quality fruits for processing in terms of its size, shape, color, appearance, texture and taste.

4.4 Packaging and labeling of Fiji dried fruits



Sample of attractive packaging

According to Kotler (2003), perhaps the most distinctive skill of professional marketers is their ability to create, maintain, protect and enhance brands. Branding is the art and cornerstone of marketing. Kotler (2003) further emphasizes that well known brands command a price premium e.g. the Japanese companies such as Sony and Toyota have built a huge brand-loyalty market. For Fiji dried fruits it would be very important to insert the word “Fiji” to any established brand name to clearly distinguish the product from producers of similar products from other countries while at the same time creating awareness and advertising Fiji products.

A perfect example of success is “Fiji Water” which is doing extremely well in the US.

In terms of Objective 7 of the study it is very important to ensure that Fiji dried fruits are properly packaged and labeled. Most marketers treat packaging and labeling as an element of product strategy. Well designed packaging can create convenience and promotional value. Various factors have been contributed to the growing use of packaging as a marketing tool. Kotler (2003) discusses four such elements of product strategy:

- Self-service: An increasing number of products are sold on a self service basis particularly in large supermarkets. The package must perform many of the sales tasks: attract attention, describe the product’s features, create consumer confidence, and make a favorable overall impression.
- Consumer affluence: Rising consumer affluence means consumers are willing to pay a little more for the convenience, appearance, dependability, and prestige of better packages.
- Company and brand image: Packages contribute to instant recognition of the company or brand.
- Innovation opportunity: Innovative packaging can bring large benefits to consumers and profits to producers.

In so far as package sizes of dried fruits it is important to consider the choice of buyers and their customers in export markets. According to ADC Commercialization Bulletin #11 (2001) selected UK retail stores sell varying sizes of packages ranging from 50g to 500g. The Table below shows the package sizes of various dried fruits sold in some supermarkets in UK as in the Table below.

Varying Sizes of Packages in UK Supermarkets

Outlet	Product	Source	Unit size
Saisbury's	Papaya, mango and banana	Thailand	250 g
	Mango	Various	
	Pineapple & “Exotic Mix”	Philippines	
Honey coated banana chips	125 g		
Holland & Barrett	Whole Sun-dried bananas	Vietnam	240 g
			Pineapples and Papaya
	Fruit Mix (pineapples, Papaya, dates, apricot, raisins and banana)	Thailand	125 g
		Thailand	100 g
Marks & Spencer	Mango	Various	500 g
			4 dried fruits

Source: ADC Commercialization Bulletin #11, 2001

Similar package sizes as suggested above for UK retail outlets can be used by the dried fruit processor in Fiji for the export markets. The same package sizes can be used for the local markets, however, some school canteens prefer smaller package sizes of around 10 g so that students would be in a position to buy them as snacks during morning recess or lunch break.

Labels perform several functions such as identifying the product or brand, describing the product or grade the product and specifying its safety. Labeling needs to be updated as innovative features are added to the product. Under the legal framework in the US processed food producers are required to include nutritional labeling that clearly states the amount of proteins, fats, carbohydrates, and calories contained in the products, as well as their vitamins and mineral contents as a percentage of the recommended daily allowance (Kotler 2003). Most countries are now adopting similar legislations to the US in order to open up market access for their processed products abroad. The Fair Trading Act prohibits misleading packs. The dried fruit processor needs to be wary of the above labeling requirements prior to designing labels for the packages.

A perfect example of an ideal packaging sizes and labeling features used by the Angas Park Fruit Company Pty Ltd, Australia is shown below. The nutritional contents of the dried fruits are clearly specified at the back of the package.

Example of preferred package sizes, labelling and nutritional information

		NUTRITIONAL INFORMATION	
			per 100g
	Energy		835kJ
	Protein		4.3g
	Fat		
	<i>total</i>		< 1g
	<i>sat. fatty acids</i>		< 1g
	<i>trans. fatty acids</i>		< 1g
	<i>poly. fatty acids</i>		< 1g
	<i>mono fatty acids</i>		< 1g
	Cholesterol		0mg
	Carbohydrates		
	<i>total</i>		44.4g
	<i>sugars</i>		40.5g
	Dietary Fibre		9.1g
	Sodium		37mg
	Potassium		1510mg
	Iron		3.1mg
	Niacin		2.5mg
	Vitamin A		400ug



Other fruit products

Fruit Slices



Lemon



Citrus



Water Melon



Orange



Mixed fruits



Pineapple

Fruit slice pink grapefruit

The above photographs were downloaded from the Internet to illustrate candies as the final product and manufactured from fresh fruit extractions (www.candy4u.com viewed 08/01/2009).

To obtain fresh cuts and cubes of Papaya a papaya cutting machine can be purchased at a relatively reasonable price. An example of such machine is shown below.

Packaging Solution

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PAPAYA CUBES EQUIPMENT

For cubing the papaya at faster rate in symmetrical shapes we have the special papaya cuber. This helps us in meeting the needs of the fruit processing industry. They are competitively priced and can be customized as per the needs of the clients.

Fruits Cuber

Suitable for making cubes (tutti-fruity) from papaya, carrot and apple, these special cutters are used in food processing industry. They have the capacity of 1-2 T/hr and can be customized as per the needs o the clients.



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Cooking Kettles Juice



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- Papaya Cubes Equipment
- Fruits Cuber
- Dehydration Equipment
- Pouch Packaging & Sterilization Equipment



Fruit Medley



Premium trail mix



California dried fruit medley

Premium Tropical Dried Fruit Medley is sealed in vacuum plastic bags for maintaining freshness. A bag of premium tropical dried fruit medley sells at \$US20.00 for 5 pounds in the USA. Tropical dried fruit medley could also be produced and sold in diced form for ready incorporation to breakfast cereals and for baking.

Muesli

“Muesli [*'mju:zli*] is a popular [breakfast cereal](#) based on uncooked [rolled oats](#), fruit and nuts”
(From Wikipedia, the free encyclopedia).

‘Packaged muesli is a loose mixture of mainly [rolled oats](#) together with various pieces of dried [fruit](#), [nuts](#), and [seeds](#). It commonly contains other rolled [cereal](#) grains such as [wheat](#) or [rye](#) flakes as well. There are many varieties, some of which also contain [honey](#), [spices](#), or [chocolate](#).

This dry packaged muesli can be stored for many months. It can be served quickly after mixing it with [milk](#), [yogurt](#), [coffee](#), [hot chocolate](#), or [fruit juice](#) and (if desired) pieces of fresh fruit. Alternatively, the mix may be soaked overnight in milk and then served with fresh fruit or [compote](#) to taste’.

The above extract from Wikipedia, viewed 26/01/2009 is a helpful guidance for the processor of the four major dried fruits namely pineapples, bananas, Papayas, mangos to manufacture packaged muesli with a mixture of rolled oats, nuts etc. and supply these to the hotel industry.



Dry muesli mix, served with milk and banana

The above picture shows the use of dry muesli mix as a tasty breakfast cereal.



Product ID: jo8 **Category:** No
**Jordans Luxury Fruit a
Nuts Muesli 400g**
Description: Jordans Luxury Fru

Jordans Luxury Fruit and Nuts Muesli 4
uesli 400g

(Jordans Luxury Fruit and Nuts Muesli 400g.ht

The packages shown on pages 38 and 39 are examples of Jordans Natural Muesli and Luxury Fruit and Nuts muesli with all the labeling features including health issues and the prices of the packs are clearly .defined in tremns of .their weights



Product

ID: jo6 **Category:** No Category

Jordans Natural Muesli 1kg

Description: Jordans Natural Muesli 850g

Price: \$9.25

(Jordans Natural Muesli 1kg.htm)

The packages shown on pages 38 and 39 are examples of Jordans Natural Muesli and Luxury Fruit and Nuts muesli with all the labeling features including health issues and the price per kilogram pack are clearly defined.

Fruit Leather

Fruit leather is a nutritious treat for people of all ages. Fruit leather can be made using either fresh, canned or dried fruits. Many fruits can be used for fruit leather including mangos, bananas, Papayas, pineapples, oranges, tomatoes etc.

According to Raab & Oheler (1999), fruit leather can be made easily at home using the following equipment:

- Shallow pans (about 30 cm x 45 cm)
- Plastic wrap
- Electric blenders or food mill
- Double boiler for cooking the puree
- Large heavy saucepan for concentrating the puree
- Nylon net or cheesecloth for sun drying

In selecting and preparing fresh fruits, the following steps are recommended:

- Select fruits that are ripe but not spoiled. You can use fruits with minor blemishes and bruises that are not suitable for canning or freezing if you remove the imperfections
- Sort and wash. Remove stems.
- Cut away blemishes.
- Pare or peel if necessary. Peel pineapples and bananas and Papaya; peel citrus and remove white membrane.
- Pit, core, or remove seeds if necessary. Core pineapples; remove seeds e.g. from Papayas, citrus.
- Mangoes can be mechanically pulped with seed and skin removed.

- Cut fruits into slices or chunks that can be pureed or ground easily.
- Make the puree immediately to avoid excessive browning.

Making fresh fruit puree

Fresh fruit puree can be made by either cooked or the uncooked method. The color of light fruits may be better if preserved by the cooked method. This method is also more satisfactory for hard fruits that must be softened before being pureed. The uncooked method is faster, however.

Cooked method

Fruit can be pureed when hot (*hot break* method) or when cold (*cold break* method). The result will be different. The hot break method retains more of the natural fruit flavor or preserves the light colors of fruit. The cold break method is faster, however.

Uncooked method

Pieces of raw fruit are pureed in a blender using the appropriate speed or grinding in a food mill using the finest blade. Run fruit puree through a strainer if desired to remove seeds. Juicy puree can be concentrated by following the instruction below.

Concentrating the puree:

Juicy puree can be concentrated to shorten the drying time. Place the ground or pureed fruit in a heavy deep saucepan. (If desired, add one tablespoon sugar to each one and a quarter cups of puree to decrease cooking time.) Cook the puree over low heat stirring constantly until the mixture thickens. Remove from heat and cool.

To preserve color ascorbic acid (vitamin C) can be added. Flavor can also be added to puree (sugar or honey can be added to sweeten the puree).

Drying the puree

- Line shallow pans (e.g. 30 x 45 cm) with plastic wraps. (Each sheet will hold 2 cups of puree)
- Pour puree on the plastic wrap and spread to 3- 6 mm thickness
- Dry in an oven or dehydrator or under direct sunlight. (Note the plastic wraps will not melt at low drying temperatures)
- The leather should feel tacky but should not contain any moisture.

Storing the fruit leather

To store whole sheets of fruit leather, roll like a scroll within the plastic wrap. If bite-size pieces are needed for snack cut one inch slices from rolled fruit leather.

Store fruit leather in plastic freezer bags or tightly sealed containers.

5.5 Machines for extracting pulps for fruit leather

In order to produce fruit leather on a commercial basis pulp extracting machines could be used to enhance production levels of puree to cater for the manufacture of various types of fruit leather to meet market demands.

Because there is an abundance of ripe mangos during season a mango pulp machine can be used to extract large volumes of ripe mango pulp to make puree for manufacturing fruit leather.. This type of machine will separate the pulp with seeds and skin as bi-products. Mangos with slight bruises and blemishes can also be used in this process. Other fruits can also be used for producing dried fruits. Examples of pulp extracting machines and details downloaded from the Internet are shown below.

Pulp Machines

Mango pulp machine is for those Countries where mango production is tremendous & sometimes mangoes are not processed or eaten. Mango is king of all the fruits & just by using this machine of 300 Kg. mango processing capacity per hour you can get fresh Mango pulp from ripe mango & on the other side you get skin & big seed of mango as by product. In India in big cities thousand of shops & dairies selling fresh mango pulp prepared in the morning sold out within the same day & consumed by consumer almost same day. Same system should work in all mango producing Countries. Mango pulp after heating to high temperature & then little cooled down can also be packed in tins & can be sold in shops & pulp retains the taste for about 9 months. This is also wonderful business.

[View Enquiry Basket](#) **Mango Pulp Machine**



Machine is highly efficient & made of stainless steel.
Works by single phase electric motor.

TINYTECH PLANTS

Description

We offer mango pulp machines, fabricated using qualitative stainless steel these machines are used for extracting pulp from mango. Our machines are highly durable and perform efficiently with a capacity of extracting pulp from 100 kg to 2000 kg mangoes per hour. These machines are in line with latest technological development and can be customized as per the specifications of our clients.

For more details please contact us.

Contact Information

Contact Person	Mr. Gopal Desai
Designation	Partner
Address	TAGORE ROAD, RAJKOT - 360002, GUJARAT, INDIA
Phone Number	91-281-2480166
Mobile	+919227606264
Fax	91-281-2467552
Website	http://www.tinytechindia.com
Year Established	1982
Bankers	CORPORATION BANK

PROCESS MASTERS EQUIPMENT (INDIA) PVT. LTD.

Subject : Mango Destonner



Description

We manufacture and export mango destonner. These mango destonner are used for the extraction of mango pulp from whole mangoes. The whole mangoes open up automatically in the crushing zone and is further transferred in the pulp extraction zone. We provide these vibration free mango destonner in different capacities.

For more information, contact us.

Contact Information

Contact Person	Mr. Sharad Ravale
Designation	Director
Address	P.NO. 37/1, BLOCK F-II, M.I.D.C., PIMPRI, PUNE - 411018, MAHARASHTRA, INDIA
Phone Number	91-20-27443647/48
Mobile	+919822841126 +919822841127
Fax	91-20-27443647/48
Website	http://www.process-masters.com
Year Established	1998
Bankers	BANK OF INDIA



**PROCESS MASTERS EQUIPMENT (INDIA)
PVT. LTD.**

Mango Processing Line



Product Code : 14



Product Specification

Mango Processing Line

We provide complete Mango processing Line for mango conveying system and mango handling system with our range of highly functional conveying system. The system can accumulate, flip, stack, rotate, push, divert or index the products between manufacturing processes. The entire system including the motor assembly in the mango Processing Line is designed for thorough food process cleaning. Further, the roller spacing allows for easy access with either hot water or air pressure. Solid faced roller surface reduces the chances of particle accumulation

Packaging Solution

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JUICE & PULP EXTRACTION

The category of juice extraction equipment, pulp extraction equipment that includes pulper, hydraulic juice press, fruit mill machine, paste making machine.

Pulper Machine

Suitable for extraction of pulp from vegetables and fruits like mango, litchi, guava, pear, tomato, passion, fruit, grape etc. They are available in different capacities as per the needs and requirements of the clients.



Hydraulic Juice Press

Cooking Kettles

Juice & Pulp Extraction
Pulper Machine
Hydraulic Juice Press
Fruit Mill Machine
Paste Making Machine
Canning Equipment
Bottling Equipment
Pickle Making Equipment
Papaya Cubes Equipment
Dehydration Equipment
Pouch Packaging & Sterilization Equipment

Showcase

View all our products / services as a slide show.
[Play Now](#)

[Add to Enquiry Basket](#)



Suitable for extraction of juice from crushed fruits like pineapple and apple etc. after crushing them in fruit mill. Available in 40 and 50 tonnes pressure capacity. (Also available roll-in-roll-out type and rotary type presses for higher capacity utilization.)

[Add to Enquiry Basket](#)

Fruit Mill Machine

Suitable for crushing hard seedless fruits before pulping or juice extraction.


Available in following models:

- PSF-120 Junior 0.5 T/hr 1HP
- PSF-121 Senior 2.0 T/hr 3HP
- PSF-122 Twin 2.0 T/hr 5HP



[Add to Enquiry Basket](#)

Paste Making Machine

	<p>Suitable for making ginger, garlic, chilly or onion paste.</p> <p>Available in 7.5 HP and 10 HP models with 50 to 250 Kg./hr. Capacity.</p>
<p>Phone No. +(91)-9310352152 Mobile No. +(91)-9818293306 / 9310252152 E-Mail: packagingsolutionindia@gmail.com</p> <p>Phone</p>	

Observations, conclusions and recommendations

Observations and conclusions

- The fruit drying industry in Fiji is in its infancy stage. The bulk of supplies of dried fruits in Fiji are derived from cheap imports of low quality dried fruits from Asian countries apart from the dried fruits used as raw material inputs for further application in breakfast cereals, bakery, desserts and confectionary products imported from Australia and New Zealand.
- Inadequacy of technologies and machinery for drying is a major issue in Fiji. The conventional method of drying agro-products in Fiji is sun drying and hot air driers, however simple solar driers have been observed to be used for research purposes and not on a commercial basis.
- The dry zones of the Fiji Islands have the favorable weather conditions for developing appropriate solar driers with the right specifications for drying fruits to suit the size of the industry in terms of the production schedule for the supply of fruits for commercial production in Fiji.
- The major market for dried fruits in Fiji is initially the local market. Insofar as export markets are concerned, the EU is a strong importer of dried fruits, however, exporters need to comply with EU regulations. The Australian, NZ and USA markets also warrant investigation, especially for fruit leather and as ingredients for muesli mixes and baking.
- Impediments and threats that exist to the development of dried fruit industry in Fiji are:
 1. Lack of adequate finance to establish appropriate driers and state of the art processing, grading, packaging and labeling facilities.
 2. Lack of co-ordination with the relevant authorities to establish links with growers for consistency of high quality and reliable supply of produce for the industry.
 3. Weak regulatory basis and unavailability of organic inputs for developing organic production.

4. Poor storage infrastructure.
 5. Lack of culture for quality.
- The processors of fruits in Fiji lack the knowledge and skills on dried fruit production
 - Labeling standards can be further improved to be competitive in export markets.
 - There is a lack of coordination amongst various stakeholders to drive the agro-industry forward. All stakeholders in the agro-industry need to work together to bring improvements in the industry.
 - Cheap imports from Asian countries dominate the imports of dried fruits that are sold throughout Fiji and with little regard to nutritional or health issues. Growers need to be encouraged to cultivate agro-produce through the use of organic inputs to maintain health standards and certification to obtain premium prices in the world markets.
 - There is a lot of wastage of agro-produce due to post-harvest losses through lack of proper handling, transportation, and storage facilities. A lot of training and development programs need to be put in place to bring about improvements in these areas.
 - The quality of agro-produce is generally poor. There is a genuine need to bring about improvements through the use of GAP (Good Agricultural Practices) as well as GMP (Good Manufacturing Practices).
 - Reject ripe fruits of different varieties with minor blemishes and bruises that are not suitable for exports, canning, or freezing (if the imperfections are removed) it can be used to manufacture fruit leather or dried fruit medley.
 - Vanua Levu has a huge potential to supply the major fruits for the dry fruit industry as land and fruits are available in abundance in the dry zone and market seems to be a limiting factor for production.

Recommendations

- **Purchase fruit supply (mangos, Papayas, pineapples and bananas) from the Western, Central and Northern Divisions.** Mangos, Papayas, and pineapples are cultivated ideally in the drier zone particularly in the Western and Northern Divisions of the Fiji Islands. Bananas are also cultivated in the dry zone but do better in the wet zone. Pineapples and Papaya are also grown commercially in the wet zone as well. These major fruits can be sourced from the geographical regions specified above.
- **Purchase fruits from the major selling points.** The four major fruits for the dried fruit industry: mangos, Papayas, bananas and pineapples are available in all municipal markets and roadside stalls throughout Fiji. Ten percent of the HTFA reject fruits are sold by exporters in municipal markets. This could be purchased by the processor of dried fruits to manufacture value added dried fruits in the form of whole, slices, dices and chunks, fruit medley and fruit leather.
- **Encourage greater plantings and production of varieties of tropical fruits best suited for preservation through drying.**
- **Commence production of dried fruit snacks for schools with major emphasis on nutritional value and health issues to compete against cheap Asian products such as dried and flavored mango skin, Papaya skin, dried and flavored ginger slices etc.**
- **Contract growers to supply the quantity and quality fruits consistently throughout the year and/or during season.** Processors and exporters should work closely with the Ministry of Agriculture in contracting farmers to supply quality and quantity of fruits consistently throughout the year or season of fruiting through well organized and planned staggered plantings of commodities using Good Agricultural Practices (GAP). The Ministry of Agriculture

should assist processors in ensuring that growers adhere to the program and monitor quality control through reducing post harvest losses and appropriate certification.

- **FRIEND gets involved in strengthening research and development to design cost effective driers for dried fruit industry in Fiji through its collaboration with FACT.** The processors should launch their own R& D programs or seek donor assistance and expertise to develop appropriate driers.
- **Establish solar driers in Lautoka as the best site in the Western Division for ease of transportation of bulk of the produce.** According to meteorological data the Western and Northern Divisions have less rain days and high sunshine hours making them an ideal locations for solar driers to be constructed and set up for commercial production of dried fruits. The meteorological data affirms that the Western Division around Nadi would be ideal and Lautoka being in close proximity would be excellent because it is the central location for the Western Division and for ease of transportation of the produce.
- **Establish solar driers in Seaqaqa as the best site in the Northern Division for ease of transportation of bulk of the produce in the North.**

It is highly recommended that processors who intend to get into dried fruit production set up a solar drying facility in the North to be located in Seaqaqa which is the major fruit producing area in the North as well as being the central location in Vanua Levu. It would be too expensive an operation to transport produce from the North to Lautoka as this would incur high transportation costs as well affecting the quality of the produce through post-harvest losses. The basic infrastructure at Seaqaqa is already in place which includes storage facilities, and 3 phase cooler systems which the government has no intention to use. It would be opportune to assist the rural communities of the Northern Division to revive the economic activities in the farming areas through provision of employment and income generation. Mangos are plentiful and the potential for pineapples, Papayas, and bananas are huge should markets be linked to growers and tree owners in the North through this venture.

- **Participate in trainings of dried fruit processors particularly quality control and Good Manufacturing Practices (GMP) in order to meet HACCP (Hazard Analysis and Critical Control Point) compliance and international CODEX requirements.**
Processors should participate in continuous trainings in dried fruit processing especially in quality control to acquire Good Manufacturing Practices (GMP) in order to meet international requirements. It is advisable for the processor to visit and observe operations in a successful dried fruit processor complex abroad.
- **Get involved in fruit production.** Processors should establish special agreements with supply line growers. This would permit full control over the supply of raw materials. By establishing the special agreement the processors will be able to participate in the raw material growing processes through sharing production expenses and ensuring good quality produce is supplied consistently. Processors should in consultation with the extension advisory service of the Ministry of Agriculture assist growers in the use of GAP and reducing post harvest losses as well as enhancing the handling, processing and storage of fruits.
- **Use the following varieties of the four major fruits for the dried fruit industry:**
 1. **Mangos-Local varieties include Fiji Mango, Peach Mango, and Baramasia. The exotic varieties of mango best suited for drying are Carabao, Tahitian, Tommy Atkins and the hybrid mango.** These varieties are favored for drying because of their taste, fleshiness and less fibrous nature of the ripe fruits.

2. **Papaya-Sunrise (Fiji Red) and Sunset (Waimanalo).** These two varieties are favored for drying because of its good eating quality and bright red and orange colors, respectively, when ripe and dried.
 3. **Pineapples- Smooth Cayenne and Ripley Queen are the two most popular varieties grown and should be used to manufacture dried fruits.** Ripley Queen is a sweet variety of pineapple and has good flavor and is preferred for eating whilst Smooth Cayenne is pulpy and juicy.
 4. **Bananas-FHIA 1 (Goldfinger), Long Finger Green and Lady's Fingers (Liga Ni Marama) are recommended for drying.** These varieties are sweet, pulpy, good taste, and good keeping quality.
Note: Drying of fruits strongly concentrates natural sugars (mainly fructose). Excessively sweet dried fruits may prove attractive to local markets (especially as more nutritious alternative to lollies etc), but less sweet dried fruits will have better opportunities for export to health-conscious consumers in Western markets.
- **Capitalize on local market outlets as well as export markets.** The local market outlets are numerous and cheap imports can be replaced by producing and manufacturing nutritious dried fruit products and creating awareness on health issues, quality of products and through attractive packaging, labeling and branding with "Fiji" in the forefront to be synonymous to being produced in a "Pollution- Free Environment". Create a competitive edge in both local and export markets to motivate and convince consumers that 'Fiji' product is superior to others and unique because it is grown in a pollution free environment with no or very little artificial agro-inputs applied to it.
 - **Diversify into processing of fruit leather, dried fruit medley, sliced fruits and muesli to minimize wastage of fruits by making use of all fruit purchased.**
 Fruits which are not of export quality can be further processed and blended with other fruits flavors to make fruit juices. Fruit medley, fruit leather and muesli are the main products of dried fruits that can be incorporated in the plan for dried fruit production.
 - **Use effective branding, labeling and packaging in developing a competitive advantage for dried fruit and other fruit produce against competitors.**
 Branding should include "FIJI" to distinguish and promote Fiji dried fruits and fruit produce in export markets. The labels should be attractive, colorful and striking bearing all nutrient contents of the produce in the package. Package sizes should vary to suit customers' needs and preferences to obtain premium price for Fiji dried fruits.
 - **Explore organic opportunities for fruit production for premium price in export markets.** This task will be difficult to achieve because there is no legal framework as yet. There is no local expertise in terms of technologies and inputs, however, in order to compete successfully in the world market it is imperative to work vigorously towards organic farming. Processors, exporters and growers need to work together towards achieving this goal. There are a lot of incentives to working in this segment because the prices of organic products are significantly higher than the traditional product.
 - **Commence trials as a pilot scheme to produce organically grown seasonal and perennial fruits at the new property of FRIEND and in partnership with growers in various locations.**
 Assistance should be sought from FACT/SPC and/or MAFF, Fiji to acquire knowledge and skills necessary for producing organically grown fruits.

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Wholesale bulk dried fruits, Apples, Coconut, Papaya, Pineapple, www.bulkfoods.com

www.candy4u.com

Annexes

Annex I

Export figures for agricultural commodities through HTFA treatment at Namaka, Nadi, Fiji.

Table 1- 2004 Exports

NATURES WAY CO-OPERATIVE [FIJI] LTD

EXPORT FIGURES FOR YEAR 2004 AND 2005						
2004 /KG	EGGPLANT	PAPAYA	PAPAYA	MANGO	BREADFRUIT	TOTAL
		N.ZEALAND	AUSTRALIA			
JANUARY	24,502	17,433	0	12,952	587	55,474
FEBRUARY	11,607	17,087	0	0	4,142	32,836
MARCH	24,003	13,087	0	0	2,466	39,556
APRIL	24,273	15,386	0	0	310	39,969
MAY	36,507	17,989	0	0	1,702	56,198
JUNE	28,732	12,526	0	0	534	41,792
JULY	35,993	14,477	0	0	0	50,470
AUGUST	45,704	18,644	0	3,075	0	67,423
SEPTEMBER	40,603	21,783	0	3,115	0	65,501
OCTOBER	38,522	28,897	5,125	4,098	0	76,642
NOVEMBER	24,012	34,579	8,285	819	0	67,695
DECEMBER	27,052	26,346	5,365	4,131	0	62,894
TOTAL	361,510	238,234	18,775	28,190	9,936	656,645

Table 2- 2005 Exports

2005 / KG	EGGPLANT	PAPAYA	PAPAYA	MANGO	BREADFRUIT	TOTAL
		N.ZEALAND	AUSTRALIA			
JANUARY	29,502	26,064	5,185	7,449	0	68,200
FEBRUARY	21,998	21,414	6,165	2,603	5,468	57,648
MARCH	20,916	17,557	2,590	0	5,425	46,488
APRIL	18,551	12,827	0	0	1,216	32,594
MAY	31,643	10,163	0	0	0	41,806
JUNE	34,847	25,942	0	0	0	60,789
JULY	35,302	22,306	1,240	0	0	58,848
AUGUST	64,368	18,322	2,600	3,070	0	88,360
SEPTEMBER	39,990	31,460	1,300	11,044	0	83,794
OCTOBER	47,610	27,762	5,470	8,717	0	89,559
NOVEMBER	40,642	37,133	10,175	1,568	0	89,518
DECEMBER	38,336	31,722	3,385	3,572	0	77,015
TOTAL	423,705	282,672	38,110	38,023	12,109	794,619

Table 3- 2006 Exports

NATURES WAY CO-OPERATIVE [FIJI] LTD

CERTIFIED FRUIT EXPORT AT H.T.F.A.

EXPORT FIGURES FOR YEAR 2006 AND 2007

2006 /KG	EGGPLANT	PAPAYA	PAPAYA	MANGO	BREADFRUIT	TOTAL
		N.ZEALAND	AUSTRALIA			
JANUARY	30,016	24,394	3,385	1,467	980	60,242
FEBRUARY	29,247	25,862	3,385	0	1,085	59,579
MARCH	23,261	23,151	13,210	0	2,158	61,780
APRIL	24,252	23,308	27,916	0	455	75,931
MAY	45,339	25,502	30,657	0	0	101,498
JUNE	41,735	26,306	44,742.00	0	0	112,783
JULY	38,241	14,944	42,527	0	0	95,712
AUGUST	41,856	17,730	37,966.50	8,089	0	105,641
SEPTEMBER	42,502	22,176	37,726	13,337	0	115,741
OCTOBER	44,961	24,283	71,259	10,905	0	151,408
NOVEMBER	39,852	30,842	57,110	4,405	0	132,209
DECEMBER	35,247	27,411	36,895	4,405	0	103,958
TOTAL	436,509	285,908	406,779	42,608	4,678	1,176,482

Table 4- 2007 Exports

2007 / KG	EGGPLANT	PAPAYA	PAPAYA	MANGO	BREADFRUIT	TOTAL
		N.ZEALAND	AUSTRALIA			
JANUARY	36,363	27,610	28,650	0	2,457	95,080
FEBRUARY	31,581	23,134	24,820	0	552	80,087
MARCH	24,254	15,173	22,138	0	3,688	65,253
APRIL	13,077	15,527	9,159	0	6,107	43,870
MAY	34,435	20,019	18,914	0	0	73,368
JUNE	40,231	14,524	10,962.50	0	0	65,718
JULY	26,369	14,480	19,887	0	0	60,736
AUGUST	45,891	15,754	35,750	8,958	0	106,353
SEPTEMBER	52,322	13,509	23,861	8,853	0	98,545
OCTOBER	64,640	24,545	28,421	5,359	0	122,965
NOVEMBER	49,813	25,619	32,100	0	0	107,532
DECEMBER	42,869	20,256	12,158	0	0	75,283

Table 5- 2008 Exports

NATURES WAY CO-OPERATIVE [FIJI] LTD

EXPORT FIGURES FOR YEAR 2004 AND 2005

2008 /KG	EGGPLANT	PAPAYA		MANGO	BREADFRUIT	TOTAL
		N.ZEALAND	AUSTRALIA			
JANUARY	27,615	29,570	9,543	0	0	66,728
FEBRUARY	28,715	18,564	6,430	0	0	53,709
MARCH	22,980	16,694	8,770	0	0	48,444
APRIL	11,770	22,274	13,757	0	0	47,801
MAY	20,651	16,280	13,720	0	0	50,651
JUNE	39,068	16,730	12,170	0	0	67,968
JULY	44,040	12,449	4,920	0	2,904	64,313
AUGUST	46,500	14,977	8,535	2,882	207	73,101
SEPTEMBER	53,078	20,866	15,104	10,175	0	99,223
OCTOBER	50,202	26,706	26,025	0	6,058	108,991
NOVEMBER						
DECEMBER						
TOTAL	344,619	195,110	118,974	13,057	9,169	680,929

Table 6 –Crop Production 2006/2007**CROP PRODUCTION**

	2006(a)	2007(a)
copra (tonnes)	11,148	10,079.45
yaqona (tonnes)	1,700	3348.64
vanilla (tonnes)	19	3.6
Cassava (tonnes)	50,021	61379
Yams (tonnes)	2,572	2245.1
Kumala (tonnes)	4,749	2293.58
rice (tonnes)	12,732	14869.5
maize (tonnes)	939	303.61
peanuts (tonnes)	144	65.1
voivoi (tonnes)	60	320
pulses (tonnes)	187	88.26
coconut (tonnes)	141,946	464
dalo (tonnes)	76,156	61662.17
Immature Ginger (tonnes)	2,333	3077
Mature Ginger (tonnes)		33.45
herbs (tonnes)	0	-
tumeric (tonnes)	52	-
Assorted Vegetables (tonnes)	23,032	20645.69
Papaya (tonnes)	2,768	9091.3
Pineapple (tonnes)	3,205	2031.5
Mango (tonnes)	243	-
Cocoa (tonnes)	12	4

Dalo ni tana (tonnes)	3,976	2090
Kawai (tonnes)	138	165
Eggplant (tonnes)	1,326	1585
Chillies (tonnes)	667	486.7
Okra (tonnes)	864	428
Cowpea (tonnes)	736	125.84
Citrus (tonnes)	481	171
Banana (tonnes)	3,352	2852.02
Watermelon (tonnes)	1,689	1870.48
Passion Fruit (tonnes)	0	0
Floriculture (tonnes)	16	22.17
Pigeon Peas (tonnes)	138	267
Duruka (tonnes)	135	87.4
Bele/Rourou (tonnes)	1,107	0
Via (tonnes)	12	0
Breadfruit (tonnes)	45	0
Vudi (tonnes)	605	854.04
Kura (tonnes)	100	152.3
Masi (tonnes)	26	0

Source: Economic Planning & Statistics Division, MAFF, Fiji, 2008

Annex II

FIJI METEOROLOGICAL SERVICE

PRIVATE MAIL BAG (NAP 0351)

NADI AIRPORT, FIJI

www.met.gov.fj

Information Sheet No.51

Revision 8

24 May 2007

CLIMATOLOGICAL SUMMARY FOR NADI AIRPORT

Latitude 17° 45' 36"S

Longitude 177° 26' 42"E

Height: 19m

Station ID V77744

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC YEAR

Mean No. of Days with Thunderstorms (1970 – 2006)

10 11 12 8 3 1 1 1 1 3 5 7 63

SUNSHINE TOTALS - Hours (1947 - 2006)

Mean My Sunshine	208	184	191	198	210	206	216	229	210	231	222	222	2527
Highest My Recorded	329	264	242	278	265	259	270	300	276	304	305	296	329
Lowest My Recorded	130	107	79	108	137	161	148	144	137	128	117	115	79

SOLAR RADIATION - Mega joules (1972 - 2006)

Mean Daily Solar Red. 20.9 20.3 18.6 16.8 14.8 13.8 14.4 16.4 18.8 21.2 21.2 21.9 18.3

AIR TEMPERATURE - ° Celsius (1942 - 2006)

Mean Daily Max ^B	31.5	31.5	31.1	30.7	29.7	29.0	28.4	28.6	29.3	30.0	30.8	31.3	30.2
Mean Daily Min ^C	22.8	22.9	22.8	21.9	20.4	19.3	18.5	18.7	19.5	20.5	21.5	22.3	20.9
Mean Daily Range ^D	8.7	8.6	8.3	8.8	9.3	9.7	9.9	9.9	9.8	9.5	9.3	9.0	9.3
Mean Daily Mean	27.2	27.2	27.0	26.3	25.1	24.2	23.5	23.7	24.4	25.3	26.2	26.8	25.6
Highest Max. Temp.	37.0	35.4	35.5	34.3	33.9	33.5	34.1	34.4	34.6	35.1	36.3	37.1	37.1
Lowest Min. Temp.	16.2	18.3	17.7	16.2	13.2	12.8	11.7	11.3	12.4	14.4	15.1	17.2	11.3

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Information Sheet No. 71

Revision 4

CLIMATOLOGICAL SUMMARY FOR LABASA AIRFIELD

Latitude: 16° 28' 08"S Longitude: 179° 20' 23"E Height: 15m Station ID: V69435

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	YEAR
RAINFALL TOTALS - millimeters (1957-2006)													
Mean Total Rainfall ³⁸⁵	373	371	248	97	71	53	45	70	113	172	236	2234	
Highest Recorded		933	1068	846	645	305	264	214	153	250	491	674	1068
Lowest Recorded		40	15	68	23	7	0	1	0	5	2	20	0
Highest 1-Day ^A		245	245.4	179.8	282.3	139.1	88.9	171.2	64.0	72.4	130.0	153.0	297.1
Date of Highest		15/03	08/65	07/71	30/77	14/97	15/60	12/71	07/97	12/78	23/72	17/75	29/86

Percentiles ("p" percent of the years have rainfalls equal to or less than R (p) mm)

p = 5	R (p) =	66	76	128	38	9	4	1	2	6	10	28
52	1299											
p = 10		108	119	155	68	12	8	2	3	8	22	51
59	1405											
p = 20		182	205	217	120	22	17	9	6	17	40	83
118	1603											
p = 30		202	234	260	145	42	23	21	10	37	55	99
142	1788											
p = 40		327	261	278	230	65	34	29	16	49	80	122
158	2025											
p = 50		398	359	360	253	85	44	34	49	64	93	140
191	2218											
p = 60		443	394	424	273	108	76	43	60	69	111	163
229	2344											
p = 70		496	461	453	301	124	97	66	67	86	127	219
290	2536											
p = 80		582	526	470	347	178	111	87	74	96	154	233
319	2704											
p = 90		625	657	675	442	204	190	143	95	144	273	342
523	2887											
p = 95		809	826	747	531	241	237	201	124	193	300	414
623	3154											

Mean Number of Days with Rainfall, (1957 - 2006)

148	>=0.1 mm	19	19	20	15	9	7	6	6	8	10	14	15	
137	>=0.5 mm	18	18	20	14	8	6	5	5	7	8	12	15	
126	>=1.0 mm	17	17	18	13	7	5	4	5	6	8	11	14	
80	>=5.0 mm	12	12	13	9	4	3	2	2	4	4	6	9	
6 58	>=10.0 mm		10	9	10	6	3	2	1	1	2	3	5	
4 36	>=20.0 mm		6	6	6	4	2	1	1	1	1	2	3	
1 9	>=50.0 mm		2	2	2	1	0	0	0	0	0	0	1	
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	YEAR

Issued by: Climate Services Division

Annex III

Research information on fruit varieties

Data for banana varieties on yield/performance

BANANA AND PLANTAIN MEANS

<i>Variety</i>	<i>Pseudo stem height at harvest (m)</i>	<i>Bunch weight (kg)</i>	<i>number of hands per bunch</i>	<i>number of fingers per bunch</i>	<i>Marketable weight (Kg)</i>
FHIA 1		33	10	146	26.9
FHIA 2	3.1	26.74	8.25	121.5	26.51
FHIA 3	3.4	23.5	9.25	148	22.15
FHIA 17		14			
FHIA 18					
FHIA 23		29	10	157	22.8
FHIA 25					
TU 8		18	8	107	15.3
DWARF CHAVENDISH	2.7	10	6.5	73.5	9.2
LADY FINGER					
VEIMAMA					
GREEN TALL	2.8	14	6	41	12.01
QAMURE	3.6	8.73	4.4	22	7.37
BLUE JAVA		18.29	7.13	97.5	15.33
VUDI MIAMI		29.75	9.5	137.5	26.6
LONG FINGER GREEN	2.8	9.8	7	36	11
THICK FINGER GREEN		12.6	5	30	8.9
BLACK LEAF MARGIN		15.15	6.69	68.06	12.91
DAMU LOA		18.4			

Source: Principal Research Officer-Fruits /Vegetables, Sigatoka Research Station, Fiji Islands, (2008).

Mango varieties in Fiji

Exotic Mango varieties

- | | |
|------------------------|----------------------|
| 1. Alphonso | 24. Mapulehu |
| 2. Brooks | 25. Mulgoba |
| 3. BegumPasand | 26. Malika |
| 4. Bangalore | 27. Momi –K |
| 5. Carabao | 28. Ngowe |
| 6. Crimson Blush | 29. Neelum |
| 7. Carrie | 30. Nan Klan –Wun |
| 8. Edwards | 31. Nimrod |
| 9. Gullivar’s Triumph | 32. Nam Dorkmai |
| 10. Gouvea | 33. Ono |
| 11. Haden | 34. Pairie |
| 12. Hardie Papaya | 35. Pirie |
| 13. Hambledon | 36. Rajapura |
| 14. Julie | 37. Sensation |
| 15. Kensington | 38. Tong Dum |
| 16. Kohinoor | 39. Tahitian |
| 17. Keith | 40. Thomas |
| 18. Kent | 41. Tommy Atkins |
| 19. Lashkar Shikhan | 42. Vitomate |
| 20. Langra | 43. Vioka |
| 21. Maya | 44. Vandyke |
| 22. ManZano Ba 34a | 45. White Pirie Pope |
| 23. Gullivar’s Triumph | 46. Willard 35 |
| | 47. Zill |
| 63. Ba 36 | |
| 64. Ba 34a | |
| 65. Ba | |
| 66. .Lautoka 39a | |
| 67, .Lautoka | |
| 68. Nadi 12 | |
| 69. Uciwai Kerosene | |

Local varieties

Parrot

48. Baramasia
49. Nadi 3
50. Rakiraki 59
51. Tevita Koro
52. Rakiraki 62

Peach

53. BM Peach
54. Nadi 5
55. Nadi 1a
56. Nadi 10
57. Nadi 1
58. Nadi 6
59. Nadi 39c
60. Nadi 7

Turpentine

61. Tavua 27
62. Tavua 29

Exotic Varieties- 47

Local varieties- 22

(Source Fruits Germplasm Collection, Legalega Research Station, 2008)

Annex IV- Sample Questionnaires

**(1) Checklist for School Canteens (including tertiary institutions) / Supermarkets
/ Hotels & Motels**

1. Organization Details:

- Organization name: _____
 - Contact person: _____
 - Manager / Principal: _____
 - e-mail address: _____
 - Phone No.: _____
 - Business activities: _____

 - Experience: _____
-

2. Types of food items purchased:

3. Types of processed snacks purchased:

4. Types of dried processed fruits purchased (mango skin, Chinese lollies, Papaya skin, processed ginger lollies, dried flavored ginger skin etc.):

5. Sources of Products purchased:

6. Estimates of quantities of products purchased locally over the last 12 months (Kgs). (if applicable)

Type of product					
Quantity purchased(Kgs)					

7. Months of purchase)

Type of product	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

8. Health issues:

1. 'Nutritious snacks are good for health.' (Tick preference)

Highly disagree: _____

Disagree: _____

Unsure: _____

Agree: _____

Highly agree: _____

2. People prefer health food snacks than junk food- reduced sugars, natural products/ingredients... (Tick preference)

Highly disagree: _____

Disagree: _____

Unsure: _____

Agree: _____

Highly agree: _____

9. 'Marketing of dried local fruit is low in Fiji'(Tick preference)

Highly disagree: _____

Disagree: _____

Unsure: _____

Agree: _____

Highly agree: _____

10. Tourists will purchase healthy dried fruits (organically produced) for snacks at souvenir shops and hotels/motels. (Tick preference)

Highly disagree: _____

Disagree: _____

Unsure: _____

Agree: _____

Highly agree: _____

(2) Checklist for Exporter/Processors- Dried Fruit Study

1. Business Details:

- Company name: _____
 - Contact person: _____
 - Managing Director: _____
 - e-mail address: _____
 - Phone No.: _____
 - Business activities: _____
- Experience: _____
-

2. Sources of Products purchased (Locality/District):

3. Estimates of quantities of products purchased locally over the last 5 years (Kgs). (if applicable)

<i>Year/Commodities</i>	Mangos	Bananas	Papaya	Pineapples
<i>Year 1</i>				
<i>Year 2</i>				
<i>Year 3</i>				
<i>Year4</i>				
<i>Year5</i>				

4. Quantities of products sold for export markets (Kgs) over the last 5 years. (if applicable)

<i>Year/Commodities</i>	Mangos	Bananas	Papaya	Pineapples
<i>Year 1</i>				
<i>Year 2</i>				
<i>Year 3</i>				
<i>Year4</i>				
<i>Year5</i>				

5. Quantities of products rejected for export markets (Kgs) over the last 5 years. (if applicable)

<i>Year/Commodities</i>	Mangos	Bananas	Papaya	Pineapples

Year 1				
Year 2				
Year 3				
Year 4				
Year 5				

6. Months of purchase)

Commodity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

7. Quality Control

- Use of chemicals: _____
- Organically grown: _____
- Grading/sorting: _____
- Cleaning: _____
- Packaging: _____
- Transportation Used: _____

8. Markets supplied and channels

- Local/Export
- Countries exported to: _____
- Channels: _____

9. Main International Competitors:

- _____

10. Advantages over competitors

- System of drying (air drying, solar/electrical generation of dryers etc.) _____

11. Competitors' advantage over you

- Technology
- Packing material
- Machinery
- Costs

12. Rules and regulations:

- Taxes imposed _____

13. Constraints faced in exporting dried fruits:

- Poor drying infrastructure: _____
- Storage problem: _____
- Low technology: _____
- Marketing issues _____

14. Future plans to increase outputs:

- Securing funds
- Processing units
- Solar plants

16. **ADDITIONAL COMMENTS:**

Fruits Questionnaire (2) for MAFF Divisional Offices

Date of Survey: _____

1. Division: _____

Location of Office: _____

2. Fruits grown locally:

	Mangos	Bananas	Papaya	Pineapples
Varieties grown				

<i>Districts Commonly grown</i>				
<i>Main market outlets</i>				
<i>Number of small growers</i>				
<i>Number of commercial growers</i>				
<i>Country of export</i>				

3. Estimates of quantities of fruits sold annually in local markets (Kg)

Market name:

Mangos		Bananas		Papaya		Pineapples	
<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>

Market name:

Mangos		Bananas		Papaya		Pineapples	
<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>	<i>Variety</i>	<i>Kg</i>

--	--	--	--	--	--	--	--

Market name:

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

Roadside stalls (aggregate estimate):

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

4. Estimates of quantities of fruits sold annually in export markets (Kgs)

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

Additional information:

5. Estimate of Weekly/Monthly supply of fruits

Commodity	Quantity (Kg)
Mangos	
Bananas	
Papaya	
Pineapples	
Other	

6. Estimate of quantities (Kg) of fruits exported over the past 5 years:

Commodity	Year 1	Year 2	Year 3	Year 4	Year 5
Mangos					
Bananas					
Papaya					
Pineapples					
Other					

7. Season for maturity /availability of fruits

Commodity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mangos												
Bananas												
Papaya												
Pineapples												
Other												

8. Quality Control

- Use of chemicals: _____
- Organically grown: _____
- Grading/sorting: _____
- Cleaning: _____
- Packaging: _____
- Transportation Used: _____

9. *Markets supplied and channels*

- *Countries exported to:* _____
- *Channels:* _____

10. *Main International Competitors:*

- _____
- _____

11. *Advantages over competitors*

- *System of drying (air drying, solar/electrical generation of dryers etc.)* _____

12. *Competitors' advantage over local producers and suppliers*

- *Technology*
- *Packing material*
- *Machinery*
- *Costs*

13. *Rules and regulations:*

- *Taxes imposed* _____

14. *Constraints faced in exporting dried fruits:*

- *Poor drying infrastructure:* _____
- *Storage problem:* _____
- *Low technology:* _____
- *Labeling/packaging:* _____
- *Marketing issues* _____
- _____

15. *Future plans to increase outputs:*

- *Securing funds*
- *Processing units*
- *Solar driers*

16. ADDITIONAL COMMENTS: Fruits Questionnaire (2) for MAFF Divisional Offices

Date of Survey: _____

1. Division: _____

Location of Office: _____

2. Fruits grown locally:

	Mangos	Bananas	Papaya	Pineapples
<i>Varieties grown</i>				
<i>Districts Commonly grown</i>				
<i>Main market outlets</i>				
<i>Number of small growers</i>				
<i>Number of commercial growers</i>				
<i>Country of export</i>				

3. Estimates of quantities of fruits sold annually in local markets (Kg)

Market name:

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

--	--	--	--	--	--	--	--

Market name:

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

Market name:

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

Roadside stalls (aggregate estimate):

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

4. Estimates of quantities of fruits sold annually in export markets (Kgs)

Mangos		Bananas		Papaya		Pineapples	
Variety	Kg	Variety	Kg	Variety	Kg	Variety	Kg

Additional information:

5. Estimate of Weekly/Monthly supply of fruits

Commodity	Quantity (Kg)
Mangos	
Bananas	
Papaya	
Pineapples	
Other	

6. Estimate of quantities (Kg) of fruits exported over the past 5 years:

Commodity	Year 1	Year 2	Year 3	Year 4	Year 5
Mangos					
Bananas					
Papaya					
Pineapples					
Other					

7. Season for maturity /availability of fruits

Commodity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mangos												
Bananas												
Papaya												
Pineapples												
Other												

8. Quality Control

- Use of chemicals: _____
- Organically grown: _____
- Grading/sorting: _____
- Cleaning: _____
- Packaging: _____
- Transportation Used: _____

9. Markets supplied and channels

- Countries exported to: _____

-
- Channels: _____

10. Main International Competitors:

- _____
- _____

11. Advantages over competitors

- System of drying (air drying, solar/electrical generation of dryers etc.) _____

12. Competitors' advantage over local producers and suppliers

- Technology
- Packing material
- Machinery
- Costs

13. Rules and regulations:

- Taxes imposed _____

14. Constraints faced in exporting dried fruits:

- Poor drying infrastructure: _____
- Storage problem: _____
- Low technology: _____
- Labeling/packaging: _____
- Marketing issues _____

15. Future plans to increase outputs:

- Securing funds
- Processing units
- Solar driers

16. **ADDITIONAL COMMENTS:**