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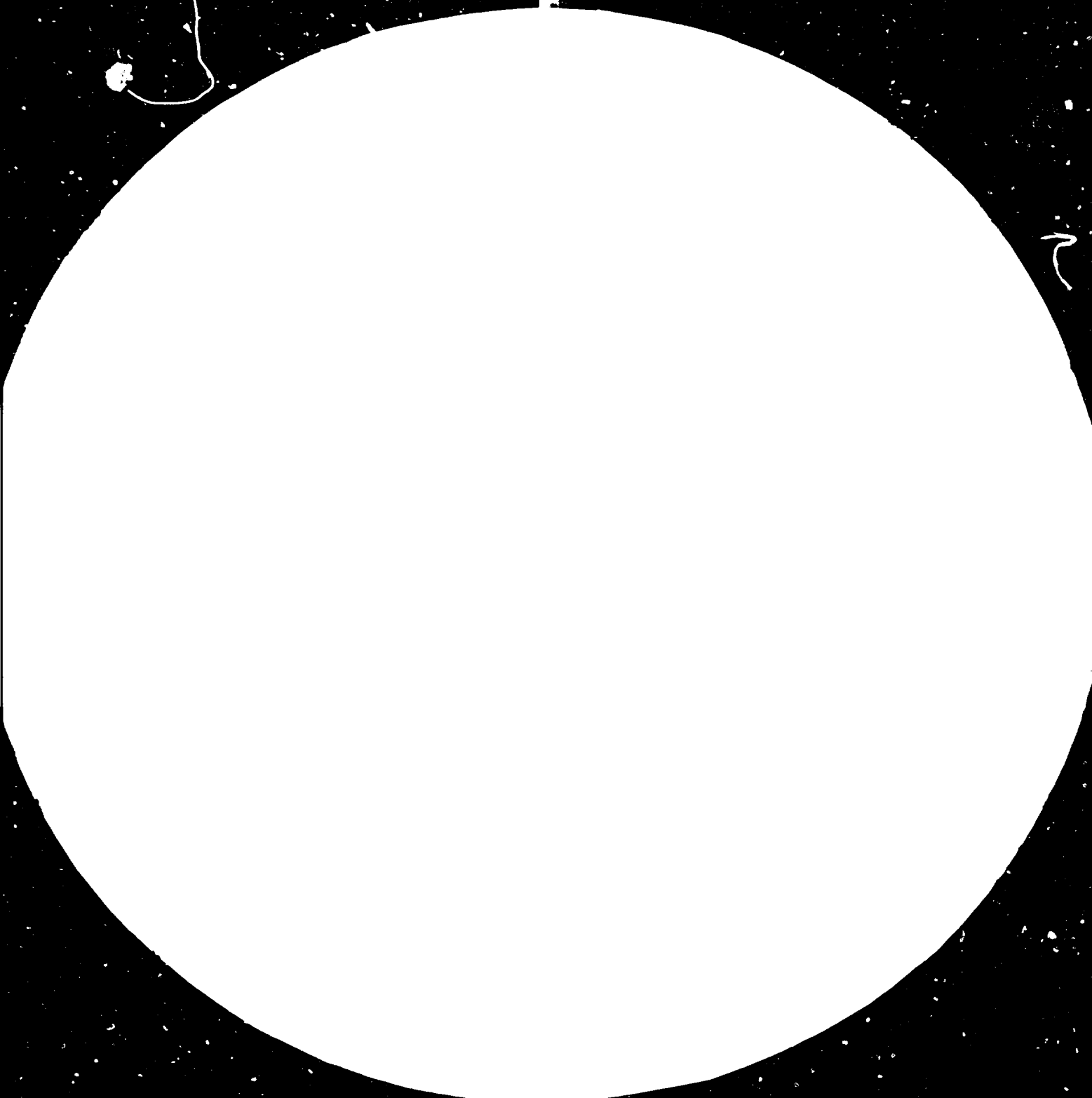

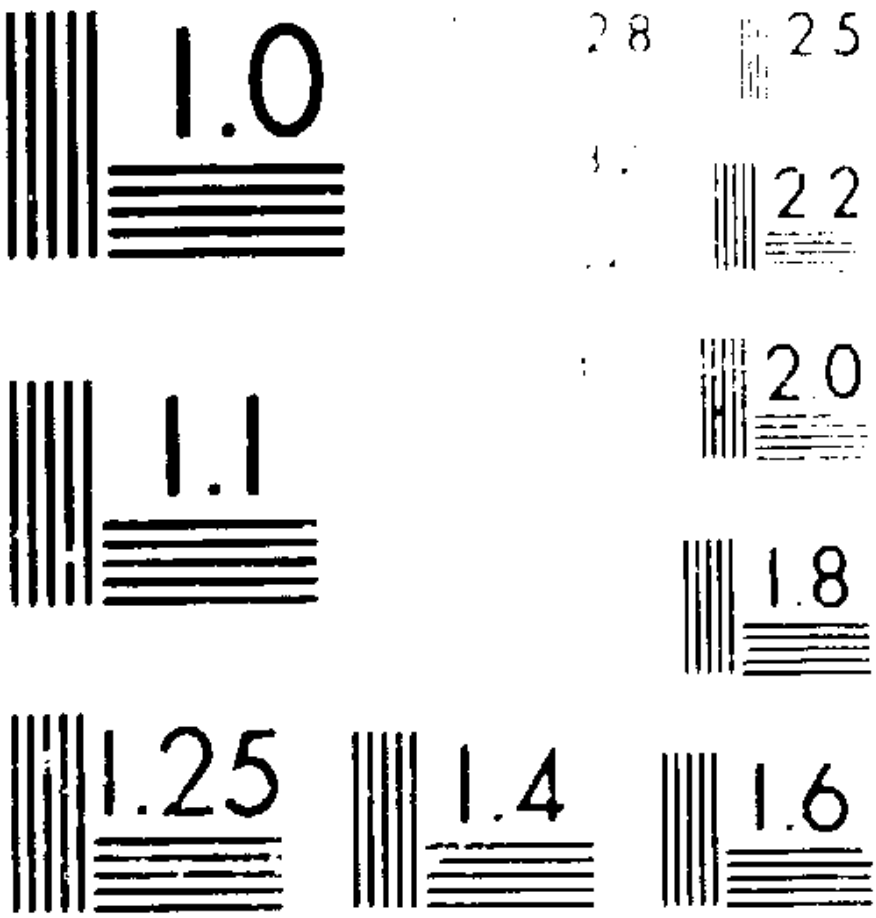
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RESEARCH AND DEVELOPMENT IN FOOD PROCESSING AND PACKAGING TECHNOLOGY

DP/MEX/82/010

MEXICO

Technical report* - Food Processing and Packaging

Prepared for the Government of Mexico
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Chaim H. Mannheim,
consultant in food processing and packaging

United Nations Industrial Development Organization
Vienna

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1. SUMMARY

This mission. which took place from 19 July to 2 September 1982, was a continuation of the mission carried out by this consultant in the summer of 1981.

In the interim period several important changes and improvements were made in the organizational structure of LANFI as well as in the physical facilities. Several new well-qualified people joined the technical staff and improved the capabilities and potentials at LANFI. With the inauguration of the pilot plant and the administrative buildings more, much needed, laboratory and office space became available for the other sections. The interior layout of the laboratories, proposed last year, still awaits completion. It is hoped that in next year's budget funds will become available for this purpose.

There is still a great need for LANFI staff to get more expertise in different fields of activity and acquire better understanding of industrial problems.

A three-fold plan for training of personnel is recommended :

a) In-house training through practical work in the laboratory supervised by senior staff and outside (UNIDO) experts.

b) Long-term thorough training abroad in specialized laboratories in fields of packaging materials and food science and technology. This training should be for advanced degrees.

c) Training in industry in Mexico is abroad to obtain practical experience and better understanding of industrial problems.

There is a great need to urge the staff to carry out more practical work and less desk and paper work. This requires changes in administrative procedures and more managerial control as regards accountability of time and funds. It is recommended to draw up detailed plans for each group including manpower as well as budgetary requirements.

After approval of plans funds should be made available per project and should be given directly to Head of Subdirection, or Department, to avoid unnecessary delays. Central computer control of these budgets should be implemented.

Specific projects were discussed during this mission and are given in the report.

The work required concerning completion of pilot plant facilities was reviewed and future requirements were discussed and are listed in the report. It is recommended to appoint a Pilot Plant Engineer who will be responsible for the coordination of all construction, maintenance and purchase of new equipment for the pilot plant. He should maintain a complete file of all engineering plans, equipment instruction manuals and purchasing information as well as spare parts. A list of much needed equipment was prepared and is given with priorities in this report.

There is also a great need for improved maintenance of physical plant including buildings and equipment. It is recommended to increase supervision concerning equipment maintenance and obtain service contracts for the more sophisticated pieces of equipment.

The continuation of UNIDO support to LANFI is recommended to strengthen technical as well as managerial capabilities. It is recommended that future misssions be of shorter duration but more frequent. This is desirable so as to encourage groups to prepare interim reports for each project.

2. INTRODUCTION

2.1 Background

In 1972 the Mexican Packaging Institute (IMEE) was established based on an agreement between the United Nations Development Program (UNDP), the United Nations Industrial Development Organization (UNIDO) and the Mexican Government.

In 1977 IMEE was integrated into the Mexican Institute for Assistance to the Industry IMAI. In July 1979 the project called "Consolidation of the Mexican Institute for Assistance to Industry (LANFI) DP/MEX/78/011 was started. UNIDO gave considerable help in consultants and equipment to LANFI mainly in the field of packaging.

In April 1981 IMAI and LANFI were integrated into one institute called LANFI - (Laboratorios Nacionales de Fomento Industrial). LANFI became a decentralized government organization with the aim to carry out research and development and provide assistance to the Mexican industry in the fields of packaging, food and chemical products.

Due to the need of the Mexican Government in the fields of Food Processing and Packaging UNIDO support will continue under the new project of 1982 called: "MEX/82/010 - Research and Development of Processed and Packaged Food Technology."

This expert served as a UNIDO consultant to LANFI in 1980 in the fields of packaging in general and metal containers in particular. He also served as UNIDO consultant in 1981 in the packaging field and gave assistance in setting up a Food Technology Pilot Plant. Thus, the present mission can be viewed as a continuation of the last two missions with emphasis on the integration of Food Processing and Packaging.

2.2 Job Description

Post title: consultant in food processing and packaging
Duration: one and a half months
Purpose of the project:
Generally the purpose of this project is to collaborate with the Mexican Government programs, by participating with technical support in the areas of food and packaging process and technology. Some of the objectives of this project are: to develop to the maximum advantages the food resources to make process criterion nomogeneous, to diffuse the use of packaging technology, to participate in elaborating new standards and in industrial training in the areas of food and packaging.
Duties:
The expert will be assigned to the National Laboratories for Industrial Development - LANFI, and will be expected to:

a. Follow up the food processing program of LANFI.
b. Help LANFI personnel in the setting up of the Food Processing Pilot Plant with special emphasis on the canning line.
c. Visit the food industries in Mexico in order to identify the main problems of this area.
d. Organize a plan of work for the Food Processing Pilot Plant in LANFI to be done in the next three years.
e. Help LANFI in the projects already started in the area of food processing.
f. Work together with Government Agencies as SAM (Sistema Alimentario Mexicano), Mexican Food System, in order to improve the food supplying system in Mexico.

2.3 Specific Objectives of Mission

Based on preliminary talks with the Director General, the Technical Director and Head of the Section for Food, Packaging and Design, the following specific objectives were set up.

a. To assist all groups in LANFI to get more expertise in the fields of food preservation and packaging in general and

in all aspects related to packaging materials, food products, processes, quality control and analyses.

b. To assist management in long-range planning

c. To assist in setting up the food pilot plant and specify new equipment.

d. To assist in planning and initiating new projects related to the optimization of processing conditions and packaging with emphasis on nutritional quality of foods.

3. DESCRIPTION OF WORK PERFORMED AND FINDINGS

3.1 Introduction

During the past year LANFI underwent several physical as well as administrative changes. The new pilot plant building was inaugurated by the President of Mexico in October of 1981. The transport packaging laboratory has been transferred and is fully operational. All packaging machinery donated by PMMI was installed in the new building. Food processing equipment was also transferred but could not be installed yet due to lack of steam, water and air connections. These installations were being carried out during this mission and important additions were recommended and accepted.

With the transfer of some of the departments to the pilot plant more space became available for the plastics, metals and food group. Unfortunately, the interior design proposed last year was not carried out due to financial difficulties. This laboratory space is still much needed and should be built as soon as funds became available.

Since last September no further equipment was ordered with one or two exceptions. The need for specific equipment will be mentioned later.

A considerable number of the administrative staff had been changed during the past year. It seems that efforts were made to consolidate several groups and streamline the operations to some extent.

The technical staff also was augmented by several well-trained people with advanced degrees. Both the physical as well as personnel improvements put LANFI in a better position to fulfil its role for the Mexican food industry.

3.2 Long-Range Plans

The two to five year plans of the institute which are to be presented to the Board of Directors were discussed. Several recommendations were made as regards priority of plans and omissions as well as unnecessary projects. Most recommendations were accepted by the technical director and changes were made accordingly.

It is strongly recommended that more detailed plans for specific projects be drawn up for the coming year. These plans should include both the scientific as well as the budgetary part. Once the plans are approved each subdirection should get a certain budget for equipment and especially expandable expenditures such as glassware, products for experiments and small items.

The latter seems most important due to the long time it takes to obtain even small funds to purchase materials.

3.3 Review of Last Year's Work

a. Metal Containers

Projects in the Metal Containers Group were reviewed, together with Dr. Ramón Catalá, another UNIDO consultant, and recommendations for future work were made.

These recommendations were drawn up jointly with Dr. Catalá and are elaborated in his report in Annex II.

In general, very interesting results were obtained especially as regards the high lead content in many canned foods including condensed milk which is used for babies.

These findings are very alarming and should be given urgent attention in future studies. For details see Annex I.

b. Papaya Study

The aim of this project was to prepare several papaya nectar formulations and evaluate their shelf-life in several different packages under ambient and accelerated storage conditions. The project was started during last year's mission and completed in the meantime. A report of the results was presented to this author.

It was found that the groups are not well-acquainted with the proper methodolcgy of preparing a report.

A thorough discussion was held with several heads of departments and sections and a short seminar on report writing was given.

3.4 New Projects

Based on preliminary talks with the suddirector and nead of departments it was decided to try and implement the interdisciplinary project approach. This means that for each project a group leader be appointed and participants from the individual sections be named.

It was found that too much time is spent in paper work rather than actual laboratory work. For example on some projects during the past 2 years very little was done except extensive literature surveys and plans and only a very limited amount of preliminary laboratory work. Great efforts were made to start as many projects as possible during this mission .

As mentioned before, the main objective behind all projects was to get more expertise in the different fields of activity. The second major objective was to optimize processing conditions for each process. The third objective was to obtain low price nutritive products.

Among the more important projects discussed and started during this mission are:

a. Fruit processing - Guayava

Guayava was chosen as the raw material for this project being a good example for learning many unit operations of fruit processing.

It was decided to prepare initially guayava pulp which would later serve as raw material for products like: nectar, drink, enriched drinks with soya, and dried products.

All the necessary equipment was set up and one batch of guayava pulp was produced. Plans were made for product development and all the necessary analyses were discussed.

As group leader, a person from the food technology group, was chosen and representatives from the materials section, food section and analytical section participated.

b. Retort Pouch

LANFI has a contract with OAS concerning the development of formulating and preserving foods in flexible pouches.

In the past year, work was started in collaboration with the author on preserving acid foods like chiles and tomato sauce. This was done due to the relative ease of processing and their relative importance in Mexico.

Furthermore, there was, and still is, a lack of suitable equipment for processing low acid foods. A suitable autoclave is on order and should arrive soon. However, a very much needed vacuum sealer and temperature recorder with suitable thermocouples is still not available.

Quotations for this equipment were obtained last year, and requisitions were made but later cancelled due to budget restrictions. These instruments should be ordered as soon as possible. For details see list of equipment in Annex II.

In the meantime it was decided to start preliminary work on the use of flexible pouches for heat processed foods. It was suggested to acquire proficiency in operating the autoclaves and obtaining heat penetration curves with model systems. This would make it possible to process actual products as soon as the autoclave arrives.

Two projects were outlined:

(i) Fish products

The object of this work is to develop products from under-utilized varieties such as lisa and compare them with tuna products.

In all cases comparative tests should be made between flexible pouches and some products in cans.

(ii) Soups

Since soups are an important component in the local diet it is proposed to develop soups especially adapted to the Mexican market.

c. Chile Project

Canned chiles make up about 30% of all canned products in Mexico. The processing of chiles involves a lot of hard labor as well as enormous losses of raw material during processing.

Almost no information could be found in the literature, using a computer search, concerning factors affecting quality of chiles.

It was therefore suggested that LANFI engage in a thorough, but applied, research project involving chiles. Processing conditions, as well as differences in variety should be investigated. The project should include chemical, biochemical as well as sensoric evaluations.

Results of this project could contribute significantly to the knowledge of this product world-wide.

d. Canned foods - General

In the past year the Metals Group carried out a preliminary study on quality of cans and canned foods in Mexico. One of the more important results of this study was that the lead content in canned foods in Mexico is very high reaching levels of up to 5 ppm. This is between 5 to 10 times the level permitted in most countries in the world.

Based on above it is strongly recommended to urgently carry out an investigation as to the causes of these high lead levels. The lead could be coming from either the raw materials or the cans. Therefore, tests must be made on both the raw materials and the cans as follows:

(i) Raw materials - the lead content of chiles should be investigated according to:
- varieties
- growing regions
- seasons

(ii) Cans - empty cans should be packed with model solutions containing salt and vinegar in concentrations identical to those in commercial products. Cans should be pasteurized and stored at 35- 37° C for 2 weeks and analysed for lead content.

Cans should be obtained from all can makers in Mexico.

(iii) Test pack with chiles - Cans from one or two manufacturers (based on results in paragraph (ii)) should be used for actual test packs.

Similar studies should be carried out with other products. For example, the lead content in condensed milk was found to be very high. Since this product is often used for babies it is very important to find the source of the lead and eliminate it.

One reason for high lead could be poor manufacturing practices in the can making industry i.e. excessive lead dust and free particles. However, this must be proven before measures can be taken.

3.5 Pilot Plant

In continuation with last year's mission considerable attention was given to the completion of all sanitary installations (steam, water and air) in the pilot plant. Unfortunately these were not completed during this author's mission and therefore work requiring pilot equipment had to be carried out in temporary facilities.

Equipment requirements for the pilot plant were discussed with the group and the list given in Annex II is based on these discussions as well as the author's own experience.

The list is divided into two priorities. Priority one being equipment needed urgently to carry out the most essential fruit and vegetables unit operations in the pilot plant. Second priority equipment are those needed to extend work to different areas such as dehydration. Third priority equipment is not listed this time due to the difficult economic situation.

In addition, contacts were resumed with Peter Stevens and Randall Swope from the Pan American Development Foundation.

An up-to-date list of equipment sent from U.S. which is still in Mexican Customs, was obtained. The equipment is in customs between three to fifteen months. The list was presented to the directors of LANFI and a firm promise was obtained from Mr. Armando Caso that all equipment will be cleared from customs by the end of August 1982.

Mr. Swope is making efforts to obtain further donations for a tray drier and other equipment.

3.6 Seminars and special lectures.

During the author's mission in Mexico he was asked to participate in Seminars and lectures as following:

a. At the: Escuela de Química.
Toluca, Mexico
August 5, 1982

Title: Extension of Shelf-life of perishables by the use of modified atmospheres.

The seminar was attended by about forty students and at the end a lively discussion took place.

b. Seminar in Glass Packaging in Mexico.
Place: LANFI
Date: August 6, 1982

Title: Preservation of food products in glass.

The abstract of this talk is given in Annex III.

c. Second Latin American Seminar on Standardization and on Sterilizable Flexible Packages.

Place: LANFI
Date: August 16 - 22, 1982

The author participated in these seminars with two lectures:

(i) Sterilization of Food Products in Retort Pouches (See Annex IV).

(ii) Accreditation of Laboratories in the Israeli Food Industry for Self-Administered Quality Control. See Annex V.

3.7 Training

The technical staff in general has a good theoretical background but often lacks practical experience. Too much time is spent on bibliographical and statistical reviews, research plans and other paper work and too little time is spent on practical work in the laboratory or pilot plant. It is highly recommended to induce staff to carry out more laboratory work. During the author's mission efforts were made to apply the interdisciplinary project approach to train staff in carrying out projects requiring interdepartmental cooperation. It is

recommended to continue efforts to implement this approach so as to increase amount of practical work being carried out. In order to do this management support is needed in supplying necessary funds for small expenditures. Management should also exercise more control as regards accountability and adherence to time tables for each project.

During the past year several people with advanced degrees joined the LANFI technical staff. This should enable LANFI to send all those people who do not have advanced degrees for further training as soon as possible. The author realizes the present economic difficulties in Mexico but nevertheless strongly recommends to draw up a long-range plan for advanced training of all personnel. Emphasis should be given to a round training for advanced degrees rather than short periods of training. The training should take place in specialized laboratories abroad in different countries.

It is also recommended that personnel stay in industries with high technical levels, in Mexico or abroad, in order to acquire much needed practical experience and get a better understanding of industrial problems.

3.8 Maintenance and Engineering Services.

As in previous years a serious lack in equipment and facilities maintenance was noted. Furthermore there seems to be no sufficient service support to the various activities. For example the electrical outlets in many places lack grounding and are dangerous to operators as well as to equipment. There is no supervision regarding electrical, steam or pressure safety. Some accidents occurred during the author's missions and others were prevented by the author. Many pieces of equipment are not operational due to some small or large fault and little is done to correct this. It is therefore recommended to employ a

qualified plant engineer to manage and oversee all problems regarding work safety, electrical, steam and pressure installations, etc. It is also recommended to improve maintenance of the sophisticated equipment in LANFI through education of the personnel and by means of service contracts in special cases.

3.9 Visits

The following visits were made during this mission.

a. Escuela de Química, Toluca, Mexico.

b. Instituto Politécnico Nacional,
Escuela Nacional de Ciencias Biológicas,
Carpio y Plan de Ayala, Mexico 17, D.F.

c. Fábricas de Monterrey, S.A.,
Toluca 2 piece can plant,
Toluca, Mexico.

d. Productos de Maíz,
Lerma, Mexico.

e. Tepepan Productos Pesqueros Mexicanos,
Mexico, D.F.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Training

In general the theoretical background of LANFI personnel is good. During the past year several staff members with advanced degrees joined the LANFI team and further improved the overall situation. However, there still is a great need for advanced and especially practical training of the junior staff.

As in previous years it is again strongly recommended to draw up a systematic long-range plan for training. This training should be divided into:

a. In-house training through practical work in the laboratory supervised by senior staff and experts.
b. Study towards advanced degrees in specialized laboratories abroad, in different fields e.g. metals, plastics, food science, etc.
c. Training in industry to obtain practical experience in industrial problems.

An offer was obtained during the author's stay from a large company in California to train two people in can making and canning technologies.

4.2 Planning

At present a two to five year plan is being elaborated at LANFI. It is recommended that also detailed plans be drawn up for the coming year. These plans should include both the scientific as well as the budgetary part.

In order to facilitate daily operations each subdivision (or department) should be given its own operational budget per year based on above-mentioned projects. These budgets should include funds for equipment as well as funds for resolving petty cash operations.

Specific plans for same projects, e.g. guayava, chiles, and retort pouch were discussed in this report.

4.3 Laboratory facilities

A significant improvement took place during the last year in expansion of size of laboratory facilities. However, unfortunately, the interior design of laboratories recommended last year was not carried out due to lack of funds. This means that laboratory bench space is still inadequate.

It is recommended to carry out the plan proposed last year which was given in detail in Annex I of last year's report.

4.4 Pilot plant

During the last year the new pilot plant was inaugurated and equipment was moved into it.

Unfortunately sanitary installations, i.e. steam, water and air were not completed at that time and therefore equipment could not be installed.

A list of very much needed equipment was prepared and listed in Annex II. It is recommended to purchase the equipment according to priorities given. It is furthermore recommended to appoint a Pilot Plant Engineer who will be responsible for the coordination of all contracting, maintenance and purchase of new equipment for the pilot plant. He should maintain a complete file of all engineering plans, equipment instruction manuals and purchasing information as well as spare parts.

4.5 Maintenance and engineering services

There is a lack in proper maintenance procedures of the physical plant including buildings, electrical services, steam, etc. In some cases such as electricity or steam, this could cause serious accidents. There is a lack of grounding of electrical motors as well as a lack in steam safety valves. As in paragraph 3, 4.4, it is recommended to appoint a plant engineer who should

coordinate all construction as well as maintenance activities of the buildings etc. in LANFI.

In addition it was found again that expensive laboratory equipment was not operative due to some minor or major fault. Very little is done to repair this equipment. It is recommended to increase supervision concerning equipment maintenance and obtain service contracts for the more sophisticated pieces of equipment.

A N N E X I

PROJECT

Title: Study the product-package interaction problems and optimization of the technological process for the preservation of chiles.

Objectives

1. To study the internal corrosion mechanism of canned "chile".
2. To establish the changes of the sensoric characteristics of preserved "chile" products.
3. To improve the technological process, and select the optimum container to obtain an improved product and reduce to minimum the container - product interaction.

Justification

Canned "chile" in different forms of preparation are a typical Mexican product, widely used by the entire population. These products rank at the top of Mexican canned foods. They satisfy the national demand and their exportation to the USA, France, Spain and other countries is growing rapidly.

The major part of the preserved "chiles" are presently packed in tin cans with severe technclogical and economical problems. From the economic aspect the tin can presents a high cost of the final packaged product. From the technological aspect there are frequent corrosion problems in these containers, due to inadequate specifications of the containers used, as was seen in studies carried out by LANFI.

LANFI found very little information concerning the technological problems regarding these products, in the literature. Visits to industry indicated severe production problems involving large losses of raw materials.

It is very important to perform a thorough experimental study taking into consideration all the different problems that "chile" preserves pose.

Description of the Project

Product: Variety of "chile"

Jalapeños (whole or in slices)

Serranos (whole)

Preparations

Preservation in vinegar and salt.

Preservation, after fermentation, in vinegar and salt.

Containers: Tin cans

Plain cans and lacquered cans obtained from manufacturers as being suitable for chiles.

Glass (jars with twist-off caps).

Flexible pouch with aluminium PET/PP.

Processing: Vacuum

mechanical

thermal - hot fill

Headspace (only in cans)

without

6-8 mm

Storage: Temperature

Ambient (23° C)

Tropical (35° C)

Time

See further.

By combining above variants, the parameters of the different lots will be selected. This selection will be done by proper statistical design to get the information required.

Preparation of samples

Since each different container needs different processing technology, preparation must be done separately, but using same raw materials and similar working conditions.

It is advisable to prepare samples under conditions simulating those existing in industry, to obtain representative results.

Samples will be prepared according to the parameters statistically established, and will be stored at different temperatures for their subsequent analyses during different periods.

Analyses

Samples should be analysed, periodically during 24 months, at intervals depending on storage temperature.

The evaluation of each kind of preparation will be based on its own characteristics.

In every analytical control, three samples from each lot will be studied using the following determinations:

Canned product:

- Analysis of the gases in headspace.
- Vacuum, headspace, net weight and drained weight.
- Corrosion degree of the package.
- Tin, iron and lead in the product.
- General appearance of the product.
- Color (Hunter parameters).
- Texture (Instron parameters).
- Flavor (organoleptic).

Product packaged in glass

- Vacuum, headspace, net weight and drained weight.
- General appearance of the food.

- Color (Hunter parameters).
- Texture (Instron parameters).
- Flavor (organoleptic).

Analyses should be done 4-5 times during 12 months of storage.

Products in flexible pouches

- Total volume, net weight and drained weight.
- General appearance of the food.
- Color (Hunter parameters).
- Texture (Instron parameters).
- Flavor (organoleptic).
- Migration.

Analyses should be carried out periodically, 4-5 times, during at least 6 months.

Prior to the preparation of the samples, a complete analysis must be done of the packages and raw materials. Thus, for reference, regarding color, a raw material sample must be stored, packaged in amber glass and frozen at -18° C. Furthermore, a complete analysis must be carried out on the processed product at zero time but should not be repeated during storage.

It is recommended not to carry out unnecessary periodic analyses, and to not perform tests from the different storage temperatures at the same intervals.

A N N E X I I

LIST OF EQUIPMENT TO BE ORDERED

Priority I

Equipment	Price	Manufacturer	N o t e
1) Pulper	Peso 220,000	Albamex, México	was ordered August 1982
2) Vacuum Sealer Mo Vac II		Woodward Research Co. 160 Howard Ave. Rochelle Park New Jersey 07662 Tel.(201) 843-3084	was ordered August 1981 order # 364 but initial payment was not made. Therefore order was cancelled.
3) Hand operated Crown cork capper	U.S. $1,500	a) Crown Cork Sealer Corp. 1200 Newkirk St. Baltimore M.D. 21224 Tel.(301) 563-8616 b) AKTRON, S.A. Denis Lacorte Amsterdam 77 - 401 Mexico 06100 D.F. Tel. 286-5759/79 286-7684	

4) Multipoint Temp. Recorder Model # 15305836-12 -43-2-000-002 10-290	U.S. $ 3,000	Honeywell , S.A. Av. Constituyentes # 900 México 10, D.F.	was requested August 1931 but not approved.
5) Temperature and Pressure controls for autoclave	U.S. $ 2,500	a) Taylor México b) AKTRON, S.A. México	
6) Can Seam Leak Tester		a) AKTRON, S.A. México b) Metal Box England	
7) Hunter Color Difference Meter	U.S. $ 8,000	Hunter Assoc. Lab. Inc. P.O. Box 2637 Reston Virginia 22030 Tel.(703)471-6870	See quotation from 8/81
8) Kettle (5 gal)		ABAMEX México	was requested
9) Refrigeration Chambers for frozen foods		Quotations should be obtained from Mexican companies	
10. Thermocouples for Heat conductivity measurements in cans and plastics	U.S. $ 1,000	D.F. Ecklund 1714 S.E. 47th St. P.O. Box 279 Cape Coral, Florida, 33904, U.S.A. Tel.(813)542.8557	Complete list was given to José Luis Camacho

Priority II

1) Tray Drier	U.S. $ 17,000	a) Procter Schwartz 7th St. and Tabor Rd. Philadelphia, Pa. 19120 (215) 329-6400
	Will send quotation	b) C.G. Sargent & Sons P.O. Box 409 E Westford Mass. 01886 (617) 692-6371
2) Double Drum Drier	Will send quotation	a) Bethleliem Corp. 25th & Lennox St. Earton Pa. 18042 (215) 258-7111
	Will send quotation	b) Mathis Machine Corp. 23158 Keller South Bend Indiana 46600 (219) 232-9693
3) Vacuum Kettle	U.S. $ 20,000	a) Groen Division Dover Corp. 1900 Pratt Blvd. Elh Grove Village, Ill. 60007

	Will send quotation	b) AKTRON, S.A. México
4) Abrasive Peeler		a) Ron Bichel & Assoc. P.O.Box 406 351 S. Lake St. Hustiford, Wisc. 53034 Tel.(404) 349-3244
		b) AKTRON, S.A. México
		c) HOBART, México
5) Cutter - Cuber	U.S. $ 2,600	Hallde Inc. 3706, 61 St. P.O. Box 729 Woodside N.Y. 11377

ANNEX III

PRESERVATION OF FOOD PRODUCTS IN GLASS

Dr. Chaim Mannheim
UNIDO Expert

Laboratorios Nacionales de Fomento Industrial

Glass bottles are used extensively to preserve and market fruit juices and fruit drinks as well as carbonated beverages including beer.

Glass jars are used to pack baby food, jams and to a lesser extent fruit compotes and several vegetable products. Glass containers are considered inert as regards their interaction with foods, nevertheless several problems exist.

In order to preserve the foods contained in glass, hermetic closures are mandatory. The most popular closures are of the "twist-off" and "pry-off" types, however, crown corks and regular corks are still used extensively for bottles. Care must be taken to prevent product contamination from closures and to assure their sealing integrity. For this purpose closures are usually heated with steam prior to use. Furthermore the glass container sealing lips must conform to very accurate specifications of the closure.

Methods of preservation of foods in glass containers include hot-filling, aseptic filling and preservation with chemicals for acid products and sterilization in an autoclave for high pH foods.

A good vacuum is needed in the container since this assures minimum residual air as well as serving as an indicator for sterility.

Hot-filling means that the glass must withstand the heat of the product and a certain thermal shock during cooling.

In the process of aseptic filling, container and product are sterilized separately and product is filled cold under very clean (aseptic) conditions. For this purpose, the container must be able to withstand the sanitizing chemicals such as caustic soda and iodoform which is no problem for glass.

Sterilization of low pH products such as vegetables and meat in glass require careful control.

No sudden temperature changes are permitted and a certain air overpressure is required to prevent removal of lids and leakage. Special care must be taken during cooling and only chlorinated cooling water should be used. This is necessary since rubber seals will only be hermetic once container is cooled to 35° C or less.

Shelf-life in glass containers is normally good but in some cases light induced changes may occur. For example oxidation of milk fat or edible oils may be catalized by light. In such cases amber bottles should be used. While no metal dissolution can occur in glass the absence of the reducing tin may accelerate browning and loss of flavor. This can be reduced by cool storage and good processing techniques. Glass bottles were recently found to offer double the shelf-life for fruit juices as compared with laminated carton packs (6 months vs. 3 months).

In summary, glass containers are, and will remain to be, important in the food industry. Their advantages are relative inertness and recyclability. However, care must be taken in their use to assure product quality.

ANNEX IV

STERILIZATION OF FOOD PRODUCTS IN RETORT POUCH

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INTRODUCTION

All calculations of thermal sterilization are based on the same principle, namely: when subjecting bacteria to a heat treatment the percentage of microbes killed per unit time, related to the number at the beginning of the time unit will invariably be equal. We can also express the same principle by stating that the killing of bacteria is a first order reaction. Since we are actually interested in the number of surviving bacteria we can state that they will decrease in an exponential manner. This means by plotting the logarithm of survivors vs. time a straight line is obtained.

Based on above, values giving the relationship between heating time, number of bacteria and temperature are as follows:

D (T) — The time required at temperature (T) to reduce specific microbial population by 90%.

F (T, z) — The equivalent time at temperature T delivered to a container for purpose of sterilization using a specific z.

z — The temperature change in °C (or °F) to cause the F or D values to change by a factor of ten.

Fo — The number of equivalent minutes at T= 121°C delivered to a container using a z = 10° C.

Q_{10} — Denotes how many times a reaction is accelerated at a 10° C temperature increase.

HTST — High temperature short time.

Assuming that the z values for most bacteria are 10 and the Q_{10} values for most chemical reactions which cause nutrient losses or sensory damage are 2 one can see the advantages of using HTST processing methods for foods. These will assure microbial sterility with a minimum of quality changes. Since the retort pouch is offering very good heat transfer the HTST concept can be applied here.

Among the aspects which distinguish heat processing of flexible pouches as compared with rigid containers such as cans in glass jars are:

Product volume and headspace control
Heat transfer
Product quality
Handling

Volume control of the product is necessary to assure same heat transfer all the time. Headspace control is required to avoid excessive expansion of the gas phase inside the pouch which may cause:

Change in shape of pouch with a tendency to become spherical. This decreases the rapid rate of heat transfer due to the change in the cross-section of the container.

Stress on seals and material.

Decrease of contact area between product and flexible wall which also decreases rate of heat penetration.

Headspace gas content can be minimized by using steam tunnels and steam vapor sealing or by vacuum sealing. The former method is preferred since it is faster and easier to use commercially. Other ways include sealing without headspace but this is difficult since precautions must be taken to prevent seal lip contamination.

In order to keep expansion of flexible pouches within required limits during processing and assure good heat transfer they must be put in special racks in the retorts and external air over-pressure must be applied. This external pressure must be kept during the entire heating and cooling cycle.

HEAT TRANSFER

The flexible pouch, in comparison to the can has a relatively high surface area to volume ratio. This provides excellent opportunities for rapid heating and cooling of the product.

The suitable heat transfer media for sterilizing pouches are water and steam with supplemental air pressure to control pouch volume and reduce stress on seals and material.

Initially only hot water was used to process pouches. However, with improved understanding about the behaviour of steam-air mixtures and improved means of control, their use has become more accepted for processing of flexibles as well as many conventional packages. This is due to the higher, about triple, heat transfer coefficient of condensing steam as compared to water.

In order to maintain a homogenous temperature distribution in the autoclave, and near the pouches, a thorough circulation of the heat transfer medium is necessary. For this purpose air-steam mixtures are advantageous.

To maintain homogeneous temperature distribution in a water bath at least 0.5 - 1.0 m/sec circulation speeds are required. This will impose considerable forces on the pouches which must be prevented by enclosing them in proper cages.

Steam air velocities along the flexible's wall should be of the order of 3-5 m/sec.

However, since the density of air-steam mixtures are only 2-2.5% those of water, the forces on the pouches will be only one-tenth those in a water bath.

Starting up a retort batch and the energy required for circulation also favour an air-steam system.

Flat flexibles, such as pouches, or trays, should preferably be processed while positioned horizontally. This enables the content to spread out equally.

Rotation of packages during processing may improve heat penetration on one hand, but on the other hand will impose additional forces on the material which may cause permanent damage. Furthermore, improvement of heat transfer in vacuum-sealed flexibles will be small due to absences of gas bubbles. In any case if flexibles are to be protected during processing, racks must be built in such a fashion that no movement of pouches will take place so that mechanical damage to flexibles is prevented.

The thickness of flexibles during processing must be fixed by special racks to assure even and reproducible heat transfer speeds at all times. During heat penetration studies, care must be taken that temperature measuring devices, i.e. thermocouples do not move during processing and are fixed at the slowest heating location.

PRODUCT QUALITY

Flexible packages offer the advantage of improved heat transfer due to their shape and walls. Thus shorter processing times will be required for obtaining "commercial sterility" and these will be accompanied by improved nutrient retention and sensoric quality.

Since the principle of HTST is applied here care must be taken to inactivate all the enzymes some of which have z values of 20 to 35 as compared with z values of 10° C for microbial destruction.

Some studies have shown improved thiamine retention in flexibles. However, in general the improvement due to HTST of pouches should not be over-emphasized. On the other hand foods in pouches can be processed

with less liquids, such as brine or syrup, and this may improve product quality considerably. In addition, the absence of almost any head-space and air in the product has also great benefits.

HANDLING

Flexibles are certainly more susceptible to damage before, during and after processing. They must be handled with extra caution at all stages making the operations more labor intensive than for rigid packages. In addition protection of flexibles in the marketing channels often mandates a secondary carton. These two points tend to make the cost of flexible packages higher. Therefore, at this point from the economic point of view flexible pouches can compete with cans only in the larger sizes i.e. for institutional packs of 3 liters or more.

In summary, flexibles offer several advantages to the preservation of heat processed foods. However, great care must be taken in all steps of processing. The use of these packages is cheaper for institutional size containers but not necessarily so for small retail packs due to slow speeds of lines, need for special precautions in handling during processing and marketing.

ANNEX V

ACCREDITATION OF LABORATORIES IN THE ISRAELI FOOD INDUSTRY FOR SELF-ADMINISTERED QUALITY CONTROL

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The regulations concerning quality control of food products for export are based on laws formulated in 1971.

A. The conditions for self-administered quality control.

1. The existence of an adequately equipped laboratory to carry out the required tests. For each type of industry there exists a detailed list of facilities required.

2. The existence of a suitable library which must contain all the standards and regulations pertaining to the products made by the company.

3. The presence of qualified personnel who will be responsible for quality control and will not be subordinate to the production manager but rather to the general manager.

4. A written assurance from the management to carry out the quality control procedures specified by regulations for each product.

5. All analyses will be recorded in a special book, kept in the laboratory at all times and will be open to review by the government inspector on demand.

6. Products will be approved for export only if they meet all requirements set out in standards and other regulations.

7. The factory has a valid licence from the Ministry of Health to produce foods.

B. Methods of Analysis and their frequency

1. All products will be analysed according to methods described in the Israeli Standards existing for each product.
2. Products which contain chemical preservatives must be analysed as to their quantity at least daily.
3. All products must be analysed routinely for presence of foreign matter. Products which may contain sand (e.g. pickles) must be tested routinely for this defect.
4. Frequency of analyses for every product and each parameter are given in a special list. The frequencies vary from one for each batch, or every hour, to tests per production day.
5. Number of samples tested depends in size of lot and is determined usually according to U.S. Mil. Standard 105D. The AQL is determined according to severity of defect.
6. Special analytical procedures exist to test the authenticity of various products.

C. Permission for self-administered quality control

Each factory interested in self-administered quality control and the right to certify by itself that products are fit for export must apply to the Ministry of Commerce and Industry.

The factory will then be inspected to verify that it fulfils all above requirements.

The right to sign export certificates will only be given to specific persons designated as being responsible for quality control.

Each shipment of products must be accompanied by a certificate that it was duly tested and found fit for export. It must be signed by one of the persons authorized to sign. Shipments reaching ports without such certificates will be returned to factory.

D. Statistical method to verify factory results and conditions for revoking licence for self-administered quality control.

From time to time the quality control institute will take samples for analysis. Samples will be taken at random according to a fixed statistical sampling plan.

These samples will be analysed in impartial laboratories and results will be compared with those recorded in the laboratory notebook of the factory.

Results of both laboratories should agree within accepted tolerances according to a special statistical plan. Different plans exist for homogeneous samples such as juices and concentrates and for particular products such as fruit compotes.

The authorization for self-administered quality control will be revoked if:

1. One of the conditions outlined in paragraph A are not met anymore.
2. There is a significant and continuing discrepancy between factory results and comparative inspection results.

3. There is any adulteration or foreign matter found in products destined for export.