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ENRICHED FOODS FOR PARAGUAY

by

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1. Background

The Government of Paraguay (GOP) has expressed an interest in the development of inexpensive, nutritious processed foods for distribution to low income persons in periurban areas. This interest stems largely from a desire to help the poor cope with rising food prices, but is also based on GOP policies to foster local production of protein enriched cereal products, particularly products which would result in reduced importation of wheat using local soybeans as an enrichment ingredient and extender. (1) Responsibility for the project has been placed with the Department of Nutrition, Ministry of Public Health and Social Welfare.

Dr. Flaviano Ojeda, Director of the Department of Nutrition, is exploring possible approaches for the project and resources which can be utilized to design and implement the project. As a result of preliminary discussions, Dr. Ojeda concluded that the project should start with a food pilot plant in which nutritious food products could be developed and in which limited production could take place for distribution to the target group through health centers. The idea called for sale of the products on a cost recovery basis. The concept for follow-on activities was not developed.

Dr. Ojeda has discussed the project with the Interamerican Development Bank (IDB) and sought funding for the pilot plant. Mr. Gildo Porto Guerra, IDB Country Representative, gave encouragement that IDB might provide financial assistance and indicated a feasibility study might be required. Subsequently Dr. Ojeda requested help for development of the proposed

project from USAID through the Development Support Bureau (DSB) Infant Feeding Project which offered assistance to LDCs wishing to introduce weaning foods and special supplements for pregnant and lactating women.

During April 21-25, 1980, Ms. Sandra Callier, representing DSB visited Paraguay to describe the type of assistance available through the Infant Feeding Project and determine the scope of work requested by the GOP. (2) As a result of Callier's discussions, the GOP requested AID advice on product and processing alternatives and preplanning of feasibility studies for the IDB loan. It was agreed that a U.S. advisor would travel to Paraguay to (1) review the status of proposed project, (2) advise the GOP concerning planning of the IDB feasibility studies including any surveys which might be required, the requirements for product development facilities, and possibilities for processing technology which might be utilized, and (3) determine what further assistance could be provided through the Infant Feeding Project. The services of P.R. Crowley, USDA/OICD, were provided by DSB in response to this request. The following is a summary of the results.

2. Status of Proposed Project

The GOP foresees that rising prices of meat, milk, and other food products could lead to the deterioration of the nutritional status of low-income persons living in the periurban areas around Asuncion. While there is not data available showing that these persons obtain inadequate food, inflationary pressures on food prices, and the obvious poverty levels in Asuncion's barrios, indicate the likelihood of future nutrition problems arising from inability to purchase adequate amounts of food, especially protein foods.

Dr. Ojeda envisions the solution to this problem as the provision of inexpensive protein enriched foods such as soy fortified wheat or maize

flours, enriched pasta, and other cereal/soy food mixes. He believes these foods can be developed to satisfy the Paraguayan tastes, can be manufactured in Paraguay, and can be distributed to the target group initially through government health centers at a price set low enough to recover costs plus only a small profit. Subsequently he believes the same foods might be distributed through other systems such as school lunch programs. The government's goal, as envisioned by Dr. Ojeda, is to provide inexpensive vegetable protein foods as replacements for expensive animal proteins in the diets of the poor in order to prevent deterioration in nutritional health.

The exact type of foods needed for this program have not yet been selected. Soybeans are believed to be the logical choice for the vegetable protein source since they are produced in large quantity in Paraguay (around 1.0 million tons in 1980) and are inexpensive compared to animal protein products. However, past efforts to introduce soybeans as a food in Paraguay have failed and Dr. Ojeda recognizes that it could be difficult to convince periurban dwellers to eat soy-containing foods. At the same time he is aware that in recent years technologists in Brazil and other Latin American countries have made significant progress in developing acceptable soy-based foods from wheat, corn, and other staples used in Paraguay. Moreover, Dr. Gonzales Moreira of the National Institute of Technology and Standards, one of the key technologists slated to be involved in the project, has direct experience with such foods through work at the Instituto de Tecnologia de Alimentos (ITAL), Campinas, Brazil. Thus Dr. Ojeda's concept has a basis of experience and at least one experienced technologist on which to build; he believes that base can be used successfully to develop and introduce inexpensive new foods in Paraguay.

As presently envisioned, the project would provide for the production of limited amounts of protein enriched foods through operation of a MOH

pilot plant and by distribution of the foods to the target group through MOH health centers. Dr. Ojeda hopes to locate the pilot plant in an existing MOH pharmaceutical factory building in Ascuncion. The factory is now operating only on an intermittent basis, and while there is inadequate space within the factory itself, an adjacent warehouse under the same roof might have adequate space and conceivably could be converted to a pilot plant.

Dr. Ojeda has also expressed an interest in including a training component in the project such that food technology students from the National University would work at the pilot plant and thereby (1) learn food technology as a discipline through a controlled work experience, and (2) provide some of the labor inputs required for food manufacture. In addition, he envisions that project personnel might receive special training at other institutions such as ITAL to prepare them better to carry out the project.

At this stage relatively little attention has been given to large-scale manufacturing arrangements or distribution systems with broad enough coverage to have significant impact on the target group. However, Dr. Ojeda recognizes the need for expanded coverage and intends to provide for this in the project design.

Dr. Ojeda has sought financial assistance for the project from the Interamerican Development Bank (IDB). Mr. Gildo Porto Guerra, IDB Country Representative, and Mr. Adolfo N. Beeck have reviewed the project concept and concluded that it appears to satisfy IDB requirements for financial support. The IDB has recently issued new guidelines regarding interest in nutrition oriented projects and, according to Mr. Porto Guerra, the guidelines seem to encompass the proposed project.

Based on preliminary fundings, the project might qualify for two types of IDB assistance. First, the GOP might receive short-term technical cooperation from institutions or individuals to help the MOH develop a

complete project proposal. This cooperation might be funded by IDB and could be provided by ITAL personnel and/or other groups with relevant experience. Second, based on the proposal generated under this cooperation, IDB might provide additional technical cooperation for building and operating the pilot plant, training, evaluation of products, preparation of feasibility studies, and other project activities. IDB might provide grant funds or reimburseable financing or some other type of project cooperation depending on the specific needs of the project.

At a meeting with IDB on August 11, 1980, it was suggested to Dr. Ojeda that as a first step in exploring possibilities for IDB technical cooperation he should submit a draft request for short-term technical cooperation as outlined above. This would allow IDB to get a better fix on the proposed project through a written description, and would also allow IDB to assist him in refining the paperwork required by the Bank as well as lead to the development of full technical cooperation toward the installation and operation of a food pilot plant.

3. Planning Advice

Advice was provided to Dr. Ojeda in the following areas: (a) Preliminary project design, (b) Types of foods, (c) Alternate approaches to the project, and (d) Organizations and individuals who might provide assistance for project design.

(a) Preliminary Project Design

In as much as the ultimate objective of the proposed project is to provide inexpensive protein-rich foods for the poorest segment of the population, it seems clear that a food pilot plant and the food products made therein are not by themselves solutions to the problem. Obviously

if the project is to be successful, the foods developed in the pilot plant must eventually be manufactured and distributed in sufficient quantity to have a significant impact on the problem. For this to take place, provisions must be made in the project for transition from the research and development activities of a pilot plant to the full scale production and distribution activities of public or private sector commercial operations. In general this means that the research and development activities should have an applied orientation to assure that the products and processes under development not only satisfy the nutritional goals of the project but are practical and financially attractive to enterprises, public or private, which might wish to consider production and distribution. It also means that the project should include an element to prepare commercial feasibility studies for each product which is considered to have enough merit to justify large scale distribution. Without this practical orientation and without provision for transition to a food production activity, the project cannot lead to meaningful results. Accordingly, it was suggested that the project should be designed to include not only the proposed pilot plant and training components but certain additional components. The following five interrelated project components were suggested.

1. The installation of a food pilot plant (small scale food development facility) in which certain foods and food ingredients can be developed and manufactured on limited basis for evaluation.
2. The operation of the pilot plant to prepare foods for evaluation.
3. The evaluation of the foods to determine if they are nutritionally sound, adequately acceptable among the target group, and economically attractive so that they might be considered in terms of their superiority to the foods already available in the market.

4. The preparation of feasibility studies for selected food products which justify their nutritional and social value in Paraguay and which propose how they might be manufactured and distributed on a large enough scale to achieve the intended impact.
5. The training of project staff, as needed, to undertake the project activities cited above, and the education of food technology students using the food pilot plant in order to broaden their skills and help prepare them for food technology careers in Paraguay.

(b) Types of Food

The MOH is generally interested in producing protein-rich foods, especially cereal based foods enriched with soybean protein which might be consumed in lieu of meat, milk, eggs, and other protein foods in the diets of the urban poor. Dr. Ojeda has projected that these foods might include enriched wheat or corn flour or processed foods such as enriched pasta and bread. However no decision has been reached as to specifically which foods might be given serious consideration and, therefore, what processes and equipment would be needed in the pilot plant. It was suggested that the MOH might wish to consider the following food ingredients and foods for development.

1. Soybean Flour - Soybean flour is almost certainly the preferred ingredient to provide protein enrichment in cereal foods. Soy protein concentrate and isolates are generally too expensive and not needed functionally for protein enrichment except in rare instances. Accordingly, provisions should be made to produce or otherwise procure soy flour which is representative of what could be produced commercially in Paraguay.

There are several alternatives for making soy flour which might be considered in Paraguay. First, conventional defatted soybean flour might be made in a soybean oil solvent extraction plant. Present solvent extraction plants in operation in Paraguay are unlikely to be satisfactory for this purpose since they quite probably produce "feed" grade soybean meal for animal feeding rather than "food" grade soybean flour as required for food enrichment. The differences between food and feed grade soy include: food grade flour is made from beans that are more thoroughly cleaned and broken beans which can lead to off flavors are often removed; the beans are dehulled and processing is carried out under more sanitary conditions to prevent contamination with yeast, molds, pathogens and excessive amounts of bacteria; the flour is treated more carefully during heat inactivation of enzymes to prevent development of off flavors; and the product is ground more uniformly and generally more finely. While feed grade soy extraction plants can often be modified to provide these features, the cost of doing so can be as high as several hundred thousand dollars. Depending on the amount of soy flour required, this investment may or may not be justified.

A second type of soy flour is full fat soybean flour (FFSF) which is made from soybeans from which the hulls have been removed and in which all the oil is retained. This can be done by extrusion cooking dehulled soybeans and grinding the extrudate in a pin-mill. This technology is currently being practiced by CIATECH in Mexico and equipment for a system which can produce up to 1,000 tons per year can be procured for about U.S. \$100,000. Alternatively, the

soybeans might be roasted in one of several devices and the roasted beans then dehulled and ground to flour. This type of processing should be somewhat less expensive than extrusion processing and yield a less oily flour. Although little information is available on the process since it has not been practiced in commerce.

Full fat soy flour would be expected to be more costly than defatted flour since it contains 20% oil versus less than 1% oil in defatted soy flour. However, depending on the food application, the presence of the oil could represent a net savings (e.g., use of full fat soy in a weaning food would probably be less costly than using defatted soy plus refined oil since the oil extraction and refining operations are omitted).

Clearly the type of soy flour required needs to be considered in the design of the project and if FFSF appears appropriate, an extrusion system and/or roaster system might be installed in the pilot plant. Otherwise, if defatted soy is appropriate, it would probably be desirable to import edible soy flour for testing (from Colombia, Brazil, U.S., etc.) until local production facilities are justified.

2. Cereal Flours - It seems likely that local sources of ordinary wheat, corn, and other cereal flours, as well as mandioca flour could be used as ingredients for enriched flour products made under the project. Thus no special facilities should be required in the pilot plant to produce these flours. However, it might be desirable to utilize modified flours such as precooked flours in certain of the products. For example, it has been found that traditional pasta products, weaning foods, atole, and other cereal-based foods benefit from use of precooked cereals in the formulation. (3) In addition

new foods, such as instant porridge, ready-to-eat cereal, puffed snacks, and possibly other foods can be made by precooking cereals. These foods could provide not only convenience, but save fuel, result in reduced levels of infestation and microbiological contamination, improved taste, and provide the consumer appeal of "modern" foods. Accordingly it would be appropriate to consider the installation of cereal cooking equipment, such as an extrusion cooker, in the pilot plant.

3. Weaning foods (special food supplements for infants and small children who receive mother's milk but are not mature enough to eat family food) - Currently imported NSTUM and CERELAC are available in the market as cereal-based food for very small children. This type of food can be manufactured at relatively low cost using several types of processes. For example, in Colombia a product of this type, Colombiharina, is made by simply blending raw rice flour, soybean flour and vitamins and minerals. Elsewhere similar products are precooked by various methods to reduce cooking time and to obtain other benefits such as improved palatability and greater caloric density. (3)
4. Fortified/Extended Bread Flour - Many institutions in the Americas and elsewhere have developed formulations and procedures through which the protein content of wheat flour can be increased and the need for importation of wheat reduced through addition of soy flour. Other "extenders" such as rice and mandioca flours have also been considered. While the inclusion of these foreign ingredients tends to damage bread quality, the use of certain additives and procedures can reduce and in some cases eliminate the adverse effects so that good bread quality can be maintained.

5. Fortified/Extended Pasta Products - The same rationale for fortified/extended bread pertains to pasta products. It has been found that substantial quantities of soy flour and processed corn flour can be incorporated in pasta without untoward effects, thereby reducing cost and improving nutritional quality. (3)
6. Substitute or Extended Milk Products - Soybean extracts or soybean flours can be used as substitutes or extenders for milk products to reduce cost, partially replace imported dairy products, or simply increase the supply. While "soybean milk" is clearly not the same as fluid cows milk it has been used as an diluent or extender to cows milk and can be flavored with chocolate or other flavorings to make satisfactory beverage products. Soybean products have also been used as inexpensive substitutes of baked goods and other processed foods.
7. Textured Vegetable Protein - Textured soy protein made by extrusion processing have been used in commerce for over 10 years. These food materials have found application as very low cost extenders and substitutes for ground, chopped, and chunk-type meat and poultry products. While the technology is not overly complex, it might be appropriate to explore market potential with imported examples of the many flavors, shapes, textures, etc. before investing in a product development program.
8. Snacks and Breakfasts Cereals - Cookies (biscuits), crackers, and other snack items, often made from wheat, are enormously popular throughout the world. Substitute snack items made from corn, rice, soy and perhaps cassava (such as puffed corn curl snacks) can be created using extrusion technology. Items of this type can be not only nutritionally superior to other snacks but can be highly

acceptable to most tastes. This technology has been applied to manufacture of breakfast cereals in Bolivia and Guyana. (3)

9. Soups - Precooked soup powders flavored with spices and other condiments and enriched with soybeans might also be an attractive food product in Paraguay. An extrusion cooked pea soup including soybeans as an ingredient was developed in Costa Rica and distributed there as a special nutritional food in Asignaciones Familiares, the large Costa Rican family nutrition program. (3) Similar foods, formulated to Paraguayan tastes might be considered for development under the proposed project.
10. Vitamins and Minerals - To the extent vitamin and mineral deficiencies are a problem in the target group, the deficiencies can possibly be effectively remedied through inclusion of vitamins and minerals in the enriched food. The fact the enriched food will be centrally processed provides the unique opportunity to incorporate vitamins and minerals and this should be given serious consideration. Although vitamins and minerals would necessarily have to be imported, the small amounts required do not represent a serious drain on foreign exchange. Certainly the small foreign exchange requirement would not warrant consideration of local manufacture.

Obviously not all of the ideas listed above will be viable in Paraguay. However, clearly there is an adequate base of ideas for enriched foods on which to develop a project. The problem is more which of the ideas should obtain highest priority and get first attention because not all the ideas can be explored at the same time. Equipment for the pilot plant obviously should be chosen based on which foods will be developed.

(c) Alternative Approaches to the Project

Certain alternative approaches to project implementation were discussed

with Dr. Ojeda and his colleagues. These included: (1) The option of omitting a pilot plant in Paraguay and instead developing products in existing pilot plants in other Latin American countries, and (2) the option of concentrating on one product, such as a weaning food, and thereby achieving more rapid implementation of a program for manufacture and distribution of that food.

1. Use of Pilot Plants in Other Latin American Countries - Several

Latin American countries are equipped with food pilot plant facilities in which one or more enriched food products of the type under consideration might be developed for use in Paraguay. Such facilities exist in Guatemala-(INCAP), Costa Rica-(CITA), Columbia-(IIT), Brazil-(ITAL and others), and Chile-(INTTECH). In addition, there are active programs for manufacture of some of these foods in additional Latin American countries including Mexico, Boliva, and Guyana (3), and the manufacturing facilities in these countries might be used in lieu of a pilot plant to assist Paraguay in its food development program.

It should be possible for project personnel from Paraguay to use the pilot plant and/or manufacturing facilities in other Latin American countries on a cost reimbursement basis to develop prototype products for evaluation in Paraguay. A number of these facilities, particularly the one at INCAP, were established on the principle that they could be used to help sister countries in Latin America. Accordingly experienced personnel and time could be expected to be made available to Paraguay to help with the project.

Use of existing pilot plant facilities would be expected to have both advantages and disadvantages. Among the primary advantages would be reduced cost and more rapid implementation since the cost of

a new pilot plant and its operation in Paraguay would be removed and the time lag of designing, building, and starting up a new pilot plant would be eliminated. Also the use of experienced manpower in existing facilities would presumably reduce errors in judgement and lead to more rapid, efficient implementation of the project. Disadvantages would include loss of some control of development activities even if Paraguayans actively participated, since the work would take place largely on foreign soil in remote places. Furthermore, it would be more difficult to develop foods to the specific taste preferences of Paraguayans when the work takes place in locations where there are few if any persons who can represent the Paraguayan culture. Perhaps most important, the physical presence of a pilot plant as a focus for the project in Paraguay would be lost. Without a visible activity center, much of the psychological and political support needed for a successful project would be missing and the project could be weakened substantially.

Dr. Ojeda considered the pros and cons for using pilot plant facilities in other countries and rejected this option as unsatisfactory.

2. Concentrating on One Product - If the project were to focus its full attention on one product, such as a weaning food or an enriched/extended bread flour, it would be expected that much more rapid progress could be made and impact achieved at a much earlier date. This approach could eliminate the need for a general food pilot plant, and after an appropriate feasibility study, Paraguay could move directly to a full manufacturing facility.

The enormous amount of product development work undertaken in other Latin American countries on enriched foods provides a reasonable foundation for this approach and several other countries have opted to bypass pilot plant type development activities and move directly to projects to implement specific approaches. For example in Bolivia, the government is currently working on a project to enrich/extend wheat flour with soybean flour and is carrying out only those specific studies required to reach a decision as to whether and how the program should be implemented. The studies include redesign studies required to upgrade an existing soybean extraction plant to make food grade flour, certain baking studies and market tests to assure that the enriched flour will be acceptable to consumers, cost analysis, etc. In Guyana the government decided to implement a project to manufacture and distribute a weaning food and focused a project on the rapid formulation and manufacture of such a food. In this case a simple pilot plant was established to produce prototypes for evaluation, but work was focused on weaning food and making a direct and immediate transition to full scale manufacture. A project by CIATECH in Mexico totally bypassed pilot plant operations. Based on the objective of using local grown soy as human food and evaluation of products made elsewhere, CIATECH designed and built a factory for full fat soy flour which went into operation in 1979 and subsequently built and put into operation a plant to make soy milk and another to make precooked soy fortified cereal products. Clearly the same pattern could be followed in Paraguay to expedite rapid impact.

This approach, however, has certain weaknesses which must be considered. Selection of a product for manufacture without the

thorough, deliberate studies involved in the traditional pilot plant approach to food development requires special commitment by decision makers and higher risk of failure. Clearly the risks are reduced and decision strengthened if the spectrum of products can be methodically examined, ideas for products and their markets assessed through field testing, and only the most marketable ones ultimately selected for manufacture. All these activities take time and cost money, but if properly executed, should lead to sounder decisions.

Dr. Ojeda considered the various aspects of concentrating on one product versus examining a range of options through pilot plant development activities and decided he wished to use the pilot plant approach.

(d) Organizations and Individuals who Might Provide Assistance for Project Design

A number of organizations in Latin America are currently involved in operation of food pilot plant facilities, evaluation of food products, preparation of feasibility studies and training of personnel. Contacts with these organizations would be useful generally to familiarize the MOH with these types of activities. In addition, one or more of these organizations could likely assist the MOH prepare a specific project design including selection of equipment, building requirements, personnel requirements, capital and operating budgets, marketing and feasibility studies, etc. The following organizations might be considered for this purpose:

-- Instituto de Tecnologia de Alimento (ITAL)
Campinas, S.P.
Brazil

- Instituto Investigaciones Tecnologicas (INTEC)
Casilla 667
Santiago, Chile
- Instituto de Nutricion de Centro
America y Panama (INCAP)
Box 1188
Carretera Roosevelt Zona 11
Guatemala, C.A.
- Instituto Investigaciones Tecnologicas (IIT)
Av. 30, No. 52 A-77
Bogota, Colombia
- Centro de Investigaciones en Tecnologia de
Alimentos (CITA)
Universidad de Costa Rica
San Jose, Costa Rica

Certain individuals with specific experience related to MOH interests might also prove very helpful in considering the design of a food development project. Suggest for these include:

- Dr. Teresa Salazar de Buckle
Junta del Acuerdo del Cartagena
Casilla No. 3237
Lima , Peru

A food technologist with vast experience in development of nutritious foods based on soy, particularly bread and pasta products, and the management of food pilot plants, food evaluation studies, and feasibility studies through her work at IIT.

- Dr. Max Rutman, Director
INUAL
Casilla 9649
Sandiago, Chile

An exceptional food technologist and planner who has assisted many organizations in Latin America develop nutrition oriented food development programs.

- Ing. Armando Camacho Griensen, Director
CIATECH
Bolivar 806
Chichauhua, Chihuahua
Mexico

An outstanding engineer who has, in a very short time, directed a program to identify food uses for soybeans in Mexico and implemented the construction and operation of several successful factories for this purpose.

4. Further Assistance Through AID Infant Feeding Project

The proposed project to develop enriched foods for Paraguay appears to be an important, useful, socially-oriented activity that can benefit the people of Paraguay. Therefore, AID/DSB through its arrangements with USDA, would be pleased to provide additional advisory services to the MOH to the extent this can help advance the proposed project.

However, in view of the fact that arrangements are being developed between the MOH and IDB through which IDB might be expected to provide both short and longer term technical cooperation, including provisions for advisory services from experienced food technologists from very capable Latin American institutions, it seems unlikely that AID need make any further contributions to the project at this time.

It was suggested to Dr. Ojeda that if he or IDB at some stage believe AID/DSB could be of help he should call on us. Assistance might be provided through correspondence, for example by providing written comments or suggestions on project design, or by supplying information on sources or costs of pilot plant equipment. In addition or alternatively, at an appropriate stage, AID/DSB might provide the short term services of an experienced technologist to travel to Paraguay and offer advice regarding final project

design or implementation. Dr. Robert Bates of the University of Florida or Dr. C. O. Chichester of the University of Rhode Island for example, both of whom have been closely associated with food development activities in Latin American institutions, might provide this type of service.

In any case, AID/DSB and USDA, feel that the type of project under consideration to be worthy of support and encourage its further development..

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