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FOOD RESEARCH
AND
DEVELOPMENT
IN
SRI LANKA



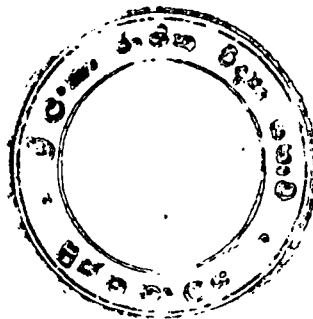
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NATIONAL SCIENCE COUNCIL OF SRI LANKA

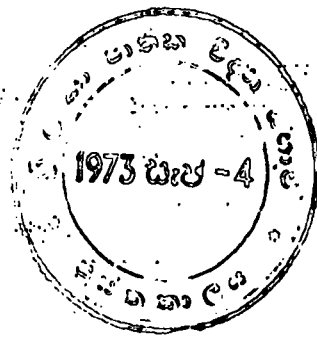
1973

*FOOD RESEARCH AND DEVELOPMENT
IN SRI LANKA*

*Report of the Sub-Committee
Food Research and Development
in Sri Lanka*



R. NO. 471



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1. MEMBERSHIP AND TERMS OF REFERENCE

1.1 MEMBERS

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Chief Research Officer, Marketing

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Scientific Officer, National Science Council

1.2 TERMS OF REFERENCE

TO IDENTIFY THOSE AREAS OF FOOD RESEARCH WHICH NEED
TO BE DEVELOPED, AND TO RECOMMEND THE MEANS BY WHICH
THIS COULD BE DONE.

2. PREAMBLE

Food research can broadly be defined as investigations of the changes occurring in food materials between post-harvest and consumption. Until recently, all the different aspects of food research were vaguely described as Food Technology. However, in recent years, three independent areas of food research have been recognised - Food Science, Food Technology and Nutrition.

Food Science:-

It is rather difficult to define the term Food Science. We can do no better than use the definition of E.C. Bates-Smith that it is "a coherent and systematic body of knowledge and understanding of the nature, composition and behaviour under various conditions of food materials". The basic sciences of mathematics, physics, chemistry and biology are all involved as are the newer sciences of biochemistry and microbiology.

Food Technology:-

To be effective, food science must be applied and this is Food Technology. Food Technology seeks to improve the quantity as well as the quality of food, and hence involves all aspects of processing, preservation, storage and packing.

Nutrition:-

The study of the various nutrients in relation to their effect on the human body is called Nutrition. The aim of such studies should be to ensure that adequate amounts of essential nutrients are available in the human diet.

During the past few years, there have been changes in the economic as well as the food situation in Sri Lanka. The conditions are in fact changing so fast that the aims and objectives of Food Research need to be revised frequently to cope with new problems that emerge. Under the present conditions in the country, Food Research must, apart from increasing production, be aimed at making better use of the available local resources and at reducing wastage.

In order to make the best use of the available facilities and staff in the country, a scheme, which would enable better co-ordination and communication between the various organizations engaged in Food Research, has to be devised. At the same time, it is essential that those areas of Food Research which have not yet received attention be identified.

It was with these objectives in view that a Sub-committee on Food Research and Development in Sri Lanka was appointed by the National Science Council to identify those areas of Food Research which need to be developed, and to recommend the means by which this could be done.

3. ORGANIZATION OF FOOD RESEARCH IN SRI LANKA

3.1 BACKGROUND

The first major study of the organization of Food Research in Sri Lanka was made in 1953 by an FAO expert, Dr. Z.I. Kertez (FAO report No. 210). He proposed the establishment of an independent Food Research Institute composed of the following divisions :-

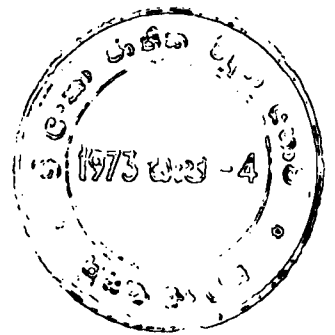
- a) Food Analysis
- b) Food Biochemistry and Nutrition
- c) Food Technology
- d) Food Microbiology, Sanitation and Food Storage
- e) Home Economics and Dietetics

The main function of such an institution was to study the utilization, nutritional value and processing of foods available in Sri Lanka. Due to several reasons, his proposals were not put into action.

In 1967, Dr. E.C. Bate-Smith presented another report on "The Organization of Food Research In Ceylon" (FAO report No. TA 2325) to the Government. This report was mainly concerned with the utilization of fruit and vegetable, but also stressed the need for co-ordinated food research in Sri Lanka. Instead of an independent Food Research Institute, he recommended the formation of a "Steering Committee", the functions of which would be :-

- a) Co-ordination of existing Food Research activities.

- b) Examination of the proposals for further Food Research activities and recommending ways of implementing them.
- c) Allocation of grants for research and training.
- d) To advise on the setting up of additional units of food research.
- e) To advise on staff requirements, salaries, etc.



The main fact which emerges from these studies is the urgent need to consider Food Research as a separate discipline of study.

In 1970, the National Science Council, which is concerned with policy for scientific research in Sri Lanka appointed a Food Panel to examine all aspects of food relevant to the country's needs and make recommendations to the Council on measures necessary "to effect improvements through existing and novel practices".

The Food Panel appointed several Sub-committees to study the following:

- a) Infestation and Pest Control
- b) Uses of Agricultural and Industrial waste products as possible sources of food and food materials
- c) The establishment of a Central Laboratory dealing with food standards, quality control and their implementation
- d) Fortified Foods
- e) Handling of bulk foods (e.g. sugar, flour) and their marketing, distribution and packaging.

Unfortunately, for several reasons, only the first Sub-committee has completed its report. However, the Sub-committee on the Central Laboratory has made the following recommendations :-

1. The National Science Council should set up a Food Laboratory which should be engaged in the following activities:

- a) Investigation of food spoilage, agricultural and industrial waste utilization, toxicity of residual effects of agro-chemicals.
 - b) "Quality Control" - Natural and Processed food whether imported or indigenous, would be subject to this control.
 - c) Training of personnel for the food industries, both in private and public sectors.
2. This laboratory should work in close liaison with other institutions engaged in food analysis or research.

The need for a central organization for the conduct of Food Research was stressed further in a memorandum entitled "Food Research and Development in Sri Lanka", submitted to the Ministry of Foreign and Internal Trade, by Dr. N.N. de Silva (Deputy General Manager, C.W.E.) This memorandum was subsequently forwarded to the National Science Council by the Ministry of Industries and Scientific Affairs for comment. The Council decided to recommend to the Ministry that -

- a) In the present context, the immediate establishment of a Central Food Research Institute was not necessary.
- b) Since certain organizations were already engaged in some of the areas of Food Research mentioned in the memorandum, these should be expanded independently, rather than being centralized in one organization.
- c) Other areas of Food Research not presently receiving attention should be developed.

4. ASPECTS OF FOOD RESEARCH CONSIDERED BY THE SUB-COMMITTEE
IN THIS STUDY

In order to determine the priorities in the field of Food Research, the Sub-committee considered the following aspects in detail:-

- a) The present state of Food Research in the country.
- b) Possible ways of co-ordinating investigations on food conducted in various institutions in Sri Lanka.



4.1 Present state of food research in Sri Lanka

Investigations relating to food are now being made in several institutions. However, there is very little co-ordination or communication, if any, between scientists engaged in similar investigations. The government sponsored institutions engaged in food research are shown in Annexure I. For detailed reports on Food Research conducted in the C.I.S.I.R., Fruit and Vegetable Utilization Laboratory, C.W.E., C.A.R.I., and Fisheries Research Station, see Annexure II - VI.

During the last five years, a number of private institutions have also shown interest in the processing of food. This has largely been the result of the government's decision to restrict imports of processed food into the country. However, it is a matter for concern that most of these institutions do not have their own research facilities, and depend on government sponsored organizations like the C.I.S.I.R., or Marketing Department for technical assistance.

On assessing the present attitude to food in the country, it is apparent that the main emphasis is on increasing production of essential food materials to meet the demands of the growing population. Despite this fact, it is encouraging to see that a considerable number of institutions are engaged in post-harvest investigations. However, in these investigations, there appears to be a marked weightage towards research on Food Technology. Not many institutions seem

interested in research in Food Science or Nutrition. This may be mainly due to the fact that at present a large amount of perishable food is produced in Sri Lanka, and there is an urgent need to find better methods of preservation to avoid wastage.

4.2 Areas of food research which need attention

Despite the fact that a considerable amount of Food Research is being done in the various institutions in relation to their specific needs, there are several areas which need greater attention from the existing units. However, since it would be impossible in the present context to obtain sufficient facilities and staff to carry out all the necessary research, priority should be given to those areas which would be of immediate benefit to the country. In the present context therefore, Food Research in Sri Lanka should be aimed at (a) ensuring minimum wastage of food currently produced in the country and (b) making the best use of our available resources. Urgent attention should therefore be paid to the following :-

- 1) Infestation and Pest Control
- 2) Nutrition Studies, especially the use of proteins in relation to the present nutritional status of the nation
- 3) Examination of fresh and processed foods for pesticide residues
- 4) Standardisation and Quality Control of Food intended for use within the country, as well as those meant for export.

4.2 (a) Infestation and pest control

It is estimated that nearly 10% of the total food produced in the world is lost due to infestation during storage. In Sri Lanka, until recently, no serious measures for assessing the extent of losses in food consignments due to infestation, or for establishing controls of any sort were undertaken on a national scale.

One of the earliest reports on "Storage and Infestation problems in Ceylon" was written by Wright in 1965. In it he assessed the total losses

during storage for all food items as being of the order of 5% annum. The most recent investigation of this problem was made by a Sub-committee appointed by the Food Panel of the National Science Council (Report of the Sub-committee Infestation and Pest Control - 1973). They estimate that the loss of imported food stuffs if calculated on the basis of Wright's estimate would amount to approximately Rs. 48.6 million. The main cause for infestation was found to be due to bad storage. Apart from imported food, infestation results in a considerable wastage of food stuffs produced within Sri Lanka itself. In the present economic situation, it is therefore vital to find methods of minimizing such wastage.

In order to achieve satisfactory infestation control, it is necessary to carry out a considerable amount of scientific research. It is also necessary "to make a careful study of local conditions and crops, means of transportation and cost of labour" (Report of the Sub-committee - Infestation and Pest Control, 1973).

The main institutions presently engaged in investigating the problem of Infestation and Pest Control are (a) the C.W.E., (b) Chalmers Granary and (c) the State Flour Mill. Of these, the Research and Development Laboratory of the C.W.E. is the best equipped to study this problem.

4.2 (b) Nutrition studies - with special emphasis on proteins

Malnutrition is one of the major problems of developing countries. For a substantial proportion of human being, the diet lacks the minimum quantities of those amino acids, vitamins and minerals which are commonly accepted as essential for health. It is therefore very important that a food research programme in Sri Lanka should include studies on the nutritional properties of food both before and after processing, and fortify foods which are lacking in the essential nutrients.

In Sri Lanka, as in many developing countries, the greatest shortfall between supply and requirements, is in the protein rich foods, i.e. meat, fish, eggs, milk, milk products, and pulses (de Mel, 1968).

Nutrition surveys conducted by the Nutrition Laboratory of the Medical Research Institute in Sri Lanka, and by several organizations in countries such as India, Guatemala, the Caribbean, Thailand etc. (Gopalan, 1973) have shown that in the current dieteries of pre-school children, the major bottle-neck is calories, and not proteins. Hence, if these children were to get greater quantities of their traditional cereal-pulse based diets in amounts that would meet their calorie requirement, their protein needs would be met. However, in Sri Lanka, the majority of the population seem unable to meet their calorie requirements. Furthermore, the existing diets are deficient in several important vitamins and minerals. Therefore, even by increasing the level of consumption of the current diets to satisfy calorie needs, there would still exist deficiencies of several essential nutrients.

It is therefore important to find without delay, methods of processing protein rich foods from both conventional and unconventional sources. In Sri Lanka, as in many other countries of the world, the full potential of food is not completely utilized. There are many types of fresh water fish and plant material growing in rural areas, which can be used as additional sources of protein. In all these instances, it is not only the ignorance of the existence of these resources, but also the lack of technical skills required for their effective processing, that prevent their utilization.

Apart from bridging the calorie-gap, methods have also to be found whereby increased intake of nutrients such as Vitamin A, Vitamin C, Riboflavin, Iron, and Calcium are made possible.

The greatest amount of protein supplementation in this country is required by the infant population. It is therefore very important to find a suitable weaning food for our infants, since it is here that the protein-calorie deficiency starts. The production of a suitable weaning food should in fact be given first priority, since the high incidence of tubercular, gastro-intestinal and other respiratory infections in infants have been closely associated with protein-calorie deficiency. In addition, one of the late effects of such deficiency in childhood may be the permanent stunting of growth.

A considerable amount of research on the production of a suitable weaning food and fortification of foods has already been carried out by the Nutrition Laboratory of the Medical Research Institute in Sri Lanka. A report on the fortification of foods is at present being prepared by a Sub-committee appointed by the Food Panel of the National Science Council.

The Nutrition and Biochemistry Laboratories of the Medical Research Institute are best suited to carry out research on nutritional studies. They could also work in collaboration with other institutes, e.g. the Universities. However, due to the lack of staff and facilities, the amount of research possible in these laboratories is limited. In order to carry out the necessary research in the field of nutrition, it is therefore essential to expand the facilities available at the Medical Research Institute.

4.2(c) Pesticide residues in food

The use of chemicals to control economic pests has grown in recent years, both in the amount, and the diversity of materials used. The trend has been away from arsenicals towards the chlorinated hydrocarbons, the organo-phosphates and the carbamates. In fact, the increase in the scale of use of chemicals to control pests, the reports of such

adverse effects as death of wild life and fish resulting from their use, and the discovery of DDT in the adipose tissues in humans have caused scientists to search for the facts concerning large scale use of pesticides and the resulting side effects.

In Sri Lanka too, there is a growing tendency to use pesticides to control economic pests. Pest control is of course necessary and desirable. However, there must be safeguards against harmful effects of these chemicals.

Safeguards against harmful effects are provided by a system of tolerances, by testing foodstuffs for the presence of residues, and by education on methods of pesticide usage that will avoid, or minimize residues.

At present, in Sri Lanka, there is very little attention given to the problem of pesticide residues. It is therefore of vital importance to make extensive studies of the levels of pesticide residues in fresh and processed food in our country.

4.2(d) Quality control of food

Annexure VII, shows the facilities available for the testing and analysis of food products (including quality control) in Sri Lanka.

It is evident that adequate facilities are already available for quality control of food in the country. However, the testing of manufacturers samples of food products as an advisory or quality control service, or the quality testing of samples of food drawn from export consignments for purposes of issuing export licences are not undertaken by any organization.

The necessity for a Central Quality Control Laboratory was considered. Since adequate quality control facilities are already available in the country, such an institute would at present be unnecessary. The simplest procedure would be to extend the facilities of some of the already existing laboratories to carry out all the necessary standardisation and quality control tests.

4.3 Co-ordination of food research

The need for a Central Food Research Institute to co-ordinate investigations on food in Sri Lanka has been stressed in many reports on food (see Background).

However, since there are several institutions already engaged in food research, we agree with the National Science Council that in the present context, the immediate establishment of any type of Centralised Food Research Institute is not necessary. Instead, it would be advisable to -

1) Expand the research facilities in the following institutions :-

a) Central Agricultural Research Institute -
Gannoruwa

b) Ceylon Institute of Scientific and Industrial Research

c) The Research and Development Laboratory
of the C.W.E.

d) Fruit and Vegetable Utilization Laboratory

e) Nutrition and Biochemistry Laboratories
of the Medical Research Institute

f) Fisheries Research Station.

2) Appoint a "Steering Committee" or Advisory Body (as suggested by Bate-Smith in 1967), to co-ordinate the food research activities in the country.

5. RECOMMENDATIONS

5.1 From our studies it becomes apparent that many institutions are independently engaged in various aspects of food research. However, in order to be effective, all these investigations have to be co-ordinated.

We agree that in the present context, there is no necessity for a Centralised Food Research Institute. Instead, we recommend that -

1) The Food Research facilities in the following organizations be expanded ;

a) Central Agricultural Research Institute -
Gannoruwa

b) Ceylon Institute of Scientific and Industrial
Research

c) Fisheries Research Station

d) Fruit and Vegetable Utilization Laboratory

e) Nutrition and Biochemistry Laboratories
of the Medical Research Institute

f) Research and Development Laboratory of the
C.W.E.

2) A "Steering Committee" or Advisory Body (as originally proposed by E.C. Bate-Smith) be appointed. This Committee which should be set up at the National Science Council, should include at least one representative from the Planning Ministry. The functions of this Committee should be ;

a) Co-ordination of Food Research activities
in Sri Lanka

b) Examination of proposals for further food
research activities and recommend ways of
implementing them

c) Allocation of grants for research and
training

d) To advise on the setting up of additional
units of Food Research, and

e) To advise on staff requirements, salaries, etc.

5.2 Priority should be given to the following areas of Food Research :-

- a) Infestation and Pest Control
- b) Nutrition Studies - with special reference to proteins
- c) Pesticide residues in food
- d) Standardisation and Quality Control of Food.

Nutrition Studies:-

We recommend that the facilities of the Nutrition and Biochemistry Laboratories of the Medical Research Institute be expanded to carry out the necessary research in the field of Nutrition. It could then work in collaboration with other institutions engaged in similar investigations.

Infestation and Pest Control :-

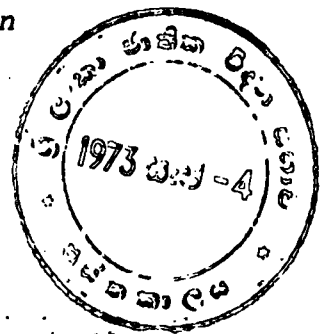
The Laboratory which is best suited to study infestation and pest control is the Research and Development Laboratory of the C.W.E. However, we feel that for greater efficiency, this laboratory should be separated from the rest of the C.W.E. We therefore recommend that the above laboratory be made an independent unit which could be a service organization for the C.W.E. as well as other institutions which may need its services.

Pesticide Residues :-

A unit to study Pesticide Residues in food is to be set up at the Central Agricultural Research Institute in Gannoruwa. We wish to emphasise, that the above unit, apart from serving its own Ministry, should also provide a service to institutions under any other Ministry.

Quality Control :-

Adequate facilities are already available to deal with area (d). Hence, a Central Quality Control Laboratory is unnecessary. However, we recommend that the facilities of some of the existing laboratories be expanded to include the quality testing and standardisation of food produced within the country, as well as samples of food drawn from export consignments.



5.3 Long-term perspective:-

In addition to considering research which would be of immediate benefit to the country, we feel that it is also necessary to consider the long-term perspective with regard to food. We recommend that it should be a continuing study, guided by the above "Steering Committee".

6. SUMMARY

6.1 Priority should be given to the following areas of Food Research:-

- a) Infestation and Pest Control
- b) Nutrition Studies - with special reference to proteins
- c) Pesticide Residues in food
- d) Standardisation and Quality Control of food.

6.2 A Centralised Food Research Institute is not necessary. Instead, the food research facilities in the following organizations should be expanded :

- a) Central Agricultural Research Institute -
Gannoruwa
- b) Ceylon Institute of Scientific and Industrial Research
- c) Fisheries Research Station
- d) Fruit and Vegetable Utilization Laboratory
- e) Research and Development Laboratory of the
C.W.E.
- f) Nutrition and Biochemistry Laboratories of
the Medical Research Institute.

6.3 Food Research activities in Sri Lanka should be co-ordinated by a "Steering Committee" or similar advisory body, set up at the National Science Council.

8. REFERENCES

- 8.1 Bate-Smith, E.C. (1967) - Organization of Food
Research in Ceylon FAO
report No.TA 2325
- 8.2 De Mel, B.V. (1968) - Role of Food Technology
in Nutrition Seminar of
the Chemical Association
under the auspices of
the CAAS
- 8.3 Gopalan, C. (1973) - Protein-Calorie Malnutri-
tion. The need for a
proper perspective.
Journal of the National
Science Council Vol. 1,
in press
- 8.4 Kertez, Z.I. (1953) - The Planning of Food
Investigation FAO report
No. 210
- 8.5 Wright, F.N. (1965) - Storage and Infestation
problems in Ceylon.
London:Ministry of
Overseas Development -
1965.

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ANNEXURE I

INSTITUTIONS ENGAGED IN RESEARCH & DEVELOPMENT

IN FOOD

1. Flour & Flour Products

1.1 State Flour Milling Corporation

Studies on the extraction rate and production of wheat germ; production of macaroni; setting up a bakery and utilization of by-products of wheat locally.

1.2 C.I.S.I.R.

Research on the manufacture of bread, using manioc flour, conducted in collaboration with the T.P.I.

2. Fish & Fish Products

2.1 Fisheries Research Station

Research and Development: (1) Studies of the Beche-de-Mer Fisheries in Sri Lanka. (2) Analysis of by-products like fish liver oil and fish meal produced by Ceylon Fisheries Corporation. (3) Chemical analysis of the different fish species. (4) Nutritional studies of the various fish species and fish products. (5) Quality analysis of fish products and issue of quality certificates for export products.

2.2 Ceylon Fisheries Corporation

Research and Development: (1) Products and processes development and new product development. (2) Work connected with freezing, storage, dehydration of fish and fish products. (3) Possibility of using locally available vegetable oil as a substitute for the imported ground-nut oil in the blending of shark liver oil. (4) Rancidity development during storage of fish meal. (5) Process improvement to increase yield in liver oils. (6) Work to improve the quality of canned sardines. (7) Reducing the alkalinity and hardness of water at Pesalai cannery. (8) Work is been done to obtain a satisfactory smoked fish and a canned fish soup fortified with vitamins.

2.3 C.I.S.I.R. - Division of Natural Produces

Research into the regeneration of 'Karawadu' waste, and extraction of protein rich concentrates.

2.4 University of Ceylon - Faculty of Science - Colombo
Campus - Dept. of Zoology

Aspects of Marine Biology in relation to food resources : (1) Physiological and behavioural studies on crabs and prawns are been pursued as this basic knowledge is required in the successful farming of prawns. (2) Distribution and ecology of edible species of mollusc.

3. Coconut Product

3.1 Ceylon Coconut Processing Board

1. Improvement of technology of dessicated coconut manufacture.
2. Improvement of bacteriological quality of the production.

3.2 C.I.S.I.R. - Food Technology Section

Utilization of coconut proteins.

3.3 C.I.S.I.R. - Industrial Microbiology Section

Microbiology of preservation and stabilization studies in relation to bottling of coconut water and preserved coconut milk.

4. Oils and Fats

4.1 Ceylon Oils and Fats Corporation

Research : into (1) Possible means of utilization of locally available raw materials and damaged raw materials from food departments and (2) Refining of glycerine.

Surveys : (1) Cultivation of cereals like maize and soya bean (2) Processing of damaged fish-meal.

4.2 C.I.S.I.R. - Section of oils and fats

4.3 Lever Brothers

Industrial fats, Margarines for industrial and domestic needs. Bakery fat compounds. Convenience foods for domestic needs.

5. Tea

5.1 Tea Research Institute

Instant tea, by-products of tea, flavour of tea, biochemical aspects of pruning, insect control and

tea manufacture. Development of tea machinery and tea manufacturing processes.

6. Fruit and Vegetables

6.1 Fruit and Vegetable Utilization Laboratory

Research is conducted in the following areas.

- i. Fruit canning
- ii. Juice processing
- iii. Manufacture of jams and jellies
- iv. Manufacture of sauces, chutney and other preserves.

6.2 University of Ceylon a) Vidyodaya Campus-Dept. of Chemistry

Research in : (1) Dehydration of vegetables and fruits. (2) Making of fruit juice concentrates.

6.3 University of Ceylon b) Peradeniya Campus - Dept. of Botany

6.4 Radioisotope Centre

Investigations of radioactivity in foods.

7. Spices, Essential Oils & Aromatic Chemicals

7.1 C.I.S.I.R. - Section of Natural Products

Research programme to include the study of the chemical constituents of locally grown essential oils and spices; the development of better methods of preparation of spice products and the evolution of new analytical techniques for the assesment of the quality of spice products. Programme includes research into methods of preparation of spice oleoresins, viz. chillies, pepper etc. and preparation of aromatic flavour compounds from Ceylon essential oils.

A programme of research, geared to the upgrading of local cocoa and coffee products commenced in 1967, but has been suspended due to lack of staff.

7.2 Fruit and Vegetable Utilization Laboratory

Processing and packaging of spices and curry stuff in the form of powder.

8. Infestation Control

1. State Flour Mill

2. C.W.E. - Research & Development Laboratory

3. Food Dept. - Chalmers Granaries

9. Nutritional Studies

9.1 Dept. of Public Health & Preventive Medicines
(Nutrition Section)

Carries out investigations into the nutritional value of foods. Surveys on incidence and prevalence of diabetic in specific population types.

Establishment of a Nutrition Laboratory proposed.

9.2 University of Ceylon - Peradeniya - Faculty of Medicine

Survey of Roundworm infection and nutritional status in collaboration with the Dept. of Preventive and Social Medicine.

9.3 M.R.I. - Biochemistry Dept.

a. Nutritional studies: cholestoral and triglyceride variation within different types of food.

b. Analysis of foods for proteins, carbohydrates, fats and minerals.

9.4 M.R.I. - Nutrition Dept.

1. Diet and nutritional surveys in various rural estate and semi-urban areas of Ceylon, with a view to formulating a Food Policy.

2. Control of anaemia - Project in collaboration with W.H.O.

3. Formulation and testing of supplementary food for infant feeding.

4. Protective influences, if any, of sesame seed oil or atherogenic effects of long continued use of saturated fats in diet.

5. Atherogenic effects of tea and coffee.

Surveys : Diet survey

Nutritional assessments

Epidemiological investigations into

various deficiency states, e.g. anaemia, avitaminosis and goitre.

9.5 University of Ceylon - Faculty of Science - Colombo

Campus - Dept. of Botany

1. Factors affecting the protein content of vegetable matter.
2. Studies on extraction and preservation of plant proteins.

9.6 University of Ceylon - Faculty of Science - Peradeniya

Campus - Dept. of Botany

Amino acid composition of cereals and tropical plants.

10. Nutritional studies of the various fish species and fish products.

ANNEXURE II

RESEARCH PROJECTS IN C.A.R.I. - GANNORUWA

The Institute has a Division of Food Technology which performs two broad functions.

- a) It serves as a servicing unit for other Disciplines of the Institute involved in crop Research, by feeding information relating to nutritional value and quality.
- b) It works on Research Projects pertaining to Food Processing according to priorities decided by the Department.

Following are some of the current areas of work under the second category.

1. Production of Manioc chips and it's conversion to flour with special reference to cyanide residues. Use of the product in blends with cereal flours such as wheat, rice and Sorghum flour for the preparation of local dishes. Use of Manioc and Sorghum as rice extenders is also being studied.
2. Processing of Soybeans into a pre-cooked, dhal-like product, conversion of Soybeans into flour and it's use in blends with starchy foods in order to produce local food preparations to known levels of nutritive value.
3. Investigations on preparation of Soy Milk both as a cottage scale product and an Industrial Product has been completed.
4. Preparation of Soy Sauce using commercial fermentative cultures.
5. Dehydration preservation of local starchy foods such as Jak and Breadfruit.
6. Methods of processing and preservation of straw mushrooms, the spawn for which is distributed by this Department. Dehydration and freezing followed by blanching are methods being investigated.
7. Studies on the Curcumin content of local Turmeric (Curcuma longa) and the effect of cultural practices on the Curcumin level of local Turmeric.
8. Development of a semi-industrial method for making a Tamarind (Tamarindus indica) pulp concentrate.
9. Studies on the process improvement for producing high quality Jaggery, decolorisation of sugar cane juice and making of clear syrup.

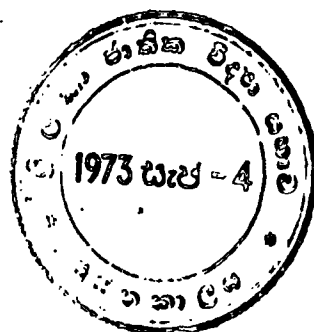
ANNEXURE III

RESEARCH PROJECTS IN

THE FOOD TECHNOLOGY SECTION OF C.I.S.I.R.

1. PROJECTS:

- 1.1 Preparation of canned or bottled coconut cream
- 1.2 Preparation of purified papain
- 1.3 Processing of starchy tubers
- 1.4 Drying vegetables
- 1.5 Soyabean processing
- 1.6 Bread from composite flour
- 1.7 Processing fruit juice
- 1.8 Separation of oil and proteins from coconut by a wet process.



2. BRIEF DESCRIPTION OF EACH PROJECT :

2.1 Coconut Cream:

A process was developed for heat sterilising coconut cream. The canned or the bottled product was stored at room temperature for 6 months without any detectable deterioration of the product. The process was tried out in the CISIR pilot plant using 50 lbs. of coconut. Scaling up operations will be undertaken jointly with the Coconut Processing Board.

2.2 Purified Papain:

A new process of purifying papain was developed using papaw latex. The product has a very high specific activity. The process developed is very simple and uses only locally available chemicals. Scaling up operations are in progress.

2.3 Starch Tubers:

This project was initiated at the request of the Ministries of Planning and Agriculture. Each of the work on this project was done with manioc. Few experiments were done with sweet potatoes.

Processes have been studied for :-

- a) Preparation of manioc chips
- b) Preparation of starch

2.4 Vegetables:

This project on dehydration of vegetables (including mushrooms) was initiated at the request of the Industrial Development Board. One officer of the IDB has been working on the project. At the request

of the Ministry of Plantation Industries jak fruit processing is also under investigation.

2.5 Soyabean:

Soyabean milk and curd were prepared on a laboratory scale. The technique used removed most of the off flavour present in soyabeans. Further work is being planned on soyabean processing.

2.6 Bread from Composite Flour:

This is a CISIR/TPI project undertaken at the request of the Ministry of Planning. A modern bakery has been installed at CISIR for the project.

2.7 Processing of Fruit Juices:

This is a joint project with the marketing Department. We are aiming at dehydrating fruit juices and for improving the quality of the canned juices.

2.8 Coconut Oil:

A new wet process was developed for obtaining water white oil and edible proteins from coconut. The oil obtained is water white and has excellent keeping qualities. The process was successfully tried using 50 - 60 lbs. of coconut at a time. Scaling up operations are in progress.

ANNEXURE IV
CENTRE FOR THE DEVELOPMENT AND
MARKETING OF FISH PRODUCTS-SRI LANKA

1. Background

The fishery sector contributed Rs. 175 million (U.S.\$ 5 million) to the GNP which amounted to U.S. \$ 2 326 million in 1969. Seventy four thousand people find employment in the fishery sector, the total Sri Lanka labour force being 3.6 million. The per caput income per year in the fisheries sector is calculated at Rs. 2,088. Fish is a highly important item in the diet of the population. In 1968, availability of protein was 46.2 g per day, thereof 8.5 g of animal origin, of which 5.5 g originated from fish.

Foreign trade in fishery products is substantial. In 1969, total imports amounted to U.S. \$ 445 million of which fishery products represented U.S. \$ 12.8 million. Of the total U.S. \$ 320 million exports, fish products generated U.S. \$ 641,000 in 1969.

The modernization of fishing methods and operations in Sri Lanka in recent years has resulted in a considerable catch increase. This is particularly noticeable in the tuna fishery. The increase in national fish production from 2,015 438 cwt. in 1965/66 to 684 435 cwt. in 1968/69 was one reason for the decreasing proportion of imports in the total consumption. The principal reason was, however, a reduction of imports of fish from 2 858 795 cwt. to 1 199 781 cwt. during the same period (fresh weight equivalent). In addition to these factors, the population increase brought per caput consumption down from 48.6 lb in 1965/66 to 35.4 lb in 1968/69; around 30 percent of the latter originated from abroad. Because of the need for foreign exchange, the Government wishes to substitute imported fish products by national production and to encourage export of fish and fishery products. It is evident that in certain fisheries surpluses occur during certain periods of the year, and that due to inefficient handling, preservation and marketing practices considerable losses are incurred. The inland fishery resources are utilized to only a limited extent due mainly to market resistance toward these species. Fishermen's co-operatives have shown considerable interest in the development of fish canning, in particular tuna and small pelagic species. The

Sri Lanka Fisheries Corporation operates a canning plant, the relocation of which to a site with regular supplies is under consideration. A fishing complex has been developed in Galle, mainly for tuna operations. The utilization of this new establishment under a joint venture arrangement, is under consideration. The substitution of imported fishery products (mainly dried and canned) by domestic produce, as well as the utilization of inland fishery resources, will require considerable development work to determine the most suitable products. Advice on the development of export products is also required. In addition, the waste presently incurred because of deficient handling and preservation practices must be reduced and investigations and advice are therefore needed. An ADB mission calculated a spoilage rate of 15 - 20 percent as regards the Ceylon Fisheries Corporation. Raising the standard of marketing operations, and determination of the potential demand for acceptable new products, as well as the planning and implementation of a suitable distribution system for these, will be the major aim of the necessary market development work.

A separate Ministry of Fisheries has been established and a Fishery Research Institute set up. So far the Fishery Research Institute is almost exclusively dealing with biological work. It is, therefore necessary to complement this work by activities in the field of fish technology. The proposed centre for the development and marketing of fish products would undertake such work which is badly needed in Sri Lanka in order to reduce present spoilage rates and to increase the fish supplies available. Training activities will have to play an important role; inter alia advice on methods of quality control to officials in charge will be needed. The centre will also function as an active information exchange on modern preservation, handling, processing and marketing techniques as well as facilities and equipment related to these fields.

UNDP sponsors a resources survey presently being carried out and a fishery census in connexion with population and agricultural censuses scheduled for 1972.

The ADB commissioned an investigation by a consulting firm for proposals concerning the reorganization of the Ceylon Fisheries Corporation and the identification of investment policies. The recommendations of the mission are acted upon already.

In all meetings of the preparatory mission with Government bodies and industry, a very strong interest was indicated in the proposed centre. The Hon. Minister of Fisheries pointed out that fisheries are given very high priority in Government policy. Sri Lanka considers her position very well suited to provide the location for a future Indian Ocean Fishery College, and for that reason, she has a great interest in the establishment and effective operation of the centre. The selection of the proposed site is an indicator of the strong support given to this project.

A cable received from the Senior Agricultural Adviser/FAO Country Representative in Sri Lanka on 5 June 1972 reiterated the strong support given by the Government by saying that the Ministry of Fisheries had included the counterpart contribution in its current budget and is ready to undertake building construction soon, upon receipt of SIDA approval of the project.

2. Purpose

The centre's purpose is :

To increase the supplies available to the consumers from domestic catches by improving the utilization of Sri Lanka's fish resources whether presently exploited or accessible in the future through improved handling, preservation, processing and marketing. In particular :

- (i) to reduce spoilage at all levels from preserving the catch on board to retailing;
- (ii) to find uses for presently not, or not fully, utilized species through products developed and market research;
- (iii) to effectively further knowledge on improved handling, preservation, processing and marketing to all parties concerned.

The main activity areas of the centre will therefore be :

- (a) To elaborate improved preservation, handling and marketing techniques and demonstrate these improved practices to all parties concerned from production to retailing.
- (b) To collect and evaluate technical and marketing information and to make it available to Government authorities, co-operatives and the fishing industry.

This information will cover, in particular, advances in methods of preservation and processing, newly developed equipment for handling and processing, product development, inland and export markets, consumer acceptability purchasing power and cost studies of the processing and distribution of fish and fishery products.

- (c) To demonstrate the utilization of fish species not yet fully used or in surplus and to improve existing processing methods; to advise on processing techniques not yet used in the country and carry out pilot processing demonstrations of small fish species to ascertain the feasibility and train local labour in the operation of this industry.
- (d) To undertake training of counterpart staff, extension workers, technical staff working in co-operatives and industry, and staff engaged in the promotion and marketing of fish and fishery products.
- (e) To carry out market assessment studies, in particular the acceptability of new products developed by the centre, and to prepare material to be used for consumer education and promotion of fish.

The main objective is to achieve a reduction of spoilage at all levels through improved preservation, handling, processing and marketing and thereby increase the fish supplies available to consumers and the following example may indicate the benefit Sri Lanka could derive from the centre's work.

Assuming that over a ten-year period, 5 percent of the present production (100 000 t in 1969/70) was not spoilt due to the centre's impact, 0.5 percent or 500 t would be saved for consumption. This figure is rather on the safe side as it can be expected that, apart from reduced spoilage, the centre's work will also have the effect that weight losses are avoided and these species, which so far have been discarded because they could not stand the present handling methods, can be marketed.

Assuming an average retail price of Rs. 2.65 per kg (the CFC average selling price was Rs. 1.21 per lb. in 1968) the output of the fishery sector would be enhanced by Rs. 1.3 million or U.S. \$ 224,000.

An increased supply of 500 t of fish per year would result in an increased per caput consumption of 0.04 kg or 0.4 in ten years.

In view of the Government's intention to drastically reduce imports of fishery products, already the substitution of Maldivian fish by domestic production could result in a gross saving of foreign exchange of U.S. \$ 1.2 to 1.3 million. The improvement of the quality of exported beche-de-mer could increase export earnings by about U.S. \$ 146 000, if a price of U.S. \$ 0.80 per lb. could be realised (exports 1968/69 127 t worth Rs. 674 500).

Other possible benefits which are difficult to quantify but which should be taken into account when appraising the centre's contribution to the development of Sri Lanka include increased supplies of animal protein, increased income for fishermen, reduction of marketing costs etc.

ANNEXURE V

RESEARCH PROJECT IN FRUIT & VEGETABLE
UTILISATION LABORATORY

At the moment, the following research projects and problems are being investigated :-

1. (a) Improvements on sterilization methods for hot pack passion fruit juice;
(b) Investigations on suspended solid content and the effect of these components on cloud stability of processed products;
(c) Effect on enzyme treatments on yield of juice and of cloud stability in passion fruit;
(d) Corrosion studies on passion fruit packs in tinsplate cans;
(e) Starch content and its effect on passion fruit processing;
(f) Freeze concentration of passion fruit juice;
(g) Investigations on processing of limes for oil and for juice;
(h) Post-harvest behaviour of limes under varying treatments of temperature, waxing and packaging;
and (i) Investigations on utilization of waste fruit juices by fermentation;
2. (a) Quality Control and testing of processed fruit products made by the Marketing Department and by the private sector;
(b) Advisory work to private sector fruit industry on improvement of quality of their fruit products;
(c) Investigations of packaging of fruit and fruit products under varying conditions as demanded by local and foreign markets;
(d) Microbiological spoilage of fruit, particularly passion fruit and pineapple;
(e) Dissemination of technical information on fruit growing and fruit processing and marketing to interested inquirers. Free consultative service to the private sector industrialists on formulation of projects, factory planning and layout, installation of machinery and on production problems;

(f) Training of personnel in fruit processing on an industrial scale and on factory management.

As you will readily note, research is only one of the functions of the Fruit and Vegetable Utilization Laboratory. Service to the fruit industry in all its technological aspects is the broader scope of this Laboratory.

ANNEXURE VI

RESEARCH PROJECTS IN THE RESEARCH & DEVELOPMENT

LABORATORY OF THE C.W.E.

1. Biological effects of Ultra-Violet Radiation:

- a) The effects of Ultra-Violet radiations on micro-organisms, with special reference to the stability of their cell membranes under radiation.
- b) The combination effects of Ultra-Violet radiations with moisture and salt content on the development of rancidity.

These are projects concerned with the preservation of dried-fish, butter, margarine and coconut oil.

2. Dried-Fish:

- a) The use of powdered dried-fish as a protein supplement in biscuits.
- b) Study of the free amino acids in different varieties of dried fish for purposes of identification and the properties of the general micro flora of dried fish.

3. Development of standards and specifications:

Trade standards have been worked-out for nearly all items, especially food items, which the C.W.E. handles.

4. Insects in Food:

A comprehensive survey of Insects in Stored Food, and investigations on behaviour of insects in relation to light and heat. The C.W.E. now has its own Fumigation Unit.

5. Fungi and Moulds in Food:

Study of the fungal flora of different items of food, especially pulses, with respect to their spoilage by fungi.

6. Chemical residues in food:

Investigations for techniques for undertaking a survey of fertilizer and insect residues in food, especially imported foods as well as various preservatives in processed food.

7. Utilization of Dates:

Study of the problems of packaging and storage of Dates as well as its utilization for manufacture of vinegar.

8. Packaging and Storage:

- a) Problems of packaging of food in consumer packs and their deterioration while in storage.
- b) Mechanical sifting of pulses and grains, prospects of milling of pulses and mechanisation of handling and storage of food under local conditions.

9. Type Cultures:

Study of the biochemical properties of microbiological cultures, especially in relation to food spoilage.

10. Economics of Food Handling:

The economics of the distribution and handling of food in Sri Lanka.

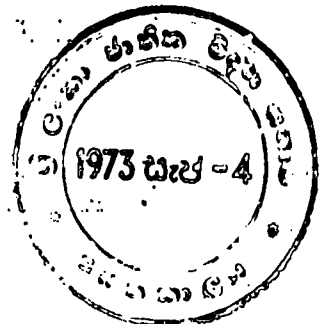
11. Uses of Manioc:

Maximum utilization of Manioc, especially as food by upgrading its nutritive value with supplementation.

12. Processing of Passion Fruit:

Utilization of Passion fruit waste and better processing methods for the juice.

In addition to the research and development, the R and D laboratory of the C.W.E. also a) formulate training programmes for traders of dried-fish, Staff trainees and Store Managers and (b) provide an advisory service on food and other items to other organizations.



ANNEXURE VII

FACILITIES FOR THE TESTING AND ANALYSIS OF FOOD

PRODUCTS (including Quality Control) in

SRI LANKA

The data collated was obtained from completed questionnaires on facilities available for research in foods in Sri Lanka, submitted by 17 organizations engaged in one or more activities concerned with this subject. Questionnaires were circulated in June 1971. Data has been brought up to date as far as possible.

Food Testing - Quality Control

1. Govt. Analyst's Department

Food and Drugs Section

Analysis of Food samples under Food and Drugs Act.

Analysis of Food samples for Customs, Health and other departments.

Analysis of liquor for Excise Department and courts.

Analysis of tea samples for Tea controller.

2. Ceylon State Flour Mill

Analysis of wheat and its products

3. Ceylon Oils and Fats Corporation

Routine quality control on animal feeds, includes nutritional studies.

4. Ceylon Coconut Processing Board

Bacteriological and physical quality control of dessicated coconut.

5. Ceylon Fisheries Corporation

1) Bacteriological and chemical analysis of canned products - seam evaluation, quality assessment of raw material.

2) Determination of Vitamin A in Fish liver cells.

6. Fisheries Research Station

Quality control of fish and fish products

Chemical analysis of fish and fish products

Quality analysis of fish products and issue of quality certificate for export.

7. CISIR

Undertakes the testing and analysis of food products in three of its Divisions.

- 1) Division of Industrial Microbiology
 - i) Bacteriological testing of water
 - ii) Bacteriological testing of food products
- 2) Division of Food Technology
 - i) Chemical analysis of foods
- 3) Natural Products Division
 - i) Testing of quality of spice products using instrumental analytical techniques.
- 4) Fats and Oils Section
8. Medical Research Institute
 - 1) Food and Water Laboratory
 - i) Bacteriological analysis of canned foods and food products from Marketing Department Cannery.
 - ii) Bacteriological analysis of dessicated coconut.
 - 2) Biochemistry Department
 - i) Analysis of food for protein, carbohydrates, fats and minerals.
 - ii) Vitamin B₁₂ and folic acid assays.
 - 3) Nutrition Department
 - i) Analysis of foods
 - ii) Evaluation of protein-quality of diets.
9. University of Ceylon
 - 1) Faculty of Agriculture & Veterinary Science, Peradeniya Campus
 - a) Division of Veterinary Microbiology
 - i) Bacteriological examination of foods
 - ii) Analysis of meat and fish products for presence of bacteria pathogenic to man.
 - b) Division of Agricultural Chemistry
 - i) Feed analysis - proximate analysis of feed stuff.
 - 2) Faculty of Medicine, Colombo Campus
 - a) Department of Bacteriology
 - i) Examination of foods for causative organisms of food poisoning.
 - 3) Faculty of Science, Colombo Campus
 - Radioisotope Centre

Investigations into radioactivity in foods such as milk, vegetables, etc. and various types of water. Expects to have a regular programme for studies

for radioactivity in foods and trace element studies in foods.

10. C.W.E. - Research & Development Division

Undertakes quality control on all supplies imported by the C.W.E. Quality control programmes include analysis of all imported items as well as post-harvest local produce, e.g. grain.

11. Fruit and Vegetable Utilization Laboratory, Narahenpita
Analysis of Foods and Quality Control

The Fruit and Vegetable Utilization Laboratory undertakes the analysis of foods for factors generally involved in food processing.

Quality control of the laboratory's own products as well as quality control for items of processed foods for export is undertaken.

The Laboratory has now finalised its programme, for establishing a quality control unit, to work together with the Export Promotion Council. This Unit will issue quality control certificates on which the licences for export of processed food products will be issued.

12. Ceylon Bureau of Standards

As Laboratory facilities for the quality control of foods is not yet available, the testing of food and food products for the Bureau is handled by various units.

Testing of products for the Standards Bureau is handled by the Fruit and Vegetable Utilization Laboratory, CISIR and the Fisheries Research Station.