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FINAL REPORT ON TASK ORDER NO. 2--
Peru Contract AID/TA-BOA-1109

Submitted to
U.S. Agency for International Development
Washington, D.C.

Submitted by
International Soybean Program (INTSOY)
College of Agriculture
University of Illinois at Urbana-Champaign
Urbana, Illinois

Summary

Under the provisions of the Task Order, the University of Illinois, through the International Soybean Program (INTSOY), was to provide technical services to improve the Government of Peru's management required resources, human and financial, for more effective agricultural sector performance. Emphasis was placed on use of these services to assist and advise the Government of Peru in the design and management of the research required to achieve increased production. Additionally as required, the technicians were to provide pertinent information in their specialty area to a "Core Group" in the Ministry of Agriculture.

Professor Carl N. Hittle was project coordinator until July 1976 at which time Professor Harry C. Minor took over the responsibility.

Technical assistance was given in the following areas:

1. Preliminary planning and preparation.
2. Soybean production and production research.
3. Soybean inoculant production.
4. Transfer of technology (extension).
5. Entomology.
6. Soybean food processing.
7. Economics--soybean marketing.
8. Economics--soybean production and planning.
9. Foods and nutrition.

United States training was provided for a six-man team from the GOP Ministry of Food. A workshop for soybean research and extension workers was conducted at Tumbes, with more than 86 in attendance.

Commodity procurement was not an objective of the Task Order, however, small amounts of seed and support supplies were provided incidental to consultants' assignments. Recommendations for major equipment and supply acquisition were made by INTSOY consultants at the request of their GOP counterparts and USAID.

In general, the objectives of the Task Order were met. Eighteen INTSOY consultants made 27 visits to Peru in carrying out assignments related to technical advisory services, project planning and administration and training activities. The recommendation of the consultants was timely, of high quality, and pertinent to the problems.

The inputs from the consultants enabled their GOP counterparts to develop realistic production plans which were incorporated into a comprehensive corn and soybean production program that will be supported by AID.

Although not an original objective, a limited training effort was carried out with enthusiastic full-hearted support of the GOP Ministry of Food, USAID and INTSOY. A training component, however limited, should be a part of every Task Order covering a broad developmental assignment.

Consultant recommendations may be grouped in the following general categories:

1. Need for research in the critical area of soybean production, breeding, pests and diseases, inoculant production, processing, and economics of production and marketing.

2. Need for training of Peruvian personnel to staff the infrastructure to accommodate the expanding soybean production.

3. Need for the development of an extension system to facilitate the transfer of technology to farmer producers.

4. Need for concerted effort to introduce food products made from soybeans to the Peruvian consumers so improvement in the quantity and quality of diets can be achieved.

Preliminary planning and preparation

Dr. Carl N. Hittle, Project Coordinator, made two trips to Peru gathering information, making recommendations, and outlining plans for the development of the project. The first trip was made March 11-16, 1974 and March 23-25, 1974 under Task Order No. 3 of Basic Ordering Agreement No. AID/CM/ta-BOA-73-30. The second trip was made April 5-27, 1975 under this Task Order No. 2. The purposesof the second visit were:

1. To initiate Task Order No. 2 of Basic Agreement AID/ta-BOA-1109. To determine priorities in relation to the Soybean Development Program in Peru, specifically those related to Task Order No. 2.

2. To assist and advise the Government of Peru in the design and management of research and extension required to achieve increased soybean production.

3. To assist in developing a coordinated soybean program with emphasis, in every sense, on the team approach which will operate effectively across disciplines, ministries, experiment stations, and universities.

4. To assist in initiating a soybean program that will develop marketing, processing, and utilization of soybeans in the country, concurrently with production.

5. To become more familiar with the soybean situation, the soybean research and its specific goals, the resources committed to achieve these goals, the time phase plan of operation for the duration of the project, and the soybean potential in the country.

6. To visit organizations and personnel concerned with all aspects of the soybean program.

7. To observe and discuss production research trials at La Molina, Vista Florida, Tingo Maria, and Chira; and to discuss the possibility of additional soybean varietal trials at other locations throughout the country.

8. To visit with personnel of the Ministry of Food relative to priority of areas where technical assistance is needed, identification of training needs, and coordination of activities between the various Peruvian organizations and agencies and the International Soybean Program (INTSOY).

9. To initiate studies which will determine the potential productic and economic advantage or disadvantage of soybeans in comparisor with other crops.

Dr. Hittle reported the following results and accomplishments:

1. Discussions with many individuals and groups, especially the various divisions of the Ministry of Food, helped in assessing the overall needs of the soybean development program in Peru. Through these discussions, it was mutually decided that the highest priority relative to the Soybean Development Program in Peru was the need for an economic feasibility study of soybeans with emphasis on assessing the comparative advantage or disadvantage of soybeans with other crops which are presently grown in the country. It was agreed that local personnel would concentrate on comparative cost studies for the next two or three months in anticipation of the arrival in Peru of a production economist from INTSOY in September 1975. It was also agreed that an inoculant specialist, to assess the inoculant production capabilities in the country, would be recruited (by INTSOY) as soon as possible.

2. Emphasis was given to selection of a coordinator for the soybean Development Program. Consideration was given to working across disciplines, in order that the various phases of the soybean industry--production, harvesting, processing, marketing, and utilization--will be well coordinated. Coordination across ministries, universities, research units, and private sector agencies was also emphasized.

3. Discussed, in some detail, the need for additional training of personnel for the Soybean Development Program.

4. Presented seminars at La Molina, Tingo Maria, and Vista Florida; giving emphasis to all aspects of the soybean industry, including production, marketing, processing, and utilization.

5. Visited organizations and personnel of the soybean program in order to advance the many phases of the soybean development program and as a prelude to visitations of other INTSOY technicians in the various areas.

6. Emphasized the apparent lack of an extension component in the soybean development program and discussed ways of bridging the gap between research and extension.

7. Questioned the need for additional processing plants in the country--at least until more detailed and in-depth studies are made. The solvent extraction plants are presently not operating to full capacity. Information from the oil industry indicates that many of these solvent extraction plants are not even operating at 50-percent capacity. Admittedly, the solvent extraction plants are all located on the coast and some of the soybean production potential might be in the Selva areas. However, before any new solvent extraction or oil processing plants are considered; the transportation costs, existing facilities, realistic production potentials in various areas, and many other factors should be carefully considered.

8. Spent considerable time discussing the various approaches to the implementation of the soybean development program. Questions considered were:

   a. Should the program be set up as a free-standing "institute"?

   b. How will the various activities of the Production Division Research Division, Commerce Division, Infrastructure Division, and the Office of Sectoral Planning for Food be coordinated?

   c. How will the various activities of the divisions of the Ministry of Food be coordinated with research programs of various universities in the country?

   d. Who will administer the program? Who will coordinate the various activities?

   These are questions which the Government of Peru will have to decide before INTSOY can be of optimum help.

Dr. Michael E. Irwin visited Peru March 25-April 9, 1975. His main interest was in soybean insects but he was also able to become familiar with the major problems facing farmers, marketing, and government organizations concerned with the soybean industry. This information was passed to Dr. Hittle when he arrived in Peru.

As a part of the planning and preparation of the project, the Ministry of Food organized a soybean development committee (PIDES) which prepared the report, "An Integral Plan for the Development of the Soybean." This report was a valuable resource in providing essential information and in helping to guide technician activities when visiting Peru.

Building upon the preliminary information, an INTSOY study team visited Peru during September-October 1975 to determine the potential for soybean development in Peru. The team members, their areas of expertise, and the dates of their visit were as follows:

Professor Carl N. Hittle (in charge) Agronomy and Plant Breeding	September 7-26
Professor Raul Abrams* Agronomy and Plant Breeding	September 7-26
Professor Alvin I. Nelson Food Processing	September 7-25
Mr. William M. Sager Transfer of Technology	September 7- October 2
Professor Sheldon W. Williams Agricultural Economics	September 7- October 2
Dr. R. Stewart Smith* Microbiology (Inoculant Production)	September 21- October 5

Because of the diverse areas of expertise of team members, the purpose and recommendations of their visits will be reported under separate areas of interest.

Mr. Charles A. Breitenbach visited Peru January 18-25, 1976 on TDY with USAID/Lima to assist in the development of a program paper on "Soy and Corn Production on Small Farms." The purpose of the TDY was to assist USAID/Lima in the preparation of operational programs for soybean development and improved highland maize production under a proposed AID project grant. To achieve this purpose the writer participated in joint discussions of the USAID Mission with Professors Carl Hittle and Alvin Nelson from the University of Illinois International Soybean Program (INTSOY) and the GOP in the case of soybeans and between the USAID and the GOP in the case of maize.

The following recommendations came out of the visit by Mr. Breitenbach:

A. Recommendations on maize

1. That the USAID place priority attention on assisting promotion of the upland floury maize program as this activity is ready for implementation.
2. That primary assistance in the maize activity be assigned to the procurement of U.S. commodities as the host government is well prepared to provide technical assistance.
3. The U.S. contribution might also consist in assistance to the production of increased quantities of certified maize seed to be used for exchange with the indigenous seed now grown by subsistence farmers.
4. U.S. technical assistance might well be given for the presentation of in-country short courses on maize promotion.

*Dr. Abrams is on the faculty of the University of Puerto Rico, Mayaguez Campus and Dr. Smith was employed by Agricultural Laboratories, Columbus, Ohio. All others were UIUC staff.

B. Recommendation on soybeans

1. The primary U.S. contribution to the soybean program needs to be technical assistance since soybean production is still new and as a consequence technical experience is nonexistent within the country.

2. Stress should be put on long-term U.S. technicians stationed in Peru and short-term TDYs with corresponding multiple round-trip travel should be reduced.

3. U.S. long-term University training should not be beyond the M.S. degree and the number of such trained personnel kept to a minimum. Short-term U.S. specialized training, when possible in Spanish, would be preferred by the Peruvians.

4. The possibility of providing short-term training by U.S. specialists in the host country should be given priority consideration.

5. U.S. dollar commodity purchases for the soybean activity should be heavily weighed towards the processing of domestic produced soybeans for human consumption.

6. AID/W should approve USAID/Peru's request to utilize $200,000 in University of Iowa unexpended contract funds for an interim maize and soybean project through September 1976.

7. The DAEC should consider the P.P.: Soy and Corn Production on Small Farms as two separate activities under a single umbrella. The corn project is technically sound and should be approved. Approval of the soy project should weigh largely on the interest of the Ministry of Food as demonstrated by the assignment of the full-time local technicians promised by Director Morales Bermudez.

8. The soybean contract requested under the P.P. should be let as quickly as possible after project approval. The contract should be put up for open bidding.

Soybean production and production research

Professors Hittle and Abrams in their September 1975 visit reported the following problems that needed attention:

1. Very difficult problem of transportation.
2. Lack of seeds when needed.
3. Lack of, or difficulty in obtaining, soybean inoculum.
4. Need for mechanization to increase efficiency of production
5. Need for better and more adapted varieties.
6. Salinity problems in some areas.
7. Need for trained personnel to help the farmers.
8. Need for hand labor.
9. Need for adequate seed storage facilities.

They made the following recommendations which emphasize the need for applied research:

1. A soybean breeding program should be initiated as soon as possible to develop adapted varieties of high yields and good agronomic and disease and pest resistance for the different soybean areas.

2. Variety trials, date of planting, plant population, crop protection, planting systems, irrigation, mechanization, etc., should be conducted in the different areas of production at different locations to develop a technological package suitable to the farmers of each area.

3. Facilitate adequate seed storage facilities and a vigorous seed production program in order to provide the farmers with high quality seed. (Reference is made to the April 1974 Mississippi State University Seed Report on "Seed Industry Development in Peru.")

4. Implementation either by the Ministry of Food or through the cooperatives, of an agricultural machinery type of service for those farmers which cannot afford to buy the equipment necessary for a more efficient type of operation.

5. Training of professional and nonprofessional personnel on a short- and long-term basis; establishing priorities in accordance with their more urgent needs.

Soybean inoculant

Stewart Smith surveyed the need for soybean inoculant use, the ded research and production potential during his visit September 21- ober 15, 1975. He stresses the need for rese rch on the soybean culant problem in the following report:

The following reasons make the immediate establishment of an inoculant plant inadvisable:

1. Immediate capital investment into an unestablished soybean production program.
2. Lack of trained microbiologist with experience or knowledge in the techniques of large-scale inoculant production.
3. Insufficient equipment available which may be utilized.
4. Need to establish the inoculant plant site.
5. Uncharacterized peat source (to be used as the inoculant carrier)
6. Availability of inoculant from other sources.

In light of the above recommendations it would be advisable in the immediate future to pursue the following actions concerning inoculant and its production.

1. Import inoculant for all soybeans to be planted. It is important that the inoculant be shipped, handled, and dispersed rapidly and under cool conditions to ensure the quality of the inoculant. Reports from various points in the country indicate that the present supply is expensive, often unavailable and occasionally past the expiration date. There are several sources of soybean inoculant available so it would be advisable to evaluate these sources both for cost and shipping methods. With the use of effective inoculant, it would eliminate the need for nitrogen fertilizer on soybeans, which is presently being done in certain situations.

   Even though increased soybean yields are not observed the first year on very fertile soils, it is still advisable to inoculate in order to establish the nitrogen fixation on these plants. This will in essence supply nitrogen to the plant from the fixation process, and decrease the requirement for inorganic soil nitrogen. In the long term, this will increase the soil fertility instead of continually depleting it.

2. Train the necessary personnel in the methods of rhizobial research, but most important is to obtain experience in the techniques and methods of producing inoculant on a large scale. Research experience and technique skills may be obtained through formal education, however, inoculant production skills should be obtained through practical experience under the supervision of one knowledgeable in the techniques of inoculant production.

3. Develop research in the following areas which would be extremely useful when the inoculant production facility is initiated.

   Peat source to be used as a carrier for the rhizobial inoculant. During a trip through the mountains east of Lima, a peat source near La Oroya was observed. This appeared to be very small in quantity and possibly high in mineral content. The majority of peat had been previously utilized for other uses. This source was also in a drainage way from mines in the area. These mines are polluting the Rio Mantaro with heavy minerals which may be toxic. Assurance was given that additional peat sources were available which were larger in area, deeper, and not in the mine drainage area.

   It would be advisable to map the various locations of peat in the mountains closest to Lima and include the available quantity at each location. Each location should be sampled and the peat analyzed for organic matter, pH, total soluble salts, nitrogen and elemental analysis. However, a very important criteria in the selection of peat to be used as an inoculant carrier is the ability of the specific rhizobia to multiply upon addition to the peat and their survival during storage. The characteristic of the peat and its treatment during the drying process markedly affect its suitability as a medium for rhizobia.

b. Develop a strain collection of Rhizobium japonicum to include strains from external sources and strains isolated from Peru. These strains should then be fully evaluated both for their effectiveness (ability to form an association with soybean that fixes adequate nitrogen), and infectivity (ability to form nodules with the host). When infectivity is determined in soil containing other strains of rhizobia capable of nodulating the soybean, this character is partly dependent on the competitive ability of a strain in the legume rhizosphere and is important when a new strain is inoculated into a soil which already has a high population of soybean rhizobia.

Because the field testing of strains of rhizobia for effectiveness is both time consuming and expensive, a preliminary screening of strains under artificial conditions is desirable. A large number of strains may be evaluated quickly and conveniently in a greenhouse or growth chamber using a nitrogen-free growth medium. Such facilities must be developed not only for strain evaluation, but also experimentation and quality control of inoculation methods and carriers.

After preliminary screening productive strains should be fully evaluated in field plots in the various soils in potential areas of soybean production. It is necessary to provide soils free of soybean rhizobia for such studies.

c. Conduct field inoculation studies in prospective soybean areas to evaluate cultivar-strain interactions, inoculation carriers, methods, and to determine rates of inoculant necessary for effective fixation. Soils in the Selva (Yurimaguas) which are acid and obtain high soil temperatures may require higher levels of rhizobia, such as would be supplied by a soil inoculation, rather than a seed inoculation method. Such high numbers may be achieved by inoculating the soil with increased rates of a granular peat carrier, or adding the rhizobia to the soil directly in a liquid form. Viability of the bacteria in a liquid form for several months may best be achieved in the frozen state.

4. Develop distribution of inoculant to all soybean production areas. Inform farmers in the proper storage, use, and benefits of rhizobial inoculant. Stress at all levels the concept that the bacterial inoculant is a viable product which must be handled, stored, and used in a proper fashion to maintain bacterial viability and thus maximum benefits from the product.

5. Select the site for the inoculant production plant. It would be recommended that the site be located in Lima because of the location of the peat supply in the mountains to the east. Also direct supply routes exist between Lima and the potential soybean production areas.

Transfer of technology

Extension Adviser Sager found during his September 7-October 2, 1975 visit that the proposed soybean production program lacked (1) a well-defined system for transfer of technology to bridge the gap between the problem (need for soybeans) and the solution (soybean production) and (2) enthusiasm for such a system of technology transfer.

His recommendations for a technology transfer program were:

A. Place a trained Peruvian soybean production agronomist in each soybean production area. The following minimum qualifications are necessary.

1. An Ing. degree in agronomy.

2. Adequate training in soybean production and related fields.

3. Be willing to work with farmers in the field.

Additional desirable qualifications include the following:

4. Have some machinery operation and maintenance skills.

5. Have an understanding that farming (food production) is a vital and honorable form of labor.

6. Preferably have an agricultural background.

7. Preferably be from the area where he will be assigned...so he will understand the people and the area...a necessary ingredient for developing trust between the farmer and the educator.

8. Be dedicated to the soybean production program. At least two people per year should be studying for the M.S. degree in agronomy and/or technology transfer skills.

B. Soybean production agronomists should be provided....

1. Adequate training (both academic and applied) in soybean production.

2. Regular and continual access to research results on soybeans.

3. Regular training through short courses at least two times per year.

4. Visits to other soybean growing areas of Peru.

5. Opportunity to take part in seminars with researchers and his counterparts in other geographic areas of soybean production in Peru.

6. Adequate support in the areas of transportation, office services, office supplies, and other necessary services.

7. Freedom to test new soybean producing techniques and new technology transfer methods.

8. Freedom to make a reasonable number of errors. These are inevitable when working with people.

9. Opportunity to travel to other countries to study soybean production in formal courses and by observation of production programs. We especially encourage that two people per year be sent to the summer-long INTSOY Soybean Production Short Course at the University of Illinois. Advanced degree training at appropriate institutions are also encouraged.

10. Financial scholarships for professional improvement.

C. The soybean production agronomist will be expected to accomplish the objective of gradual acceptance of soybeans by farmers by using the following techniques:

1. Regular on-farm visits to farmers in his area to advise them about soybean production.

2. Conduct on-farm demonstrations of production techniques including variety trials, seeding methods, seed inoculation, weed control, seeding dates, seeding rates, etc. (Program leaders must recognize that he will on occasion demonstrate a failure.)

3. Print and distribute timely production information to farmers.

4. Work with and enlist the support of cooperative leaders.

5. Involve farmers in program planning of the technology transfer program. They can help establish priority as to the kind of soybean production information they want and need.

6. Use local leaders in the diffusion of soybean production information.

7. Hold farm tours, field days and educational meetings... enlisting support of experiment station research personnel and other qualified people.

8. Hold seminars of soybean producers to provide them opportunity to share experiences in soybean production including both successes and failures. This is especially important in the early phases of soybean introduction.

Steps toward implementing a technology transfer program are indicated in the Integral Plan for Development of the Soybean. Our concern is that a coordinated commitment by the groups involved in PIDES is not as yet indicated for this essential educational activity.

Mr. Sager visited Peru April 5-23, 1976 for the purpose of assisting in mechanical soybean planting in the Bagua area. Many difficulties were encountered with movement of inputs, machine failure, and personnel confusion that resulted in failure to plant any soybeans. Adviser Sager's impressions and recommendations follow.

The planter--a piece of junk

A. Loaned for use in the Bagua area by...SOMERIN (Sociedad Mercantil International S.A.) Rosendo Marquez T., Gerente.

B. A faulty piece of equipment.

1. Three-point hitch gave way and bent out of shape as the planter was transported from the assembly point at the Ministerio in Bagua to La Papaya Cooperativa. This occurred on the road without seed or fertilizer.
2. Size of openings at point of seed drop varied causing variation in seeding rate.
3. Improper size pinions for soybeans.
4. Defective parts. Clamps which held units to tool bar were of the wrong shape and faulty material. All had to be rebuilt and reinforced. Two broke making these revisions necessary.
5. Not enough units for size of tractors. At least four planter units are necessary.
6. Did not work properly in making furrows and seeding at the same time.

C. Much time used in making adjustments.

Recommendations

A. Secure at least one more unit and plant four rows...two each on ridges between 1.2 meter irrigation furrows.

B. Secure nine-point gear for soyas.

C. Before taking another planter to Bagua, conduct field trials at Vista Florida or a similar location to locate possible defects and to be sure it works for the purpose desired.

D. An ag engineer who is knowledgeable in use and adjustment should be assigned to the project for a few days to get the equipment working.

The farmers

A. Appear to be interested in soya.

B. Have many questions and much to learn.

C. Are intelligent managers and will produce soyas if given proper support in form of seed, inoculant, equipment, information, compensation, etc.

The soya program at Bagua

A. It can succeed if the program is vigorously supported at this time

B. It is of utmost importance that a specialist be assigned to Bagua to work directly with the farmers to keep the project moving. Follow through NOW is necessary if the program is to succeed.

Mr. Sager visited Peru April 11-21, 1977 to observe initial soybean production efforts in the Huallago Valley south of Tarapoto. In addition to conferences with local agricultural officials he observed eight soybear fields in various stages of growth noting production problems and possibilities. His recommendations, which follow, not only cover the area of production, but also offer recommendations for extension efforts or the transfer of technology to the farmers.

There is substantial potential for soybean production in the fertile soils of the Tarapoto area and the Huallago Valley. The following suggestions should help capitalize upon the indicated potential of the area.

1. More comprehensive applied soybean research at El Porvenir. This would include variety testing, seed rates, seeding dates, inoculation studies, herbicide trials, yield studies, fertility studies, micronutrient studies, etc.

2. A comprehensive, quality seed production program at El Porvenir.

3. Machinery studies need to be carried out...probably at El Porvenir.

4. Adoption of soybean production programs will be enhanced by use of demonstrations. These would be carried out by sectoristas who have been adequately trained to do so.

5. Tests should be carried out immediately to discover the exact nature of the problem we refer to as 'possible iron deficiency'.

Additional recommendations regarding qualifications and support, and objectives of "sectoristas" parallel those general recommendations for production specialists offered in Mr. Sager's 1975 report (see above).

Entomology

Professor Michael E. Irwin visited Peru March 25-April 9, 1975 to learn about insect pest problems on soybeans. The purposes were:

1. To become familiar with the specific insect pest problems on soybeans grown in the various areas of potential soybean production in Peru.

2. To identify and contact entomologists and other crop protection oriented personnel interested in soybean pest management and become familiar with their approaches to soybean pest control.

3. To make a survey of insects associated with soybeans in the various growing areas of Peru.

Professor Irwin reported the following results and accomplishments from his visit:

1. While in Peru, I conversed with many entomologists, a few of whom were directly or indirectly involved in soybean pest control. I saw firsthand the major insect and other arthropod pest problems plaguing the coastal growing area. I was unable to visit the interior since soybean production there occurs between May and October.

2. I contacted entomologists and plant pathologists in Peru and found that very little has been done concerning soybean pest control, and no work on pest management has been attempted on soybeans.

3. Collections of soybean arthropods were made at La Molina, to the south of Lima, Chiclayo and Lambayeque, all of which are now being processed and incorporated into our international soybean arthropod collection.

Soybean food processing

Professor Alvin I. Nelson, a member of the INTSOY study team in the September 1975 visit, outlined the following processing and product suggestions.

A. Soy milk or beverage

1. Examine soy milk processes that are available for use and/or development in Peru.

a. Modified traditional method (hot water extraction) for producing a soy milk.

b. Northern Regional Research Lab (Mustakas) process.

c. Prepare a high quality, full fat soy flour and use certain techniques employed in process a and b.

2. Equipment required for research and development of soy beverage.

a. Dry cleaning equipment for raw beans.

b. Drier for heating and drying raw whole beans prior to dehulling.

c. Equipment for dehulling.

d. Equipment for separating out hulls (should be possible to use dry cleaning equipment listed in a).

e. Blanching equipment.

f. Drier for blanched beans.

g. Grinding equipment (to prepare a finely ground material--as fine or finer than flour).

h. Jacketed kettle for hydrating and additional cooking of soy slurry.

i. Continuous centrifuge or filter.

j. High pressure homogenizer--at least 5,000 psig-maximum.

B. Soy protein fortification of wheat flour

1. Certainly the protein fortification of wheat flour with extracted soy flour should have a very high priority.

2. Why? Because the technology is thoroughly understood and this type of program has been successfully implemented in a number of countries and areas. Additionally the nutritional value of the program has been shown to be excellent.

3. Possible problems

a. Obtaining a very good quality extracted soy flake for grinding into flour is of critical importance.

b. Need for check on raw material (raw bean) quality.

c. Check on factory capabilities and product quality.

4. Visit by solvent extraction specialist

a. This would appear to be highly desirable and very necessary if plants are to be brought up to standards which would allow high-quality production of flake and oil products.

5. It is suggested that a program be considered which would aid in improving and maintaining quality of extracted flake.

a. This would be concerned with raw material quality (see suggestions on raw material quality).

b. The program would also be concerned with establishing standard operating as well as quality control procedures for solvent extraction plants.

C. Whole soybean processing

1. Whole soybean processing offers many advantages.

a. Whole beans are highly nutritious--40 percent protein and 20 percent fat. High quality protein, highly unsaturated, no cholesterol.

b. Can set up and operate a processing plant on a large or small scale.

c. Capital investment invariably much less than for oil extraction.

d. Fits with a developing soybean production scheme. Only a very small fraction of raw material needed for production of products from whole beans as compared to solvent extraction.

2. Preparation of whole soybean for processing.

a. Either whole beans (entire bean including hull) or cotyledons (hull removed) are used for processing various products.

b. Preparation procedures are straightforward and can be easily carried out. After preparation including hydration and blanching the resulting precooked beans are bland in taste and can be used as a raw material to prepare a great many different products.

c. Products that have been prepared by this process

(1) Drum-dried products such as whole soybean flake, soy corn, soy-rice, soy-wheat, and soy-banana mixtures

(a) The soy-cereal mixtures offer great potential because proteins of the combination complement each other nutritionally. Thus, the mixture is superior nutritionally to either of the raw materials.

(b) An almost unlimited number of combinations of soy with other foods could be prepared.

(2) Soy nuts--easily prepared and generally well accepted

(3) Soy butter--this might be described as an analogue of peanut butter.

(4) Canned foods.

(a) Very good products can be prepared.

(b) Adequate thermal process conditions must be developed for each specific can size and formulation.

(5) Soy beverage base--the procedure for this product is covered by a University of Illinois Foundation patent and practice of the patent requires a royalty fee.

(a) Dairy analogues such as milk, ice cream, ice milk, yogurt and a type of margarine can be prepared from this base.

(6) Many other products such as soybean dal, full fat soy flour, etc., can be prepared using this process.

3. Concepts for rapid preparation of food containing soybeans for small village industry and home use are under investigation at the University of Illinois.

a. This work appears highly promising and as progress is made the reports can be forwarded to the interested parties.

D. Textured Soy Protein (TSP)

1. Extrusion processing of extracted soy flour offers a rapid and relatively inexpensive method for preparation of meat extenders and meat substitutes.

2. It is suggested that samples (about 5 pounds) of various types of textured soy protein be obtained from the U.S.

a. These products should be obtained from at least two manufacturers.

b. Literature on preparation and use of TSP should be obtained from the manufacturers.

3. These products should be thoroughly evaluated.

a. If certain products are well received, larger quantities to be used for extensive consumer testing should be obtained.

4. If the TSP products are found to be acceptable it is suggested that the following study be initiated.

a. Make an accurate estimation of the quantity and types of products that appear to be desirable for the consumer.

b. Determine the economic feasibility:

(1) Should the product be produced in Peru or would it be more desirable to import TSP?

5. If the products are well accepted and it appears desirable to produce TSP in Peru.

a. Proceed with plans for a small extrusion plant for production of TSP in Peru.

6. The quality of the extracted flake is of critical importance to the production of high quality TSP. Thus, much effort must be expended to assure high-quality flakes from the solvent extraction process.

E. Quality of raw soybeans. The quality of the raw soybeans used for processing is critically important to the processing industry.

1. Oil extraction

a. The quality of oil will directly reflect the quality of the raw material.

(1) Moldy beans, immature beans, foreign material (weeds, seeds and trash) in the raw material seriously reduce the quality or may eliminate the oil for human consumption.

b. The quality of extracted flake or meal will directly reflect the quality of the raw material.

(1) Defects (as described above) will eliminate use of extended flake for human food and, if very severe, the product may not be suitable for animal feed.

2. Products prepared from whole soybeans.

a. The quality of the raw material must be very good to be suitable for use in preparation of products from whole soybeans.

Thus, it is suggested that a program for development of standards for quality of raw soybeans be started.

Professor Nelson also reported the following recommendations.

Soy beverage or milk

Two areas, soy beverage or milk and fortification of wheat flour, were indicated by government officials as being of immediate interest, with the soy milk having the highest priority. More than a week was spent at the Instituto de Investigaciones Agro-Industriales (IIAI), La Molina working on soy milk. IIAI is interested in developing a processing concept to be used in Peru which will produce a product that would be acceptable. As regards processing concepts two approaches were suggested by government officials. One would be the preparation of a soy powder or product in a central plant (probably Lima) that could be shipped along with milk powder, butter oil, etc., to various milk processing plants where the final product would be prepared, packaged and distributed. The other approach would be preparation of a soy-cows' milk beverage (such as a 50-50 blend) starting with the raw soybeans at each milk processing location. The first approach appears to be the most feasible and attractive for use in Peru. The reason for this statement is that preparation of a soy-cows' milk beverage at each milk processing point would require a substantially greater investment in soybean preparation and processing equipment at each location and it would be very difficult to control the processing procedures and quality of the products produced.

Thus, it appears that preparation of a full fat soy flour or powder in a central location and shipping the soy component to the various local milk processing plants for final formulation and processing is the most practical approach. Such a procedure would generally follow the process developed by Mustakas at the Northern Regional Research Laboratory in Peoria, Illinois and this process is available for general use. However, adaptation of this process for use in Peru will require a great deal of in-country research and development time and effort.

A version of this process was investigated at IIAI. The first products that were prepared were acceptable in flavor but poor in texture. However, the products were encouraging as a first attempt even though the preparation and processing revealed many serious deficiencies in the available equipment. Equipment at IIAI is lacking or inadequate for a thorough test of this conceptual approach. Specifically, equipment for cleaning raw soybeans, dehulling raw soybeans, separating the cotyledons from the hull, grinding blanched and dried soybeans into a fine powder and a high pressure homogenizer are not available at the Institute. The Institute has a homogenizer but this unit is plagued with valve problems and cannot be operated over about 2,000 to perhaps 2,500 PSIG pressure. Whether a homogenizer of this type will be entirely suitable is open to question. However, new parts should be ordered so that a thorough test of the unit could be made.

The food technologists at IIAI are well trained and are quite capable of developing a soy-cows' milk process for Peru if proper and adequate equipment is available and a realistic time schedule is developed for carrying out this work. The best process for Peru will undoubtedly vary from the original Mustakas process but, as stated before, it can be developed if suitable equipment is available and a reasonable time schedule is set up.

The suggested approach for development of a process follows:

1. Immediately order the parts necessary to overhaul the St. Regis homogenizer at the IIAI pilot plant.

2. Obtain a seed cleaner which with screen changes can be used for hull elimination. Perhaps a used seed cleaner is available in Peru.

3. Construct in Peru a double roll dehuller. The rolls should be about 15 inches long and about 8 inches in diameter. The surface of the rolls should be knurled on a lathe which will assist in feeding the beans between the rolls. Ball bearings should be used and one set of rolls should be movable to allow spacing adjustment. The rolls should turn towards each other with one roll running about 50 RPM faster than the other. Roll speeds of perhaps 500 and 550 RPM would probably be desirable.

4. Obtain small grinding equipment, such as a pin mill, which is suitable for grinding full fat soy flour. It may be necessary to obtain a sifter or other means of eliminating the coarse particles for further grinding to a fine flour or powder.

5. Order a small laboratory or pilot-type Manton-Gaulin, high-pressure homogenizer. Consideration of suggested items 4 and 5 should be made at once because delivery of this equipment will require a number of months.

6. Items 1, 2, and 3 hopefully can be obtained within a short period of time. This would allow development work to proceed in a realistic manner at IIAI.

7. A thorough economic feasibility study is required to determine the relative cost of producing a soy-cows' milk blend of beverage on the basis of the process suggested in this report. Certain cost information is available on this process in the U.S.

8. Reasonable progress on points 1 through 7 should encourage detailed planning on a pilot operation suitable for producing a soy-cows' milk for consumer testing. This pilot plant should have a capacity of several thousand liters per day. Development of a pilot operation, along with thorough consumer testing is an absolute necessity before investment in universal processing facilities. Processing facilities for the entire country of Peru would be extremely costly and are only justified if a satisfactory product can be developed at an attractive cost.

Soy protein fortification of wheat flour

Protein fortification of wheat flour with extracted soy flour is strongly recommended. Addition of 12 percent good quality extracted soy flour to wheat flour essentially doubles the protein nutritional value of the bread. This is a remarkable increase in nutritional value at very little, if any, additional cost. Additions of 12 percent soy flour to wheat flour would reduce the quantity of wheat that must be imported. The quality and acceptability of bread made from the soy-wheat flour is as good or better than bread made from only wheat flour. However, it is necessary to add an emulsifier to the formulation when baking bread using the soy-wheat combination.

Blending of the extracted soy flour with wheat flour can be readily accomplished at the flour mill with very little or no increase in processing costs. However, it must be emphasized that the quality of the extracted soy flour be very good. Thus, good quality soybeans which are thoroughly cleaned and dehulled prior to solvent extraction are required for preparation of good quality extracted soy flour. This requirement should be considered when plans for expansion of existing or construction of new oil extraction plants are made.

Finally, it is again emphasized that the fortification of wheat flour with extracted soy flour could be easily accomplished. Since bread is universally used in Peru, the improvement in nutrition, especially for the poorer people, would be remarkably improved. The rapid nutritional gain available from a product that is virtually assured of being accepted by consumers and is comparatively easy to process, argue strongly in favor of this course of action.

Oil extraction

It is recommended that an economic survey of present and projected edible oil needs be made as well as a technical feasibility study to determine which existing plants should be expanded and where new plants should be located. Some of the plants are equipped with out-moded items

that should be replaced to increase production capacity and produce better quality products. New plants should be located in some of the new production areas and, no doubt, in certain cases it may be more desirable to build new plants than to upgrade existing facilities.

It is also important to consider that, if the program of protein fortification of wheat flour with soy flour is undertaken, a high-quality extracted soy flour is required. This must come from a plant which uses good quality raw soybeans that are dehulled before solvent extraction. Sanitary production procedures and quality control must be used to produce an extracted flake suitable for human food use.

A thorough economic survey of present and projected oil needs as well as a technical feasibility study is highly recommended. The technical feasibility study should evaluate present plant capacity and develop recommendations for improvements in present plant equipment and production capacity. Locations for new plants as well as production capacity of these plants should be recommended.

Professor Nelson again visited Peru during January 1976. He reported meeting the recently appointed General Director of IIAI, Dr. Hector R. Pimental Macedo who indicated much interest in the soy beverage studies and soy fortification of wheat flour. Equipment needed by IIAI to continue work on soy products included repair for homogenizer, a new pin mill, a seed cleaner, all-purpose hammermill, dehulling device for raw soybean and steam jacketed kettle for blanching or cooking soybeans.

Professor L. K. Ferrier visited Peru January 13-27, 1977 to participate in the "First Course on Soybeans in Peru" and also to visit IIAI and to discuss plans for their work with soy foods and to carry spare valves for the St. Regis homogenizer at IIAI and to assist with their installation.

He reported his results and accomplishments as follows:

1. I attended the "Primer Curso de Soya en el Peru" and presented a talk on using whole soybeans for food.

2. We had discussions at USAID and IIAI concerning the utilization portion of the present and future USAID soybean technical assistance program. In general, the plans for work on soybean foods at IIAI appear acceptable and most of the equipment and facilities needed are available. At this time the funds available to IIAI to carry out its share of the project are inadequate.

3. The valve seat reamer was too large. Therefore, we could not ream the valve seats and install the valves in the St. Regis homogenizer at IIAI.

Professor Ferrier again visited Peru June 20-28, 1977. The objectives of this visit were as follows:

1. To assist food technologists at the Instituto de Investigaciones Agro-Industriales (IIAI) with problems involving their soybean food research.

2. To participate in the program of the INTSOY food and nutrition team where that program related to preparation and use of soybean foods. The general objectives of the team were to identify:

   a. How soy foods might be used, in what form, and by what target groups.

   b. Methods of gaining acceptance of soy food.

   c. Organizational relationships required for the development, production, and use of the soy foods.

   d. The constraints in getting soy foods used in primary areas of nutritional deficiency.

   e. Potentials for coordination with other international agency soy food programs.

He reported the following results and accomplishments:

1. I assisted some of the staff at IIAI by answering questions about their research projects on soybean processing and soy-containing foods.

2. Five pieces of equipment for processing soybeans had recently arrived. I inspected these and answered questions from Maria Zuluetta about them. The new equipment consists of an Alpine fan beater mill, a Fitzpatrick hammermill, a seed cleaner, a soybean dehuller and a Gaulin homogenizer. The homogenizer arrived in February and was first used at the end of April. The other equipment had just arrived and had not been tested before my visit.

3. I assisted with the design and selection of equipment for a pilot plant for manufacture of dried cereal-legume food products such as weaning food and corn-soy-milk (CSM).

4. In company with other members of the team, I visited:

   a. A communal farm kitchen which is operating under the auspices of the Office of Applied Nutrition (ONAA).

   b. The Institute of Nutrition.

   c. The Institute for Nutritional Research located in the Clinica Anglo Americana.

Professor Ferrier made the following comments and recommendations regarding nutrition in Peru:

1. Protein calorie malnutrition (PCM) is estimated to affect 30 percent of children under age 6 in Peru. It is undoubtedly a major factor in the high infant mortality rate (also 30 percent) in Peru. The most important factors which appear to contribute to PCM in Peru are:

   a. The depressed general economy in Peru.

   b. The particularly depressed rural economy and very low agricultural productivity in Peru. (According to a 1977 report by the agricultural attache, U.S. Embassy, the rural people constitute 40 percent of the population but received only 13 percent of the income in 1976.)

   c. The rapid population growth (3 percent per year) relative to the growth in agricultural productivity (1 percent per year).

   d. The lack of an infrastructure capable of making best use of existing food supplies.

   e. The generally poor knowledge of sound nutrition by the common people.

   Thus it is imperative that substantial improvements be made in food production and food utilization. However, such improvements will be inadequate without concomitant improvements in the general economy, food storage and distribution systems and nutritional education of the common people.

2. IIAI and other food, agricultural and nutritional institutions in Peru recognize that PCM is one of the most important problems facing Peru today. These people need strong encouragement and they must be provided adequate finances to continue this work.

3. There is a clear and urgent need for well-trained technical personnel to perform the necessary research, education and technical tasks necessary to solve national nutrition problems.

   Therefore technical education at all levels from paraprofessional field worker to Ph.D. should be a top priority objective of the GOP.

Economics--marketing

The initial appraisal of the economic aspects of soybean production and marketing problems was made by Professor Sheldon W. Williams during his visit with the INTSOY study team during September-October 1975. His report on the economic aspects of soybean cultivation follows.

Observations and discussions in both the northern coastal area and in the Bagua basin convinced us that it will be possible to grow soybeans successfully in both of those regions. Similar but somewhat less certain conclusions were drawn in our visit to Tarapoto, where agriculture is

somewhat less developed. This conclusion rested upon evidence that soils in those areas were suitable for soybeans, that adequate supplementary irrigation was available where needed, and that climatic conditions would support production. Salinity may pose problems in limited areas, particularl on the coast, but we assume those problems can be mitigated with careful water management.

In both regions, soybeans seem likely to be produced mainly in rotation with rice. Factors responsible for this include both disease problems in rice, which limit production to one crop per year, and in some cases, limited water supplies, though adequate for soybeans. Thus soybeans generally will not be directly competitive with the dominant, presumably most profitable, crop in those areas.

Land uses with which soybean production will compete will include production of maize, other beans, perhaps sorghum, grazing for cattle on the rice fields in the dry season when other grazing is in short supply, and perhaps other forages, fruit, or vegetable crops in some situations. The comparative advantage of soybeans as a commercial crop under these conditions needs to be investigated in carefully planned, well-executed studies in each important potential growing area over a period of three to five or more years. Such studies are essential because the extent of soybean production will be determined in large measure by their comparative profitability in relation to competing uses for the land and other resources used in production and by how well soybeans fit into the farming systems of these areas. In turn, indication of the potential extent of production by areas is a prerequisite to developing the marketing and educational programs needed to complement soybean production.

There are two reasons why extensive research on the comparative advantage of soybeans is needed. First, a careful evaluation of available data on soybean production costs and returns strongly suggested that those data were careful estimates--"budgets"--of the costs that would be incurred and the yields obtained if the recommended package of practices was followed Such data are not representative of farm conditions. But comparative advantage is determined by growers' actual performance in soybean production and by the relative monetary reward they receive from their performance.

Such research is especially needed because soybeans are a new crop. We assume growers' performance in soybean production will improve as they gain experience with the crop. Consequently, studies continuing over a period of years are necessary.

Because grower performance in soybean production is of critical importance (yields per hectare will be a major determinant of cost per kilogram and the profitability of soybeans), the research on comparative advantage should be designed to provide information about the quality of performance and factors contributing to it. To do this would require periodic observations of the soybeans during the growing season by the investigator (field man). In these visits, he would obtain the information needed to estimate plant population per hectare, to judge the success of inoculation, to appraise the adequacy of weed control and the water supply, and to record other observations about the crop and favorable and unfavorable conditions for it. At the time of these visits, the field man could bring up to date his record of operations, inputs, etc., involved in production, thereby obtaining more accurate data than he would if he visited the grower only after the crop was harvested.

In addition to the data for soybeans, cost and returns data also will be needed for all alternative uses of land and other resources which compete directly with soybeans. These will include maize, other beans, perhaps sorghum, use of rice land for grazing instead of for crops, and perhaps some forage, fruit, vegetable, or other crops of which the writer is unaware. These studies should compare costs and returns from alternative uses of the same quality of land in the same season. For example, because clearing fields of straw, stubble, and the like after rice apparently involves appreciable expense, costs and return comparison of alternatives will not be valid unless the comparison involves use of land that had been in rice in the immediately preceding season.

In this research, information needs to be obtained about the farming systems in the surveyed areas, problems involved in fitting soybeans into those farming systems, and potential changes in farm organization that will facilitate the adoption of soybeans. An example of this need was especially apparent in Bagua. Large numbers of cattle are raised on some farms in that area. During the rice-growing season, when most of the rain falls, they apparently graze on nonarable land. But during our visit which was in the dry season, they were grazing on the field that had been in rice. Since the cattle evidently are raised largely if not entirely on grass, it is conceivable that farmers place a high value on grazing in the rice paddies. To make any substantial portion of their crop land available during that season, will require training in the production of improved forages as well as soybeans, and very likely the credit needed to finance inputs for both the improved forage and soybean crops. These will be needs which do not exist with the present farming system.

Even on farms where soybeans fit readily into the farming system, observations should be made and information obtained about barriers to the expansion of soybean production. Possible barriers may include reluctance to try a new crop, a general lack of information, uncertainty about obtaining credit, and uncertainty about the market for soybeans. Obtaining this information is necessary if such barriers to production are to be lowered.

The cost of production estimates examined appear to have been carefully made and seemed complete with one exception. The cost items did not include any charge for the use of land. An "opportunity cost" charge should be made to recognize that when land was used for the crop under consideration an opportunity was foregone to profit from using it in another way. In comparing the profitableness of competitive crops, the absence of such a charge does not materially affect conclusions. However, costs of producing a crop are incomplete unless such a charge is included.

In studies of cost of production, it is important that detailed information be obtained about the quantities and prices of all the inputs used in production that are of appreciable importance. Only in this way can comparisons be made over time and over periods of changing prices. Fortunately, this detail has been provided in the cost information made available to this technician.

Shifting to the problem of marketing, Professor Williams reports the following.

Soybean marketing is a broad topic. As a basis for discussion with my counterpart, developed brief statements about several aspects. In the limited time available, attention was devoted only to items which appeared most pressing.

Establishing and using standards and grades are essential in order to provide incentives to growers to supply the qualities of soybeans needed to manufacture good soybean products, and particularly for soybeans processed directly into human foods. It is encouraging that the Government of Peru recognizes this need and is beginning to specify standards. Continuing study, effort, and experience will be necessary to develop satisfactory grades. Information about United States grades and standards for soybeans was provided to help those involved in developing standards for Peru. However, as was emphasized, U.S. standards are not ideal and in some respects may not be suitable for conditions in Peru. Consequently, development of standards and grades is a problem on which technical assistance should be provided by the INTSOY marketing economist during his visits to Peru, and between visits if practicable.

Among the most important soybean marketing questions to be faced in Peru, will be determination of the optimum type, size, and location of soybean processing facilities. A final determination cannot be made in the near future because it will be greatly affected by the eventual extent and location of soybean production. The extent and location of production cannot be predicted with assurance until growers in all areas have had more experience in soybean production and there has been a more widespread development of the Selva. Nevertheless, investigations are needed at this time to guide the development of facilities.

Existing solvent extraction plants on the coast can provide facilities for processing soybeans into oil and meal suitable for livestock feed during the early years of soybean development. The plant visited by this technician in Piura (Calixto Romero S. A.), like that visited by the processing specialist in Lima, has the facilities and the technology to do this, and presumably others also can do so. As suggested by the processing technician, both technical and economic appraisals should be made of the solvent extraction industry. The economic component should determine present and prospective operating costs of existing plants, and should provide indications of operating efficiency, opportunities for improvements in productivity, and of the probable economic effects of increasing volume of full capacity and of expanding facilities to accommodate volumes above present levels of capacity. Added information about transportation costs for soybeans, soybean oil, and soybean meal, the location and volumes of plants using oil and meal also will be needed to make possible a careful economic determination of the optimum complex of these facilities in the Costa. In later years, as the Selva develops similar analyses should be made for that region

As we learned in our visit to Bagua, as soybean production gets under way in areas far from the coast, there will be demands for establishing processing facilities in those areas. Timely assistance will be needed to guide planning, both initially to avoid rash decisions, made prematurely, and also to assist in long-term planning for those areas. Some indication of factors that should be taken into account is given in the

brief analysis--made hurriedly and with limited data--"Considerations about Soybean Processing: Bagua Area." Because soybeans cannot be processed into oil and meal (or flour) effectively in small plants, a careful evaluation of alternative marketing arrangements should be made in such situations. Such evaluations seem likely to be needed not only for Bagua but also for Tarapoto, and perhaps other basins in the Selva as soybean production gets under way in them.

Economic feasibility studies are needed of proposed foods incorporating soybean products. Such studies are needed to estimate costs of producing and marketing those products. That information is needed to appraise the potential benefits from the production of those foods and to assist in determining prices for them. Given that information and the findings of acceptance studies of the product, projections can be made of the potential demand for them. Such studies should be made as soon as production techniques are stabilized for the proposed blend of cows' milk and soy beverage and for the fortification of wheat flour with extracted soybean flour. In time, similar studies may be needed for other products.

Economics--production

Professor Alfred G. Harms visited Peru March 12-27, 1976 to study the comparative advantage of soybeans as a commercial crop in relation to competing uses for land and other resources in production.

He reported that budgets were developed for rice, corn, and soybeans for high jungle area under both mechanized and nonmechanized production methods. Rates of performance, costs, yields, and prices used were based on data supplied by MINAL and from information gathered on tour from farmers, extension workers and other individuals contacted.

The price of the crops is guaranteed by GOP so that budgets could be developed to show returns to labor and management after direct cash costs were covered. Because of the land tenure system with land held under "usufruct," there is no land charge and the labor was assumed to be operator and family labor without a direct cash cost.

With the assumption made, soybeans were competitive with the other crops and can work into a rotation following the major crop, rice.

The budgets were used to support the project proposal.

Professor Harms visited Peru again June 12-28, 1977. The purpose of the visit was to visit Tarapoto and Yurimaguas as prospective areas for soybean production and to confer with personnel of the Ministry of Food, USAID/Peru, and other organizations on soybean production opportunities and problems.

His report and recommendations were written from a farm management concept. The following is a summary of his impressions.

1. This visit and a prior visit to the Bagua-Jaen area in March 1976 have confirmed the desirability of these areas for the expansion of soybean production in Peru. Productive soils, adequate rainfall, with supplemental irrigation in Bagua-Jaen, and other favorable climatic conditions will contribute to the successful production of soybeans.

2. The completion of the road from Tarapoto to the Bagua-Jaen area will enhance the production of soybeans by facilitating the movement of productive inputs into the area thus tending to lessen their cost. Similarly, the road allows the export of the soybeans from the area to the processing plant at Piura until the construction of the proposed processing plant in Tarapoto. After its construction, the soybean oil and oil meal not needed in the area can be moved to other areas of Peru where needed.

3. The construction of the oil mill (proposed for 1980) will allow the processing of soybeans and other oilseeds produced in the area. Both the oil and oil meals will be available for local consumption with excess supplies moving to other areas. This will lead to more efficient use and reduced transportation charges.

4. The initiative and determination of the farmers and merchants in these areas to make and take advantage of increasing production of promising crops such as soybeans will help in bringing about the success of this venture. The atmosphere of the area reminds me of the kind of conditions that must have existed on the United States frontier a century ago as the settlers surged westward in taming the continent. The high jungle area is a dynamic place of frontier expansion.

5. The evidence is clear that the farmers in the areas are responsive to economic signals in guiding their production plans. Recent high prices and improved marketing of corn have brought about an increase in corn acreage from 8,000 ha. two years ago to 20,000 ha. in 1977. Conversely, cotton acreage has decreased from 2,000 ha. two years ago to 600 ha. in 1976 because of marketing problems. Proper pricing of soybeans with timely pick-up and payment by EPSA is necessary to call forth the soybean acreage needed to supply the demand in Peru for soybean oil, oil meal, and soy products to augment the quantity and quality of diet of Peruvians.

6. The Ministry of Food has developed plans to facilitate the introduction and expansion of soybeans in the areas. Research investigations in the production, processing, and utilization are being planned and undertaken and extension education help is given to farmers through demonstrations, advice on problems, and aid in supplying inputs. The ministry staff members assigned to the soybean production effort are competent, cooperative, enthusiastic, and determined to carry out the plans.

7. The GOP has set the purchase price of soybeans at a level that promises to make soybeans competitive with corn and peanuts and supplementary to rice as a succeeding crop. Additionally, the establishment of grade factors will allow for a sounder and more just evaluation of the product when offered for sale by the producers.

Professor Harms noted the following problems.

1. Extensive varietal trials to test for yield, disease and insect tolerance or resistance, standability, freedom from shattering, nutrient needs, etc., have not been conducted in all possible soybean production areas.

2. The iron deficiency symptoms showing up in the Huallaga Central need to be investigated to determine cause and ways to correct the problems. Possibly a different variety, foliar applications of iron solutions, or nutrient supplements may answer the problem.

3. There is some evidence of problems arising from lack of timeliness on the part of the farmers in land preparation, planting, cultivating, and weeding of soybeans. Some of these problems arise from the delay in getting tractor hire service at the proper time. Additional services or reliance on traditional methods may be necessary.

4. The problem of poor stands was quite evident in most soybean fields observed. This could be due to poor seed quality affecting the germination, in the seedbed preparation, or from lack of moisture at planting.

5. As indicated in the above point, seed bean quality may be a problem as it is in many tropic production areas. Seed storage structures with air conditioning and relative humidity control may be necessary as production increases. If seed quality is lowered by rains and poor weather at maturity, then timeliness of planting is needed to bring about the maturation and harvest during low rain fall periods.

6. Although disease and insects have not been serious problems, they also will increase as additional acreages of soybeans are planted in the area. Plans need to be outlined to meet these threats should they occur.

7. Harvesting problems will mount as additional acreage comes under production. Some thought needs to be given to small threshing units that could be made available to farmers to perform this vital task.

8. Hopefully EPSA will be able to efficiently purchase and transport to the coast the soybeans produced in the area. Delays in pick-up of soybeans and delays in payment for the soybeans will discourage increases in production.

9. A lack of cash or credit will hunder the expansion of the soybean on other crop acreage because of increasing cost and need for adequate inputs for efficient production.

His recommendations are as follows.

1. Proceed with the expansion of soybean production at a modest pace for several years while concentrating efforts on the investigation of problems of soybean through an expanded research program.

2. Conduct more extensive variety trials in the area of planned soybean production to select varieties of high yields with other desirable characteristics.

3. Concentrate efforts in the soybean production program to the Tarapoto and Bagua-Jaen area so the limited human and physical resources available are not spread too thinly.

4. Commence experiments and research efforts on existing and expected problems as soon as resources can be assigned

5. Bolster extension efforts in the field to aid farmers in overcoming present production difficulties.

Economics--planning

Mr. Dan Condron, University of Missouri, working under the guidance of Professor Melvin Blase, was in Peru from January 13 until May 2, 1977 gathering material for an analysis of agricultural development planning for the Huallaga River Valley. The objective of the study was to determine the optimal use of farm-level agricultural resources with special reference to soybeans. Consideration was given to:

1. Determining the optimal use of land and other factors of production under existing product prices in the Huallaga River Valley.

2. Determining the competitive strength of soybeans relative to other crops in competition for the resources of the region.

3. Determining the changes in product-mix of the region that would be expected under optimal allocation conditions as a consequence of varying the prices of key agricultural commodities produced there.

Food and nutrition

Four faculty members of the School of Human Resources and Family Services, University of Illinois, visited Peru June 12-28, 1977. They were Pauline Paul, Professor of Food and Nutrition and Director, SHRFS; Constance McKenna, Assistant Director, Cooperative Extension Service; Mary Frances Picciano-Milner, Assistant Professor of Nutrition; and Barbara P. Klein, Assistant Professor of Foods and Nutrition.

The study focused on the role of soybeans in augmenting nutrition but also covered a wide variety of associated inquiry as outlined in the following statement.

The purposes stated by the four SHRFS faculty members were as follows

A. Pauline Paul, Professor of Food and Nutrition and Director, School of Human Resources and Family Studies

1. Determine potential for increasing consumer use of soybeans and/or soy products.

2. Obtain information on typical food patterns for a variety of population groups, e.g., income level, age, education, urban, rural, playa, mountain, selva, etc.

3. Obtain information on Peruvian food preparation procedures and resources available for obtaining and preparing food, e.g., money, barter, garden plot, etc.

4. Learn how bean-type products are usually prepared and consumed.

5. If beans as such present too many difficulties, determine what products processed from soybeans have the best potential in terms of how they will work in people's usual preparation and consumption patterns, what they will cost, and whether or not the products can be produced in-country.

B. Constance McKenna, Assistant Director, Cooperative Extension Service

1. Survey the informal education systems currently meeting the needs of Peruvian homemakers classified as urban, rural, general population and low income.

2. Obtain information on the existence, organization of groups comparable to Homemakers Extension clubs. These may include church groups, government-sponsored organizations, ladies' auxiliaries, etc.

3. Learn what governmental agencies are responsible for nutrition/health/sanitation programs for out-of-school youth and adults. Learn who determines program content and what delivery systems are used in these programs.

4. Observe to what extent mass media, TV, radio, newspapers, other media are used for educational purposes.

5. Determine if there is sufficient interest in extension-type delivery systems to warrant establishing a liaison with the appropriate agency/institution for purposes of developing and adapting an extension-type outreach program for Peru.

C. Mary Frances Picciano-Milner, Assistant Professor of Nutrition, and Barbara P. Klein, Assistant Professor of Food and Nutrition

1. To identify Schools of Home Economics and determine current foods and nutritional related activities.

2. To visit areas of the country where soybeans are being grown and determine distribution routes to areas where they are to be consumed.

3. To visit areas where applied nutrition programs are either in pilot stages or in full operation.

4. To become familiar with general food behavior and practices.

The detailed recommendations of the food and nutrition team are included below.

Paul

1. A much broader look at appropriate ways of introducing soybeans into the Peruvian diet would be beneficial for their program planning and development. This would need to take into account the food habits of population groups in different parts of the country, the very low economic resources of many people, and the nutritional benefits to be gained from each type of product.

   a. Whole beans can be used in many areas where people customarily eat beans. Whole bean use probably is least possible in mountains due to long cooking time required by high altitude effects on boiling point of water. However, even for these areas precooked then fried beans could be used as snack foods.

   b. Since they are short of food oils as well as protein, they will undoubtedly wish to continue oil extraction. They might either upgrade their solvent extraction equipment so the residue is suitable for use as human food, or stop at the expeller level of oil extraction which leaves the cake available for human use.

   c. There seems to be considerable potential for use of soy flours, either as such or in blends with other flours. Such flours could be incorporated into a variety of foods generally eaten--breads, pastas, soups, sauces, etc. Partially or completely defatted soy flours would have the advantage of greater storage stability than full-fat soy flour.

   d. More highly processed products such as texturized soy protein is probably out of reach economically to most of the people, so would not reach those in real need.

2. Soybean production and oil extraction plants for the southern part of the country might be considered. The Madre de Dios area was suggested to us as a potential location for such work.

3. A more "global" approach to their food supply and nutrition education problems under the present AID-Peru contracts should be pursued if possible. The Peruvians want and need to look at all possibilities for increasing their self-sufficiency in food supply, not soybean potential only.

4. The Peruvians are to be commended for their interest in indigenous plant protein sources such as quinoa and tarwi. If possible, this work should be increased and perhaps expanded to other items such as canihua and isano.

5. The hypothesis that wild plants and/or herbs may be a significant source of Vitamin A for some groups suggests that much more detailed food consumption studies may be needed, to identify the various plants and amounts used, and to do analyses for nutritive value.

6. Work on foods and nutrition appears to be done in several ministries and a number of agencies within these ministries. Some central administrator or office to coordinate the work and facilitate communication among these disparate groups might be beneficial.

7. Some thought should be given to changes in local customs and family structure which may result from the shift from local subsistence to commercial agriculture. In many areas, husband and wife have customarily shared the work of raising food. Teaching the men to raise crops for sale without cognizance of the women's role may have unfortunate repercussions.

8. U.S. advisors going to Peru should have at least some ability to speak Spanish so they can communicate directly with the people with whom they work.

Klein

1. Progress has been made on the development of soybean milk--technical problems are close to being worked out. Progress could be more rapid if there were more technical personnel available for the project, as well as more financial resources. The development of these products (soybean milk or any others) should be carried through to the test marketing stage. (Weaning food should probably be next priority.)

2. Those groups in Peru which are involved in providing high protein, low cost foods to vulnerable populations should meet at least annually to exchange current information. This would involve manufacturing, marketing, nutrition personnel.

3. The lack of senior scientists involved in research is noted. Success of the technical advances depends on the availability of such people. Every effort should be made to promote graduate level education in food science and nutritional biochemistry. At another level, there is a need for nondegree technical training and for nutritionists, dieticians, and food technologists.

Picciano-Milner

1. From a nutritional standpoint, the most vulnerable population groups are pregnant and lactating women, infants from birth to one year, preschool children from one year to five years and school age children from 6 to 14 years. Nutrition outreach programs to some of these groups were noted, particularly for pregnant and lactating women and school age children. Since there is a high index of protein calorie malnutrition in Peru and it is most evident among preschoolers, nutrition programs to reach this segment of the population should be implemented. It appears that soybeans and soybean products could be possible foods in these nutrition outreach programs.

2. Nutrition planners should consider the nutrient contributions that human milk can provide. Therefore breast feeding should be encouraged as long as possible.

3. Existing nutrition programs should be evaluated to determine if those most in need are being served, if objectives are being met and if implementation design uses available resources efficiently. Only with objective evaluation can more effective programs be developed. Moreover, evidence of effectiveness serves as a convincing argument for program support.

4. Nutrition surveys have indicated a high incidence of endemic goiter and iron deficiency anemia in Peru. Preventative measures should be considered. It may be possible to fortify a staple food with iodine and to fortify weaning foods and bread with iron. The most appropriate vehicles would need to be determined in view of Peruvian consumption patterns and the particular segment of the population to be reached.

McKenna--Recommendations for improving nutrition education, especially as related to the use of soybeans

A. Persons/agencies having responsibility for nutrition education should:

   1. For organization/administration

      a. Be sure that the national leaders have basic facts readily available for use in decision-making concerning the production and processing of soybeans as well as soy's potential for utilization in various food forms and its potential for contributing to improved nutritional health for the people of Peru.

There is often a tendency to assume that national leaders know specific facts whereas often their broad responsibilities have directed their thinking elsewhere. For example, national leaders may know that soy is mostly used for making oil with residues utilized for animal feed; but do they know that a different oil extraction process would leave a soy meal residue fit for human consumption? Do they know that soy enriched wheat flour adds proteins to the daily diet? Would knowing such soy-related facts influence key policy decisions?

b. Continue efforts already underway to coordinate existing nutrition education programs so as to more accurately ascertain their scope and impact, to better identify gaps in the availability of nutrition programs such as appears to exist for preschool children, and to avoid the possibility of costly duplication of effort. Such coordination should exist both at the administrative planning level and among field staff involved in program delivery. Also, coordination can help identify where information about soy use can best be integrated into existing programs. For example, it would be most helpful if the coordinating group would agree on one basic food pattern to be adopted in all nutrition education programs. Three and five food groups have been used. Such differences serve to confuse the public.

c. Give consideration to expanding the role of the Instituto de Investigaciones Agro-Industriales to include providing soy information as part of a planned outreach function. This would mean establishing new positions at the Instituto for extension education specialists on soy and providing them with support funds for travel, secretarial assistance and publications. Having specialists in production, food processing, and nutrition and home consumption would require persons with substantially different background training and professional expertise.

The broad concept of extension education involves programming to transmit knowledge based on scientific research to people who should have access to such information even though they are no longer students in a formal academic setting.

Extension educators begin with scientific facts and design educational programs to create awareness of these facts, to teach specific information about them to select groups, and to generate the motivation to utilize this new information in changing daily habits where appropriate. The extension education program design consists of five basic steps: (1) analyze the situation, (2) plan a program to meet specific needs, (3) identify resources available to help, (4) implement the program, and (5) evaluate the program's effectiveness.

The amount of scientific detail and the level of complexity of information presented should be carefully geared to the needs, interests, and comprehension of each specific audience.

Questions raised by each audience can serve as the basis for future programming and can also help identify areas for additional research. For example, it is entirely conceivable that ideas for the development of new soy foods might come directly from people participating in various programs. Besides pure research for research's sake we need research that will help people meet their expressed needs. Nutritionists would be a key audience for soy specialists.

d. Give consideration to expanding the role of the Instituto de Investigaciones Agro-Industriales to utilize existing staff capabilities and equipment already on location to conduct additional research on the nutrition composition of soy (for example, amino acids) to be able to supply basic soy nutrition facts needed in extension education programs for nutritionists and others responsible for nutrition planning. Added financial resources would be required for essential operating costs (chemicals, etc.).

e. Develop plans to make ongoing consultation available from appropriate experts to key administration and other staff as needed. A specifically mentioned current need is for help in developing and presenting TV programs.

f. Consider conducting a one-time workshop for interagency teams consisting of administrative and field staff to tour and learn about various nutrition education programs in the United States that are (1) counterparts of those operating in Peru and (2) others having potential for adaptation to Peruvian needs.

2. For nutrition educators (program delivery staff)

Professional staff

a. Encourage and support their continued personal professional development

(1) Establish a professional library at a central location available to interested staff. Include professional journals specific to nutrition and health. Journals on educational methodology are also important for example:

(a) Journal of Extension (USDA)

(b) Journal of Home Economics (AHEA)

(c) Adult Education Journal (AEA)

Also, it would be useful to include for reference copies of Spanish language publications printed in the U.S. and other countries. For example, the University of Illinois has several short publications developed for use in special programs.

(2) Encourage staff to participate in professional organizations such as the Associacion de Dietetica y Nutricionistas del Peru which is a part of the Association of Latin-American Dietetica y Nutricionistas.

(3) Consider sending, expense paid, a fluent bilingual staff member to national professional meetings in the U.S. such as the National Association of Extension Home Economists, the American Home Economics Association, and the American Dietetic Association. This update on programs and scientific facts can be shared in Peru and serve as a marvelous source of stimulation.

b. Expand the number of nutrition educators as rapidly as resources permit.

Paraprofessionals (auxiliaries). Employ them when:

a. Level of nutrition education to be taught is elementary.

b. Audience is comprised of children or the general public in informal settings.

c. The intended audience is low income and hard to reach by other staff. They can pave the way for program acceptance.

B. Specific groups to be given special consideration for nutrition education programs

1. Medical professionals whose responsibility is related to knowledge of nutrition. Professional performance is improved and accurate information disseminated to the public by knowledgeable medical practitioners. Up-to-date information on soy should be made available by such means as seminars and newsletters.

The importance of this phase of soy education must not be overlooked. Most may know that soy is a protein rich food, but not all may be aware that high fat products may be associated with absorption problems in infants under one year of age.

2. School teachers. Their need for in-service education and the ways to accomplish it are similar to that of medical professionals. However, school teachers reach many more individuals on a repeat contact basis and therefore can be of great influence.

Motivating teachers to include information about soy as part of their nutrition education program will be a real challenge. Besides providing workshops, seminars and/or newsletters, consideration might be given to the following:

a. Preparing self-study packets which teachers can use as their time permits. If materials include in-depth background information, one professional will be better educated. But if materials include items for use with students or ideas of soy-related teaching projects, then a whole group of Peruvians learn. Examples of materials for students:

   (1) Literature--a story to be read to the class (mystery format) on how children were malnourished, but a remedial source could not be identified. After trying several solutions, it was found that soybeans provided necessary protein and calories for weight gain and increase in height.

   (2) Mathematics--problems can use soybeans. How many grams of soy meal equal one kilo? Learning to count can be a game in which the class guesses how many soybeans are in a cup and then counts them out to see who guessed closest to the actual number.

b. Having a national contest for school teachers, either

   (1) An essay on importance of soy in solving national nutritional problems.

   (2) A soy recipe contest.

   Essays could be published in newspapers or recipes put into a cookbook for sale. In either case, the name published serves as prestige, and a small reward for the best entry serves as enticement to enter the competition.

3. General public

   <u>Community leaders, adults, children</u>

a. Awareness--each of the above groups must first know about soybeans before they can effectively promote their use. Some specific possibilities are:

   (1) Offer to make soy programs available to various officials, business organizations, social clubs and other groups.

   (2) Use mass media for wide exposure.

(3) In supermarkets, give away free samples of foods prepared using soybeans with a recipe for preparation. Not all potential soy users are low income.

(4) Have an ongoing program of field trips to the Instituto de Investigacion Agro-Industriales for various school children and university students.

Soybeans will gain wider acceptance if people know how soy can improve nutrition, if they understand how to use soy products and if using soy is practical and affordable.

Participation--involve people in planning to solve nutritional problems. People who get involved tend to be more committed to the success of projects than others. Being able to contribute to the solution of a problem is a very satisfying experience for most people. The difference in attitude towards a program is noticeable when people feel it is "ours" rather than "yours."

Another important concept in getting people's involvement in nutrition education is the "teachable moment." People tend to learn fastest and best when information is presented when they need it in a form they can easily understand and use. Teachable moments are plentiful for pregnant women, new mothers, community leaders trying to increase the budget, nutritionists trying to develop educational programs, doctors trying to eradicate dietary deficiencies.

Examples of participation programs:

(1) Open public meetings on topics of general interest.

(2) Soy seminars or workshops for interested groups.

(3) Mothers' clubs where soy use can be explained and demonstrated as part of a broader, ongoing nutrition education program. Mothers' clubs can help women organize for learning ways to increase the family income by making and/or producing goods for sale. Education to help mothers be better consumers of goods and services would also prove valuable.

(4) Youth clubs which could be established to do for children what mothers' clubs do for women.

(5) Community organization to solve a particular problem. For example, what will our school do about providing a feeding program when donated foods are no longer available?

(6) A poster contest can be organized for children of various age groups. A small prize would serve as motivation, and good posters could be reproduced for use in various educational programs.

C. Cautions--important factors to remember.

1. Planning needs to be both short term and long term.

2. Coordinated efforts which include sharing information and cooperation at many levels improves the likelihood of nutrition education programs having widespread and effective impact.

3. Nutrition education programs developed to reach everybody may be so general as to be of limited effectiveness. Pinpointing specific audiences helps give programs focus.

4. Peru has a significant number of excellent nutrition education programs. However, accessibility is essential. Available resources limit outreach possibilities. Setting priorities is essential. Beware of generating demands that cannot be met.

5. Continuing evaluation of nutrition education programs is necessary to provide evidence of success and to help identify gaps and new needs as they arise. Needs are dynamic and vigilance is the best way to keep nutrition education programs on target.

Summary

It is clearly evident that Peru recognizes the importance of providing nutrition education on a broad scale to help ensure the good health of its people. Considerable effort has been made to survey the eating patterns and nutritional needs in various parts of the country. Results from these studies have been used as the basis for planning a wide variety of nutrition education programs. The greatest need now appears to be for careful coordination among various nutrition education programs to best utilize limited resources and for expansion of existing programs as resources permit to bring appropriate nutrition education programs within the reach of all Peruvians.

Training--GOP Study Team

A six-man Peruvian study team visited the United States, Puerto Rico, Colombia, and Ecuador during the period September 11-October 22, 1976. Training in soybean production was conducted at the University of Illinois, the University of Arkansas, Mississippi Agricultural and Forestry Experiment Station, Northeast Louisiana Experiment Station, University of Georgia, University of Puerto Rico, International Center of Tropical Agriculture (CIAT), Institute of Columbian Agriculture (ICA), and National Institute of Agricultural Investigations (INIAP).

The members of the team were:

Ing. Rodolfo Vargas S., Specialist, Research Division, Ministry of Food

Ing. Rufino Montalvo S., Specialist, Experiment Station, LaMolina, ICRIAI

Ing. Alejandro Lerzundi S., Specialist, Sectional Office of Food Planning, Ministry of Food

Ing. Eudocio Chavez A., Specialist, Oilseeds, Production Division, Ministry of Food

Ing. Arturo Palacios P., Specialist, Agricultural Feeds, Marketing Division, Ministry of Food

Ing. Moises Rondon C., Chief, Oilseeds Division, EPSA

The recommendations of the team follow:

1. One ought to implement, with the necessary resources, the Integral Plan for the Development of the Soybean, to achieve profitability of production and the sustaining development of soybean production in the country.

2. To locate the areas of soybean production in the country, taking into consideration the production potential, rotation alternatives, and location of industry that should profit by production, as well as the concentration of services necessary to achieve good production.

3. To develop the capability of the personnel of our country, involved in the development of the soybean, in countries with advanced technology such as the United States, Brasil, Puerto Rico and others.

4. The research institutions of the country must maintain contact principally with INTSOY of the Universities of Illinois and Puerto Rico, with the Delta Branch Experiment Station of the University of Mississippi, with research institutions of Brasil and other countries, in order to gain information and genetic material.

5. In developing countries, like ours, one ought to use soybean products which do not require sophisticated processing, with prices that may be in balance with the majority, of high nutritional value and of easy acceptance by the consumers. As an initial phase, it is recommended to use the whole soybean in the household preparation of foods and drinks that can be adapted to the liking of the consumer, fulfilling an important role in nutrition education.

6. Besides the direct utilization of the whole soybean in human nourishment, other immediate possibilities in our country are:

   a. Oil extraction and use of the resultant meal, in part, for the preparation of flour to be mixed with wheat flour in the bread industry, crackers and pasta products, and other protein mixtures; and the other part of the preparation of balanced feeds to use in animal feeding.

   b. Utilization of the whole soybean for the preparation of milk and flours.

7. To encourage the cultivation of soybean in the country, one ought to readjust the prices to reflect the costs of production and to establish the most adequate infrastructure and channels of commerce.

Training--short course for soybean research and extension workers

The first course of soybeans in Peru was held at Tumbes January 17-22, 1977. Joint sponsors were the Ministry of Food, INTSOY and AID. Eighty-six participants were in attendance.

Members of INTSOY who took part in the seminar were Professors W. N. Thompson, H. C. Minor, Raul Abrams, L. K. Ferrier, M. A. Ellis, and Extension Adviser Mike Sager.

Sager's report, which follows, captures the spirit of the undertaking.

Purpose of the seminar was to provide the participants a general overview of soybean production, marketing, and utilization. By design...Peruvians did most of the lecturing. Participants were mostly middle level government workers with four landowners and soybean producers in attendance.

Eudocio Chavez, Rodolfo Vargas, Ricardo Vilamonte and their associates deserve recognition for the manner in which they arranged the seminar. When we worked with them in October 1976, we encouraged attention to all details and they followed through very well.

The seminar was publicized by the Government of Peru in newspapers, radio, and television as "The First Soybean Seminar in Peru." Banners proclaiming the seminar were over the highway on each side of Tumbes and on the city plaza. The event was accorded opening and closing ceremonies by the prefectura (local political leader) and the local military commander. The seminar was held in Tumbes at the direction of the President, Marciano Morales Bermudez.

Leaders of the seminar kept the program relatively punctual. Roll was taken as the sessions opened each morning and afternoon to assure attendance. Each participant was presented a certificate upon completion of the course.

To what degree did the seminar attain its objectives? I would evaluate the seminar as being successful. It was designed to provide a general overview of soybean production and utilization potentials in Peru and to generate an awareness of these possibilities. It can be said that the seminar reached these objectives and was a necessary and valuable step in evolution of the Peruvian soybean program. The seminar was not a scientific exercise because it was not designed as such.

Again, I wish to give emphasis to the excellent planning and attention to detail of those Peruvians who were charged with the responsibility of conducting the seminar. Their hard work and enthusiastic approach to matters will have a positive effect on the Peruvian soybean program.

10-4-77dt