

9310560

PDAFV-320

IANE 47340

Commercial Soybean Food Development
Activities in Mexico

Alvin Siegel

ISR-81-6

November 1980

International Soybean Program, INTSOY

College of Agriculture
University of Illinois at Urbana-Champaign
113 Mumford Hall
1301 West Gregory Drive, Urbana, Illinois 61801 U.S.A.

College of Agricultural Sciences
University of Puerto Rico, Mayaguez Campus
Mayaguez, Puerto Rico 00708

INTERNATIONAL SOYBEAN PROGRAM (INTSOY)

INTSOY/Peru

TRIP REPORT - Acapulco, Mexico
Mexico City, Mexico
Chihuahua, Mexico

NAME: Alvin Siegel
TITLE: Assistant Professor, Food Science
Soybean Processing Specialist, INTSOY
DIVISION: INTSOY/Peru
TRAVEL PERIOD: November 9 - 20, 1980
ITINERARY: See attached APPENDIX A

PURPOSE:

1. To attend the World Conference on Soya Processing and Utilization November 9 - 14, 1980.
2. To visit the National Institute of Nutrition, Mexico City, concerning soybean activities.
3. To visit the Universidad Iberoamericana, Mexico City, concerning the Master Degree Program for Ing. Eddy Barnett M. (IIA) - soybean project scholarship.
4. To visit the American Soybean Association, Mexico City, concerning soybean food promotion and utilization activities.
5. To visit several companies and organizations involved in soybean food development and promotion. Emphasis on the application of Low-Cost Extrusion Cookers (LEC's) at the commercial level - State of Chihuahua.

PERSONS CONTACTED: See attached APPENDIX B

BACKGROUND:

Increased interest in the utilization of extrusion processing for the preparation of low-cost soybean-based nutritious foods applicable to developing countries prompted both attendance at the World Soya Conference and visits to private companies and institutes engaged in soybean food development and promotion activities.

Emphasis in this report is justifiably given, therefore, to the contacts made with these companies and institutes currently devoted to soybean food uses - either nutritional evaluation or research. It appears that the State of Chihuahua, supported by the state sponsored CIATECH and the Chihuahua Institute of Research and Development in Nutrition, have made strong gains in promoting Low-Cost Extrusion Cookers (LEC's) for soybean foods. The activities of these groups and affiliated companies are outlined in this report.

.....

WORLD CONFERENCE ON SOYA PROCESSING AND UTILIZATION (ACAPULCO)

OVERVIEW

The conference covered most aspects of traditional soybean processing and utilization geared to the large industrial sector. (See appendix B). The area of soybean oil extraction and product use was emphasized. The direct use of soybeans as a human food source and new foods applicable to both developed and developing countries, aside from traditional products, did not receive sufficient attention. All aspects of nutritional value of soybeans was adequately covered and very well presented.

Round table discussion groups did provide the opportunity for direct exchange with speakers eventhough the topics scheduled did not always match the formal presentations. More contributed research papers would have added an increased scope. Exhibits did provide an opportunity for receiving a good deal of information on soybean processing equipment.

COMMENTS

A. Conference Coverage:

- Traditional Soybean Processing and Utilization - soybean oil, soybean cake for animal feed, soybean oil by - products, textured vegetable protein (TVP), soybean isolates and concentrates, soybean flours.

B. More Coverage Needed:

- New Soybean Processing - Fermented soybean foods, small scale soybean extrusion, soybean beverages, soybean product development for small and medium-sized industry, in-country soybean food development programs, marketing studies for soybean foods.

NATIONAL INSTITUTE OF NUTRITION (MEXICO CITY)

The National Institute of Nutrition (INN) is a government supported institute devoted to various aspects of nutrition science. The earlier existence of a government hospital led to the establishment of the INN in 1956. The hospital is a part of the Institute.

The five basic divisions of the Institute are as follows:

1. Hospital
 - metabolic studies
2. Medical research - gastro-intestinal
3. Nutrition Education
 - films
 - TV
4. Administration
5. Nutrition Research
 - Physiology
 - Epidemiology
 - Experimental Nutrition
 - Food Technology

Various work of the Institute includes nutrition population studies and the analysis of the Mexican food intake in relation to nutrient requirements. The food Technology group concentrates on the composition of foods (essential amino acids), nutritive value of Mexican foods, and food toxicology. This group has also worked with development of nutritious food blends.

Soybean research has been conducted during the past six years in the area of product development, evaluation of existing products, and chemical evaluation of soybean varieties. It is estimated that 2% of the soybean production is used for human food - (98% - animal feed).

At the Institute, soybeans are viewed as a potential plant protein source for extending animal protein products. Animal protein foods (meat, milk) are increasing in price giving rise to using soybeans as an extender substitute. Soybean food promotion programs have emphasized the use of soy flour in tortillas (3%), textured vegetable protein (TVP - soya) in cominuted meats and sausages, and beverages containing cow's milk solids and soy flour. There is one major "soy beverage" company and four major TVP companies in Mexico.

The Institute itself is sponsoring the development of extruded food mixtures (sesame seed, cottonseed, soya) under its on-going research program (a laboratory model Wenger X - 5 is in use).

It was pointed out that fermented soybean foods may have good possibilities in product development programs. One such product is Tempeh. Another area for more research is Tofu (soybean curd).

Overall, more studies are needed on the acceptability of soybean foods by the community. High importation of soybeans does not insure that it will be for human food. Although one can find a large number of soybean "speciality" foods, the market is small. The National Institute of Nutrition does have the potential for evaluating and promoting soybean foods.

UNIVERSIDAD IBEROAMERICANA (MEXICO CITY),

The Department of Nutrition and Food Sciences of the Universidad Iberoamericana offers a Master's of Science in Food Technology. The program, which covers two years, consists of five semesters (courses) and thesis research. Ing. Edy Barnett M. of IIA has undertaken this program since August, 1979 with a scholarship provided by the INTSOY/Peru - Soybean Project.

Title of Thesis:

"Interaction of Soybean Factors, Sodium Polyphosphate, and Water in the Preparation of Anchovie Sausages".

Discussions were held with Edy Barnett and his thesis adviser, Prof. Carlos Lever, concerning thesis research activities. Full-fat and defatted soy flours in addition to soy isolate, and textured soybean protein will be used to make sausages. Soybean components will be used at levels of 0, 15%, 30%, and 50%; polyphosphates - 0.2%, 0.3%, 0.5%; and water - 0-50%.

Laboratory analyses of raw materials and final products will include proximate analyses, bacteriological assays and physical analyses. Sensory evaluation will also be conducted. The course work and thesis research for the Master's degree will be completed July, 1981. (A time extension is being made accordingly - from March to July).

According to Prof. Lever, in Mexico 12% of the soybeans in the form of textured soybean protein and isolates are used for human consumption primarily in comminuted meats (sausages). The use of soybean as an extender of meat products has gained the widest use in research and development activities in the Department of Nutrition and Food Sciences.

SOYBEAN FOOD DEVELOPMENT IN THE STATE OF CHIHUAHUA, MEXICO

- A. Visits to four (4) soybean food companies (attached report)
- B. Visit to the Centro de Investigaciones y Asistencia Tecnológica del Estado de Chihuahua (CIATECH) - (Center for Research and Technical Assistance of the State of Chihuahua) Development of Low - Cost Extrusion Cookers (LEC's)
- C. Visit to Instituto Chihuahuense de Investigación y Desarrollo de la Nutrición, Chih., Mexico. (Chihuahua Institute for Research and Development in Nutrition)

A. VISITS TO EXTRUSION COMPANIES IN CHIHUAHUA

Three extrusion companies and one granola (snacks) company was visited. The companies were located in several cities in the State of Chihuahua (Mexico). It should be pointed out that some of the plants were equipped with Brady low-cost extruders, while some others had locally-manufactured extruders (based on the Brady system). The latter were locally produced under the supervision of CIATECH.

1. Visit to the Delivias Co. (PADSA)

- Location: Delivias City - Chihuahua, Mex.
- Time in Operation: 3 years
- Products Produced: Full-fat soy flour and SOYAVEN
(maternized milk based on soy flour)
- Production Capacity:

Full-fat soy flour - 900 kg/hr

Soyaven - 1000 cans of 400 gms each per shift

- Total Actual Production: 25% of installation capacity
- Personnel for actual production:

- 1 plant manager,
- 1 lab analyst,
- 3 sales personnel,
- 1 secretary,
- 1 accountant,
- 8 plant workers

(SEE FLOW A)

A) PROCESSING FLOW FOR FULL-FAT SOY FLOUR

Whole Soybeans

Weigher

Cleaner ----- Local manuf.

Cracker ----- Roskamp, Iowa, U.S.A.

Air-Separator ----- Local manuf.
(hulls)

Conveyer ----- Local manuf.

Extruder ----- Brady' equipped with pressure
and temperature controls

Drier

Mill -----
(pin mill) Alpine - Contraplex, U.S.A.

Packaging

Storage

According to the flow, the process starts with raw, whole soybeans which are cracked, dehulled, cooked (extruder) and ground.

The most expensive equipment in the flow is the Pin Mill (approx. \$30,000). This equipment is indispensable for making full-fat soy flour since it is the only mill capable to finely grinding the soy flour eventhough it has a high fat content.

B. FLOW FOR PROCESSING SOYAVEN

Soyaven is a mixture of soybeans, oats, and sucrose. The oats and soybeans are cooked together in the Brady extruder. The final product has a granular appearance which is broken down (more fine) in the blender during the addition of sucrose, vitamins, minerals, and vegetable oil.

(SEE FLOW B)

2. Visit to the Basic Foods Co. of Chihuahua (ALBACHISA)

- Location: Chihuahua City, Chihuahua
- Time in operation: 1 year
- Products produced: FIF Milk and Ri-K (malted)
- Production Capacity: 500 lts per shift (8 hrs)
- Total Actual Production: 500 lts (one shift only) - DIF
800 - 1000 lts - Ri-K (malted)
- Personnel:
 - 1 manager
 - 1 accountant
 - 2 drivers
 - 4 plant workers

This plant is intended for milk production. Two types of milk are processed as follows:

FIC Milk - This product is sold to school feeding programs. This milk-substitute contains defatted milk powder containing 8% added full-fat soy flour (produced by the Delicias Co.).

Malted Milk - This is 100% soy milk (based on full-fat soy flour).

The system for pasteurization is long time-low temperature.

(SEE FLOW C)

B) PROCESSING FLOW FOR SOYAVEN

Whole Soybeans and Oats

Cleaner

Mixer

Cracker

Air-Separator
(hulls)

Conveyer

Extruder

Cooler

Mixer

----- Addition of vitamins,
minerals, sucrose and oil

Storage

Canner

Storage

11-

C) PROCESSING PLAN FOR HI-K MILK (GALLEY - 100% SOY)

Full-fat Soy Flour

Weigher

Dissolve in water ----- Addition of sugar,
salt, and oil

Slow Pasteurization
(1hour at 88°C)

Holding

Homogenizer

Plate cooler

Mixing ----- Addition of flavor and
color agents

Packaging

Refrigeration

The price of Ri-K (malted) is 10% less than that of regular cow's milk. It is sold in the open market.

For the preparation of DIF milk, a process very similar to the one for Ri-K is followed with the only exception being the addition of 3% full-fat soy flour for every 100 liters of defatted powdered cow's milk.

DIF milk is sold to school breakfast programs (public schools). All the equipment with the exception of the homogenizer is locally manufactured. The agency in charge of quality control is CIATECH. The milk products are sold in tetra pack cartons of 1, 1/2 and 1/4 liter. Storage stability is seven (7) days under refrigeration.

The product labels for all processed products manufactured at the three visited plants state that they contain "vegetable protein". They do not state the words "soy or soybeans". In the case of Ri-K milk (malted), it is not indicated that this is soy milk; the label reads "milk, vegetable protein."

3. VISIT TO THE IMPROVED FOODS CO. (ALMESA)

- Location: Cauhtemoc City, Chihuahua
- Time in Operation: 11 months
- Products Produced: Enriched maize flour (8% full-fat soy flour) for making tortillas
- Production Capacity: 12-18 metric tons per day
- Total Actual Production: 3 metric tons per day
- Personnel:
 - 1 plant manager,
 - 1 analyst,
 - 1 secretary,
 - 4 plant workers

(SEE FLOW D)

D) PROCESSING FLOW FOR SOY - FORTIFIED MAIZE FLOUR

Whole Maize

Cleaning

Pre-cracking
(rollers)

Storage
(2 bins)

Mixing
(bin mixer)

Extruder
(CIATECH

Addition of 5% water to
improve processing

Cooling

Mill

Pin and hammer

Storage

Packing
(sacks)

It should be noted that this product (enriched maize flour) has a higher price than regular maize flour. The extra cost is covered (subsidy) by the state government since this flour is used in institutional feeding program.

4. VISIT TO A COMPANY (SMALL) MAKING GRANOLA-TYPE BARS

- Location: Chihuahua City, Chihuahua
- Time in Operation: 8 months
- Products Produced: granola - type bars
- Production Capacity: 384,000 bars of 30 gms each per day
(8 hrs)
- Total Actual Production: 120,000 bars of 30 gms each
- Personnel: 1 operations manager, 6 workers

The company manufactures sweet snacks for the state school lunch programs. Each granola bar is sold specifically to this program at a price of 10 U.S. cents. In view of the good results with this product (economic aspect), it is planned to begin its commercialization in the open market (public).

The granola bars are strictly sold as a sweet without mentioning its nutritional value. The bars contain 10% full-fat soy flour (on a weight basis).

(SEE FLOW E)

The process is quite simple consisting of blending the solid ingredients in a low-speed blender followed by the addition of other liquid ingredients. The final moisture content of the mixture (dough) is about 18%. The wet dough is subsequently poured into greased baking molds (60 cm x 60 cm x 5 cm) which are divided into small squares using metal gratings. The filled mold is covered with a wooded press which fits the grating divisions to form a uniform layer. The wood press is removed and the flat dough is baked. The dough squares (granola bars) are later separated from the molds and allowed to cool before packaging.

This system for producing granola bars is especially attractive since it requires a small amount of simple equipment, namely, a cereal flaking roll, bread mixer, and conventional oven. In addition, it is a profitable operation since the final product possesses both a uniform shape and color, and oven weight loss is only 5%.

E) PROCESSING FLOW FOR GRANOLA 1A

Whole Oats

Sheeting

Mixing
(solids)

Addition of full-fat
soy flour

Addition of Liquids
(incl. dissolved solids) ---

Sugar syrup, oil, salt
glucose, vanilla

Molding

Pressing

Baking

Cooling

Packaging

Plastic bags
(heat - sealed)

B. CENTER FOR RESEARCH AND TECHNICAL ASSISTANCE OF THE STATE OF CHIHUAHUA - CIATECH

CIATECH, created in 1976, is a government-funded institute (Federal - 90%; State - 10%) dedicated to improving the nutritional status of the Mexican population through assisting the private sector in the development of nutritious foods. An outstanding emphasis has been given to the promotion of soybean foods based on in low-cost extrusion cookers (LEC's). Positive results have been realized in this effort.

The major functions of CIATECH can be outlined as follows:

- Technical assistance to small and medium sized industries.
- The development of Agro-Industrial projects making the best use of raw material available in the State of Chihuahua.
- Research and development for new processes and products and the improvement of existing ones.
- Technical exchange with research centers both in-country and foreign.

CIATECH has six (6) divisions namely:

- Information
- Engineering and Technical Assistance
- Applied Research
- Analytical Services and Quality Control
- Administration
- Market Studies

Concerning soybean food development, the Engineering and Technical Assistance Division has supported the design of extrusion equipment and plants, the installation of equipment in these new plants, the quality control for final products, and the economic and sales feasibility of the new products. The Applied Research Division has developed new technologies for utilizing various food products locally-available. This work has involved the enrichment of traditional foods with those containing a high protein content to improve their nutritive quality.

The specific study for the utilization of soybeans to enrich basic foods has realized the design and construction of three plants:

- PADSÁ, Delicias City. Full-fat soy flour - low-cost extrusion cooking (Brady).
- ALBACHISA, Chihuahua City. Malted soy milk and beverages in various flavors.
- ALMESA, Cuahúomoc City. Maize flour enriched with soybeans for making tortillas - low-cost extrusion cooking (CIATECH-designed extruder).

The positive results obtained by CIATECH in a relatively short time demonstrate the enormous potential for the soybean food industry. State and Government support is a key factor in addition to the dedication and technical expertise of the CIATECH staff. The development of soy foods at the local level with locally-designed equipment clearly demonstrates a route to be taken for other soybean food programs in developing nations.

C. CHIHUAHUA INSTITUTE FOR RESEARCH AND DEVELOPMENT IN NUTRITION

The general activities and research emphasis of this Institute involve clinical trials (in cooperation with the Chihuahua Children's Hospital), nutritional studies for children and adults, baby-food development, biochemical analyses of local foods, and school feeding programs. This Institute has on-going involvement with the soybean food utilization and product development program of the State of Chihuahua. The specific areas for soybean use is in the evaluation of a soy-oat infant formula and the promotion of soybean milk/beverage products.

In 1977, the Institute initiated research activities for the development of a new product based on soybeans and oats intended as an infant formula. The team of researchers included medical doctors nutritionists, and technicians. Staff from the Chihuahua Children's Hospital worked cooperatively with the Nutrition Institute. A product named "Soyaven" was developed containing full-fat soy flour (32.1%), pearléd oats (25.6%), sucrose (34.1%), vegetable oil (5.8%), vitamins and minerals (2.1%). Soyaven contains 17.5% protein (4.0% moisture basis). The overall product development program has involved formulation, nutritional evaluation with laboratory animals, clinical studies with infants, chemical analyses and the installation of a plant to produce Soyaven (PADSA).

See attached report - Development, Evaluation, and Industrial Production of a Powdered Soy-oats Infant Formula Using a Low-Cost Extruder.

The Nutrition Institute has also worked with soy milk/beverage development, namely DIF and Ri-K which are soy-fortified milk and whole soy milk products, respectively. Biochemical and microbiological analyses support the open marketing of these products.

The work of this Nutrition Institute strongly emphasizes the need for a cooperative effort, i.e. industry, government, state, research and technical institutes, in promoting soybean food development programs.

19

APPENDIX A

ITINERARY

Sunday, November 9 - Friday November 14 (Acapulco)
Soya Conference

Saturday, November 15 (Acapulco/Mexico City)

Sunday, November 16 (Mexico City)

Monday, November 17 (Mexico City)
U. S. Embassy - Barnett Scholarship
American Soybean Association

Tuesday, November 18 (Mexico City)
National Institute of Nutrition
Universidad Iberoamericana

Wednesday, November 19 (Mexico City/Chihuahua)
Soybean Food companies
Nutrition Institute - Chihuahua

Thursday, November 20 (Chihuahua/Mexico City)
Soybean Food companies

APPENDIX B

PERSONS CONTACTED (specific):

National Institute of Nutrition (Mexico City)

- Dr. Fernando Pérez Gil
Division of Nutrition

- Ing. José Luis Camacho
Division of Nutrition

Universidad Iberoamericana (Mexico City)

1) - Ing. Eddy Barnett M. (IIA)
Student, Masters Program -
Food Science - Soybean Project

2) - Professor Carlos Lever J.

3) - Ing. Victor Manuel Navarro F.
Dept. of Nutrition and Food Science

American Soybean Association (Mexico City)

- Mr. Gil Harrison
Director - ASA - Mexico City

- Ms. Ruth S. Orellana
Director of Human Nutrition
Centro de Nutrición Humana
Georgia N° 46, Cal. Napoles
Mexico 18, D. F.

State of Chihuahua, Mexico

1) - Dr. Francisco R. del Valle
University of Chihuahua

2) - Dr. Margarita Escobedo Gameros
Technical Director

- Dr. Hector Villanueva
Pediatrición, Medical Center

- Ing. Carmen Graciela Torresdey
Administrative Director

- Instituto Chihuahuense de Investigación y
Desarrollo de la Nutrición
Apartado Postal N°1719
Calle Jimenez N° 4403

3) - Ing. Armando Camacho G.
Director
Centro de Investigaciones y Asistencia
Tecnológica del Estado de Chihuahua (CIATECH)
Apartado Postal 1067

4) - Ing. Mario Vega Pineda
Production Manager

- Ing. Joaquín Ponce
General Manager

Productos Alimenticios Delicias S. A. (PADSA)
Apartado Postal 376
cd. Delicias, Chih.