

SEMI PROCESSED OR STORED FRUITS AND VEGETABLES AS RAW MATERIALS IN THE FOOD PROCESSING INDUSTRIES AND THE CATERING SECTOR — Market opportunities in Sri Lanka

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Fruits and vegetables grow abundantly in Sri Lanka and are used either for direct consumption or processing into secondary products for the consumer market. Cultivation is seasonal, depending on the rains, there being two seasons of production namely the Maha extending from October to April and the Yala from May to September. Large quantities of produce are then available in all parts of the country, but it has been estimated that 20-30% of the country's production goes waste each year due to losses caused by several factors along the post harvest chain.

These include harvesting at an incorrect state of maturity, poor handling practices, unsatisfactory packing, lack of proper packaging, transport delays, inadequate distribution channels and unsuitable storage condition till sale.

During seasons of glut large quantities of fruits and vegetables have been seen to perish at the distant sites of production where supply rapidly exceeds the demand and distribution facilities are not available. Producer prices fall very low and in contrast in the urban areas consumers are unable to obtain their requirements of fruits and vegetables and are often compelled to pay high prices for the poor quality often deteriorating produce which reach the urban markets. This situation is even more serious in the off seasons, when large scale consumers like the fruit and

vegetable processing industries, hotels and catering establishments experience considerable difficulties in obtaining their requirements of raw materials.

Objectives and Methodology

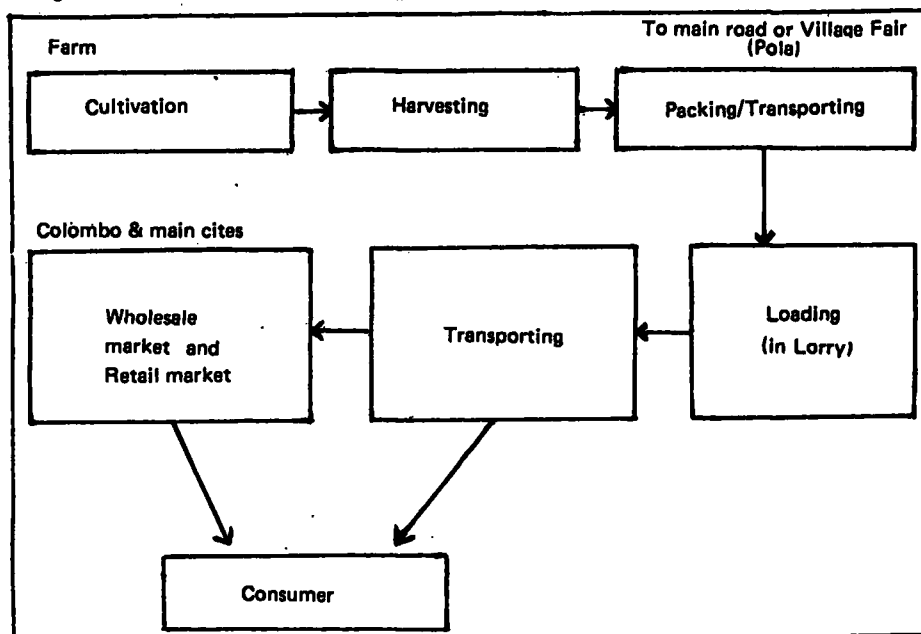
The CISIR with support from the International Development Research Centre, Canada carried out a survey of selected Fruit and Vegetable processing industries and Hotels (categorised as Industrial consumer establishments) with a view to firstly determining whether these consumers experienced any difficulties and problems in obtaining their necessary requirements of raw materials, and thereafter to seek their response to the possibility of utilizing an alternative source of supply namely preserved or stored fruit and vegetable raw material for processing/cooking. Special

techniques for the conservation and preservation of fruits and vegetables are available today which are being used in many countries. These could be introduced at the sites of production in distant areas. This leads to the concept of establishing small scale primary processing centres for the conservation or preservation of all excess produce in these different districts of production.

Briefly the techniques for preservation/conservation include:

1. Prolonged storage in the natural form by controlled atmosphere storage, prepacking and wax coating techniques. This raw material could be utilized for processing to all types of products and has wide application.
2. Storage in the form of fruit/juice or fruit pulp - by chemical preservation or freezing techniques. Products could be utilized for the manufacture of cordials, squashes, jams, preserves, chutneys and sauces.
3. Storage as whole or sliced fruit - using steeping preservation techniques. Products could be utilized for the manufacture of chutneys, pickles and preserves.
4. Storage as sliced dehydrated fruits or vegetables - using techniques of

Figure 1 FRUITS AND VEGETABLES — THE POST HARVEST CHAIN



1. FAO Report Rome, Italy, Analysis of an FAO survey of Post Harvest crop losses and developing countries 1977

solar and hot air drying. Products could be used for the manufacture of chutneys, pickles and preserves

5. Excess produce could be also processed at village level into simple products such as fruit bars, fruit leather, candies etc. which would ensure maximum utilization of these raw materials.

The necessary information in this survey was obtained by means of questionnaires, personal visits to consumer organisations and follow up by telephone and mail wherever necessary. Information on fruit and vegetable production, existing marketing channels and price variation data were obtained from the Department of Census and Statistics, Ministry of Agricultural Research, Markfed organization. Marketing Department, Central Bank and by interview with traders, commission agents, transporters and middlemen from the large wholesale markets of Colombo and Kandy.

The consumers surveyed initially included 34 industrial establishments

and 103 hotels distributed as in Table 1.

The information obtained regarding supplies and purchasing pattern of fruits and vegetables by these organisations included the following:

- fruits and vegetables utilised and products prepared.
- quantities consumed
- sources of purchase
- frequency of purchase
- location from where they were supplied
- storage period prior to use
- problems of spoilage if any in the raw materials prior to use and extent of spoilage.

The response/reaction of consumers to the newly suggested supplies of raw materials was ascertained by personal interview with production managers of 30 selected industries and with the food and beverage managers or the chefs in 30 selected hotels.

TABLE 1 - CONSUMER DISTRIBUTION

<u>Industries</u>				
Location	Small scale *	Medium scale *	Large scale *	Total
Colombo	6	5	3	14
Ja-ela, Hanwella, Kaduwatha	2	2	7	11
Kandy and the hill country	-	3	3	6
Galle	1			1
Jaffna		1	1	2
Total	9	11	14	34
*Based on capital investment -		Small scale -	Rs.0.5M capitol	
		Medium scale -	Rs.0.5-2.0.OM	
		Large scale -	Rs.2.OM	
<u>Hotels</u>				
Location	Small 0-200*	Medium 201-400*	Large 400*	Total
Ancient cities	6	3	3	12
Wild life	2	2	0	4
Kandy and hill country	11	7	3	21
Colombo	4	8	5	17
South & Southwest coast	20	10	11	41
East cost and Jaffna	4	2	2	8
Total	47	32	24	103

*number of meals served per day

Fruit and Vegetable Production and Distribution

Cultivation and production data obtained was mainly based on target estimates. However it enabled the identification of the major areas of production for different fruits and vegetable in the country. (see table 2)

An analysis of the existing marketing system is schematically represented in Figure 2 and mainly applies to the produce which enters the trade channels. There is also a considerable quantity of produce in the rural area which is consumed by the growers and rural people and which is difficult to assess accurately.

Primary producers customarily bring their fruits and vegetables by carrying them as a head load, or on a bicycle or by lorry to the main road or to the village fair or pola on specified days of the week. Generally there is no grading or sophisticated form of packaging and wholesale traders, commission agents, transport contractors, cooperative officers, Markfed officials, Marketing Department officials and individual private consumers inspect and purchase the goods. These are then despatched to Colombo and other main towns. Poor packing of produce, overloading and improper storage till sale often contributes to the increase of spoilage and shortens the shelf life of the raw materials.

Fruit and Vegetable Supplies to Industries and Hotels

Sources

The main sources of supply of fruits and vegetables to processing industries are through the middlemen or transport agents or nearest wholesale market or in a few instances the grower himself. In the 34 industries surveyed it was found that trans-

2. Dept. of Census & Statistics Agricultural Information Division.

porters or middlemen supplied raw materials to 22 industries (4 entirely and 18 partly). 17 industries (50%) had been regularly adopting the practice of purchasing produce from the nearest wholesale market and among these 7 were totally dependent on the market while the others were to some extent reliant on the middlemen and in one instance total supplies were from the grower himself. The majority (25) of the industries were located in Colombo and its suburbs and were therefore greatly dependent on the middlemen and the wholesale markets for their supplies. In contrast industries in the hill country and outstation had greater contact with the grower.

Hotels were mainly supplied by agents, that is regular suppliers who function in purchasing raw material from many sources, sort, select and grade the produce and sell them at different prices to hotels according to quality and grade. For example Grade I produce is sold at approx. 300% their cost while lower grades are priced proportionately less. Hotels also purchase produce from the nearest wholesale markets. Among the 103 hotels surveyed it was found that 48 (14%) used both sources. It was also found that hotels in the south and southwest coast of Sri Lanka relied to a greater extent on the regular suppliers while Colombo hotels obtained supplies equally from both sources. A point to be noted here is that produce reaching the consumer in the above manner has travelled through the post harvest chain and is being redistributed once again and the quality and condition of the produce would be greatly affected by the conditions prevailing and methods used during handling, packing, transport and storage prior to sale. The main point of concern being the existing gap or lack of contact between the primary producer and the end user and the lengthy channel it has to travel to reach the consumer,

TABLE 2 - MAJOR PRODUCING AREAS OF FRUITS AND VEGETABLES IN SRI LANKA

Fruit/Vegetable of Importance*	75% PRODUCTION AND ABOVE		
	Wet Zone(District)	Intermediate Zone (Districts)	Dry Zone (District)
Ash Plantain	Ratnapura, Kandy, Kegalle	Kurunegala	Monaragala, Hambantota
Beans*	Kandy, Nuwara-Eliya Ratnapura	Badulla, Matale	---
Beetroot*	Kandy, Nuwara-Eliya	Badulla	Jaffna
Bitter Gourd	Ratnapura, Gampaha, Kegalle	Kurunegala	Hambantota
Brinjal	Ratnapura	Badulla, Kurunegala	Hambantota, Monaragala
Cabbage*	Kandy, Nuwara-Eliya Ratnapura	Badulla	Jaffna
Chillies*	Kandy	Kurunegala, Matale	Anuradhapura, Jaffna, Polonnaruwa
Cucumber*	Ratnapura, Kandy	Kurunegala,	Hambantota, Monaragala
Ginger*	Gampaha, Kegalle	Kurunegala	---
Knol Kohi	Nuwara-Eliya, Kandy, Ratnapura	Badulla	---
Leafy Vegetables	Colombo, Galle, Gampaha	---	Batticaloa, Hambantota
Leeks*	Kandy, Nuwara-Eliya, Ratnapura	Badulla	---
Mustard*	Ratnapura	metale	Anuradhapura, Puttalam Moneragala
Okra	Gampaha, Kandy	Kurunegala	Batticaloa, Hambantota
Onions red*	Ratnapura	Kurunegala, Matale	Jaffna, Mullativu
Potatoes*	Nuwara-Eliya	Badulla	Jaffna
Pumpkin Ash*	Ratnapura	Kurunegala	Hambantota, Moneragala
Pumpkin Red*	---	Kurunegala	Hambantota, Moneragala, Anuradhapura, Amparei
Raddish	Kandy, Matara, Nuwara-Eliya	Badulla	Hambantota
Snake Gourd	Kandy, Ratnapura, Gampaha	Kurunegala	Hambantota, Moneragala
Tomato*	Kandy	Kurunegala, Matale	Hambantota, Moneragala
Fruits			
Bread Fruit	Galle, Kandy Kegalle, Matara	---	Hambantota
Cashew	Kalutara, Ratnapura	Kurunegala	Hambantota
Jak*	Gampaha, Degalle, Ratnapura, Galle	---	Hambantota

Fruit/Vegetable of Imprtnce*	75% PRODUCTION AND ABOVE'		
	Wet Zone(District)	Intermediate Zone (Districts)	Dry Zone (District)
Lime*	Ratnapura	Kunegala	Hambantota, Moneragala Amparai
Orange*	Gampaha	Kurunegala, Matale	Hambantota, Moneragala Puttalam
Orange*	Ratnapura, Kegalle	—	Hambantota, Moneragala
Papaya*	Ratnapura	Kurunegala, Matale	Hambantota, Moneragala
Passionfruit*	Kalutara, Gampaha, Galle	Badulla	
Pineapple*	Gampaha, Kegalle, Galle	Kurunegala, Matale	Hambantota
Plantain	Kandy, Kegalle, Ratnapura.	Kurunegala, Matale	

* Produce in demand by processing industries and hotels.

Source: 1978-1982 Department of Census & Statistics (Agricultural Information Division).

Storage of Produce and Spoilage Problems

Produce once purchased is not utilized or consumed immediately but may be stored for a short period prior to use. It was found that 28 of the industries stored purchased raw materials for over 2 days and 21 (62%) indicated serious spoilage problems. The greatest spoilage encountered by industries were with tomato, papaya, passionfruit, lime,

TABLE 3

mango and pumpkin ranging from 5-26% of the material purchase. Hotels too store raw material for short periods and all had experienced problems of spoilage. The highest spoilage was encountered with tomato, leafy vegetables such as leeks, cabbage, lettuce, cauliflower and fruits such as papaya, plantain and pineapple. The extent of spoilage ranged from 2% to 10%.

Supplies in the Off Season

It was confirmed that these consumer organisations had many problems in the off seasons when prices of fruits and vegetables increased due to the shortages. Hotels were totally dependent on their suppliers and had no means of long term storage. They were compelled to pay the higher prices demanded or as an alternative remove the corresponding product from the menu.

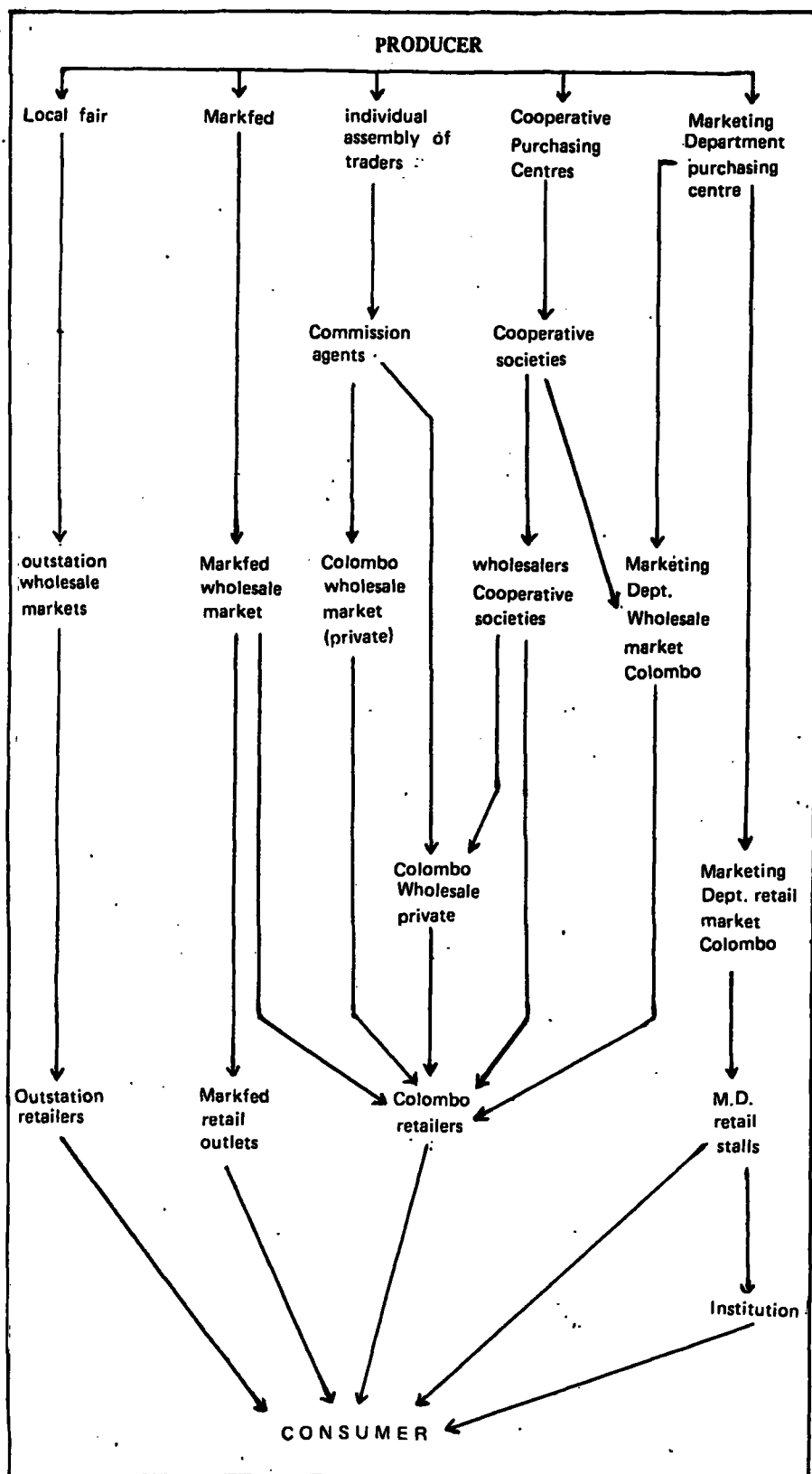
It was significant to note that processing industries had made some problems. 9 industries had already adopted the practice of using preserved juice and pulp manufactured during the season. 4 of these industries completely met the demand in this manner while the others in addition utilized excess (production stocks or purchased)

material at the higher price. It was also significant to note that among the industries utilizing preserved raw material 3 industries purchased it from a common supplier of preserved raw material thus demonstrating that the objectives of this study were already in practice. The main items which were currently being preserved by some industries for the off season in the form of

FRUITS AND VEGETABLES PROCESSED BY INDUSTRIES TO DIFFERENT PRODUCTS

Fruits Juice Based Products			Fruit Pulp Based Products		Fruit Whole and Sliced		
Canned Juice	Ready to drink beverage	Cordials	Jams/Jellies	Chutneys/Sauces	Canned Fruit	Preserves	Pickles
Passion	Passion	Passion	Passion	Tomato	Pineapple	Red-pumpkin	Lime
Pineapple	Pineapple	Pineapple	Pineapple	Mango	Mango	Ash-pumpkin	Garlic
Mango	Mango	Mango	Mango	Ambarella	Papaya	Ginger	
Tomato	Woodapple	Papaya	Tomato		Jak	Chow	
Papaya	Beli	Lime	Papaya				
Woodapple		Orange	Pumpkin-Red				
Beli		Woodapple	Pumpkin-Ash				
		Beli	Woodapple				
		Nelli	Marmalade				
			Orange				
			Strawberry				
			Mulberry				

Figure 2 -
EXISTING CHANNELS OF DISTRIBUTION OF FRUITS AND VEGETABLE
IN SRI LANKA



Source: L A C Alles et al, Report of a Workshop on Post Harvest Food Losses in Sri Lanka, February, 1980.

juice and/or pulp included pineapple, mango, tomato, passionfruit, lime, woodapple and pumpkin. They were preserved using sodium metabisulphite and stored in 3 or 5 gallon PVC containers.

Apart from the above, it was found that 2 industries managed solely on excess production stocks to meet the demand while 1 industry stopped production and sales in the off season. It was important to note that 21 of the industries purchased raw material at a higher price during the off season to meet the demand. It is a possibility that these industries would be interested in utilizing the alternate preserved supplies suggested

Demand for Fruits and Vegetables by Industries and Hotels

This was assessed in terms of the nature and quantities of raw material processed or consumed, the types of products manufactured and the maximum capacities for production in industries or in terms of the quantum of meals served by hotels.

Fruits and vegetables processed by industries were classified in accordance with their utilization in different categories of products (Table 3). Fruit juice based products included cordials, squashes, canned juice and ready to drink beverages (eg. fruit nectar), fruit pulp based products included canned fruit, preserves and pickles. The fruit in greatest demand by most industries was passionfruit followed in decreasing order by pineapple, mango, lime, woodapple, tomato, marmalade orange, pumpkin, papaya, chow chow and ginger. The maximum quantities required by a single plant were as high as 6000 metric tons per annum for passionfruit and 200 tons for tomato, pineapple and mango. Extremely large capacities for production were available in some industries but were under-

TABLE 4 - FRUITS, VEGETABLES AND THEIR PRODUCTS UTILISED BY HOTELS

Vegetables	Fruits	Fruit Juices and Cordials	Canned fruits	Jams and Jellies	Souce, Chutney Pickles
Beans	Avocado	Grapefruit	Mango	Guava	Tomato (s)
Beetroot	Pears	Lime	Pineapple	Mango	Ambarella (c)
Brinjal	Banana	Mango	Tomato	Marmelade	Mango (c)
Cabbage	Grapefruit	Nelli	Jak	Mixed fruit	Brinjal (p)
Carrots	Lime	Orange	Bell cream	Passion	Lime (p)
Cauliflower	Mango	Passion	Woodapple	Pineapple	
Celery	Mangosteen	Pineapple	cream	Woodapple	
Chillies	Melon(water)	Tomato			
Cucumber	Orange				
Garlic	Papaya				
Ginger	Pineapple				
Okra	Woodapple				
Leeks					
Lettuce					
Mushrooms					
Onions					
Potatoes					
Spinach					
Tomato					
Tamarind					

utilized for various reasons predominantly the lack of good raw material and the need for a wider market. The maximum capacity available in one of the largest processing industries was 7000 bottles/day for cordials, 18,000 bottles/day for jams, 10,000 units/day of canned juice, 6000 units/day of canned fruit and 7000 units/day of sauces. The products in greatest output were jams, cordials and fruit juices and to a lesser extent for chutneys, sauces and pickles. Canned products were mainly confined to the few export oriented industries.

Hotels consume a wider range of produce which include fresh fruits and vegetables, fruit juices, canned fruit, jams and jellies, sauces, chutneys and pickles (see Table 4). The specific demand varied with the number and types of consumers patronizing the hotel. The local populace consume many of the tropical vegetables while foreigners requirements were influenced by their nationality and background.

Consumption demand in hotels was

assessed in terms of the number of meals served per day (Table 1) and the hotels surveyed were categorised as follows:-

small - 0-200 meals served per day
 Medium - 201-400 meals served per day
 Large - 400 meals served per day.

The survey showed that the demand was not influenced by the nationality of the foreigners and the main desire was for tropical delicacies. The peak demand was during the months of January and the lowest demand was in June. In addition to locally available produce specific imported items were used including canned mushroom and bottled gherkins and olives. The quantitative demand was found to vary proportionately with the consumption category of the hotel and corresponding variations were seen in the peak and slack months of tourist occupancy as expected. A significant point of concern was that the peak tourist season did not always coincide with the growing seasons of the fruits and vegetables in demand and hence hotels were compelled to often purchase produce at high prices during the off season.

Consumer Acceptability trends of the suggested Stored/Preserved Fruit and Vegetable Raw Materials

The response of production managers/R & D managers in processing industries and food and beverage managers/chefs in hotels was evaluated.

It was found that 9 (30%) of the industries were already familiar with the practice of using stored juice and pulp for the off season. The majority 28 (93%) of the industries were interested in the availability of stored fresh raw material, while 22 (8%) of the industries/were interested in using preserved juice and pulp if the quality was good. 14 (70%) of the industries were interested in the availability of dehydrated products. Many industrialists were interested in the possibility of using steeped fruit in brine but wanted to see the products first. The suitable sizes of packs of these products for supply were assessed and quantities of 3.5 and 10 gallon for juice and pulp supply found to be appropriate for supply.

Hotels

The possibility of providing semi-processed/preserved supplies to hotels was also similarly assessed. All hotels were interested in a supply of stored raw material in the natural form. The response to the idea of supplies of preserved juice was also very good as most hotels now utilize cordials and squashes (725 ml bottles) as their main source of juice. The juices in greater demand were passionfruit, mango, tomato and grapefruit, lime and pineapple. An encouraging response was also obtained for pulp from tomato and tamarind and lime Juice for use in culinary preparations. Requests were received for supplies of specific products which included mushroom in steeped liquor, pickled olives, onions and gherkins and for dehydrated carrot as garnishing/and ash plantain chips as snacks. convenient packs for supply determined as before were as follows:-

- Fruit juices - 1-3 gallon packs
- Mushrooms - 1-3kg packs
- Tomato pulp - 0.5 gallon packs
- Tamarind extract - bottles (725 ml)
- Dehydrated products - 2kg packs.

Conclusions and Recommendations

It was established that there were many problems in the supply of the fruits and vegetable raw materials to industries consumers. Most of these problems were due to the existing post harvest problems in transport and storage which are difficult to control. The response to an alternate source of supply of stored/preserved raw material was good. There are large quantities of fruits and vegetables being produced in the glut season in different rural districts which are under-utilized and go waste. It is recommended that programmes be planned to develop suitable semi-processing technologies for preservation of these raw materials for use in the off season. These programmes could be carried out in small scale fruit and vegetable processing centres set up in the different districts of production in Sri Lanka.