

A.I.D. EVALUATION SUMMARY - PART I

PD ABC-512

1. BEFORE FILLING OUT THIS FORM, READ THE ATTACHED INSTRUCTIONS.
 2. USE LETTER QUALITY TYPE, NOT "DOT MATRIX" TYPE.

IDENTIFICATION DATA

A. Reporting A.I.D. Unit: Mission or AID/W Office <u>ST/AGR/AP</u> (ES# _____)		B. Was Evaluation Scheduled in Current FY Annual Evaluation Plan? Yes <input type="checkbox"/> Slipped <input checked="" type="checkbox"/> Ad Hoc <input type="checkbox"/> Evaluation Plan Submission Date: FY <u>89</u> Q <u>4</u>	C. Evaluation Timing Interim <input checked="" type="checkbox"/> Final <input type="checkbox"/> Ex Post <input type="checkbox"/> Other <input type="checkbox"/>
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D. Activity or Activities Evaluated (List the following information for project(s) or program(s) evaluated; if not applicable, list title and date of the evaluation report.)

Project No.	Project /Program Title	First PROAG or Equivalent (FY)	Most Recent PACD (Mo/Yr)	Planned LOP Cost (000)	Amount Obligated to Date (000)
936-4132	Soybean Utilization Research Project	85	9/92	5,950	3,295

ACTIONS

E. Action Decisions Approved By Mission or AID/W Office Director Action(s) Required	Name of Officer Responsible for Action	Date Action to be Completed
1. Develop a new Scope of Work for the next two years.	H. Kauffman (UIUC)	
2. Acquire additional non-ST/AGR project funding.	H. Kauffman	
3. Extend the project by 3 years depending on the success of No. 2 above.	F. Mertens	July 91
4. Conduct a mid-term project evaluation in late 1991 or early 1992.		

(Attach extra sheet if necessary)

APPROVALS

F. Date Of Mission Or AID/W Office Review Of Evaluation: _____ (Month) _____ (Day) _____ (Year)

G. Approvals of Evaluation Summary And Action Decisions:

	Project/Program Officer	Representative of Borrower/Grantee	Evaluation Officer	Mission or AID/W Office Director
Name (Typed)	F. Mertens	H. Kauffman	B. Carter 10/10/90	D. Bathrick
Signature	<i>F. F. Mertens</i>	<i>H. Kauffman</i>	<i>F. Alejandro</i> 10/5/90	<i>D. Bathrick</i>
Date	Jan. 1, 1990	28 Feb 91		

a-

ABSTRACT

H. Evaluation Abstract (Do not exceed the space provided)

The project's ^{Purpose} ~~function~~ is to develop, test, adapt and disseminate new soybean products and soybean processing techniques through research, information dissemination, training and technical assistance.

This evaluation was conducted by an outside contract team to evaluate the project's achievements in relation to project goals, the quality and appropriateness of the research, and the efficiency of the research and to make recommendations as to future planning. The team (a) reviewed project documents and reports, (b) interviewed AID, project staff at the University of Illinois in Urbana/Champaign (UIUC), the principal investigator, representatives from private enterprise (equipment manufacturing, soybean processing and a swine producer) and other researchers at the institution and (c), visited four sites in Illinois, Ohio and Iowa.

The evaluation team found the project to be on schedule in its progress towards the goals which were drastically changed after one year of implementation due to political pressure by commodity groups and were reduced by more than 30% because of AID budget cuts.

Specific findings and conclusions are:

- 1) The results of INTSOY's research is having an encouraging impact on LDCs private and public sectors, and agribusiness in LDCs and the USA are utilizing INTSOY's dry and wet processing methods in the production of human and animal feed.
- 2) The State of Illinois and UIUC are supportive of this program and are funding 30% of the project costs.
- 3) The INTSOY project should be extended for another 3 years beyond the current termination date of January 31, 1992.
- 4) The primary focus of the project should be redirected to technology transfer and implementation in LDCs; e.g. research in production and market development should be major components for the remainder of the project.
- 5) Project management and manpower in certain areas should be changed to improve cost effectiveness and impact potential.
- 6) A strategy should be developed to acquire additional financial resources to implement the suggested changes.

COSTS

I. Evaluation Costs				
1. Evaluation Team		Contract Number OR	Contract Cost OR	Source of Funds
Name	Affiliation	TDY Person Days	TDY Cost (U.S. \$)	
Cornelius Hugo	KSU	17	8,266	Program
Louis A. Wollermann	Consultant	<u>14</u>	<u>4,510</u>	
	Total	31	12,776	
2. Mission/Office Professional Staff		3. Borrower/Grantee Professional		
Person-Days (Estimate) <u>20</u>		Staff Person-Days (Estimate) <u>15</u>		

A.I.D. EVALUATION SUMMARY - PART II

SUMMARY

J. Summary of Evaluation Findings, Conclusions and Recommendations (Try not to exceed the three (3) pages provided)

Address the following items:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Purpose of evaluation and methodology used • Purpose of activity(ies) evaluated • Findings and conclusions (relate to questions). | <ul style="list-style-type: none"> • Principal recommendations • Lessons learned |
|---|--|

Mission or Office:

S&T/AGR/AP

Date This Summary Prepared:

1/18/90

Title And Date Of Full Evaluation Report:

Interim Evaluation of the Soybean Utilization Research Project Sept. 1989

PROJECT PURPOSE

Project Purpose: The Soybean Utilization Research Project (936-4132) is implemented by S&T/AGR/AP through a cooperative agreement with University of Illinois at Urbana-Champaign (UIUC) to undertake the International Soybean Program (INTSOY), to develop, test, adapt and disseminate new soybean products and soybean processing techniques through research, information dissemination, training and technical assistance.

Evaluation Purpose and Procedures: The purpose of this external evaluation is to conduct a comprehensive evaluation of the performance and implementation of the project, specifically, to : (1) determine the capability of the contractor to develop and disseminate new soy products and processes from raw whole soybeans, (2) conduct collaborative research and testing of new products and processes and promote the commercial application of these products in the less developed countries, as well as in the United States, and (3) promote the dissemination of information and conduct training courses on soybean utilization. This evaluation covers the period from the beginning of the current project April, 1985 through August 1989.

On September 5, 1989, the two member evaluation team arrived in Des Moines, Iowa to review project linkages with an equipment manufacturer. On September 6 a one week intensive review was initiated with UIUC administrative officials, INTSOY research personnel, and private industry representatives. From September 11 through September 19 the team remained in Washington, D.C. reviewing the project with representatives of the American Soybean Association, S&T/AGR officers, and writing the report.

Findings and Conclusions: Generally, the evaluation team found the project to be well implemented by a competent, mutually supportive INTSOY research team. Principal findings and conclusions include:

- The benefits of the utilization research being conducted by INTSOY is having a positive and encouraging impact in LDCs, in the private as well as public sector. In LDCs, an increasing number of private entrepreneurs are using the INTSOY technology to produce soybased human foods, animal feeds, and edible oil; public sector agencies are applying the technology in social programs designed to improve nutritional conditions.
- U.S. agriculture and agribusiness are already reaping the benefits from INTSOY's dry and wet processing systems, as exemplified by increased equipment sales; higher productivity in swine growing operations; and small, rural based manufacturing of soy-based products.

C'

S U M M A R Y (Continued)

- The State of Illinois and UIUC's commitment to this program is solidly demonstrated by their underwriting of 30 percent of the cost of the program through infrastructure development, equipment, and administrative and scientific staff time.
- Private sector support for this project is demonstrated by the donation of processing and analytical equipment to INTSOY, making manufacturing facilities available for test runs and demonstrations, and donating personnel time to the project.
- Collegial rapport among INTSOY's utilization research personnel is outstanding. Staff members are very supportive of each other and their commitment to the project is demonstrated by their countless "extra" man- hours.
- The positions taken by Land of Lincoln Soybean Association and ASA in regard to this project are very favorable and receptive to proposals for funding certain components of the program.

Principal Recommendations: The evaluation team recommends:

- that the INTSOY project be extended for another 3 years beyond the current termination date of January 31, 1992. Current real funding levels should be maintained, and serious consideration should be given to a higher level of funding;
- given the success at INTSOY in achieving a new state of the art in soybean processing, the primary focus of the project be redirected to technology transfer and implementation in LDCs; research in product utilization and market development is key to developing an even greater "pull" for INTSOY's processing technologies;
- that additional ways be explored to strengthen existing linkages between the INTSOY program and other AID units such as Food for Peace, S&T/Nutrition, and the Aquaculture Section; other federal agencies engaged in soybean utilization research (USDA/OICD and its collaborative university network); and other centrally funded projects such as the Seed Technology project at MSU and the Grain Postharvest Systems project at KSU;
- to reassess INTSOY's role and potential contributions, given the changing perceptions within the soybean economy, as evidenced by the new expanded check-off and the decision to establish the National Soybean Research Center at UIUC; INTSOY is in a position to play an even greater international role in support of soybean utilization, and could be instrumental in furthering national as well as international goals of concerned representatives.
- to conduct a mid-term project evaluation in late 1991 or early in 1992 to assess progress and a final evaluation in 1994 to assess overall impact;

S U M M A R Y (Continue.)

to modify certain project design and management procedures and increase manpower in certain areas to improve cost effectiveness and impact potential (detailed recommendations are contained in Section III);

to develop a strategy to expand the existing funding program in order to acquire additional financial resources necessary for implementing the general recommendations described above, especially the reorientation to product utilization and market research in LDCs (detailed recommendations are contained in Section III); of the evaluation report.

ATTACHMENTS

K. Attachments (List attachments submitted with this Evaluation Summary; always attach copy of full evaluation report, even if one was submitted earlier; attach studies, surveys, etc., from "on-going" evaluation, if relevant to the evaluation report.)

One evaluation Report.

COMMENTS

L. Comments By Mission, AID/W Office and Borrower/Grantee On Full Report

S&T/AGR comments:

Two outstandingly qualified experts, who did an excellent job, comprised the evaluation team. The evaluation was conducted very professionally and the ST/AGR office agrees in general with their findings and recommendations. The project made excellent progress in its research in spite of major changes in project goals and numerous physical obstructions. The office especially supports the following recommendations:

- 1) The project should immediately direct their emphasis to technology transfer without discontinuing the basic research. The project should concentrate on specific technologies geared for specific LDC situations which have a high probability of success and which can be easily implemented by the private sector.
- 2) The project should make every effort to find additional project funding through mission by-ins, domestic commodity groups, private sector or other donor agencies.
- 3) The project should be extended by three years. The project extension should be developed in 1991 but should be made dependent upon the success the project has in implementing points 1 and 2 above.

XD-ABC-512-A

70497

**INTERIM EVALUATION
OF THE
SOYBEAN UTILIZATION RESEARCH PROJECT
(936-4132)**

PREPARED FOR:

**S&T/AGR/AP
Washington, D.C.**

PREPARED BY:

**Cornelius Hugo, Agricultural Economist
and
Louis A. Wollermann, Food Scientist Consultant**

**FOOD AND FEED GRAINS INSTITUTE
Kansas State University
Manhattan, Kansas**

September 1989

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ACRONYMS

AVRDC	Asian Vegetable Research Development Center
FAO	Food and Agricultural Organization of the United Nations
IAR&T	Institute for Agricultural Research & Training
IITA	International Institute of Tropical Agriculture
INTSOY	International Soybean Program
KSU	Kansas State University
LDC	Less Developed Country
MSU	Mississippi State University
OICD	Office for International Development and Cooperation
S&T/AGR	Bureau for Science and Technology/Office of Agriculture
UIUC	University of Illinois at Urban-Champaign
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

DEFINITIONS

The following concepts and definitions are provided to assist those readers not versed in the subject matter of soybean processing and utilization nor familiar with the technical "jargon" used in this area.

Soybean:

Soybean is the seed of a leguminous plant of the glycine species, native to Eastern China, but now cultivated virtually around the world. The seed is unique in that it has a substantial oil as well as a substantial high quality protein content (18 to 20% oil and 35 to 40% protein).

Dry Processing:

1. Extrusion Processing:

Extrusion processing can be considered as a continuous cooking system in which raw food materials (such as soybeans) are subject to varying degrees of temperature, pressure, and shear. The extruder produces heat by friction under pressure. A screw transports the ingredients through a series of restrictions within a cylindrical chamber, finally forcing the material through a die. The process results in value added "extruded" food or feed products which are suitable for a range of end uses. There are several advantages to this process that are particularly relevant to its application in low-cost food and feed products (see Appendix 18).

Cooking: Dry extrusion achieves cooking by moist heat at low moisture content (less than 30% initial moisture), at high temperatures (up to 275 degrees Fahrenheit), and in a short period of time (less than 30 seconds). Adequate gelatinization of starch is achieved in a fraction of the time required in conventional cooking.

Drying: The extruder subjects the raw food or feed material to high temperature and pressure within the barrel. Upon exit, the super-heated moisture flashes into vapor and escapes from the product, resulting in considerable drying of the product. Hence, little or no further drying is required and the product is shelf stable.

Sterilization: The high temperature, short-time cooking given to the initial raw material is highly effective in reducing the natural microbial load on the raw material. This, coupled with initial low moisture content, renders the extruded product microbiologically stable.

Improved Nutritional Value: Extrusion also results in the reduction of the anti-nutrients (trypsin inhibitors) of soybeans to reasonably low levels. This improves the nutritional value of

the processed products. In addition, the denaturation of the proteins is less than that experienced through conventional technology. This again is positive in terms of nutritional qualities.

Expansion: The sudden transfer of the product from a zone of high pressure and high temperature to atmospheric conditions (low pressure and high temperature) results in considerable expansion in the soy/cereal blends (examples: soy/corn, soy/beans, soy/rice). This imparts low density and open structure to the product, which is an important functional characteristic for snack-type products.

2. Extrusion/Expelling:

In 1985 INTSOY researchers found that when whole soybean at low moisture content was directly extruded under appropriate conditions, the extrudate emerged in a semi-fluid state. The extrusion process disrupts the bean tissue, liberating the oil into the matrix and simultaneously cooking the mass. The liberation of oil into a free state and a drop in oil viscosity due to the high temperature produce the semi-fluid state of the extrudate.

This extrudate is feed directly into an oil expeller. An expeller is essentially a continuous mechanical press which separates the oil from the soybean meal, resulting in (1) a partially defatted meal which can be used in human as well as animal feed products, and (2) a highly stable (natural antioxidants) and edible oil (free of any off-flavors) requiring little further processing.

3. Significance:

The significance of this combined process for both developed and developing marketing economies include the following:

- This technology represents a relatively low-cost operation for the utilization of soybeans as a food raw material.

- This process has achieved an oil recovery rate of 75% and higher oil yields are expected from more efficient commercial expellers. This will enable an increase in availability of edible oil in situations where it is in short supply.

- The extrusion process resulted in a drastic increase in the throughput of the expellers. This would necessarily improve the economics of the expelling process and, at least in part, justify the investment in extrusion. A further advantage is the improvement in milling characteristics of the expeller cake, with the lowfat (5%) cake being easily ground in conventional milling systems such as hammer mills.

- Low-fat soy flour can be prepared as a highly nutritious value-added product for human consumption.
- This concept should stimulate the fortification of cereal flours with soy flour on a decentralized basis. This may become the basis for an ancillary industry.
- Where desirable, the process can be made labor intensive, and thereby, provide employment.
- Under extensive soybean farming conditions, such as in the United States, the process may be adopted as an on-farm operation for production of crude oils for dust control and meal for animal feed formulation.
- This development should increase the overall demand for soybeans as well as for processing equipment.
- A new dimension is added to foster utilization of soybeans for improving the nutritional status of many countries.

Wet Processing:

1. Process

Wet processing of raw soybeans results in an intermediate high solids and protein soymilk base that can be used for preparation of various types of soymilk and dairy analogs. INTSOY research in this area has resulted in the development of a (1) home and village processing method and (2) a new commercial method. Both processes use relatively straightforward technology that can be applied in a modest village operation or at a relatively high commercial level (see Appendix 19).

While the commercial method is somewhat more elaborated than the home and village processing method and includes some additional steps they both apply the same concepts which include: (1) clean raw soybeans, (2) dry, split, and remove the cotyledons (commercial method only), (3) blanch, (4) grind, (5) filter soymilk from ground slurry, (6) simmer and flavoring (home and village method only), (7) pasteurize and homogenize the soymilk (commercial method only).

2. Significance

These processes result in a high-quality soybean milk base that is free of cholesterol and lactose and with a protein content equal to cow's milk. Because it is inexpensive it does offer an alternative to millions of people in Asia, Africa, and Latin America who are unable to drink cow's milk due to their allergic reaction to lactose.

The soy milk is suitable for making yoghurt, ice cream, and other dairy analogs such as tofu and tempeh (typical oriental cheese-like dairy analogs).

The byproduct of this process, known as "okara" is suitable as an ingredient for animal feeds.

Both processes eliminate the objectionable beany flavor of the traditional soymilk.

As developed, these processes are appropriate for developing countries since they require a low capital investment (between \$50,000 to \$250,000) as compared to so-called "turn-key process" which are fully automatic processes to manufacture soymilk at 2,000 or more liters per hour, which cost millions of dollars. They are uncomplicated simple to maintain, and flexible to labor input.

Soyfoods:

Dry processing of soybeans leads to value added intermediate soybean meal and oil which can be further processed into highly nutritious soybased foods. The meal can be used in a number of food products including (1) a partially defatted soy flour suitable for breads and tortillas, (2) weaning foods, (3) beverages, and (4) products for general protein fortification of other foods that are traditionally consumed in many countries. The oil can be further processed into cold processed food emulsions such as mayonnaise, salad dressing, and margarine, or into liquid cooking oils or shortening (solid cooking oil).

Frozen Green Soybeans:

Frozen green soybeans are immature beans that are harvested while still in the pod, removed from the pod, blanched, and quick frozen. They are served and consumed just as any other green vegetable.

EXECUTIVE SUMMARY

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On September 5, 1989, the two member evaluation team arrived in Des Moines, Iowa to review project linkages with an equipment manufacturer. On September 6 a one week intensive review was initiated with UIUC administrative officials, INTSOY research personnel, and private industry representatives. From September 11 through September 19 the team remained in Washington, D.C. reviewing the project with representatives of the American Soybean Association, S&T/AGR officers, and writing the report.

Findings and Conclusions: Generally, the evaluation team found the project to be well implemented by a competent, mutually supportive INTSOY research team. Principal findings and conclusions include:

- The benefits of the utilization research being conducted by INTSOY is having a positive and encouraging impact in LDCs, in the private as well as public sector. In LDCs, an increasing number of private entrepreneurs are using the INTSOY technology to produce soybased human foods, animal feeds, and edible oil; public sector agencies are applying the technology in social programs designed to improve nutritional conditions.
- U.S. agriculture and agribusiness are already reaping the benefits from INTSOY's dry and wet processing systems, as exemplified by increased equipment sales; higher productivity in swine growing operations; and small, rural based manufacturing of soy-based products.
- The State of Illinois and UIUC's commitment to this program is solidly demonstrated by their underwriting of 30 percent of the cost of the program through infrastructure development, equipment, and administrative and scientific staff time.
- Private sector support for this project is demonstrated by the donation of processing and analytical equipment to INTSOY, making manufacturing

facilities available for test runs and demonstrations, and donating personnel time to the project.

- Collegial rapport among INTSOY's utilization research personnel is outstanding. Staff members are very supportive of each other and their commitment to the project is demonstrated by their countless "extra" man-hours.
- The positions taken by Land of Lincoln Soybean Association and ASA in regard to this project are very favorable and receptive to proposals for funding certain components of the program.

Principal Recommendations: The evaluation team recommends:

- that the INTSOY project be extended for another 3 years beyond the current termination date of January 31, 1992. Current real funding levels should be maintained, and serious consideration should be given to a higher level of funding;
- given the success at INTSOY in achieving a new state of the art in soybean processing, the primary focus of the project be redirected to technology transfer and implementation in LDCs; research in product utilization and market development is key to developing an even greater "pull" for INTSOY's processing technologies;
- that additional ways be explored to strengthen existing linkages between the INTSOY program and other AID units such as Food for Peace, S&T/Nutrition, and the Aquaculture Section; other federal agencies engaged in soybean utilization research (USDA/OICD and its collaborative university network); and other centrally funded projects such as the Seed Technology project at MSU and the Grain Postharvest Systems project at KSU;
- to reassess INTSOY's role and potential contributions, given the changing perceptions within the soybean economy, as evidenced by the new expanded check-off and the decision to establish the National Soybean Research Center at UIUC; INTSOY is in a position to play an even greater international role in support of soybean utilization, and could be instrumental in furthering national as well as international goals of concerned representatives.
- to conduct a mid-term project evaluation in late 1991 or early in 1992 to assess progress and a final evaluation in 1994 to assess overall impact;
- to modify certain project design and management procedures and increase manpower in certain areas to improve cost effectiveness and impact potential (detailed recommendations are contained in Section III);
- to develop a strategy to expand the existing funding program in order to acquire additional financial resources necessary for implementing the general recommendations described above, especially the reorientation to product utilization and market research in LDCs (detailed recommendations are contained in Section III);

SECTION I

INTRODUCTION AND BACKGROUND

A. Summary Scope of Work

The purpose of this evaluation is to conduct a comprehensive review of the performance and implementation of AID project 936-4132 with the International Soybean Program (INTSOY) of the University of Illinois at Urbana-Champaign (UIUC) since April 1, 1985. The evaluation team is to assess the progress made to develop, test, adapt and disseminate new soybean products and soybean processing techniques through research, information dissemination, training and technical assistance (see Appendix 1 for the complete scope of work of the evaluation).

The evaluation team members include:

Dr. Cornelius Hugo, Agricultural Economist
Dr. Louis A. Wollermann, Food Scientist

B. Methodology

The two member evaluation team arrived in Des Moines, Iowa on September 5, 1989 to interview with INSTAPRO, the manufacturer of the extruders used by INTSOY in its utilization research program. The team began the review of the Soybean Utilization and Research Project at UIUC on September 6, 1989. Extensive discussions were held with administrative and advisory personnel of the University, INTSOY staff, and industry representatives. Visits were made to a private sector soybean processor near Lima, Ohio, the Illinois soybean producer's organization, the Land of Lincoln Soybean Association in Bloomington, Illinois, and a swine producer near Urbana. The team departed for Washington, D.C. September 9, 1989 to meet past and present project managers at S&T/AGR, S&T/Nutrition, and representatives of the American Soybean Association (see Appendix 2).

C. Project Description

Recognizing the importance of soybeans as a feed crop and its potentially higher value as a food crop, USAID has worked cooperatively with INTSOY since 1973, when it first awarded a contract to INTSOY to implement the Development of Improved Varieties of Soybeans project (931-0560). This project carried out a worldwide testing of soybean varieties which was instrumental in identifying and introducing improved varieties and production technology in developing countries, resulting in soybean acreage increases in several LDCs; also, it created the world's primary depository of soybean germplasm at UIUC.

1. Objectives

The goal of this project is to increase food availability and improve food consumption in developing countries. It seeks to achieve this by capitalizing on the results of this past research activity through the following program objectives:

- * Develop and disseminate new soy products and processes from raw whole soybeans.
- * Conduct collaborative research and testing of new products and processes and promote the commercial application of these products in LDCs, as well as in the United States.
- * Promote the dissemination of information and conduct training courses on soybean utilization.

2. Scope

INTSOY will focus on soybean utilization to improve the nutritional status of the rural and urban poor in developing countries. The program will work closely with the U.S. soybean industry and with national and international soybean organizations. INTSOY will be an active partner in regional networks coordinated by the International Institute of Tropical Agriculture (IITA) and the Asian Vegetable Research and Development Center (AVRDC).

INTSOY's three-phased utilization program will consist of (1) undertaking development research at UIUC, (2) extension and testing of the products and processes in cooperating countries, and (3) on-site technical assistance in selected countries (see Appendix 4 for detailed activities).

3. Adjustment to Program Objectives

As originally structured and agreed on by S&T/AGR and INTSOY in April, 1985, the Cooperative Agreement contained a fourth objective which related to the "conduct of collaborative research on specific problems affecting soybeans and methodologies for introducing more diverse germplasm into soybean breeding programs" (see Appendix 5). The purpose of this objective was to assist international efforts being undertaken by other donor agencies and research institutions to achieve greater global production of soybeans, specially in LDCs.

The concerns of American soybean producers (represented by the American Soybean Association) in regard to declining domestic production and share of the international market were instrumental in refocusing the project's objectives entirely to soybean utilization. Consequently, all activities related to soybean breeding and production were removed from the scope of work of the project when the second tranche of obligation was approved in 1986. Previous commitments in this area with several international institutions as well as the Department of Agronomy at UIUC required a gradual phase out of these activities. This shift in project fund utilization and program activities was accomplished in 1986 (see Appendix 16).

D. Project Funding

Since April 1985 USAID's funding for the Soybean Utilization and Research project has declined from the original budget for the Cooperative Agreement DAN-4132-A-00-5177-00. Table I-1 summarizes projected budget versus actual obligations over the life of the project. From an initial obligation of 12% above budgeted amounts for the first year of the project, subsequent obligations were reduced annually to 80% in the second year, 63% in the third, 68% in the fourth and 69% in the last and current year. These reductions resulted in a total obligation of 77% of the budget over the life of the project.

TABLE I-1

INITIAL FINANCIAL PLAN FOR COOPERATIVE AGREEMENT

(\$)

Cost Element	Project Year 1 4/1/85- 12/31/85	Project Year 2 1/1/86- 12/31/86	Project Year 3 1/1/87- 12/31/87	Project Year 4 1/1/88- 12/31/88	Project Year 5 1/1/89- 12/31/89	Total
Salaries and Wages	273,135	364,844	338,582	364,166	390,711	1,731,438
Fringe Benefits	35,131	46,793	43,207	46,468	49,853	221,452
Travel & Transport	43,000	42,000	36,000	36,000	43,000	200,000
Per Diem & Allowances	25,222	22,222	22,222	22,222	26,222	118,110
Equipment	30,000	20,000	15,000	5,000	5,000	75,000
Other Direct Costs	47,000	109,000	151,000	133,000	89,000	529,000
Overhead	184,409	256,562	262,825	267,509	265,228	1,236,533
Total	637,897	861,421	868,836	874,365	869,014	4,111,533
Running Total		1,499,318	2,368,154	3,242,519	4,111,533	

ACTUAL FINANCIAL OBLIGATIONS OF COOPERATIVE AGREEMENT

	4/1/85 12/31/86	1/1/86 1/30/87	1/31/87 12/29/87	12/30/87 12/29/88	12/30/88 12/31/89
Total	717,491	695,000	550,000	600,000	600,000
Running Total		1,412,491	1,962,491	2,562,491	3,162,491
Funding Differential	112.48%	80.68%	63.30%	68.62%	69.04%

Source; Cooperative Agreement and Modifications
 File: T-I-1.WK1; T-I-1.PRN

SECTION II
PROJECT EVALUATION

A. Accomplishments

1. Processing and Utilization Research

Since completion of the project's reorientation to utilization research in 1986, INTSOY's staff has successfully accomplished a series of research activities to develop and refine processing methods to prepare a range of products from raw soybeans, for both human and animal consumption. The progress in each area of the utilization research component are summarized below.

a. Extrusion/Expelling

The emphasis on processing technology since the 1985 realignment of the research program at INTSOY has provided excellent progress in achieving workable systems, at acceptable costs, which can lead to oil and protein ingredients suitable for food use as is or for formulation into other food products, of excellent nutritional value.

As an alternative to the conventional manufacturing process for soy oil and soy flour, which requires hydrocarbon solvent extraction (a high capital cost, high minimum volume procedure), INTSOY has developed a simple but unique merger of two established unit operations (extruding and expelling) that achieve essentially the same objective.

A "cut and try" approach to machine selection has identified a suitable extruder, available in various capacities, and several expellers that can be made to perform satisfactorily, with minor modifications, to permit effective coupling of the two machines, in series, and achieve a successful overall process. In this work they have been guided by the conformance of the characteristics of the finished products and those properties deemed necessary to obtain acceptable food precursors.

The extrusion process may be used alone to produce a product known as full fat soy flour (actually a press cake that can be ground into flour) that has application as a food or feed ingredient. It can also, by adjusting processing conditions, deliver a low viscosity, hot slurry of soybean solids in oil that serves as an improved feed stock for the expeller which will greatly reduce energy consumption and damage to the nutritional and organoleptic properties of both the oil and the press cake. The press cake can be ground into a low fat soy flour that has more applications as a food or feed ingredient than the full fat soy flour.

In conjunction with "perfecting" the procedures for soybean processing as described herein, INTSOY is applying the techniques to the preparation of mixed flour containing soy plus other seed or vegetable components such as corn, rice, wheat, and cassava to create nutritionally improved precursors for breakfast cereals, baked goods, or formulated feeds.

b. Wet Processing

A second very important area of soybased food stuffs, described as wet-processed foods, has been extensively researched and the results disseminated by INTSOY. These constitute, mainly, improved versions of traditional oriental foods such as soymilk, tofu (coagulated, pressed protein) and tempeh (fermented soybean cake).

The techniques developed during the early work of INTSOY permit the preparation of soymilk without the objectionable beany flavor that results from the enzyme catalyzed oxidation and partial hydrolysis of polyunsaturated fatty acids that is experienced during wet processing. This has overcome the strong resistance to the acceptance of soymilk by non-oriental cultural groups that have not traditionally been consumers of such products.

Application of this improvement is in place among such consumer groups but this is not to say that improved consumer acceptance could not be achieved among those who tolerate the shortcomings of the traditional products. This would be a worthwhile part of the product and market research program at INTSOY and might be a desirable subject for presentation at the upcoming (1990) soybean utilization research conference planned for Beijing.

The wet process technology has been extended to production of two soy-based analogues of popular dairy foods, namely yogurt and soft-serve frozen desserts. These represent economical alternatives to milk derived products and are expected to gain ready acceptance, especially in Asia and Africa where lactose intolerance is prevalent. Commercialization is underway in the United States and is generating data on production and marketing that can be used to assess the feasibility of application in LDCs (see Appendix 11).

INTSOY has additional research projects outlined that will entail further work in the yogurt/frozen dessert area, and in the tofu category. Basic manufacturing technology is in hand, therefore emphasis will be given to flavor/texture optimization and to improved process and product uniformity.

Some by-product utilization will also be addressed, particularly toward a fraction from the soymilk process known as "okara", which is the solid residue from the filtration step. It is a high fiber material that contains sufficient amounts of protein and fat to warrant recovery. It has been demonstrated to be an acceptable component of baked foods. The recovery and utilization of okara will significantly affect the economics of soymilk production and sales.

c. Frozen Green Beans

To further capitalize on the diversity of food uses for soybeans field and laboratory trials were conducted to demonstrate that soy beans can be harvested in the immature state, processed, and packaged much like frozen green lima beans. After small scale studies, done in conjunction with other university groups, an arrangement was made with the Green Giant Division of Pillsbury to use their equipment, facilities, and expertise in conducting a field trial. Results were encouraging and further collaboration is planned.

No doubt the immature beans might be harvested and promptly processed for immediate home consumption, either as a "green-bean-in-the-pod" form of vegetable or as a "shellie" (removed from the pod before cooking). This would encourage early adoption as a new component of the diet in LDCs where soybeans are already under cultivation. Also, invitations to private sector firms to assist with the financing of further research, especially in the product and market research and development area would greatly enhance the potential for introducing soybeans as a green vegetable in more advanced economies.

2. Collaborative Utilization Research

INTSOY's second objective is to conduct collaborative research with private and public institutions in LDCs, as well as in the United States to test, adapt, and promote the processes and products developed.

a. Collaboration in LDCs

From its inception INTSOY has vigorously pursued a policy of establishing collaborative utilization research, in all its phases from raw material selection through processing to marketing and distribution. Major early programs were developed in India and Sri Lanka which led to the establishment of self-sufficient research and development centers and private sector enterprises.

INTSOY has literally, "explored the world", in terms of searching out and assessing the opportunities in various national and multinational locations to establish collaborative agendas for jointly supporting and conducting feasibility studies in raw material supply, appropriate scale of processing technology transfer, utilization in home and/or industry and exploration of the socio-economic manifestations to be expected.

The decision was made to place major emphasis on interacting with private entrepreneurs and government institutions that are committed to promoting economic development and would see their goals and those of INTSOY as complementary.

A review by INTSOY personnel of a long list of countries and institutions to sound out their potential for collaborative utilization research resulted in a select list of 37 countries based on their need for edible oil and/or protein sources and their favorable reaction to the idea of applying INTSOY technology (see Appendix 6). The 37 countries selected represent a realistic cross-section in terms of location, land mass, population, GNP, per capita income, etc., but can all be considered, in one sense or another, to be developing countries. These countries are distributed throughout sub-Saharan Africa, South Asia, South America, and the Central America/Caribbean region. INTSOY is still open, of course, to inquiries from other countries not on this list but is not actively seeking them due to budget limitations in following through on their requests.

Since this initial survey, much has already been accomplished in terms of collaborative research through INTSOY personnel working in various African and Far East countries to introduce the extrusion/expulsion process and equipment, to assist entrepreneurs with both wet and dry processing and to teach the potential utilization of soybeans, whether as a grocery item for home consumption or a commodity item for making value-added commercial products (see Appendix 10).

Many of the 37 countries identified by INTSOY as suitable candidates to benefit from the extruder/expeller and/or soymilk process technologies were judged to have viable potential for the successful establishment of private sector enterprises based on these technologies. Every country visited to date has been presented with a description and analysis of the potential for this technology in terms of, not just the alleviation of dietary deficiencies but also of feasible measures to implement the necessary commercial operations and to improve the local economy thereby.

In the vast majority of cases the response has been favorable to both objectives however, financial limitations and lack of a clear elucidation on the market potential inhibit prompt adoption of the program. This aspect of the INTSOY program is being addressed through concerted efforts to involve other agencies in supporting the establishment of entrepreneurs in the business. INTSOY can cite a few success stories such as India and Sri Lanka earlier in the program and some more current ones such as Africa Basic Foods in Uganda, Ken Soy in Kenya, Bich Chi in Vietnam (funded by the Mennonite Central Committee), and the IITA funded operation in Nigeria (see Appendix 10).

There is no shortage of enthusiasm for the program in most of the LDCs, just that gaining support to start and maintain commercial enterprises is a slow and difficult task. The intensified product and market research activity planned for the immediate future will help stimulate the needed support.

Since entrepreneurs in 57 countries have requested quotes on extruders and expellers as well as technical assistance the prospects for this objective appear quite good. Several of these countries already have established operational hulled extraction plants currently functioning but still see opportunities for utilizing the INTSOY system (see Appendix 6).

More specifically, INTSOY was given the responsibility for conducting collaborative soybean utilization research with the International Institute of Tropical Agriculture (IITA) in Nigeria, where significant opportunities exist, according to IITA personnel who indicate that soybeans are an established crop in the country and consumers accustomed to purchasing soybased products from Nestle and other private enterprises. INTSOY was also charged with the development of similar research activities with the Asian Vegetable Research and Training Center in Taiwan.

Progress in this area has been very positive (see Appendix 10 for more details), especially since the addition of another nutrition/processing specialist in 1988. Under INTSOY's leadership and guidance IITA has expanded its soybean utilization research and training activities. For example, IITA has added to its staff a Japanese specialist in oriental soyfoods to conduct research on tofu and similar products, and has obtained dry processing equipment from EAR Export/Import. Another IITA scientist is conducting research on the use of extruded soy flour produced using INTSOY's extrusion/expelling technology. A new pilot processing plant will be built at IITA. A workshop on soybean foods production was held at Lagos in February, 1989, with the participation of INTSOY personnel.

Linkages to the Institute for Agricultural Research and Training (IAR&T) in Ibadan were established to prepare a proposal for a soybean utilization project that would involve INTSOY setting up improved wet and dry processing

facilities. IITA and IAR&T have received a grant from the International Development Research Center (Canada) to develop methods of increasing soybean utilization research in rural households. So far the two institutions have conducted 50 demonstrations, and both manufacture and sell soymilk on a daily basis.

IITA is currently conducting work with a commercial bakery to utilize soy flour in bread and desires to encourage and support efforts by a major dairy to manufacture and distribute soymilk. This dairy has purchased processing equipment and is in the process of identifying suitable packaging equipment.

The collective opinion is that there is enormous scope and possibilities for soybean production, transformation and utilization in Nigeria. INTSOY's collaboration with IITA and IAR&T is more than likely to attract further research support, and private investments which will end up providing inexpensive protein rich food products in both rural and urban markets.

While, in spite of the severe constraints (specially manpower and funds) faced by the project, great strides were made with IITA and IAR&T in the area of collaborative research, the same constraints have prevented INTSOY from developing similar activities with AVRDC, and perhaps some relevant institution in Latin America. Aside from these constraints, this specific activity is further qualified by its predication on external funding and interest on the part of those foreign institutions supposed to collaborate. As alluded to in the review of future plans, these issues need to be taken into account when planning future activities and their probability of succeeding.

b. Collaboration in the United States

INTSOY has also conducted substantial collaborative work in the U.S. especially with the private sector in the area of machine selection and process optimization. In this regard they evaluated various extruders and expellers and encouraged the manufacturer of the, "best fit", extruder to optimize certain models of his machine to fit the needs of the INTSOY process.

INTSOY has, in addition, counselled with a small, nearby machinery import/export enterprise on the international promotion and sale of both the dry and wet processing methods developed by INTSOY. Several exports of the extruder have already taken place (at least 11 to Zambia alone); the combined extruder/expeller system has been exported to India and Vietnam; and further export negotiations are taking place with several private and public companies in other countries.

A domestic private sector enterprise was recently established by a former university graduate student in which both the dry extruder/expeller and the improved soymilk manufacturing process are on stream. This entrepreneur has enjoyed an early success with this enterprise and credits the advice and encouragement of the INTSOY staff with having a key role in it. He reciprocates by making available, when feasible, his time and facilities for experimental work and for visitors to observe the commercial implementation of the INTSOY systems. This arrangement is especially valuable to INTSOY when entertaining visitors from LDCs.

Since the full fat soy flour produced by the extrusion procedure is equally applicable to animal nutrition products, INTSOY has encouraged activity in this area by collaborating with the extruder manufacturer and the Department of Animal Nutrition to assist a swine producer in central Illinois to establish his own operation in which he grows the beans, extrudes the full fat soy flour, compounds his own feed, and produces large numbers of pigs.

He has been able to document several advantages both in costs of inputs and better yields due to better weight gains, feed utilization and diminishment of respiratory impairment from feed dust. This success story has been widely publicized in Illinois and has stimulated numerous other swine producers to follow suit.

Future plans are to pursue a similar course of action among domestic poultry producers, as well as advocate such activity in the LDCs who adopt the INTSOY system.

3. Information

INTSOY serves as an information resource mainly in two ways. One, as a clearing house for exchange of technical publications relating to all phases of soybean technology from selection to finished product distribution and, two, in developing and providing material to the media for presentation to the general public.

Informal communications with the scientific community, of technical information has been practiced by the staff since the organization and start-up of the program. This has consisted of sharing of technical references gleaned from the scientific literature, findings of the program's research, and responding to questions from a myriad of places around the world. The director of the INTSOY program reports the receipt of some 900 requests for information on soybean utilization over the last year. Requests for INTSOY publications continue to increase, of which 89 percent came from LDCs, especially from Africa. A total of 1,401 publications were sent to 28 countries during 1988.

In order to formalize and expand the information function of the program, the services of a communications specialist were made available by the College of Agriculture Communication and Extension Office. This specialist has developed and implemented a program utilizing all the segments of the media to publicize the accomplishments of INTSOY, to communicate their relevance, and to garner support for the program.

He has coordinated the preparation of numerous bulletins and booklets for general distribution, as well as "videos", radio scripts, and exhibits for various fairs, conferences, and other media events. Also, he has prepared press releases for UPI, AP, and numerous newspapers and magazines whose audience is primarily the agricultural community (see Appendix 7).

Of particular value is the quarterly INTSOY Newsletter which provides the recipients with a continuing source of information about the current activities of INTSOY and the "spin-offs" that have evolved from prior INTSOY research. The written materials are of excellent professional quality both as to content and as to printing, photography, and presentation.

An excellent opportunity to disseminate information of which INTSOY took full advantage is the captive audience formed by the many visitors who come to UIUC to see the INTSOY operation. In the period of January 1988 to August 1989 37 such occasions occurred, with visitors running the gamut from local citizens to foreign public and private groups (see Appendix 8).

The countries represented were quite diverse as were the professional specialties, e.g., scientists, farmers, economists, agency administrators, businessmen, educators, and students. Particularly encouraging was the substantial number of businessmen from LDCs who benefited from the tours, demonstrations, lectures, and literature hand-outs which were all an integral part of this activity.

4. Training/Technical Assistance

Using the term training/technical assistance in its broadest sense, activities conducted by INTSOY have spanned the entire spectrum from graduating Ph.D.'s; to one-on-one soybean utilization instruction; to instruction of housewives in LDCs, equipped only with the most rudimentary tools, to make soybeans and/or soybean products the "piece-de-resistance" of their family dinner; to researching opportunities for private entrepreneurs and helping them set up soybean processing facilities in LDCs and in the U.S.

This component of the INTSOY project has been financed through direct Mission buy-ins for specific in-country short courses or technical assistance; by other sponsors and donors such as USDA, UNDP, FAO, as well as under subcontract to other private contractors such as Winrock, or private donor groups such as Fulbright, for either in-country or on-campus activities. A total of US\$335,800 has been provided by these sources for these training/technical assistance activities (see Appendix 14).

Essentially, the training activities for participants from LDCs have taken one of three forms: short courses, workshops, and short duration individual instruction. This latter has ranged from four months for an engineering professor from India to one week for a beverage technologist from Pakistan. INTSOY has endeavoured to limit this one-on-one type of training in that it has proved to be very time consuming and expensive. (The 1988 schedule lists fourteen trainees and nine in 1989). In preference to the individual instruction approach they now emphasize workshops and short courses where group instruction and hands-on participation can achieve their goals at less cost (see Appendix 9).

Very early work in India and Sri Lanka allowed the staff members involved at that time to carry out a "learn by doing" exercise that served as the refining process for developing and presenting the INTSOY short courses and workshops to LDC personnel.

The short course, entitled "Soybean Processing for Food Use" has been presented once at UIUC from May 28 to July 15, 1986 with 12 participants, and once at the Soybean Foods Research Center in Sri Lanka from January 11 to February 11, 1988 with 21 participants (see Appendix 9).

Whereas short courses involve longer time periods and mainly technical/professional personnel, workshops are of short duration (one to ten days) and may include personnel with minimal technical/professional background.

A workshop was held in Zimbabwe from February 24 through March 7, 1986 with 27 participants representing six southern African countries. In 1987 a two part workshop was held in Zambia with October 8 and 9 directed toward soybean producers and processors and the period from October 11 through the 16 focusing on home and village utilization. Total participation in the two workshops exceeded 100.

A workshop was planned for August 1989 in Beijing but was postponed until 1990 due to the adverse political climate prevailing at that time. Future short course and workshop possibilities that have been planned or discussed include Uganda (1990), Kenya (1990), Zambia (1990), and Zimbabwe (1991).

Inherent in achieving the objectives of any program such as INTSOY is engaged in, is a strong requirement to provide technical assistance, especially in those instances in LDCs where commercialization efforts are planned or actually going on.

The establishment of the INTSOY processes as a commercial enterprise in Sri Lanka was brought about by long-term on-site provision of technical assistance. In India hands-on guidance is being provided to established the fledgling soybean processing industry now using the extrusion/expulsion technology with periodic follow-up in ensuing years. An INTSOY representative will be returning to India within calendar 1989 to assist in the further implementation of this technology.

Other examples of training/technical assistance work with private and public sector companies include Vietnam (in cooperation with the Mennonite Central Committee); Kenya (Ken Soy Company, private); Zambia (Lee Yeast and Soy Nutrients, both private); Ivory Coast (in cooperation with FAO to develop the Project for Development of Soybean Production and Utilization); and Uganda (one cooperative, three private companies, and Ministry of Agriculture); (see Appendix 10).

Out of these activities the information and experience gained will permit the preparation of appropriate, "how to", manuals for use in those and other LDCs. The requirements for technical assistance will be quite substantial if INTSOY is successful in its plan to proliferate the commercial adoption of its technology in African LDC's alone.

B. Impact of Project

In a relatively short period of time INTSOY's research, training, and outreach efforts have achieved a visible and encouraging degree of impact on U.S. agriculture as well as private and public institutions in LDCs. Lack of information and time made it impossible to fully quantify the level of impact but a qualitative assessment and examples are provided below.

1. U.S. Agriculture and Agribusiness

In the U.S. the INTSOY systems for dry and wet processing of soybeans have provided new opportunities and approaches to firms engaged in agricultural production, equipment manufacturing, and processing. The following examples can be listed:

Use of the extrusion system to produce animal feed has been adopted by several swine producers in the State of Illinois. The apparent advantages of producing feed on the farm were documented in one farm and include (1) lower unit cost per ton of feed, (2) better quality control, (3) higher weight gain rate, (4) lower dust levels and reduced respiratory problems, (5) improved heat resistance during the summer months, and (6) lower weight loss of lactating sows. The reported gain in the feed to weight ratio dropped from 3.3:1 to 2.9:1. The significance of these improvements for swine producers and consumers cannot be overstated. Furthermore, the improved resistance to heat is very important to swine producers in the tropical areas of the world.

The application of the wet and dry INTSOY system near LIMA, Ohio has created 80 new jobs in a rural community of less than 3,000. Again, the significance of this development for the rural sector cannot be exaggerated (see Appendix 11).

The cleaning, roasting, and cracking of raw soybeans for subsequent use in the extruder/expeller and/or wet processing has added a new dimension to local seed and grain processing. The potential for "value added" processing at the local, rural level, translates into jobs, incomes and increased economic well-being.

Soybased intermediate products can be used as lower per unit cost substitutes in the formulation of dietary products. Formulation for such substitution is taking place in the private sector (see Appendix 11).

The manufacturer of extrusion equipment has observed a positive impact on the level of sales in the area.

2. LDCs

In LDCs, the current and future potential impact of INTSOY's systems for dry and wet processing of raw soybeans (or mixtures with other grains) is perhaps of far greater significance, due to the following reasons:

a. Basic Human Nutrition: Many African countries, especially those in the sub-Sahara region are experiencing growing deficits in food supplies, with an intensifying shortage of high-quality protein, particularly for young children. In West Africa, one-third or more of the protein consumed comes from plant products with inferior proteins such as tubers (cassava, yams) and plantains (see Appendix 12). The same issue of quality of nutrition holds true for some

countries in Asia such as Pakistan, India, Bangladesh, and Sri Lanka, to name a few.

Soybeans contain all the essential amino acids, and in combination with other locally grown grains such as corn, rice, and millet, these technologies (wet and dry processing) are fully capable of producing low cost/high quality human foods made from soymeal or soymilk. Such products can be introduced or incorporated into existing food items which are based on soybean. Other products can be extended with soybeans without changes in flavor, texture, or appearance (bread, pasta products, peanut butter, dairy products).

b. Animal Feeds: Poultry and egg production are invariably one of the first protein sources whose demand and production increase steeply as a country makes the change from a subsistence to a market oriented economy. This growth in demand and production comes about due to the favorable feed conversion ratio, short production period, low investment needs, and therefore favorable poultry and egg prices as compared to other animal protein sources.

The very same technology used to make soybased human foods can be used to produce animal feeds without changes or adjustments to the equipment. Thus a dual purpose installation can be adjusted to market conditions as the need arises, a flexibility not provided in conventional feed mills.

c. Edible Oils: Many of these countries which can barely feed their inhabitants also suffer from severe shortages of edible oils. For example, Kenya imported US\$50 million of palm oil in 1987. India and Pakistan import even greater amounts. These expenditures put a severe stress on the foreign exchange needs of many LDCs. Again, the wet and dry processing technologies developed by INTSOY can play a critical role in increasing the supply of edible oils (in terms of quantity and quality) and reducing the need for hard currencies. This technology can be instrumental in increasing the demand for soybeans which can be locally produced, or imported, and processed into highly nutritious human foods, animal feeds, and edible oil.

d. Employment: Because of the relatively low cost, low complexity, and low volume needs of this technology, it lends itself readily for implementation in LDCs, without adaptations. Its potential to be "variable" in terms of labor requirements makes it suitable for different labor input levels. Since it can be decentralized (not all units have to be in one place) it can generate employment in different regions, create demand for soybeans and generate interest in local production, and reduce transportation costs.

These examples of the positive impact of these processing systems on human and animal nutrition, foreign exchange earnings, employment and income, as well as general welfare are already taking place to varying degrees in some African countries (Kenya, Uganda, Zambia, Zimbabwe, Nigeria, Ghana, and Ivory Coast) and Asian countries (India, Pakistan, Bangladesh, Sri Lanka, and Vietnam).

C. Project Management

1. Management Structure

INTSOY's programs and activities are managed within the College of Agriculture of UIUC. Its director reports through the Office of International Agriculture to the Dean's Office of the College of Agriculture. The director also reports to S&T/AGR for program related work, to AID Contracts for contractual and financial matters, and to USAID Missions for buy-in related technical assistance, information and training.

Aside from its own staff, INTSOY has access to staff members and other resources in six departments (Agricultural Economics, Agricultural Engineering, Agronomy, Animal Science, Food Science, and Plant Pathology), four divisions (Family and Consumer Economics, Foods and Nutrition, Human Development and Family Ecology, and Nutritional Sciences), two offices (Agricultural Communications and Extension Education, Agricultural Entomology Research and Extension), the School of Human Resources and Family Studies, and the Vocational Agricultural Service (see Appendix 13).

This direct linkage to these departments, divisions and other units of the University endow INTSOY with an enormous potential for additional resources relevant to its program and activities. INTSOY also benefits from the guidance provided periodically (four meetings per year) by the INTSOY Executive Committee. The membership of this committee consists of representatives from the above mentioned units, plus INTSOY's director.

2. Staffing Levels

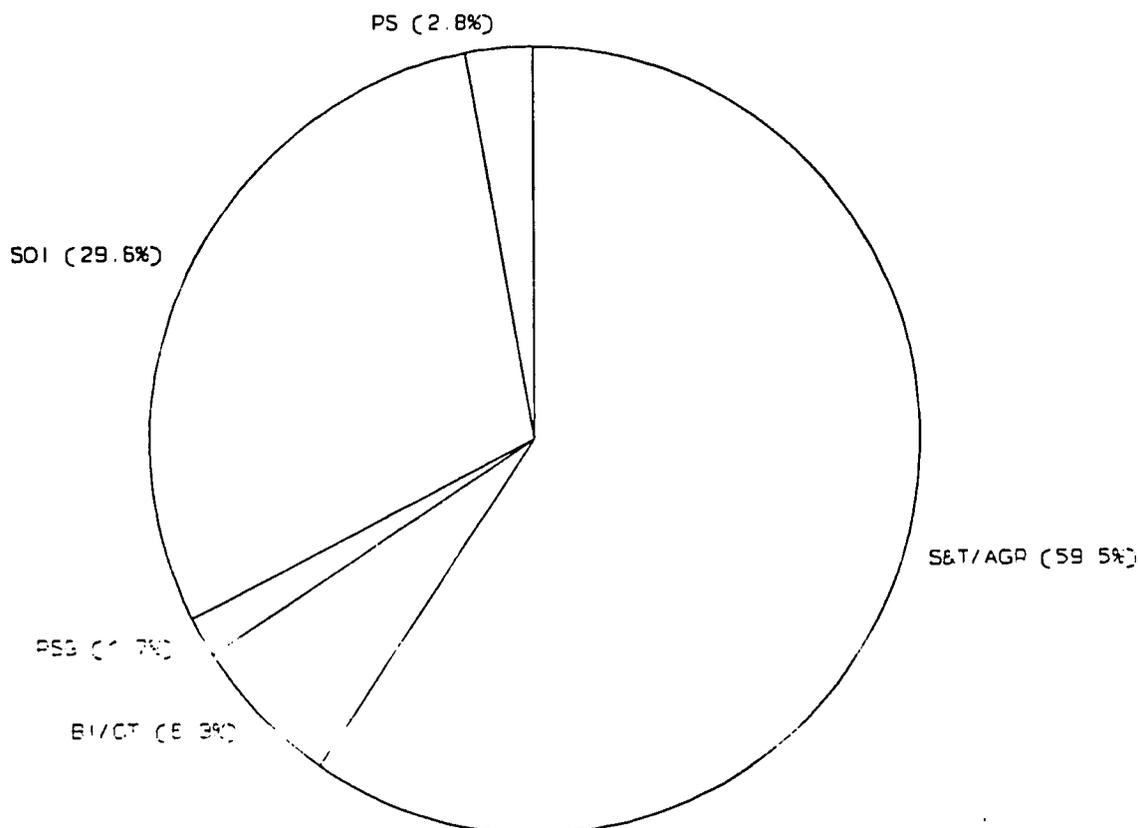
INTSOY's staff consists of administrative, scientific, technical and support personnel. Since the reorientation of the research program (completed in 1986) the composition of the research staff has changed accordingly. At present, the program employs a total of 13 unclassified and classified persons to carry out the soybean utilization research and training/technical assistance activities (9), information and outreach activities (1), and administration (3); (see Appendix 13).

Additionally, a large number of Research Associates (unclassified personnel from eight other departments in the College of Agriculture) collaborate at no direct cost to the program to carry out studies related to human and animal nutrition as well as impact analysis of introducing soybean processing technology in LDCs (see Appendix 13).

3. Source of Funding

The INTSOY program has been financed from different sources. Total obligations, cost sharing, and other matching contributions over the life of the Cooperative Agreement (April, 1985 through December 1989) amounted to US\$5,312,221. Figure II-1 summarizes the percentage breakdown by source of funding (see Appendix 14 for details).

FIGURE II-1
 SOURCE OF FUNDING FOR INTSOY PROGRAM
 1985 - 1989



Source: Appendix 14

Of the total amount, S&T/AGR's contribution of 59 percent (\$3,162,491) has been instrumental for the maintenance of a core staff to continue with the utilization research at UIUC. The State of Illinois (SOI) contributed 30 percent or \$1,574,000. Of this amount \$1.4 million or 89 percent was utilized for the renovation of the Agricultural Bioprocessing Laboratory providing INTSOY with a modern and permanent base for the utilization research and training activities of the program. Also, its proximity to the teaching and research facilities of the Food Science Department enhances their cooperative efforts and potential.

SOI also contributed another \$174,000 for laboratory equipment and matching salaries. The equipment contribution (\$39,000 for an expeller and a fiber and protein analyzer) strengthened the soybean utilization and soy based product

quality research efforts. Another \$135,000 was contributed for personnel support.

A total of \$335,000 or six percent was contributed through "Buy-Ins" under the Basic Ordering Agreement as well as by other sources such as FAO, USDA, and UNDP. These contributions were the main sources for funding training (on campus and overseas) as well as technical assistance assignments to LDCs.

The private sector has contributed a total of \$150,000 or three percent in the form of equipment needed for extrusion/expeller research as well as analysis of soy based product quality characteristics. The donated or rent free equipment consists of expellers, extruders, rancidity analyzer, and gas chromatograph as well as accessories, supplies, and service.

Program Support Grants also provided by AID through the Office of International Agriculture provided an additional \$89,930 or two percent for project funding.

D. Relationship to S&T Office of Agriculture Mandate

The S&T Office of Agriculture Mandate is "to (1) increase the incomes of the poor majority and to (2) expand the availability and consumption of food while (3) maintaining and enhancing the natural resource base". A number of criteria were developed which form the principal decision-making mechanism to guide and manage S&T/AGR projects and activities. These criteria relate to the three elements of the focus statement as well as the cross-cutting program considerations that relate to the role of the S&T Office of Agriculture (see Appendix 15 for details).

INTSOY project activities fully satisfy the first two elements of the mandate and contribute indirectly to the third. Most criteria of three elements are either met or are at least not violated. Some examples are used to demonstrate this.

The potential for increasing incomes in LDCs is satisfied through increased employment opportunities as the dry and wet processing technologies are introduced. This has already been the case in countries such as Sri Lanka, India and Zambia.

This technology has been demonstrated economically feasible in LDCs due to its lower acquisition and operating costs. The relative simplicity of the technology as compared to other options makes it highly attractive as a low technology concept.

Due to its flexibility, this technology permits easier response and adaptation to market changes and growth, thus enhancing the income potential of those entrepreneurs who adopt it.

The technology is ideally suited for "the improvement of food consumption by utilization of a more nutritional crop" (soybeans) as well as "for improving consumption from new product utilization techniques" (simpler methods of processing).

The "scope for private sector participation in the provision of services and development of new food products for consumers" is one of the greatest potentials of this technology.

Since this technology is based on soybean utilization, it lends itself to assist in the maintenance and enhancement of the natural resource base. Being a legume, soybean fixes nitrogen from the air thus avoiding soil depletion. This is very beneficial to other basic food crops such as grains.

The potential for extending existing foods (soups, peanut butter, breads, snacks) by adding highly nutritious soybean meal, or using soymilk for dairy analogues (milk, yogurt, ice cream) not only enhances the nutritional qualities of these products but reduces the pressure to either produce or import more wheat or dry milk, for example.

E. Cost Effectiveness of Project

The three objectives of the project have been listed in Section I, and the success in meeting these objectives have been documented throughout the report. Progress made during the last three years indicate that INTSOY is part of a nascent network determined to increase the utilization of soybeans, especially as a human food in LDCs. Worldwide, the benefits of the research, training and technical assistance undertaken by the network will be felt by consumers (specially low income groups) through improved nutrition, producers through additional income from soybean sales or on farm transformation into animal protein, and private sector entrepreneurs through new enterprises which provide additional sources of employment and income.

1. Measuring Cost/Benefit Relationships

Many direct outputs of the project lend themselves to quantification in different degrees. Examples include the numbers of new or improved products developed and tested; number of short courses, workshops, and seminars implemented and their participants; information on equipment and products provided to persons in LDCs; and number of equipment sold and installed. Nevertheless, an evaluation of the economic and social benefits of the project is likely to be complex since the final impact and benefits are manifested well beyond these direct outputs.

Two concrete examples will be used to highlight this point. In Sri Lanka and Kenya two weaning foods for babies were introduced and are being marketed successfully by private and public institutions. There is no question as to the acceptability of the economic (private sector benefits) and the health and social benefits (public sector and consumers) being generated. The mere fact that quite a number of babies are being weaned on a highly nutritious diet is sufficient.

What would make these results more candid and show their true impact would be to have the answers to questions such as how many babies are using these weaning foods? What their general health and mortality rates are relative to other babies using traditional weaning foods? What segment of the population

is using the soybased weaning food? What is the rate of adoption by the general public? What subsidies, if any are being given by the governments? What additional employment and income sources are being created by this food industry? What were the conditions (socio/economic, political/economic, and policy) which allowed this to happen?

In Columbus Grove, Ohio, a community of less than 3,000 persons, a new food processing plant using the dry and wet processing technologies developed with project funds is already employing 80 people. The president of the firm expects to have a second shift working by the end of the year for a total employment of around 150 persons. The economic and social benefits generated by the employment of these persons cannot be questioned. However the final impact goes beyond this basic number and must be expressed in terms of wage and income impact on the community by the ways this additional income is disposed off. Assuming an average wage rate of \$7.50 per hour, and a final employment level of 150 persons this small industry would pump a little more than 2 million dollars annually into the community and surrounding area.

What does this mean to the socio/economic welfare of this rural community? Using a simple dynamic income multiplier model and some assumptions, a final income multiplier of 1.66 can be estimated. This annual payroll would thus translate into a final infusion of new income into the whole community of approximately 3.3 million dollars per year (see Appendix 20).

What can be inferred from these examples is that the combined economic and social benefit/cost ratio of the 3.2 million dollars invested by S&T/AGR in this project must be greater than one by a comfortable multiple. In other words, a higher investment level could have been justified and probably would have led to faster and more significant pay-offs. However, lack of the type of information mentioned above prevents the calculation of the true magnitude of this cost/benefit relationship at this time, especially in LDCs.

2. Improving Cost Effectiveness

Any discussion of cost effectiveness has to take into consideration the invaluable contribution provided by the INTSOY staff to the project in terms of their expertise, dedication, judgement, cultural sensitivity, developmental orientation and personal time put into every activity of the program.

The cost effectiveness of the project can be improved by increasing the rate at which the International Soybean Program is progressing toward the stated objectives. For this purpose, four key additional means are highlighted here, explained in terms of constraints in the next sub-section, and taken up again as part of the recommendations.

First, while the current collaborative research and technical assistance relationships have been developed in a cost effective manner, funding reductions and program changes prevented establishing other linkages (e.g., AVRDC in Asia) and strengthening others. The need for an "outside" and an "inside" directive to guide the project components, and balance total available inputs vs. expected outputs is needed to optimize achievable development opportunities in LDCs and focus utilization research and training accordingly.

Second, in spite of some severe program constraints, INTSOY staff has diligently carried out their responsibilities according to annual work plans submitted to S&T/AGR. Most of the constraints have been overcome and the current attitude within the soybean sector is most propitious for mitigating the funding shortage. At this moment, the development and implementation of a true "management by objectives" plan for each thrust and activity of the program should supersede the current annual work plans being used, and adjusted periodically (every 6 months to reflect changes in funding, staff, dates, outputs, or other input/output relationship, and new initiatives).

Third, the provision of additional graduate training in various aspects of soybean utilization research would give the staff far more flexibility to carry out its ambitious research and outreach program. The synergy from this combination (staff-research assistants) would not only enhance the cost effectiveness of the research component but would permit senior staff to carry out collaborative research and technical assistance programs without interruption of on-going research at UIUC. This kind of training would also be of high value to students from LDCs who could be very instrumental in the transfer of relevant technology.

Fourth, because so many resources (funds, manpower, infrastructure) are being devoted to multiple objectives, goals, and activities, the need to document market and product research and development, research findings, synthesize these results, assess impact, and strengthen the capability to assist more African countries is made more apparent and urgent. The final measure of success of this project will be its contribution to the degree to which policy changes are made and implemented, nutritional improvements take place, soybased agribusinesses develop, increases to consumer and farmer surpluses are achieved, and foreign exchange situations improved.

F. Constraints to Carrying out Program

The soybean utilization research project made considerable progress toward the program objectives set for it. There have been, however a number of constraints which prevented INTSOY from achieving a higher rate of success in all the goals set for the project. It must be noted, however that most of the constraints have been overcome or could be, depending on the financial support of the project. These constraints, ranked in terms of their perceived negative impact on the project are summarized below.

1. Change in Project Orientation

The current project as contained in the Cooperative Agreement reflected a continuation of efforts which began in 1973, when AID awarded a contract to INTSOY to implement the Development of Improved Varieties of Soybeans. INTSOY was staffed and structured to continue in this direction when the change in project orientation from production to utilization took place. The phase out of the production component was completed in 1986.

This change implied that during the first two years of the project more time and effort was expended in the production than in the utilization component (see Appendix 16). As a result only the last three years of the project could be dedicated to utilization research.

2. Staff Changes

As a result of the change in project orientation, adjustments had to be made in staff composition as well. Scientists engaged in production and breeding research were terminated and searches for food and processing technologists were undertaken. Two more food scientists were added during 1987 and 1988. This new personnel has, in spite of the short time made great strides in moving ahead with the utilization research.

3. Budget Cuts

The original Cooperative Agreement called for a project life budget of \$4,111,533. Obligations to INTSOY amounted to \$3,162,491, representing a reduction of 23 percent over the life of the project. These nonrealized obligations prevented the program from moving ahead faster and further in terms of its goals and objectives.

4. Changes in Laboratory location

Due to planned construction programs at UIUC it was necessary to move the soybean utilization research laboratory five times in five years. The dismantling, moving, and reassembly of all the equipment consumed valuable time. The research laboratory is now permanently housed in the renovated Agricultural Bioprocessing Laboratory.

5. Lack of Equipment

The complete refocusing on utilization meant additional research equipment for which no provisions had been made in the original Cooperative Agreement. The response of the private and public sector to donate or purchase the necessary equipment attests to its interest and commitment to this project. Nevertheless, valuable time and effort had to be used to obtain, install, and start up such equipment and research.

6. Graduate Research Assistants

One of the most efficient means available to undertake basic and applied research is through graduate research assistants on Masters or Ph.D. programs. Given the above constraints it has been very difficult to establish an ongoing utilization research program with enough critical mass to justify a great number of graduate students. So far only two graduate students have participated in the project. This situation, however is likely to change with the establishment of a permanent laboratory and the addition of the two food scientists mentioned.

7. Definitive Implementation Plan

The original log-frame contained in the Project Paper contains the "objectively verifiable indicators" and "means of verification" for the goals established for the project. As the changes to the Memorandum of Agreement went into effect in 1986, the original level of outputs for the utilization research component of the project were not revised, nor were these revised as budget cuts went into effect. Although annual work plans were drawn and submitted to S&T

for approval, these were not adjusted to reflect impact of constraints. In other words, research, training, collaborative, and outreach efforts have been undertaken diligently and in good faith but without definitive goals and verification taking place.

G. Work in Progress and Future Plans

Actually, work is on-going in all the areas of INTSOY's utilization and collaborative research, information, and training/technical assistance that have been discussed in this report up to this point. Also, a very ambitious research and collaborative program is planned for the future.

1. Processing and Utilization Research

Some 25 to 30 specific research tasks have been identified and described in outline form as "research project plans" (see Appendix 17). Each designates one or two staff members as, "in charge", and one or more, "cooperators", however, six or seven people comprise this entire list of planned research participants. Operating personnel are not identified, but one must assume this entire program is not to be carried out under an "all chiefs-no indians" format. The projects are classified in five categories with seventeen being contained in the first two, that is, dry and wet processing.

The plans are not prioritized within the categories, nor do they show manpower allocations, time tables, or target dates. A PERT chart or similar scheduling mechanism on each would be desirable so as to intermingle tasks and minimize slack time. INTSOY will likely be hard pressed to achieve all of this by the proposed late 1991/early 1992 re-evaluation date.

2. Collaborative Utilization Research

In pursuing the aforementioned list of research plans, INTSOY will enlist the aid of several locally available resources particularly in the area of nutritional assessment such as Protein Efficiency Ratio (PER), which involves rat feeding studies, in cholesterol lowering studies in both humans and animals (hamsters), and in bio-availability of those minerals that may become complexed with phytic acid and/or fiber in the soy flour. Arrangements are confirmed to provide for most of this activity.

A rather ambitious program has been proposed in regard to collaborative projects in several African nations, which will likely require on-site involvement of several of those people designated as, "in-charge", or collaborators in the various research plans. These on-site activities cannot be readily delegated to lower echelon members of the INTSOY staff, therefore making it doubly important to develop each research plan in greater detail and to prioritize them, so they can be conducted primarily by the lower echelon group (see Appendix 10).

3. Information

The numerous information activities (video, radio, press releases, news letter) as related in II.A.3. will be continued. Additional emphasis will be

given to those information activities directed toward the LDCs in support of the planned increase in collaborative research and encouragement of commercialization in the LDC arena.

With the establishment and implementation of the wider variety of research activities that will evolve in the National Soybean Research Center, it is quite probable that INTSOY will be called upon to render assistance in developing the necessary information resource in that location.

4. Training/Technical Assistance

Several in-country short-courses, workshops and seminars have been planned for 1990 and 1991 in Nigeria, Uganda, Kenya, Zambia, Zimbabwe, Bangladesh, Vietnam, and Sri Lanka. Again, all these training activities are to be carried out by the same personnel involved in utilization research at INTSOY. Careful forward planning will be essential to avoid conflicting time schedules. As with previous training/technical assistance activities, these are to be funded through Mission buy-ins and other donor agents.

Follow-up technical assistance has also been programmed for these countries as well as in the Ivory Coast and Ghana. Carrying out these expected technical assistance activities will further stress the limited manpower available within INTSOY (see Appendix 10).

H. National Soybean Research Center

The State of Illinois earmarked a total of \$4.0 million for the construction of a National Soybean Research Center at UIUC. The building is near completion and negotiations are under way with State officials, Illinois branch of ASA, and ASA in St. Louis for continuous funding of future research programs. The Center, as developed by the interested parties will emphasize the "national" aspects of soybean research. INTSOY is expected to take leadership in the utilization research area and provide the necessary international linkages for outreach, collaborative research, and training in this area.

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

- INTSOY's multidisciplinary program in soybean utilization research, outreach, training and information fully satisfies the S&T Office of Agriculture mandate.
- The benefits of the utilization research being conducted by INTSOY is having a positive and encouraging impact in LDCs, in the private as well as public sector. In LDCs, an increasing number of private entrepreneurs are using the INTSOY technology to produce soybased human foods, animal feeds, and edible oil; public sector agencies are applying the technology in social programs designed to improve nutritional conditions.
- The 100 plus quotes for supplying equipment and technical assistance sent in 1989, in response to inquiries from 57 countries attest to the perceived benefits of this technology both in the private and public sector.
- U.S. agriculture and agribusiness are already reaping the benefits from INTSOY's dry and wet processing systems, as exemplified by increased equipment sales; higher productivity in swine growing operations; and small, rural based manufacturing of soybased products.
- The INTSOY processing techniques are very relevant to the important policy/economic issue of "value-added" programs at the farm or rural level.
- The complete shift in program orientation from production to utilization, and the reduction in funding obligations during the life of the project were key constraints which prevented the project from achieving a higher degree of success in terms of its basic and collaborative research and training objectives.
- Although very laudable, future plans for research (both at UIUC and in collaboration), training, and technical assistance are too optimistic, given current staff and funding levels. Careful reevaluation of future plans and securing commitments for additional funding from other sources is essential.
- Further processing research will focus on fine-tuning the combination processes at various levels of production capacity, since, "scale-up", of such a procedure is seldom linear with respect to volume, the inputs of a processing engineering component would be valuable in this endeavour.

- The research component, the existing application of both technologies in LDCs and U.S., and continuous requests for information are clear indicators of the unfulfilled potential. Without diminishing the research component, a reorientation of the project to product end-use research and analysis would be instrumental in guiding research and increasing cost effectiveness.
- The State of Illinois and UIUC's commitment to this program is solidly demonstrated by their underwriting of 30 percent of the cost of the program through infrastructure development, equipment and administrative and scientific staff time.
- The recent \$1.4 million renovation of the Agriculture Bioprocessing Laboratory which houses INTSOY provides a permanent, modern and well located facility for research, training, and administration.
- The recently constructed National Soybean Research Center at UIUC creates a central focus for soybean related research at the national and international level.
- Private sector support for this project is demonstrated by the donation of processing and analytical equipment to INTSOY, making manufacturing facilities available for test runs and demonstrations, and donating personnel time to the project.
- The increasing number of visits by local and international groups is a testimony to the value they place on the research being undertaken and the products being developed at INTSOY.
- Collegial rapport among INTSOY's utilization research personnel is outstanding. Staff members are very supportive of each other and their commitment to the project is demonstrated by their countless "extra" man-hours.
- The position taken by Land of Lincoln Soybean Association and ASA national office in regard to this project is very favorable and receptive to proposals for future funding of certain components of the program.

B. Recommendations

The recommendations contained below are offered in two sets. The general recommendations are global in nature and outline the recommended future extension, orientation, structure, linkages and role for the project. The specific recommendations are more managerial in nature and designed to make the project more cost effective and measurable. Also, reasons and approaches to the key issue of additional sources of funding are offered.

1. General Recommendations

- a. Extend the INTSOY project for another 3 years beyond the current termination date of January 31, 1992. Current real

funding levels should be maintained, and serious consideration should be given to an increased level of funding. Not extending or a short extension of the project would cut off or undermine the tremendous potential that has been developed to increase nutritional levels in LDCs.

- b. Given the success at INTSOY in achieving a new state of the art in soybean processing, redirect the primary focus to technology transfer and implementation in LDCs. Research in product utilization and market development is key to developing an even greater "pull" for INTSOY's processing technologies.
- c. Identify additional opportunities to strengthen existing linkages between the INTSOY program and other AID units such as Food for Peace, S&T/Nutrition, and the Aquaculture Section; other federal agencies engaged in soybean research (USDA/OICD and its collaborative university network; and other centrally funded projects such as the Seed Technology project at MSU and the Grain Postharvest Systems project at KSU.
- d. Reassess INTSOY's role, given the changing perceptions within the soybean economy, as evidenced by the new expanded check-off and the decision to establish the National Soybean Research Center at UIUC. INTSOY is in a position to play an even greater international role in support of soybean utilization, and could be instrumental in furthering national as well as international goals of concerned representatives.
- e. Conduct a mid-term project evaluation in late 1991 or early in 1992 to assess progress and a final evaluation in 1994 to assess overall impact.

2. Specific Recommendations

- a. Modify project design and management procedures to improve cost effectiveness and impact potential.
 - (1) Revise project log-frame in relation to general recommendations in B.1.
 - (2) Develop specific "management by objectives" type annual work plans by project component to reflect revised log-frame output levels, input requirements, and expected completion dates.
 - (3) Modify reporting system to reflect annual advances made towards goals and objectives contained in revised log-frame.
 - (4) Develop and incorporate in the annual report specific information depicting sources and uses of funds by component and activity.

- (5) Strengthen the product and market research and development component of the project consistent with general recommendation B.1.b.
- (6) Acquire additional man-power through direct hire or collaborative support from other departments in the following areas:
 - Processing engineering to evaluate the technology and verify that it has a sound theoretical basis; to seek out and research any potential theoretical approaches that can further enhance the project.
 - Product and marketing research and development to assess total market potential for soy-derived products; and to provide feed back for research guidance and product development emphasis.
 - Research assistance in the form of graduate students to accelerate the progress of basic and applied research; and to expand the formal side of the training component of the project.
- (7) Conduct the Soybean Processing for Food Uses Short Course on an annual basis, expanded to include concepts of small business administration and marketing management.
 - Make workshops an integral part of every LDC collaborative effort.
 - Reorganize the one on one training to be cost effective, by being very selective about participants and considering their enrollment as special students in UIUC.
- (8) Initiate work on compiling "how-to" manuals on all aspects of the extruder/expeller operations, wet processing, home and village level extension service, and business administration and marketing management, in at least three languages (English, French and Spanish)
- (9) Prioritize the nutrition research component to reflect the needs of the LDCs and quantify the nutritional parameters of the products derived from the INTSOY processes.
- (10) Improve procedures and methods to quantify the "Objectively Verifiable Indicators" of revised Log-frame.

- b. Develop a strategy to expand the existing funding program in order to acquire additional financial resources necessary for implementing the general recommendations described above.
- (1) Solicit a major contribution from ASA's new check-off funds earmarked for implementing the product and market research and development as described in paragraph three of specific recommendation 2.a.(6).
 - (2) Solicit contributions from major vegetable processors such as Del Monte, Green Giant, and Birdseye to continue the research into the utilization of green soybeans as a fresh frozen vegetable.
 - (3) Approach USAID Food for Peace and other food relief agencies with a proposal by which they could make use of INTSOY's unique process and product developments in their endeavors to relieve hunger in LDCs.
 - (4) Continue to encourage buy-ins from USAID Missions and other donor agencies through proposals, personal visits and demonstration of INTSOY's process.

ARTICLE I - STATEMENT OF WORK

I. BACKGROUND

A.I.D. awarded a contract to the International Soybean Program (INTSOY) of the University of Illinois-Urbana Champaign in 1973 to implement the development of improved varieties of soybeans. This contract, which was amended several times, has been instrumental in the identification and introduction of improved varieties and production technologies that led to soybean acreage increases in several LDCs. The present project, implemented under a cooperative agreement with the same institution, capitalized on those results. The new project, implemented 4/1/85 was designed to develop, test, adapt and disseminate new soybean products and soybean processing techniques through research, information dissemination, training and technical assistance.

II. OBJECTIVE

The objective of this purchase order is to acquire the Contractor's services to conduct a comprehensive evaluation of the project's performance and implementation in accordance with the Scope of Work of the revised Cooperative Agreement and logframe of A.I.D. project 936-4132 with the University of Illinois during the past four years.

III. SCOPE OF WORK

The contractor shall serve as Team Leader. In this capacity he shall be responsible for assembling a written report, stating the findings of the evaluation in respect to the degree of progress of the goals and purposes of the project and make recommendations as appropriate. Specific items to be considered are:

- A. At the University of Illinois at Champaign-Urbana level:
 - 1. What is the status of matching funds of the University to the project; in terms of personnel, physical plant and operating expenses?
 - 2. What progress has been made in relation to the intended outputs of the present cooperative agreement?
 - 3. What has been the impact of the project on the agricultural community in the state of Illinois and the U.S. agriculture, especially the American Soybean Association?
 - 4. What has been the impact of the project on the local industries within Illinois and US

industries that have an interest in soyfoods?

- B. At the international level:
1. What is the status of collaborative research with international Agricultural Research Centers, National research Institutions and private enterprise in LDCs?
 2. What has been the value of the results received from testing of the research products in LDCs?
 3. Have there been project relationships with other donor projects and PVOs and what has been their value?
- C. At the A.I.D./Washington level:
1. Has the project complied with requirements of the cooperative agreement, I.E., travel reports, annual reports, voucher submission, etc.?
 2. What is the nature of interaction (actual or potential) of the INTSOY project and the activity funded by the S&T/Nutrition office which also deals with food which includes soybeans?
 3. What is the nature of the INTSOY project to the present formulation of the S&T/AGR portfolio? How well does this activity meet the guidelines of the focus statement? Where may modifications be made to further improve on their activities in reference to A.I.D.'s greater needs?
- D. Future directions for the INTSOY activity.
1. Make recommendations as to project continuation/termination. What would be an effective project budget level for continuation? What are the priorities of project activities to be considered if further budget cuts are required? What would be the ramifications of terminating the project?
 2. What would the possibility be of the Land of Lincoln Soybean Growers Association funding a significant portion of the project? Is there a contemplated grower/researcher priority list for research?
 3. What interactions should be encouraged to maximize the investment of this project?

IV REPORTS

Oral presentation of the contractor's findings shall be made after completion of the draft report. One final report shall be submitted to the Project Manager, Frank Mertens, S&T/AGR before the PACD of the Purchase Order.

APPENDIX 2
EVALUATION SCHEDULE AND PERSONS CONTACTED

USAID/INTSOY

Agenda for September 5, 1989 Visit with
Triple "F", Inc. Insta Pro-Division

- 2:30 - Overview of Triple "F" and Insta-Pro
- 3:00 - Tour of Insta-Pro pilot plant and
assembly area
- 3:30 - Relationship of INTSOY and Insta-Pro
- 4:00 - Discussion of extrusion-expelling potential
for export
- 4:30 - Overview of other Insta-Pro markets and
potential

TEAM EVALUATION OF THE USAID-FUNDED INTSOY PROGRAM
September 5-9, 1989

SCHEDULE

5 SEPT. (TUE)

- 12:00 Dr. Kauffman will meet team in Des Moines for lunch and initial discussions
- 2:30 Triple "F" Company (makers of INSTA PRO extruders used by INTSOY in their extrusion/expelling research) - Leroy Hanson, President
- Tom Welby, General Manager
- 6:30 Flight TW542 Des Moines/St. Louis
- 8:46 Flight TW630 St. Louis/Champaign
- 9:32 Arrive Champaign

Reservations at Illini Union - UIUC Campus

6 SEPT. (WED)

- 7:00 Breakfast - H. E. Kauffman, A. I. Nelson
- 8:30-9:00 Office of International Agriculture - J. J. Nicholaides, T. A. McCowen
- 9:00-9:15 Dean & Director Agricultural Experimental Station -
W. R. Gomes, D. A. Holt
- Tour of facilities
- 10:00 Coffee with INTSOY staff - ABL Kitchen
- 10:30 Terms of Reference for the Review (219 INTERPAKS Conference Room)
INTSOY Overview - H. E. Kauffman
- 12:00 Lunch - Illini Union
- 1:30 Processing and Product Development (219 INTERPAKS Conference Room)
A. I. Nelson & Staff -
- dry processing (extrusion/expelling)
- wet processing (soy milk, dairy analogs)
- green soybeans
- Oriental soyfoods
- home and village
- nutrition
- economics
- other
- 6:30 Dinner - Kauffman's Home

25

7 SEPT. (THU)

7:00 Depart by University plane to Lima, Ohio to visit
Grove Country Foods Inc. - A. I. Nelson, H. E. Kauffman

9:00 Observation and discussions about extrusion/expelling
operation - C. Hastings, J. Schroeder

11:30 Lunch

1:00 Depart for Bloomington

2:30 Arrive Bloomington to visit the Land of Lincoln Soybean Association
(part of the American Soybean Association) - W. Tiberend

4:00 Depart Bloomington (by car)

4:45 Arrive Seymour - BAR Export Co. - L. Boodram

5:30 Return to UIUC

8 SEPT. (FRI)

8:00 Development/Outreach Activities (219 INTERPAKS Conference Room)

- Overview H. E. Kauffman
- Outreach
 - North America A. I. Nelson
 - Africa K. E. Weingartner
 - Asia W. B. Wijeratne
 - Latin America D. R. Erickson
 - Other
- Training W. B. Wijeratne
- Information services R. Wynstra

12:00 Lunch - Illini Union

1:30 Meeting with INTSOY Executive Committee (219 INTERPAKS Conference Room)

3:00 Discussions/Appointments as per request of evaluation team

9 SEPT. (SAT)

Morning Final Discussions/Report Writing

2:15 Depart for Washington Flight PI 1106

2/6'

INDIVIDUALS INVOLVED IN THE REVIEW

UIUC Administrative Officers

Dr. W.R. Gomes	Dean, College of Agriculture
Dr. D.A. Holt	Associate Dean, College of Agriculture
Dr. John J. Nicholaides	Associate Dean, Director of International Agriculture, Assistant Vice Chancellor for Research, College of Agriculture
Dr. Thomas A. McCowen	Associate Director, Office of International Agriculture

INTSOY Staff

Dr. Harold E. Kauffman	Director, INTSOY
Dr. Alvin I. Nelson	Soybean Utilization Program Leader
Dr. Wilmot Wijeratne	Dry processing
Dr. Karl Weingartner	Nutrition and Home & Village Processing
Dr. Kukiart Tanteeratarm	Wet Processing
Dr. Sheldon W. Williams	Economist
Mr. Rob Wynstra	Communications Specialist
Mr. Dan Erickson	Data Management, General Operations
Mrs. Firdousa Begum	Analytical Technician
Mr. Scott Buchanan	Pilot Plant Technician
Mrs. Marise Galenari	Academic Hourly
Mr. Steve Smith	Academic Hourly
Mr. Dennis Clarke	Academic Hourly

INTSOY Executive Committee

R. A. Easter	Animal Science
J. F. Evans	Agriculture Communications
T. Hymowitz	Agronomy
M. E. Irwin	Agricultural Entomology
J. B. Sinclair	Plant Pathology

INTSOY Research Associates

Dr. Tony Soskins	Agricultural Economics
Mrs. Anne Swartz	Graduate Student
Mr.	Graduate Student

Private Sector

Dr. Leroy Hanson	President, Triple "F", Inc.	
Mr. Tom Welby	Executive Vice President, International, ST.Ltd.	INSTA-PRO
Dr. Carl W. Hastings	President, Grove Country Foods	
Mr. Tom Kennell	Swine Producer	

Associations

Mr. W. Lyle Roberts

Chief Operating Officer, Land of Lincoln
Soybean Association

Mr. John Baize

Staff Vice President, American Soybean
Association

S&T/AGR/AP

Mr. Frank Mertens

Project Officer

Dr. Loren L. Schulze

Previous Project Officer

Dr. Samuel G. Kahn

Senior Nutrition Advisor, Office of Nutrition

PEOPLE CONTACTED DURING USAID REVIEW

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Telephone: (515) 276-5406
FAX: 515-276-5749

Dr. Leroy Hanson, President (Triple "F")
Mr. Tom Welby, General Manager (INSTA PRO)
Mr. Bob Woods, Business Manager (INSTA PRO)

GROVE COUNTRY FOODS

9679 State Route 12E
Columbus Grove, Ohio 45830
Telephone: (419) 659-5636

Dr. Carl Hastings, President
Mr. A. Schroeder, Chairman

SRM SEEDS INC.

110 Walnut Street
Columbus Grove, Ohio 45830
Telephone: (419) 659-5635

Mr. T. Mershman, Vice President

LAND OF LINCOLN

2422 E. Washington Street
Bloomington, Illinois 61701
Telephone: (309) 663-7692

Mr. W.L. Roberts, Jr., CEO

Mr. Tom Kennell (Swine farmer)

R.R. #1
Eureka, Illinois 61530

UNIVERSITY OF ILLINOIS OFFICIALS

Dr. W.R. Gomes, Dean College of Agriculture
Dr. D. Holt, Associate Dean, Director Agriculture Experiment Station
Dr. J.J. Nicholaides, Associate Dean, Director Office of International
Agriculture
Mr T.A. McCowen, Associate Director, Office of International Agriculture

APPENDIX 3
REFERENCES CONSULTED

LITERATURE CONSULTED

1. Soybean Utilization and Research Project Paper, S&T/AGR, Project 936-4232.
2. INTSOY Annual Report, Soybean Utilization Research, January 1 - December 31, 1988.
3. Annual Report, Soybean Utilization Research Report, September 1, 1986 - December 31, 1987.
4. Annual Report, Soybean Utilization Research Report, April 1, 1985 - August 31, 1986.
5. International Soybean Program, Assorted Pieces of Literature.
6. BAR Export/Import, Inc., Assorted Pieces of Literature.
7. Triple "F", Inc., Assorted Pieces of Literature.
8. U.S. Soybean Production and Utilization Research, A Report to the Senate Committee on Agriculture, Nutrition and Forestry and House Committee on Agriculture, Soybean Research Advisory Institute, March 1984.
9. Soya Bluebook, 1987.
10. National Geographic, The Prodigious Soybean, July 1987.

APPENDIX 4

REVISED STATEMENT OF WORK FOR COOPERATIVE AGREEMENT
ADN-4132-A-00-5177-00

January 30, 1986

SOYBEAN RESEARCH AND UTILIZATION
DAN-4132-A-00-5117-00

REVISED STATEMENT OF WORK FOR PERIOD
January 1, 1986 through December 31, 1986

- I. Goal/Objectives. INTSOY has the following program objectives:
- A. Develop and disseminate new soy products and processes from raw whole soybeans.
 - B. Conduct collaborative research and testing of new products and processes and promote the commercial application of these products in the less developed countries, as well as in the USA.
 - C. Promote the dissemination of information and conduct training courses on soybean utilization.

II. Description and Scope: INTSOY will focus on soybean utilization to improve the nutritional status of the rural and urban poor in developing countries. The program will work closely with the U.S. soybean industry and with national and international soybean organizations. INTSOY will be an active partner in regional networks coordinated by the International Institute of Tropical Agriculture (IITA) and the Asian Vegetable Research and Development Center (AVRDC).

INTSOY's three-phase utilization program will consist of undertaking development research at UIUC, extension and testing of the products and processes in cooperating countries, and on-site technical assistance in selected countries.

The program will include the following activities:

- 1. Processing and Utilization Research at UIUC. The product development work will focus on the following:
 - (a) develop a simple, relatively, low-cost process to produce a high-quality soy milk which has no patent restriction (the process will be published in a scientific journal);
 - (b) expand the use of extrusion cooking to fortify cereals, vegetables or fruit with soy (major work will be on corn and soy products);

January 30, 1986

- (c) Develop low-cost farm or village level oil extraction methods to complement extrusion cooking so the oil can be extracted and the protein meal can be used for human food and animal feed (the process will be published in a scientific journal)
 - (d) refine home preparations of soybean dishes to reduce cooking time and increase convenience and flexibility;
 - (e) develop simple processes for converting soybean residues and other ingredients into animal feed; and
 - (f) promote and expand the consumption of soy products with a strong social marketing program.
2. Collaborative Utilization Research. INTSOY will work with scientists, government officials, private industry, and international organizations to undertake the following:
- (a) help establish a strong soybean utilization research and training center for Africa at IITA in Ibadan, Nigeria;
 - (b) help establish a national soybean utilization research program in Zambia and Zimbabwe;
 - (c) conduct collaborative research activities with Sri Lanka for domestic and regional products;
 - (d) cooperate with India in the development of new uses for soy meal as a human food and the expansion of the use of whole beans for oil and protein food; and
 - (e) cooperate with private companies developing soy products in Nigeria, Zambia, Zimbabwe, India, Sri Lanka, Thailand, Philippines, Costa Rica, Colombia and other countries.
3. Information and Training Activities:
- (a) publish and distribute the INTSOY Newsletter;
 - (b) publish and distribute an International Soyfood Newsletter;
 - (c) respond to individual requests for technical information about processing,
 - (d) publish periodic reports on soybean utilization research;
 - (e) conduct the short course on soybean utilization;

- (f) participate in regional training programs in Zimbabwe, and the Philippines, jointly sponsored by FAO, IITA, and host national programs,
- (g) expand the number of graduate students and visiting scholars working on soyfood utilization at UIUC;
- (h) participate in regional soybean workshops in Zimbabwe (February), Thailand (March), Thailand (September); and
- (i) promote the expansion of soyfood consumption with a strong social marketing program in a number of developing countries.

APPENDIX 5

COOPERATIVE AGREEMENT ADN-4132-A-00-5177-00

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

SEP 30 1985

Mr. William D. Morgan
Associate Director
Grant and Contract Administration
University of Illinois at
Urbana-Champaign
105 Davenport House
809 South Wright Street
Champaign, Illinois 61820

Subject: Cooperative Agreement No. DAN-4132-A-00-5117-00
Soybean Utilization and Research Project

Dear Mr. Morgan:

Pursuant to the authority of the Foreign Assistance Act of 1961, as amended, the Agency for International Development (hereinafter referred to as the "Government," or "A.I.D.") hereby provides to the University of Illinois at Urbana-Champaign (hereinafter referred to as the "University" or "Recipient") an amount not to exceed \$717,491 as the initial funding to support the University's research program to increase the production and utilization of soybeans, as detailed in the Schedule and the Program Description, which are appended as Attachments A and B, respectively, to this Cooperative Agreement.

This Cooperative Agreement is effective and obligation is made as of the date of this letter and shall apply to commitments made by the University in furtherance of program objectives during the period beginning April 1, 1985 and ending December 31, 1989.

This Cooperative Agreement is conditioned upon the University's administration of indicated funding in accordance with the terms and conditions set forth in the Schedule, the Program Description, the Standard Provisions (Attachment C), and Alterations to the Standard Provisions (Attachment D), which are appended hereto, to which the University agrees by acknowledging receipt of this Cooperative Agreement by authorized signature below.

Please have the enclosed original and eight (8) copies of this Cooperative Agreement signed, and return said original and seven (7) copies to this office as soon as possible, making certain to return all copies marked "Funds Available."

Questions concerning this Cooperative Agreement should be directed to H. T. Simon, Contract Specialist, of this office who may be reached at (703) 235-9137.

Sincerely,



Phillip Casteel
Agreement Officer
A/N Science and Technology Branch
Central Operations Division
Office of Contract Management

Attachment A - Schedule
Attachment B - Program Description
Attachment C - Standard Provisions
Attachment D - Alterations to the Standard Provisions

ACKNOWLEDGED:

The Board of Trustees of the University of Illinois at Urbana-Champaign

BY: Craig S. Bazzani

TYPED NAME: CRAIG S. BAZZANI, COMPTROLLER

TITLE: Comptroller
ATTEST: Earl W. Porter, SECRETARY,
DATE: _____

FISCAL DATA

Project Name: Soybean Utilization and Research
Project No.: 936-4132
PIO/T No.: 5361192
Appropriation No.: 72-1151021.3
Allotment No.: 543-36-099-00-20-51
Budget Plan Code: DDAA-85-13600-AG11
Total Obligated Amount: \$717,491
Total Estimated Amount: \$4,111,533
Funding Source: A.I.D./Washington (M/FM/PAFD)
DUNS No.: 04-154-4081

4/8

SCHEDULEI. Authority, Purpose, and Program Description

- A. Pursuant to the Foreign Assistance Act of 1961, as amended, this Cooperative Agreement is being awarded to support the University's Soybean Utilization and Research Program, as more specifically detailed in Attachment B, entitled "Program Description."
- B. A.I.D. will therefore compensate the University for reasonable, allocable, and allowable expenses incurred in the furtherance of program objectives in accordance with the terms and conditions of this Cooperative Agreement. Any instance of inconsistency between the terms and conditions of this Cooperative Agreement, including Attachments, and the University's proposal of June 13, 1985, as revised on August 15, 1985, shall be resolved in favor of the terms and conditions stated in this Cooperative Agreement.

II. Period of Agreement

Funds obligated hereunder are available for the execution of program objectives under the terms and conditions of this Agreement during the period beginning April 1, 1985 and ending December 31, 1989.

III. Funding Obligation, Estimated Cost, and Method of Payment

- A. Funding in the amount of \$717,491 is obligated by this Cooperative Agreement in support of the program objectives stated herein. Such obligation sufficiently funds activities described in the Program Description through January 31, 1986.
- B. The total estimated amount of the Cooperative Agreement is \$4,111,533. Subject to availability, additional funding up to said total estimated amount of the Agreement may be obligated. At no time, however, shall A.I.D. be required to reimburse the University for costs incurred in excess of obligated funding.
- C. Payment shall be made to the University in accordance with the procedures set forth in Attachment D, Alterations to the Standard Provisions, No. 7A, entitled "Payment - Letter of Credit (August 1984)."

IV. Financial Plan

A. The following is the Financial Plan for this Cooperative Agreement. As a budget summary, the Financial Plan sets forth cost detail for all activities contemplated in the Program Description. Without prior written approval of the Agreement Officer, the University may not vary an individual cost element amount by more than fifteen percent (15%) of the amount indicated for the cost element below.

Cost Element	Project YEAR 1 FR:(4/1/85- TO:12/31/85)	Project YEAR 2 (1/1/86- 12/31/86)	Project YEAR 3 (1/1/87- 12/31/87)	Project YEAR 4 (1/1/88- 12/31/88)	Project YEAR 5 (1/1/89- 12/31/89)	TOTAL
Salaries and Wages	\$273,135	\$364,844	\$338,582	\$364,166	\$390,711	\$1,731,438
Fringe Benefits	35,131	46,793	43,207	46,468	49,853	221,452
Travel and Transportation	43,000	42,000	36,000	36,000	43,000	200,000
Per Diem and Allowances	25,222	22,222	22,222	22,222	26,222	118,110
Equipment	30,000	20,000	15,000	5,000	5,000	75,000
Other Direct Costs	47,000	109,000	151,000	133,000	89,000	529,000
Overhead	<u>184,409</u>	<u>256,562</u>	<u>262,825</u>	<u>267,509</u>	<u>265,228</u>	<u>1,236,533</u>
TOTAL	<u>\$637,897</u>	<u>\$861,421</u>	<u>\$868,836</u>	<u>\$874,365</u>	<u>\$869,014</u>	<u>\$4,111,533</u>

B. Any revisions to the Financial Plan shall be made in accordance with Attachment C, Standard Provision No. 6, entitled "Revision of Financial Plans."

C. It is understood that the University will contribute to program costs in accordance with its proposal.

V. Reports, Notifications, and Publications

A. As more fully described in format, content, and frequency in the paragraph entitled "Reports" of the Program Description (Attachment B), the following reports shall be prepared and submitted by the University as an integral component of this Cooperative Agreement:

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- 1) Annual Workplans
- 2) Technical Administration Reports
- 3) Travel Reports

B. Submissions of the indicated reports shall be directed to the cognizant A.I.D. Project Officer, as follows:

Agency for International Development
Bureau for Science and Technology
Office of Agriculture (S&T/AGR/AP)
Washington, D.C. 20523
ATTN: Project Officer (Project No. 936-4132)

C. Prior to the submission of a scheduled report, events may occur that have significant impact upon the research program. In such instances, the University shall inform the Agreement Officer as soon as any of the following or similar types of circumstances become known:

- 1) Problems, delays, or adverse conditions that will materially affect the University's ability to attain program objectives, prevent the meeting of applicable time schedules and goals, or preclude the attainment of project work activities during the established period of the Agreement. Such disclosures shall be accompanied by a statement describing action taken or contemplated, and any assistance required to resolve the situation.
- 2) Favorable developments or circumstances that enable time schedules to be met sooner than anticipated or allow more work activities to be accomplished than originally projected.

D. If during the course of general program activities the University is required to produce information or provide reports related to this research program to other U.S. Government Agencies, the University agrees to furnish a copy of such documentation to the cognizant A.I.D. Project Officer.

E. Twenty-five (25) copies of any applied research field manuals, handbooks, state-of-the-art documents, or research papers presented in technical journals, resulting from activities supported by this Agreement will be furnished to the cognizant A.I.D. Project Officer.

F. Financial reports shall be submitted in accordance with the procedures set forth in Attachment D, Alterations to the Standard Provisions, No. 7A, entitled "Payment-Letter of Credit (August 1984)." All financial documents submitted shall contain the following identification information on the face sheet:

Cooperative Agreement No.: DAN-4132-A-00-5117-00
Project Name: Soybean Utilization and Research
Project Officer: S&T/AGR/AP, Project No. 936-4132

VI. Substantial Involvement Understandings

Under the terms of this Cooperative Agreement, A.I.D. anticipates substantial involvement in the following areas during the life of the Program:

- 1) Monitoring of program activities to establish specific research directions or redirections in response to research findings and in order to respond to interrelationships with other entities as these may evolve. It is understood, however, that the University will be solely responsible for compliance with applicable Federal, State, and local requirements (e.g., the National Environmental Policy Act of 1970, as amended, and the Export Administration Act of 1979, as amended) relating to the activities described in the Program Description; and
- 2) Determination of content, format, and distribution of the annual workplans and the technical administration reports.

Exercise of these understandings shall be in accordance with statutory authorities of the Foreign Assistance Act of 1961, as amended, and the Federal Grants and Cooperative Agreements Act of 1977.

VII. Negotiated Overhead Rates

In accordance with Attachment C, Standard Provision No. 5A, entitled "Negotiated Overhead Rates - Predetermined," the following overhead rates shall apply to allowable expenditures incurred in furtherance of the program objectives under this Agreement:

<u>TYPE</u>	<u>FROM</u>	<u>TO</u>	<u>RATE</u>	<u>LOCATION</u>	<u>APPLICABLE TO</u>
Predetermined	4/1/85	6/30/85	42.2%	On-Campus	Organized Resea:
Predetermined	7/1/85	6/30/86	48.4%	On-Campus	Organized Resea:
Predetermined	4/1/85	6/30/85	24.1%	Off-Campus	Organized Resea
Predetermined	7/1/85	6/30/86	29.3%	Off-Campus	Organized Resea

The indicated overhead rates shall be applicable to Total Direct Costs less:

- 1) The cost of services of specialized service facilities (PLATO and CSO);
- 2) Subgrant and subcontract costs exceeding \$25,000 each;

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- 3) The cost of an item of purchased equipment with an estimated life of one year or more and an acquisition cost of \$500 or more, including lease-purchase agreements; and
- 4) Arrangements under which Federal financing is in the form of loans, scholarships, fellowships, traineeships, or other fixed amounts based on such items as education allowance or published tuition rates and fees of an institution.

VIII. Local Cost Financing

In accordance with Attachment C, Standard Provision No. 11, entitled "Local Cost Financing with U.S. Dollars," the University, in furtherance of program objectives, is authorized local cost financing of supplies and logistical support materials in cooperating countries in an amount not to exceed \$50,000.

IX. Special Provisions

- A. Capital expenditures for general purpose equipment (i.e., articles of nonexpendable, tangible personal property having a useful life of more than two (2) years, and an acquisition cost of \$500 or more per unit, the use of which is not limited only to research, medical, scientific, or other technical activities) and special purpose equipment (i.e., equipment which is used only for research, medical, scientific, or other technical activities) with a unit acquisition cost of \$1,000 or more, shall be allowable costs in furtherance of program objectives only when approved in advance by the Agreement Officer. The acquisition of the equipment identified in the University's proposal of June 13, 1985, as revised on August 15, 1985, is hereby approved by the Agreement Officer.
- B. The Standard Provisions applicable to this Agreement are set forth in A.I.D. Form No. 1420-51 (February 1982), appended hereto as Attachment C, and are modified as set forth in Attachment D, entitled "Alterations in Grant - (November 1984) Attachment to A.I.D. Forms 1420-51, and -52." References to "Grant" and "Grantee" in the Standard Provisions are hereby changed to "Cooperative Agreement" and "Recipient," respectively.

The following Standard Provisions are considered inapplicable to this Agreement:

- No. 7B: Payment - Periodic Advance
- No. 7C: Payment - Reimbursement
- No. 10A: Procurement of Goods and Services
under \$250,000
- No. 13B: Title to and Care of Property
(U.S. Government Title)
- No. 13C: Title to and Care of Property
(Cooperating Country Title)

X. Authorized Geographic Code

The acquisition of goods and services under this Agreement shall be accomplished in accordance with the following authorized Geographic Codes in the indicated order of preference:

- 1) United States ("000")
- 2) Participating Country

Program Description

The University of Illinois at Urbana-Champaign's International Soybean Program (INTSOY), as a resource center specializing in research on tropical soybeans, is undertaking a program to: 1) develop and disseminate new soy products and processes, 2) establish and coordinate research networks among national and international agricultural research institutions, 3) conduct collaborative research on specific problems affecting soybeans (e.g., diseases and insects) and methodologies for introducing more diverse germplasm into soybean breeding programs, and 4) promote the dissemination of information and the development of training courses on aspects of soybeans.

ACTIVITIES

The Program will include activities which seek to improve the nutrition of the rural and urban poor in developing countries through increased utilization of soy products, and which contribute to further development of the University's institutional capabilities. Such activities are expected to include:

1. Utilization Activities - in developing new soy products and processes, it is anticipated that the University will:
 - a. Produce a high quality soy milk using a low-cost process which has no patent restriction;
 - b. Develop a combined soybean/grain, soybean/vegetable, or soybean/fruit product, with or without nutritional addition through extension cooking;
 - c. Develop a low-cost, village or town level extraction process using a continuous oil expeller which will allow farmers to partially remove oil from their soybeans in order to increase market value;
 - d. Continue to refine village or home level processes for preparing soybean dishes for home consumption;
 - e. Develop recipes and concepts for direct consumption of soybeans;
 - f. Develop simple processes for converting soybean residues and other ingredients into animal feeds; and
 - g. Initiate efforts to expand the utilization of soy products in developing countries.

2. Networking Activities - the University will organize and coordinate soybean research networks in Asia, Africa, and Latin America. Such networks are expected to:
 - a. Promote research and planning activities among national and international soybean programs;
 - b. Identify and develop cultivars for soybean growing areas;
 - c. Develop appropriate soybean management technology for specific production areas;

- d. Promote the utilization of soybeans by exchanging information on practical programs to introduce soybeans and soy products in developing countries; and
- e. Organize working group meetings and monitoring tours to study problems and to transfer methodologies and technologies.

3. Research Activities - through collaborative research activities, especially with developing country scientists, the University is expected to:

- a. Continue research efforts to control soybean rust and red leaf blotch;
- b. Continue research on the seedborne nature of soybean anthracnose;
- c. Seek to perfect a non-toxic method of controlling most seedborne fungal pathogens of soybeans which does not contaminate the environment and is easily adaptable in developing countries;
- d. Begin studies on the effect of seedborne fungi and bacteria on the quality of products made from soybeans;
- e. Initiate an international trial to determine the validity of a model to predict soybean mosaic virus spread, yield loss, and seed transmission;
- f. Develop controls for the yellow mosaic virus which is transmitted by whiteflies;
- g. Initiate research on the peanut stripe virus which can infect soybeans;
- h. Initiate a screening program to identify soybean germplasm which is resistant or tolerant to the lima bean podborer;
- i. Design and test integrated soybean pest management programs;
- j. Collaborate on biotechnology research efforts which seek to make wide crosses of wild, perennial Glycine species with soybeans to introduce new genes for resistance to diseases, insects, and other forms of stress such as drought or salt; and
- k. Compile a directory of soybean germplasm, and assist selected developing countries in obtaining funding to collect, evaluate, and preserve their indigenous germplasm.

4. Information and Training Activities - in gathering and disseminating soybean information, it is anticipated that the University will:

- a. Publish and distribute an international newsletter on soybean research;
- b. Respond to individual requests for technical information;
- c. Publish periodic reports on specific soybean research topics;
- d. Conduct trainee-sponsored courses in soybean utilization and production; and
- e. Contribute to regional network training programs.

REPORTS

Throughout the life of the Program, the University will prepare and submit the following documents:

1. Annual Workplans - Within sixty (60) days from the effective date of this Cooperative Agreement, the University shall prepare and submit to the Agency's Bureau for Science and Technology, Office of Agriculture, Agricultural Production Division (S&T/AGR/AP) two (2) copies of a draft workplan which outlines the anticipated schedule of activities through December 31, 1986. Based upon collaborative review, a final workplan will be agreed upon within thirty (30) days of the submission of the draft workplan.

A similar annual workplan, subject to the collaborative review process described above, shall be submitted one (1) month prior to the completion of each project year over the remaining three (3) years of the Cooperative Agreement, and will summarize progress to date and describe the activities anticipated to be accomplished during the next Project Year.

2. Technical Administration Progress Reports - On an annual basis, the University shall submit to S&T/AGR/AP twenty-five (25) copies of a progress report, in a mutually-agreed-to format, which details Program accomplishments of the preceding twelve (12) month period. Each progress report will also include a summary financial statement and a consolidated account of Program activities on the whole. The first report, covering the period beginning April 1, 1985 and ending December 31, 1985, will be submitted to S&T/AGR/AP by February 28, 1986. Subsequent reports will be submitted within sixty (60) days after the completion of each Project Year.
3. Travel Reports - Within thirty (30) days after the completion of each international trip authorized in writing by the cognizant A.I.D. Project Officer, the University will submit two (2) copies of a report which summarizes the accomplishments of the trip to S&T/AGR/AP.

Additional distribution of the indicated reports is subject to the mutual agreement of the University and A.I.D.

EVALUATIONS

Two (2) formal evaluations of Program activities will be conducted during the term of the Cooperative Agreement. The first evaluation, at the end of Project Year 3, will focus particularly on the University's utilization and networking activities. The second evaluation will take place at the completion of Project Year 5.

APPENDIX 6
INFORMATION REQUESTS BY COUNTRY, ENSTITUTION,
EQUIPMENT AND PRODUCT



Office: (217) 337-6100
Fax: (312) 948-9630
Telex: 754477 BAR EX UD
Cable: BAR Export/Import

P.O. BOX 421 URBANA, ILLINOIS 61801 USA

1 SEPT. 89

List of Countries with groups who have shown interest in
Extrusion/Expelling systems.

- | | |
|----------------------|---------------------|
| Algeria | Suriname |
| Argentina | Syria |
| Australia | Switzerland |
| Bangladesh | Taiwan |
| Belize | Tanzania |
| Botswana | Thailand |
| Canada | Trinidad |
| China | Turkey |
| Colombia | Uganda |
| Barbados | United Kingdom |
| Dominica | USSR |
| Dominican Republic | Venezuela |
| Ecuador | West Germany |
| Egypt | Yemen Arab Republic |
| Ethiopia | Zaire |
| Guatemala | Zambia |
| Guyana | Zimbabwe |
| Haiti | Bolivia |
| Honduras | |
| India | |
| Iran | |
| Italy | |
| Ivory Coast | |
| Jamaica, Japan | |
| Kenya | |
| Martinique | |
| Mexico | |
| Nepal | |
| Netherlands Antilles | |
| Nigeria | |
| Pakistan | |
| Peru | |
| Philippines | |
| Saudi Arabia | |
| South Africa | |
| Spain | |
| Sri Lanka | |
| St. Lucia | |
| Sudan | |

TOTAL

- 57 COUNTRIES

- MORE THAN 100

QUOTES SENT OUT

COUNTRIES WHICH REQUESTED ASSISTANCE/INFORMATION
IN SOYBEAN PROCESSING

<u>COUNTRY</u>	<u>NO. INQUIRIES</u>	<u>COUNTRY</u>	<u>NO. INQUIRIES</u>
<u>AFRICA</u>			
Burundi	2	Nigeria	10
Ethiopia	1	Uganda	1
Kenya	1	Zaire	1
Liberia	1	Zambia	1
Malawi	1	Zimbabwe	1
<u>ASIA</u>			
Bangladesh	1	Pakistan	2
China	2	Philippines	1
India	9	Singapore	2
<u>EASTERN EUROPE</u>			
Austria	1	Germany BRD	1
Bulgaria	1	USSR	1
<u>EUROPE</u>			
Belgium	1	France	1
England	1	Italy	1
<u>MIDDLE EAST</u>			
Israel	2	Yemen	1
<u>LATIN AMERICA</u>			
Argentina	1	Honduras	3
Belize	1	Mexico	1
Brazil	1	Peru	2
Colombia	2	Puerto Rico	1
Guatemala	1	Surinam	1
Guyana	1	Trinidad	2
<u>NORTH AMERICA</u>			
Canada	4	United States	51
<u>OCEANIA</u>			
Australia	2		

ORGANIZATION REQUESTING ASSISTANCE/INFORMATION
IN SOYBEAN PROCESSING

USAID Missions	1
Private Industry	38
International Research & Development Organizations	4
Private Consulting Firms	3
Private Volunteer Organizations	5
National Research & Development Organizations	4
National Research & Development Organizations (Abroad)	20
Private Individuals	27

NUMBER OF REQUESTS FOR ASSISTANCE
WITH EQUIPMENT AND PRODUCTS

Equipment

Expeller	26
Extruder	26
Mill	1
Seed Cleaner	0
Dehuller	2
Oven	0
Soymilk	8
General	4

Product

Soymilk/Dairy Analog	24
Oil	7
Meal	2
Cake	6
Flour	9
Snack	1
Feed	7
Weaning	3
Tofu	3
Tempeh	2
Green Beans	28
Texturized Soy Protein	3

APPENDIX 7
PUBLIC INFORMATION PRODUCED AND OUTLETS

Radio And Television Stories Produced

INTSOY:

Utilization Short Course--Harold Kauffman
Green Soybeans--Al Nelson
Extrusion/Expelling--Al Nelson
Soy Flour--Al Nelson
Extrusion for Swine--Tom Kennel
Omega 3 in Pork--Bob Easter
Soymilk--Al Nelson

International Ag:

Importance of Ag Development I--John Nicholaides
Importance of Ag Development II--John Nicholaides
Changes in Ag Assistance--Harold Kauffman
U of I Kenya Project--Burt Swanson
Training (Radio only)--John Santas

Special:

15-Minute TV Program on USAID Program Support Grants
16-Minute TV Overview of INTSOY. *we saw this*

Outside Radio and TV Coverage

Short Course--Local CBS
Illinois Forum on Full-Fat Soy--Local CBS, Local NBC
Dean Campbell on Ag Development--Voice of America
Al Nelson on Extrusion/Expelling--Christian Science Monitor Radio
John Nicholaides on Ag Development--Brownfield Radio Network
Omega-3 in Pork--Paul Harvey Syndicated Radio
Soybean Documentary (Nelson on Extrusion)--Handel Film Company

Special Showings And Exhibits:

Annual State Corn-Soy Conference--1988 and 1989
U of I Agronomy Day--1988 and 1989
Iroquois County Soybean Growers Conference--1989
Agricultural Experiment Station Open House--1988
Illinois Bean Boosters Training Session--1989
Forum on Full-Fat Soybeans--1988
Extension Service Annual Conference--1988

Visitor Presentations:

More than 50 presentations in 1988 (about 1,000 people);
Including: Farm Bureau, Farmers Union, State Legislators, Foreign
Ambassadors, Visiting Delegations From at Least 20 countries,
Soybean Checkoff Board, International Ag Advisory Committee, and
Land of Lincoln Soybean Association

*↳ in California: school children
program in State
for soybean.*

Outlets for Print Stories From Ag Communications

All stories to:

Associated Press and United Press International Wireservices
72 Illinois Daily Newspapers
7 Indiana Daily Newspapers
2 Kentucky Daily Newspapers
5 Missouri Daily Newspapers
8 Regional Farm Weeklies
51 Major Illinois Weekly Newspapers
8 National General Farm Magazines

Top Stories to:

19 National News Outlets

These Include:

National Public Radio
Washington Post
Newsweek
Voice of America
Reuters
Christian Science Monitor
Los Angeles Times
New York Times
Wall Street Journal
USA Today
ABC, NBC, CBS, and CNN News
US News And World Report

Selected Stores to:

100 Specialized Farm and Trade Magazines

Outlets for Radio And TV Stories From Ag Communications

Television Stories to:

15 Illinois and Indiana TV Stations
2 National Networks (Morning Ag Report and Ag Day)
1 RFD 24-Hour National Satellite Feed
1 USDA National Satellite Feed

Radio Stories to:

100 Stations Nationwide

APPENDIX 8

VISITORS TO INTSOY PROGRAM 1/1988 - 8/1989

Visitors to INTSOY Program
January 1988 - August 1989

** COUNTRY		
IAN TAYLOR	NGO ADMINISTRATION	ALL ASPECTS
CHUCK HERRILL	NGO ADMINISTRATION	ALL ASPECTS
LATIN AMERICAN WORLD PORK EXPO TEAM		ALL ASPECTS
** COUNTRY 12 FOREIGN GOVMTS.		
NATIONAL DEFENSE UNIV. REPRESENTATIVES	VIP	NEW SOYBEAN FOODS
** COUNTRY BANGLADESH		
KURT WENGER	DEVELOPMENT SPCLST.	EXTRUSION/EXPELLING
** COUNTRY BRAZIL		
DR. ANKUNES	SCIENTIST	FUNCTIONAL PROPERTIES OF PROTEIN IN SOY
DR. IBERE LINS	SCIENTIST	ALL ASPECTS
** COUNTRY CANADA		
MR. TINO BREUER	FARMERS REP.	ALL ASPECTS
** COUNTRY CHINA		
CHINESE DELEGATION LOW-LAND DELEGATION FROM HEILONGJIANG	VIP SCIENTISTS	VIDEO
** COUNTRY ENGLAND		
GRAHAM L. LEWIS	BUSINESSMAN	
** COUNTRY GAMBIA		
3-4 STUDENTS		SOYPRODUCTS
** COUNTRY HAITI		
MR. FREQUIRE VILSAINT	DEVELOPMENT WORKER	SPECIAL PRODUCTS FOR HAITIAN SCHOOLS
** COUNTRY INDIA		
MR. CHANDANI	BUSINESSMAN	
JAYESH D. SHAH	BUSINESSMAN	ALL ASPECTS
DR. R. JAMBUNATHAN	SCIENTIST	ALL ASPECTS
NAWAB ALI	VIP	OBSERVE FACILITIES AND RESEARCH PROJECTS
** COUNTRY ITALY		
DR. ERIC KUENEMAN	VIP	EQUIPMENT NEEDS FOR ALL PROCESSING VIDEOS
7 FOOD JOURNALISTS		

** COUNTRY JAPAN DR. S. MATSUI	SCIENTIST	PROCESS. AND UTILIZATION
MR. S. ISHIHARA	SCIENTIST	PROCESS. AND UTILIZATION
HON. MOTONOBU HIRAMATSU	VIP	NEW SOYFOODS AND PROCESSES
** COUNTRY KENYA JUDITH KIMIYE EGERTON UNIVERSITY COMMITTEE	SCIENTIST EDUCATIONAL	ALL ASPECTS OVERVIEW OF INTSOY
** COUNTRY KOREA DELEGATION OF 7 KOREANS	BUSINESSMEN	SOYBEAN PROCESSING
** COUNTRY NIGERIA OLUWADIYA G. ADEOGUN H.O. OGUNDIPE	BUSINESSMAN SCIENTIST	ALL ASPECTS EXTRUSION/EXPELLING
** COUNTRY PAKISTAN SYED ASAD ALI ABDIR RAHMAN KHAN	BUSINESSMAN VIP	SOYMILK SOYPRODUCTS
** COUNTRY PESOTUM, ILL HOME EXTENSION CLUB		VIDEOS, SOYFOODS
** COUNTRY PRC MRS. LIN LING MR. TIAN REN LIN	SCIENTISTS SCIENTIST	SOYBEAN PROCESSING GENERAL SOYBEAN PROCESSING
** COUNTRY SOUTH AFRICA MR. PETE C. BARWISE MR. WIN DEJAGER MR. BROER STAPELBERGER	BUSINESSMAN BUSINESSMAN BUSINESSMAN	EXTRUSION/EXPELLING EXTRUSION/EXPELLING EXTRUSION EXPELLING
** COUNTRY SOUTH KOREA KOREAN WORLD PORK EXPO TEAM	BUSINESS	OVERVIEW OF INTSOY
** COUNTRY TAIWAN TAIWAN FAO COUNCIL OF AGRICULTURE SUNDAR SHANMUGASUNDARAM	SCIENTISTS SCIENTIST	ALL ASPECTS GREENSOYBEANS
** COUNTRY THAILAND DR. MOGENS LEMONIUS	SCIENTIST	GENERAL INTSOY ACTIVITIES
** COUNTRY UGANDA MR. EBRAHIM N. MUWANGA	BUSINESSMAN	ALL ASPECTS

** COUNTRY USA		
ILLINOIS FARMERS' UNION	FARMERS	ALL ASPECTS
ILLINOIS LEGISLATORS	VIP	ALL ASPECTS
ILLINOIS FARMERS BUREAU	FARMERS	ALL ASPECTS
MERRITT HORN	BUSINESSMAN	OIL EXPELLING AND USES
ROBERT C. STOEW	BUSINESSMAN	
DON BARTON	CONSULTANT	
RALPH CUMMINGS	CONSULTANT	
DR. PAUL CAREY	BUSINESSMAN	ALL ASPECTS
FARM BUR. WOMEN'S COMM. OF CHM. CO.		RELEVANCE OF PROCESSING PRODUCT IN HOME
NATIONAL FARMER'S UNION	VIP	RANGE OF PRODUCTS
MARIANNE PLAUS	AG MARKETING SPLST	EXPELLING
JOHN WILHAM	BUSINESSMAN	EXTRUSION/EXPELLING
TRYGZE J. STROMMEN	BUSINESSMAN	EXPELLING
KEN ALLEN		GENERAL ACTIVITIES AT INTSOY
MRS. SUSAN DICARO	BUSINESS	SOY ICE CREAM, SOY PRODUCTS
DR. FRANCIS TUAN	ECONOMIST	CHINA CONFERENCE
GEORGE TIMMONS		GREEN SOYBEANS
CHUCK BROWN		GREEN SOYBEANS
ILLINOIS SOYBEAN		EXTRUSION/SOYFOODS
JOHN KNOVSKY	STUDENT	GREEN SOYBEANS
** COUNTRY USSR		
6 MANAGERS OF STATE OPERATED FARMS	VIP	GENERAL INTSOY ACTIVITIES
** COUNTRY VIETNAM		
RECTOR PH. M SON KHAI		GENERAL INTSOY ACTIVITIES
PROFESSOR TRAN PHUOC DOUNG		GENERAL INTSOY ACTIVITIES
** COUNTRY WORLD BANK-AFRICA		
STEPHEN CARR	SCIENTIST	ALL ASPECTS
** COUNTRY ZAMBIA		
STEPHEN MUYAKWA	BUSINESSMAN	ALL ASPECTS
PETER MAGANDE	BUSINESSMAN	ALL ASPECTS
** COUNTRY ZIMBABWE		
MR. ROY BIRCHALL	BUSINESSMAN	SOYFOODS
CASPER MOMBESHORA	SCIENTIST	VALUE ADDED PRODUCTS

APPENDIX 9

INTSOY SHORT COURSES AND 1988 TRAINING SCHEDULE

INTSOY SHORT-TERM TRAINING SCHEDULE - 1988

Name of trainee	Country	Category/Affiliation	Duration	Training interests
Ananda Herath	Sri Lanka	Lab technician Dept. of Agriculture	3 months	Laboratory analytical techniques, extrusion/expelling, soy beverages, dairy analogs
P.A.C. Pitigala	Sri Lanka	Pilot plant foreman Dept. of Agriculture	3 months	Operation, repair, & maintenance of soy processing equipment, dry extrusion, extrusion/expelling, refrigeration & air conditioning
S. D. Kulkarni	India	Senior scientist (techn. & engineering) CIAE - Bhopal	2 months	Extrusion/expelling, baking, laboratory analysis, personal computers, thermal effect evaluation for soybeans
B. K. Mital	India	Faculty (technologist) G. B. Pant University - Pantnagar	2 months	Soy beverage, dairy analogs, fermented soy products, solvent extraction, personal computers
S. K. Mittal	India	Faculty (technologist) G. B. Pant University - Pantnagar	2 months	Extrusion/expelling, soy flour utilization, fermented soy products, solvent extraction, analytical techniques
Y. C. Agrawal	India	Faculty (Engineer) G. B. Pant University - Pantnagar	2 months	Extrusion/expelling, solvent extraction, supercritical extraction, library search and data base management
B. S. Bisht	India	Senior scientist (techn. & engineering) CIAE - Bhopal	2 months	Dry extrusion, extrusion/expelling, process evaluation, laboratory techniques, solvent extraction, personal computers and data base management
A. K. Tikoo	India	Faculty (engineer) G. B. Pant University - Pantnagar	4 months	Dry extrusion, extrusion/expelling, analytical techniques, library search, personal computers
Seyd Asad Ali	Pakistan	Technologist/industry	1 week	Soy beverages
Woo-Jung Kim	Korea	Faculty (technologist) King Sejong University	1 week	Soy beverages and tofu
Tran Phuoc Duong	Vietnam	Faculty (technologist) University of Kan-Tho	2 weeks	Extrusion/expelling Project proposal preparation
Lucy Kehinco	Nigeria	Student trainee University of Illinois	2 months	Home and village level soy food preparation
D. B. Weeraratunga	Sri Lanka	Extension specialist Dept. of Agriculture	1 month	Overview of soybean utilization, production aspects, harvesting, handling and storage of soybeans
M. M. Premachandra	Sri Lanka	Extension specialist Dept. of Agriculture	1 month	Overview of soybean utilization, production aspects, harvesting, handling and storage of soybeans

Total number of trainees = 14

Countries: India, Sri Lanka, Pakistan, Korea, Vietnam, Nigeria

Total person months = approximately 25

* CIAE = Central Institute of Agricultural Engineering

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INTSOY SHORT-TERM TRAINING SCHEDULE - 1989

Name of Trainee	Country	Category/Affiliation	Duration	Training Interests
P. C. Bargale	India	Scientist (Agr. Eng.) CIAE - Bhopal	2 weeks	Soybean processing
L. K. Sinha	India	Scientist (Agr. Eng.) CIAE - Bhopal	13 weeks	Dry extrusion, extrusion; soy flour utilization
V. K. Tanwar	India	Faculty (Food Science) G. B. Pant University Pantnagar	12 weeks	Extrusion/expelling analytical techniques
Gurmukh Singh	India	Faculty (Food Science) G. B. Pant University Pantnagar	11 weeks	Soybean processing, soy flour utilization
J. C. Joshi	India	Scientist (Biochem.) CIAE - Bhopal	12 weeks <i>analytical</i>	Soybean processing, ^{oriental} oil soy foods, nutrition, & techniques
Lakshmi Jayasekera	Sri Lanka	Soybean Food Research Centre - Peradeniya	4 weeks	Oriental soy foods analytical techniques
* Kaswija Mtebe	Tanzania	Faculty - Univ. of Tanzania - Morogoro Fullbright Scholar	6 months	Extrusion/expelling
* Nazma Azreeli	Trinidad	Quality Assurance Mgr. National Flour Mills Port-of-Spain	7 weeks	Texturization, analysis oil refining
Gadissa Gobena	Ethiopia	Private	6 weeks	Home and village level utilization
T.D.W. Siriwardena	Sri Lanka	Soybean Foods Research Centre - Peradeniya	2 years	Graduate student M.S.
* D.B.T. Wijeratne	Sri Lanka	Soybean Foods Research Centre - Peradeniya	Ongoing	Graduate student Ph.D.

* Not completed

SHORT COURSES

1. U.S.A., May 28 to July 15, 1986. Twelve persons from nine countries attended the UIUC-based, 7-week course on "Soybean Processing for Food Use." (see attached schedule)

2. Sri Lanka, January 11 - February 11, 1988. The short course, "Soybean Processing for Food Uses," held in Peradeniya, Sri Lanka, was attended by 21 participants representing Sri Lanka, India, Pakistan, Bangladesh, Nepal, Nigeria, Kenya, Ethiopia, and the United States. (see attached schedule)

1986 SOYBEAN PROCESSING FOR FOOD USES

May 28 - July 15, 1986

Tuesday, 27 May

Arrival

Wednesday, 28 May

- 8:30 - 9:00 am Orientation - Dr. L. S. Wei, Professor of Food Science.
- 9:00 - 9:15 am Welcome - Dr. A. J. Siedler, Head, Dept. of Food Science (3-0130).
- 9:45 - 11:30 am Orientation and Objective of Short Course - Prof. A. I. Nelson.
- 1:00 - 4:30 pm Tour - Department of Food Science and the University of Illinois. Drs. Tsao-Ming Wei and Wilmot Wijeratne.

Thursday, 29 May

- 8:30 - 9:00 am INTSOY Program - Dr. H. E. Kauffman, Director of INTSOY (3-6422).
- 9:00 - 11:00 am Soybean Production in Developing Countries - Mr. Danny Erickson, INTSOY Agronomist.
- 11:00 - 11:30 am Discussion
- 1:15 - 4:45 pm Round Table Discussion
Each participant is required to present a short talk on his or her country's program - Dr. L. S. Wei, Professor of Food Science, A. I. Nelson, Professor Emeritus Food Science, Drs. Sing-Wood Yeh and Wilmot Wijeratne.

Friday, 30 May

- 8:30 - 11:30 am Overview of Sensory Evaluation - Prof. Emeritus, Dr. J. Tobias (Acting Head, Dept. of Food and Nutrition, 3-1324).
- 1:00 - 4:30 pm Composition and Grading of Soybeans (Lecture & Lab) - Dr. Sing-Wood Yeh and Dr. Wilmot Wijeratne.

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Monday, 2 June

- 8:30 - 9:30 am Field trip - Midwest Soy Products
- 10:00 - 12:00 noon Field trip - Anderson Grain Elevator
- 1:30 - 4:30 pm Processing soybeans for oil and meal - Dr. L. S. Wei

Tuesday, 3 June

- 8:30 - 11:30 am Soybean Oil Refining and Processing (Lecture) - Dr. E. G. Perkins, Professor, Dept. of Food Science, Univ. of Ill., (Morning session meets at Burnside's Research Lab) (3-1875)
- Quality of Soybean Oil (Lecture) - Dr. E. G. Perkins.
- 1:00 - 4:30 pm Antinutritional Factors - Dr. John W. Erdman, Jr., Professor, Dept. of Food Science. (3-2527)
- Review of Human Nutritional Requirements - Dr. John W. Erdman, Jr.

Wednesday, 4 June

- 8:00 - 10:00 am Soybean Meal for Animal Feed - Dr. Robert A. Easter, Assoc. Prof., Dept. of Animal Science (3-2557)
- 10:10 - 12:00 am Detection of Microorganisms in Foods - Dr. Scott Martin, Assoc. Prof., Dept. of Food Science, (includes demonstration of microbial control) (3-0516)
- 1:00 - 2:00 pm Margarine Manufacture - Dr. L. S. Wei
- 2:00 - 5:00 pm Tour of Spectrum Foods, Inc. - Joyce A. Lee Decatur, IL. (Tel. 875-3050).

Thursday, 5 June

- 8:00 - 11:45 am Preparation of Soybean Protein Concentrates and Isolates (Lecture & Lab) - Dr. L. S. Wei, Dr. Wilmot Wijeratne
- 1:00 - 5:00 pm Preparation of Soybean Protein Concentrates and Isolates (Lab Contd.) - Dr. Wilmot Wijeratne and Dr. Tsao-Ming Wei

Friday, 6 June

- 8:15 - 10:00 am Processing Whole Soybeans - Basic Concepts - Prof. Emeritus, A. I. Nelson, Food Science, Univ. of Illinois.

10:00 - 11:45 am Soaking and Cooking Whole Soybeans (Lab) - Prof. A. I. Nelson, et al.

1:15 - 4:30 pm Cooking Experiments Continued. Dry Dehulling of Soybeans (Lab) - Prof. A. I. Nelson, et al.

Monday, 9 June

8:30 - 11:30 am Full-Fat Soy Flour Production and Drum-Drying of Soy Products (Lecture/Lab) - Dr. L. S. Wei, et al.

1:00 - 5:00 pm Determination of Quantity and Quality of Soybean Oil and Oil Characterization (Lab) - Dr. L. S. Wei and Dr. Wilnot Wijeratne.

Tuesday, 10 June

8:00 - 11:45 pm Determination of Trypsin Inhibitors (Lab) - Dr. Sing-Wood Yeh and Dr. Tsai-Hing Wei.

1:00 - 5:00 pm Determination of NSI/PDI (Lab) and Determination of Protein by Micro-Kjeldahl (Lab) - Dr. Sing-Wood Yeh and Dr. Tsao-Hing Wei

Wednesday, 11 June

7:00 am Driving - Champaign-Urbana to Des Moines, Iowa
Prof. A. I. Nelson and L. S. Wei

Thursday, 12 June

8:00 - 12:00 am Lecture/Demonstration/Discussion of Extrusion Technology - Dr. Leroy J. Hanson, President, Insta Pro International, 10301 Dennis Drive, Des Moines, Iowa 50322 (Tel. 515/276-4524)

1:00 Driving - Des Moines, Iowa to Geneva, Wisconsin.

Friday, 13 June

9:00 - 12:00 noon Field trip of Kikkoman Foods, Inc., Walworth, Wisconsin 53184 (Dr. Shinichi Sugiyama, Executive Vice President and General Manager. 414/275-6181).

1:00 pm Driving - From Walworth to Champaign.

Saturday, 14 June - Wednesday, 18 June

Attend IFT Annual Meeting and 1986 Food Expo at Dallas, Texas

Thursday, 19 June To be announcedFriday, 20 June8:00 - 12:00 noon Determination of Urease (Lab) - Drs. Wilmot Wijeratne and Tsao-Ming Wei (at 294 Ag. Eng. Sci. Bldg. all day)1:00 - 5:00 pm Assay of Lipoxygenase Activity - Drs. Sing-Wood Yeh and Tsao-Ming WeiMonday, 23 June8:00 - 12:00 noon Extrusion (Lab) - Prof. A. I. Nelson and Dr. Wilmot Wijeratne
Characterization of Extrudates (Lab) - Prof. A. I. Nelson and Dr. Wilmot Wijeratne1:00 - 5:00 pm Twin Screw Extruder Operation (Lab and Lecture) - Prof. Ricardo Villota, Dept. of Food Science (3-9336)Tuesday, 24 June8:00 - 12:00 noon Mechanical Extraction of Oil (Lab) - Prof. A. I. Nelson and Dr. Wilmot Wijeratne1:00 - 5:00 pm Characterization of Products From Expeller (Lab) - Dr. Wilmot Wijeratne and Dr. Tsao-Ming WeiWednesday, 25 June8:00 - 9:30 am Soybean Beverages (Lecture) - Prof. A. I. Nelson9:45 - 12:00 noon Soybean Beverage (Lab) - Dr. Sing-Wood Yeh1:00 - 5:00 pm Soybean Beverage (Lab) (contd.) - Dr. Sing-Wood YehThursday, 26 June8:00 - 5:00 pm Soybean Beverage (Lab) (contd.) - Dr. Sing-Wood YehFriday, 27 June8:00 - 5:00 pm Preparation of Soy Yogurt and Soy Ice Cream (Lab) - Prof. A. I. Nelson, Dr. Sing-Wood Yeh, Sarah Martinez and George Lanter

Monday, 30 June

- 8:00 - 12:00 noon Oriental Soybean Foods (Lecture) - Dr. L. S. Wei
 1:00 - 5:00 pm Oriental Soybean Foods (Lab) - Dr. Sing-Wood Yeh

Tuesday, 1 July

- 5:00 am Driving to St. Louis, Mo.
 9:00 - 12:00 noon Functional Soy Protein in Food Products (Lecture/
 Demonstration) - Dr. Charles W. Kolar, Ralston
 Purina Co., 900 Checkerboard Square, St. Louis, MO
 63164 (314/982-2979)
 1:00 pm Driving to Champaign from St. Louis.

Wednesday, 2 July

- 8:15 - 10:00 am Harvesting, Handling and Storage of Grain and Soybeans.
 (Lecture) Dr. Gene Shove, Prof. Agr. Eng. (3-6762)
 10:15 - 12:00 noon Visit South Farm - Mr. Danny Erickson, INTSOY
 Agronomist.
 1:00 - 5:00 pm Individual Program

Thursday, 3 July

- 8:30 - 5:00 pm Visit Farms - (Mr. and Mrs. Ken Blanck, R.R. 1, Box 59,
 Onarga, IL 60955, Tel. 815/457-2648).

Friday, 4 July

Holiday (Independence Day)

Monday, 7 July

- 8:00 - 9:30 am Home and Village Level Concepts for Preparation of
Soybean Products (Lecture) - Prof. A. I. Nelson
 9:45 - 12:00 noon Soybean Program Development in Sri Lanka - Dr. M. M. M. M.
 Wijeratne and Mr. T. D. W. Siriwardena.
 1:00 - 5:00 pm Country Report

Tuesday, 8 July

8:00 - 12:00 noon Home and Village Level Preparation of Soybean Products
(Lecture/demonstration) - Ellen Jayawardena/Chief
Instructor, Home Level Training Unit, Sri Lanka
Department of Agriculture

1:00 - 5:00 pm Home and Village Level Preparations (Lab) - Ellen
Jayawardena

Wednesday, 9 July

8:00 - 5:00 pm Home and Village Preparation (Lab) - Ellen Jayawardena

Thursday, 10 July

8:00 - 5:00 pm Home and Village Preparation (Lab) - Ellen Jayawardena

Friday, 11 July

8:00 - 5:00 pm Home and Village Preparation (Lab) - Ellen Jayawardena

Monday, 14 July

8:00 - 10:00 am Participants Course Evaluation - Dr. L. S. Wei

11:00 am

Presentation of Course Certificates

1:00 pm

Preparation for Departure

Tuesday, 15 July

Participants Depart

SOYBEAN PROCESSING FOR FOOD USES - 1988

Sunday, 10 January

- Arrival - Travel to Kandy

Monday, 11 January

- 9:00 - 9:30 a.m. - Registration
- 9:30 - 9:45 a.m. - Welcome - Dr. S. L. Amarasiri, Acting Deputy Director of Agriculture, (Research)
- 9:45 - 10:00 a.m. - Opening Address - Mr. D. Nilaweera, Additional Secretary, Ministry of Agricultural Development and Research
- 10:00 - 10:30 a.m. - INTSOY Program/Introduction of Speakers
Dr. H. E. Kauffman, Director of INTSOY
- 10:30 - 11:00 a.m. - Comments by USAID Representative
- 11:00 - 11:30 a.m. - BREAK
- 11:30 - 12:00 a.m. - Announcements
- 1:30 - 4:30 p.m. - Tour of research facilities at Central Agricultural Research Institute (CARI)

Tuesday, 12 January

- 9:00 - 9:30 a.m. - Objectives of the Training Course
Professor A. I. Nelson
- 9:30 - 11:00 a.m. - Soybean Production in Developing Countries
(Lecture) - Mr. C. D. Dharmasena,
Agronomist/Project Co-ordinator,
Sri Lanka Soybean Program
- 11:00 - 12:00 a.m. - Discussion
- 1:30 - 4:30 p.m. - Round Table Discussion - Each participant is
required to make a brief presentation (5 minute
maximum) on his/her country's plans/programs fo
utilization of soybeans

Wednesday, 13 January

- 9:00 - 11:00 a.m. - Review of Human Nutritional Requirements (Lecture)
Professor Priyani Soysa
- 11:00 - 12:00 a.m. - Antinutritional Factors in Soybeans (Lecture)
Dr. W. B. Wijeratne
- 1:30 - 3:00 p.m. - Processing of Whole Soybeans - Basic Concepts (Lecture)
Professor Nelson
- 3:00 - 4:00 p.m. - Extrusion Processing Principles (Lecture)
Professor Nelson
- 4:00 - 5:00 p.m. - Dry Extrusion of Soybean Food Products (Lecture/Laboratory)
Professor Nelson and Dr. Wijeratne

Thursday, 14 January

- 9:00 - 10:00 a.m. - Mechanical Extraction of Soybean Oil (Lecture)
Professor Nelson
- 10:00 - 12:00 a.m. - Extrusion Processing (Laboratory)
Professor A. I. Nelson and
Dr. W. B. Wijeratne
- 1:30 - 5:00 p.m. - Dry Extrusion and Mechanical Expelling of Oil from Soybeans (Laboratory)
Professor Nelson and Dr. Wijeratne

Friday, 15 January

- 9:00 - 12:00 a.m. - Utilization of Expeller Cake and Expelled Oil (Lecture/Laboratory)
Dr. Wijeratne and Mrs. F. Hewavitharana
- 1:30 - 2:30 p.m. - Composition and Grading of Soybeans (Lecture) Dr. Wijeratne
- 2:30 - 5:00 p.m. - Grading of Soybeans (Laboratory)
Dr. Wijeratne and Mrs. Hewavitharana

Monday, 18 January

- 9:00 - 12:00 a.m. - Determination of Trypsin Inhibitors (Lecture/Laboratory)
Dr. T. M. Wei and Dr. Wijeratne
- 1:30 - 5:00 p.m. - Determination of Nitrogen Solubility Index/Protein Dispersibility Index and Determination of Protein by Micro-Kjeldahl (Lecture/Laboratory)
Dr. T. M. Wei and Dr. Wijeratne

Tuesday, 19 January

- 9:00 - 12:00 a.m. - Preparation of Soybean Protein Concentrates and Isolates (Lecture/Laboratory)
Profssor L. S. Wei, Dr. T. M. Wei and Dr. Wijeratne
- 1:30 - 5:00 p.m. - Preparation of Soybean Protein Concentrates and Isolates (Laboratory-continued)
Dr. T. M. Wei and Dr. Wijeratne

Wednesday, 20 January

- 9:00 - 12:00 a.m. - Processing of Soybeans for Oil and Meal (Lecture) Mr. A. P. Ponweera
Ceylon Oils & Fats Corp. Representative
- 1:30 - 3:30 p.m. - Refining, Processing, and Quality of Soybean Oil (Lecture) Mr. W. Yasakularatne
Ceylon Oils & Fats Corp. Representative
- 3:30 - 5:00 p.m. - Manufacture of Margarine (Lecture)
Mrs. R. Santhiapillai
Lever Brothers (Ceylon) Ltd.

Thursday, 21 January

- 9:00 - 12:00 a.m. - Full Fat Soy Flour Production and Drum Drying of Soy Products (Lecture/Laboratory)
Dr. Wijeratne and Dr. T. M. Wei
- 1:30 - 5:00 p.m. - Determination of Quality and Characterization of Soybean Oil (Laboratory)
Dr. T. M. Wei and Dr. Wijeratne

Friday, 22 January

- 9:00 - 12:00 a.m. - Determination of Urease Activity in Soybean Products (Lecture/Laboratory)
Dr. T. M. Wei and Dr. Wijeratne
- 1:30 - 5:00 p.m. - Assay of Lipoxygenase Activity (Lecture/Laboratory)
Dr. T. M. Wei and Dr. Wijeratne

Saturday and Sunday
23 & 24 January

- Field Tour - North Central Province
Visit to Soybean Cultivations, Storage
Facilities, and Processing Plants in
Anuradhapura

Monday, 25 January

- 9:00 - 10:30 a.m. - Soybean Beverages (Lecture)
Professor L. S. Wei
- 10:00 - 12:00 a.m. - Soybean Beverages (Laboratory)
Professor L.S. Wei and Dr. T. M. Wei
- 1:30 - 5:00 p.m. - Soybean Beverages (Laboratory-continued)
Professor L. S. Wei and Dr. T. M. Wei

Tuesday, 26 January

- 9:00 - 12:00 a.m. - Soybean Beverages (Laboratory-continued)
Professor L. S. Wei and Dr. T. M. Wei
- 1:30 - 5:00 p.m. - Review of Products Prepared from Solvent
Extraction of Soybeans (Lecture/Display)
Professor L. S. Wei

Wednesday, 27 January

- 9:00 - 12:00 a.m. - Preparation of Soy Yogurt
(Laboratory)
Professor L. S. Wei and Dr. T. M. Wei
- 1:30 - 5:00 p.m. - Soy Ice Cream
(Laboratory)
Professor L. S. Wei and Dr. T. M. Wei

Thursday, 28 January

- 9:00 - 12:00 a.m. - Oriental Soybean Foods (Lecture)
Professor L. S. Wei
- 1:30 - 5:00 p.m. - Oriental Soybean Foods (Laboratory)
Professor L. S. Wei and Dr. T. M. Wei

Friday, 29 January

- 9:00 - 12:00 a.m. - Soaking and Cooking of Soybeans
(Lecture/Laboratory)
Dr. Wijeratne and Mrs. Hewavitharana
- 1:30 - 5:00 p.m. - Economic Aspects of Soybean Processing and
Marketing - Dr. Jane E. Gleason

Sunday, 31 January

- Travel to Colombo for Field Tour

Monday, 1 February

- Visit Lassalle's Community Feeding Programme
- Spices & Essences (Ceylon) Ltd.
- U.N. Gunasekara - Tofu Plant

Tuesday, 2 February

- Visit Industrial Development Board (IDB)
- UNICEF Headquarters

Wednesday, 3 February

- Visit Ceylon Oils & Fats Corporation, Seeduwa
- CARE, Thripasha Factory, Ja-Ela

Thursday, 4 February

- National Holiday - Return to Kandy

Friday, 5 February

- 9:00 - 10:30 a.m. - Home and Village Level Concepts for Prepara-
tion of Soybean Products (Lecture)
Dr. Wijeratne
- 10:30 - 12:00 a.m. - Development of the Soybean Utilization Program
in Sri Lanka (Lecture)
Dr. Wijeratne and Mrs. Hewavitharana
- 1:30 - 5:00 p.m. - Home and Village Level Preparation of Soybean
Food Products (Lecture/Demonstration)
Miss E. Jayawardena and Mrs. Hewavitharana

Monday, 8 February

9:00 - 5:00 p.m.

- Home and Village Level Preparation of Soybean Food Products (Demonstration/Group Work)
Miss Jayawardena and Mrs. Hewavitharana

Tuesday, 9 February

9:00 - 5:00 p.m.

- Home and Village Level Preparation of Soybean Food Products (Demonstration/Group Work)
Miss Jayawardena and Mrs. Hewavitharana

Wednesday, 10 February

9:00 - 10:30 a.m.

- Functional Properties of Proteins in Food Systems (Lecture)
Dr. Wijeratne

10:30 - 12:00 a.m.

- Soya - The Protein Source in Thripasha - Integrated Health Nutrition Intervention for Sri Lankan Malnourished Mothers and Children (Lecture/Demonstration)
Dr. (Mrs.) B. V. de Mel

1:30 - 3:00 p.m.

- Soybean Meal for Animal Feed (Lecture)
Ceylon Oils & Fats Corp. Representative
Dr. P. A. L. Harischandra

3:00 - 5:00 p.m.

- Micro-Organisms in Foods (Lecture)
Dr. Upali Samarajeewa

Thursday, 11 February

9:00 a.m.

- Individual Consultations and Discussions

7:00 p.m.

- Presentation of Certificates and Closing Ceremonies

Friday, 12 February

- DEPARTURE

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WORKSHOPS/TRAINING COURSES

1. Zimbabwe, February 24 - March 7, 1986. Twenty-seven persons from six southern African countries participated in a soybean training program in Harare, Zimbabwe.

2. Zambia, October 8 - 16. ¹⁹⁸⁷ A two day workshop was held on October 8 - 9 for large scale soybean producers and processors in Zambia. The second part of the workshop was held on October 12-16 and covered home and village level utilization of soybeans. Over 100 Zambian participants attended the workshop in total. (see attached schedule)

ZAMBIA SOYBEAN UTILIZATION WORKSHOP

TARGET GROUP: INDUSTRY

OBJECT: INDUSTRIAL PROCESSING AND USE OF SOYBEANS IN ZAMBIA

Thursday (October 8)

Chairman:

9:00 - 9:15 Welcome/Orientation/Objectives ————— Javaheri/Temba?
9:15 - 9:45 Opening Speech ————— GRZ Official
9:45 - 10:15 Break
10:15 - 10:45 Overview of Soybean Processing
and Utilization————— Wijeratne
10:45 - 11:15 Current INTSOY Program————— Nelson
11:15 - 12:15 Dry Extrusion: Processing and
Products————— Nelson
12:15 - 12:30 Discussion
12:30 - 1:30 Lunch

Chairman:

1:30 - 2:00 Quality of Raw Materials and Good
Manufacturing Practices————— Nelson
2:00 - 2:30 Soybean Beverages & Dairy Analogs————— Wijeratne
2:30 - 3:15 Human and Animal Nutrition————— Weingartner
3:15 - 3:45 Break
3:45 - 5:00 Discussion

FRIDAY (October 9)

Morning: Demonstration of equipment/processing/products

Closing discussion

ZAMBIA SOYBEAN UTILIZATION WORKSHOP

TARGET GROUP: HOME ECONOMICS OFFICERS

OBJECT: HOME AND VILLAGE LEVEL PREPARATION OF SOYBEAN FOODS

Monday (October 12):

Chairman:

9:00 - 9:15 Welcome/Orientation/Objectives ----- Temba/Javaheri
9:15 - 9:45 Opening Speech ----- GRZ official
9:45 - 10:15 Break
10:15 - 10:45 Overview of Soybean Processing and
Utilization----- Wijeratne
10:45 - 11:15 Human Nutritional Requirements ----- Ashraf
11:15 - 11:45 Food Situation in Zambia (with reference
to protein availability) ----- Zambian?
11:45 - 12:15 Why Soybeans for Zambia ----- Zambian?
12:15 - 12:30 Discussion
12:30 - 2:00 Lunch Break

Chairman:

2:00 - 2:15 Soybean Production in Zambia ----- Javaheri/Temba?
2:15 - 2:30 Soybean Processing in Zambia ----- Joseph Mwele
3:00 - 3:30 Quality of Soybeans for Food Use ----- Wijeratne
3:30 - 4:00 Antinutritional Factors of Soybeans ----- Weingartner
4:00 - 5:00 Discussion

Tuesday: (October 13):

Chairman:

8:30 - 10:00 Processing of Whole Soybeans - Basic
Concepts ----- Wijeratne

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10:00 - 10:30 Break

10:30 - 12:00 Home and Village Concepts for
Preparation of Soyfoods ————— Wijeratne

12:00 - 12:30 Discussion

12:30 - 2:00 Lunch

Chairman:

2:00 - 4:30 Lecture/Demonstration ——— (In Charge) -Jayawardena
Scholastica
Ashraf

- Soaking and cooking whole soybeans
- Preparation of full fat soy flour
- Infant weaning food

4:30 - 5:00 Discussion

Wednesday (October 14):

Chairman:

8:30 - 9:30 Soy beverages, yogurt & ice cream————— Wijeratne

9:30 - 10:00 Uses of Full-Fat and Partially Defatted
Flour in Zambia ————— Chabala Mwale

10:00 - 10:30 Other soy products for Zambia—————

10:30 - 11:00 Break

11:00 - 12:30 Questions and answers

12:30 - 2:00 Lunch Break

2:00 - 5:00 Visit to factory or nutrition center

Thursday (October 15):

A.M. and P.M. Demonstration of Making Various Soyfoods
(In charge) — Jayawardena
Scholastica
Ashraf

Friday (October 16):

8:30 - 10:00 Questions and Answers (Panel)

10:00 - 10:30 Closing Remarks

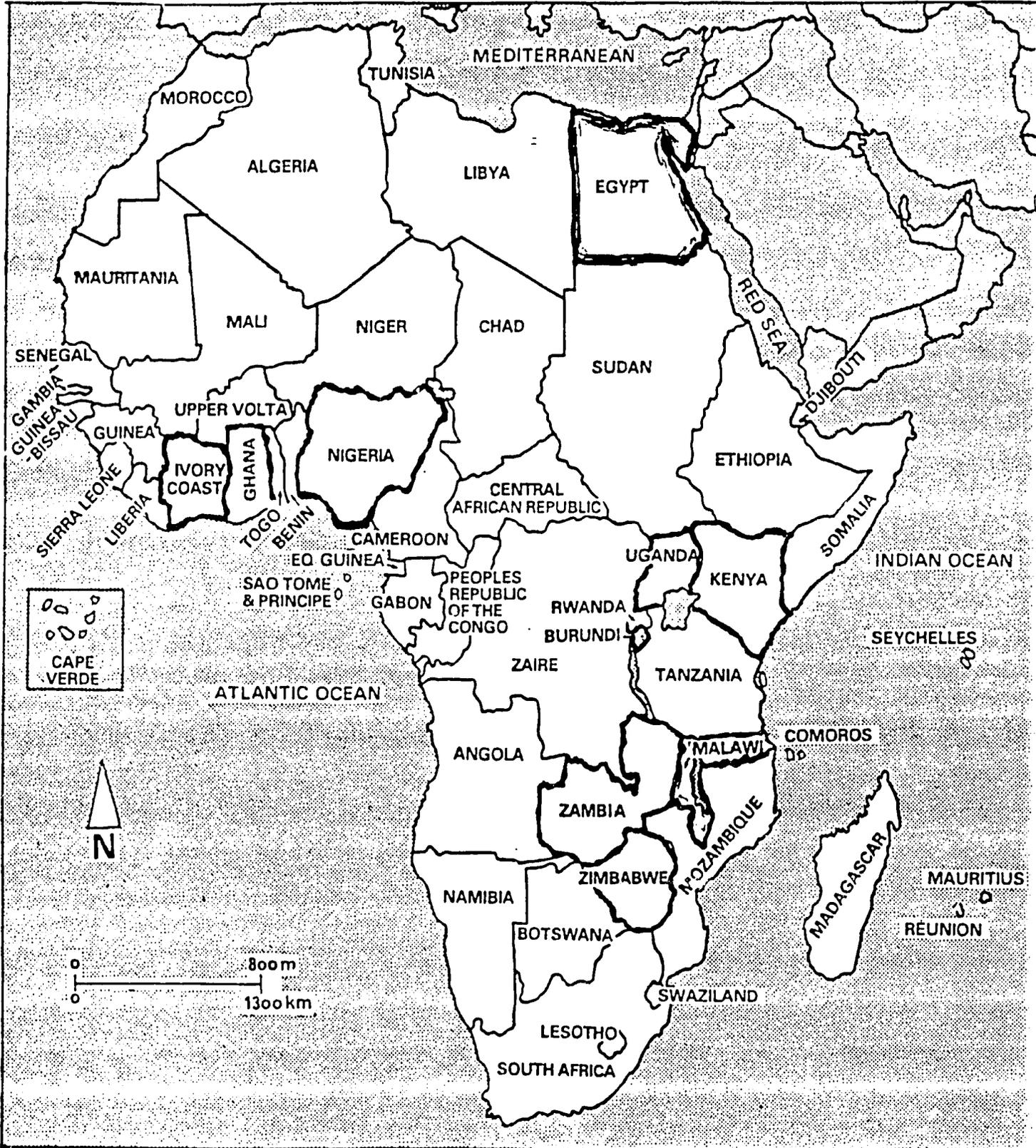
APPENDIX 10

CURRENT AND POTENTIAL FUTURE PROJECTS IN AFRICA AND ASIA

Current Projects

Invited

AFRICA



al

Africa Projects

Nigeria

Collaboration with Institute for Agricultural Research & Training (IAR&T).
Collaboration with International Institute of Tropical Agriculture (IITA).
Advising food companies and businesses.
Training.
Special Project (see below).

Ghana

Collaborate with soybean breeder.
Special Project (see below).

Ivory Coast

Special Project (see below).

Uganda

Conduct in-country training course (January 1990).
Advise Africa Basic Food Co. and other companies.
Install extruder to be operated in conjunction with existing screw press.
Advise Experiment in International Living (EIL) on roasting equipment.

Kenya

Advise and assist Ken-Soy Co. in acquisition and installation of
extrusion/expelling equipment.
Conduct in-country workshop on June 1990.

Zambia

Advise companies on soy processing.
Conduct in-country training course February 1990.
Conduct feasibility study for Soy Nutrients Co. (?)

Zimbabwe

Collaborate with Oilseeds Processors Association
Advise NUTRESCO
Participate in workshop March 1991.

Special Project

INTSOY and FAO (Food and Agricultural Organization of the United Nations) are involved in a joint project to establish and field test a model for extrusion/expelling technology in Africa. Since November 1988, the following countries were visited by an INTSOY/FAO team: Burkina Faso, Ivory Coast, Ghana, Togo, Benin, Nigeria and Cameroon. The purpose of the visits was to

ascertain the interest of the governments in a soybean project involving medium-scale technology to produce edible soybean oil and protein-rich soybean-based foods. Information on soybean production, research, marketing, and utilization was collected. Since May 1989, the team has made follow-up visits to Ivory Coast, Nigeria and Ghana, the countries that appear to have the most potential for such a project.

On August 7 and 8, 1989, a INTSOY/FAO team met with senior officials of the United Nations Development Program (UNDP) in New York City, to discuss the possibility of UNDP funding the project. The response was favorable. UNDP gave some suggestions as to what immediate steps should be taken. There is a possibility that the project could be funded in 1991, at the start of UNDP's next five year budget cycle.

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TRIP REPORT - EAST & WEST AFRICA
KARL WEINGARTNER
October 25-December 10, 1988

SUMMARY

Four countries in East Africa, Uganda, Kenya, Zambia, and Zimbabwe - were visited from October 25 to November 16. Meetings and visits were made to USAID Agricultural Development Officers, government officials, and representatives of companies interested in manufacturing soyfoods. In Uganda, INTSOY was requested to supply consultants for the USAID/MFAD project that is supervised by Ohio State University. INTSOY may be asked to conduct an in-country training course in 1989. Technical assistance was given to the African Basic Food Company. In Kenya, there were discussions about a USAID/INTSOY in-country training course for June 1990. INTSOY will assist Ken Soy in developing a soybean factory to make human food. In Zambia, a soybean workshop funded by the ZAMARE project was proposed for 1989 or 1990. INTSOY may participate in the ZAMS project to test small-scale oil processing equipment.

The trip to West Africa was an exploratory step in the development of an INTSOY/FAO Africa-based utilization project. The project involves the field testing of a new INTSOY technological process in which soybean oil and high-grade, protein-rich defatted soybean cake are manufactured using medium-scale equipment. Five countries, Ivory Coast, Ghana, Togo, Benin, and Nigeria - were visited between November 17 and December 6, 1988. In each country, government officials and FAO staff were interviewed to determine the country's initial degree of interest in such a project. Information on soybean utilization, marketing, and research was also collected. Nigeria has the necessary inputs, a market in some areas, personnel trained in food technology and home economics, and expanding soybean production. However, linkages between the producer and the market are weak. The project would address this constraint. In Ghana, government officials expressed strong support for this project idea (from departmental directors to the ministerial level). A national soybean production scheme is scheduled to begin in 1989. Before our discussions, the government had not considered how it would affect utilization. Ivory Coast is implementing a new soybean production program in the northwest part of the country. It has a well-trained staff of researchers and extension agents. This project would provide a local market for part of the intended soybean production and inexpensive protein-rich food for the rural and urban areas. Burkina Faso, Togo, and Benin are less suited for this project. Only a small area in Burkina Faso is suitable for soybean cultivation. There is currently little expertise in food technology to develop locally acceptable food products. In Togo, the government has not expressed strong interest in the project. In the future, the private sector may find the technology profitable. In Benin, the scale of the project might be inappropriate for the current level of development in the country.

TRIP REPORT
NIGERIA, UGANDA, KENYA, ROME
February 10 - March 3, 1989

SUMMARY

The objective of this trip was to lecture at a soybean workshop and to develop collaborative projects between INTSOY and African research and business groups involved in soybean utilization. In Nigeria, I lectured at the Soybean Foods Production Workshop sponsored by the American Soybean Association (ASA), held at Lagos, Nigeria from February 13-15, 1989. There is a possibility for INTSOY/ASA collaboration. One scientist from the Institute for Agricultural Research and Training (IAR&T) in Ibadan, Nigeria, may be recruited to spend July 1989 at INTSOY as a visiting scholar. The International Institute of Tropical Agriculture (IITA) also in Ibadan, Nigeria, is continuing research on soybean utilization. Two scientists from the institute will visit INTSOY in March 1989 to discuss joint INTSOY/IITA projects. In Uganda, INTSOY has been requested to submit by May 1989, a complete plan for an extrusion/expelling factory which will manufacture edible oil and high protein flour. An in-country utilization course is planned for January 1990. In Kenya, Ken Soya is progressing in its efforts to purchase soybean processing equipment. In FAO (Rome, Italy), plans had been made for a trip to West Africa in Spring 1989, in order to produce an FAO/INTSOY project document.

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Trip Report - Uganda, Kenya, Ghana
Ivory Coast, Rome
May 24 - June 25, 1989
Karl Weingartner
International Soybean Program (INTSOY)
Urbana, IL, U.S.A.

Summary

The visit to Uganda involved meetings and site visits to determine INTSOY's role in the MFAD project. In meetings with Mr. Ken Lyvers, Agricultural Development Officer, USAID/Kampala, Dr. Al Agard, Project Officer USAID/Kampala, Dr. Trevor Arscott, Team Leader, MFAD and others, a program was approved. INTSOY's budget will be \$139,000 over four years. The money will be used for travel, training, an extrusion/expelling study and equipment. An in-country training course in soybean utilization has been proposed for January 1990. Discussions were continued on the possibility of an INTSOY extrusion/expelling factory. USAID/Kampala has decided to postpone the decision about the factory until it receives and evaluates a report on Ugandan oil mills that is being prepared by RONCO.

Three West African countries, the Ivory Coast, Nigeria and Ghana, were visited to gather information for an FAO/INTSOY extrusion/expelling project document. In June 1989, the Ivory Coast received a loan of 30 billion Fcfa (\$80 million) for a rural agricultural development project that will include soybeans. The agency involved with this project (Direction et Controle des Grands Travaux, DCGTX) has not yet formulated a soybean utilization program. It has requested FAO to install two extrusion/expelling factories in the Ivory Coast as soon as possible.

The following recommendations were made during the debriefing with Ken Lyvers and Dr. Trevor Arscott:

1. In 1989, initiate a soybean utilization program involving the International Soybean Program (INTSOY) and the MFAD project.
2. Arrange for a soybean utilization expert as a consultant to visit USAID/Kampala four times during 1989.
3. Strengthen African Basic Foods by: (a) helping upgrade existing equipment; (b) assisting in development of new products; and (c) investigating the use of extrusion/screw press technology to produce human and animal foods.
4. Survey existing oil mills to determine: (a) crushing capacity and (b) ability to extract oil from soybeans.
5. Conduct a training course to teach government home economists how to prepare soybeans in the home.
6. In consultation with Dr. David Muduuli, Makerere University, investigate the development of small, rural soymilk factories.

ACTION

1. Talk/visit Dr. W. Harrison of African Basic Foods.
2. Check on extrusion equipment.
3. Contact/visit Mark Erbaugh, MFAD Coordinator at OSU, Columbus, Ohio.
4. Contact Dr. Poul Hansen, Food Science, OSU about dairy equipment.
5. Contact Thomas Brennan, ASA about collaboration in animal feed demonstration.
6. Obtain rubber gasket for Dr. Edison Rugumayo's oil press.
7. Set up schedule for 1989 visits to Uganda with Ken Lyvers, Mark Erbaugh and Dr. Trevor Arscott.
8. Get information on roasting machine for Experiment in Living (send information to Ken Lyvers).
9. Follow up with Dr. Chuck Simkin, MFAD (Kampala) on training course for home economists.

COUNTRY REPORT - UGANDA
(October 28-November 2, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

Mr. Ken Lyvers, Agricultural Development Officer
Dr. Albert Agard, Jr., Agricultural Adviser
Dr. Fred Winch, Assistant Director
Dr. William Fenster, Adviser Ministry of Agriculture
(MFAD Project)
Dr. Charles Simkin, Crop Research Adviser (MFAD Project)
Dr. Trevor Arscott, Team Leader (MFAD Project)

Ministry of Agriculture

Dr. Austin Osuan, Commissioner, Agriculture Extension
Dr. Gadi Gumisiriza, Soybean Breeder, Nanoulong Research Station

Makerere University

Prof. John Mugerwa, Dean, Faculty of Agriculture and Forestry
Dr. David Muduuli, Senior Food Chemist
Dr. Edison Rucumayo, Department of Agriculture Engineering

African Basic Foods Ltd.

Mr. Charles Nakyaali, Managing Director

Uganda Grain Milling Company

Mr. J. B. Kashsiri

DISCUSSION

USAID funds for an agricultural project, Manpower for Agricultural Development (MFAD) which is administered by the Ohio State University (OSU). The project has a staff of one AID project officer and three agricultural scientists recruited by OSU. The Agricultural Development Office (ADO) in Kampala wants to include soybean utilization in this MFAD project.

Soybeans are reported to grow well in all regions of Uganda. Yields from initial on-farm trials average 700-1000 kg/ha. Trials from research stations yield at least 1.5 mt/ha. Help is needed to develop a utilization component. A program needs to be implemented to train the trainers--home economists and extension workers--people who can train other people in how to cook soybeans. As of now, home utilization is confined to roasting soybeans as a snack. There is a need to develop processes to extract oil from soybeans and utilize the high-protein cake for human and animal use. This will require evaluation of low-cost and durable machines.

COUNTRY REPORT - UGANDA

February 19-24, 1989

Contacts

U.S. Agency for International Development (USAID)
Mr. Ken Lyvers, Agricultural Development Officer
Dr. Albert Agard, Jr., Agricultural Adviser
Dr. William Fenster, Adviser, Ministry of Agriculture (MFAD Project)
Dr. Charles Simkin, Crop Research Adviser (MFAD Project)
Dr. Trevor Arscott, Team Leader (MFAD Project)

Ministry of Agriculture

Dr. Austin Osuan, Commissioner, Agriculture Extension
Dr. Gadi Gumisiriza, Soybean Breeder, Nanoulong Research Station
Mr. F. A. Ojacor, Deputy Commissioner for Agriculture
Sarah N. Kiyi--gi, Deputy Commissioner for Agriculture
Abby Kalule Sewali, Senior Agricultural Officer/Home Economics
Mr. Y. W. Mwaule, Director of Research

Makerere University

Professor John Mugerwa, Dean, Faculty of Agriculture & Forestry

Companies

Mr. Charles Nakyaali, Managing Director, Africa Basic Foods Ltd.
Mr. Thomas Katto, Chairman, Sanyutex Ltd.
Mr. Patrick Katto, General Manager, Sanyutex Ltd.

Central Cooperative Union

Mr. William Verner, Advisor
Mr. William Okoroi, General Manager

FAO

Mr. Amir Khalil, FAO Representative

Discussion

Talks were held with USAID and the Uganda Central Cooperative Union concerning the extrusion/expelling project that INTSOY had submitted to USAID/ Kampala in February 1989. USAID has now requested INTSOY to submit a complete project proposal. Emphasis is to be given to the description of equipment, equipment maintenance, plant design, schedule of operation, budget, and training of employees. USAID and the Uganda Cooperative could start funding this project as early as July 1, 1989.

The Commissioner for Agriculture, Deputy of Commissioner for Agriculture, Director of Research, and Head of Home Economics expressed approval for having an in-country soybean utilization workshop. It was suggested that INTSOY conduct two workshops, one week each, back to back,

during January 1990. In-country costs are estimated at roughly SH1.5 million.

Africa Basic Foods is refurbishing its facility. Mr. Paul Alrod, an engineer with experience in extrusion processing, will spend six weeks at Africa Basic Foods helping to repair and redesign the existing equipment. The factory manager is building a space for a quality control laboratory and storage area for the products. They requested INTSOY to design and provide equipment for a simple, functional quality control laboratory.

Action

1. Develop proposal on extrusion/expelling project.
2. Invite Dr. Agard to visit INTSOY.
3. Design quality control laboratory for Africa Basic Foods.
4. Invite scientists to China conference.
5. Contact Dr. Simkin.
6. Contact Binderskampel (Netherlands).
7. Contact Khalil.

Uganda
May 24 - June 3, 1989

People Contacted

USAID

Mr. Ken Lyvers, Agricultural Development Officer
Dr. Albert Agard, Jr., Agricultural Adviser
Dr. William Fenster, Adviser, Ministry of Agriculture (MFAD)
Dr. Charles Simkins, Crop Research Adviser (MFAD)
Dr. Trevor Arscott, Team Leader (MFAD)
Mr. Isaac Aviga-Aluba, Agronomist

Ministry of Agriculture

Mr. Faustine Ojacor, Acting Commissioner, Ag. Extension
Dr. Joseph Mukiibi, Secretary for Research
Dr. Gadi Gumisiriza, Soybean Breeder, Namulonge Research Station
Mrs. Abby Kalule-Sewali, Senior Ag. Officer, Home Economics

Makerere University

Prof. John Mugerwa, Dean, Faculty of Ag. and Forestry
Dr. Edison Rugumayo, Dept. Agric. Engineering

Agencies

Mr. Thomas Carr, Agricultural Cooperative Development
International (ACDI)
Mr. William Verner, ACDI
Mr. William Salmond, Experiment in International Living (EIL)
Mr. Richard Newberg, RONCO Consulting Corporation

Companies

Mr. Charles Nakyaali, Africa Basic Foods
Mr. Mike Ochieng, South Bukedi Coop Union (Tororo)
Mr. Charles Twagira, Oilseeds (Uganda) Ltd.
Mr. Nirmal De, Uganda Bags & Hessian Mills Ltd.

Discussion

Workshop: The idea of having a soybean utilization workshop was proposed in October 1988. The subject was brought up and approved during a meeting with the acting Commissioner of Agriculture (Extension), Secretary for Research and the Senior Home Economics Officer, on May 25. A follow-up meeting was held on May 31 and was attended by Mrs. Abby Kalule-Sewali, Dr. Gadi Gumisiriza, Issac Aviga-Aluba and me. The following was proposed for the workshop: (a) a budget of five million shillings, (b) the time of instruction will be one week (5 days), (c) a schedule of events, subjects and speakers, (d) the number of participants to be reduced from 67 to 40 and (e) Dr. Warren Harrison of African Basic Foods should be invited to attend the workshop. On another occasion, Mukano District Farm was visited. Many workshops for agricultural workers have been held there. The farm has a large classroom, dormitories and a recreation room. There is both an indoor kitchen with electric stove and an outdoor kitchen. The outdoor kitchen will be suitable for the home/village soybean utilization demonstrations.

In another meeting, Dr. Chuck Simkins proposed that USAID supply additional inputs to assist the Extension workers in reaching the people in their district with this information. In my exit meeting with Ken Lyvers and Al Agard, it was proposed that it might be appropriate to invite only Extension workers from the districts in which soybeans are now being grown. Lyvers also approved the idea of Dr. Harrison attending the workshop.

Action:

1. Gumisiriza, Aviga-Aluba and Mrs. Kalule-Sewali to meet on June 12.
2. Simkins and Gumisiriza to meet Lyvers and Agard to check on possible additional inputs by USAID following the workshop.
3. Gumisiriza to find out when school bus will be available in 1990.
4. Mrs. Kalule-Sewali and Gumisiriza to check on possibility of visiting nutrition hospital during the workshop.

5. Weingartner to make follow up-visit in November 1989.

Extrusion/Expelling Processing Factory: In February 1989, USAID/Kampala requested that INTSOY design an extrusion/expelling factory that would be able to process small quantities (several tons/day) of soybeans. The advantage of such a system is that the equipment costs are reduced by an order of 100 to 1,000 times. Information relating to the power requirements were sent to William Verner for his evaluation. A meeting held on May 31 was attended by Lyvers, Agard, Arscott, Verner, Newberg, Aviga-Aluba and Weingartner. Verner suggested that the equipment cost might be too high for the amount of soybeans to be processed. Newberg thought that the process might be relevant for Uganda. He felt, however, that more economic information was needed.

It was decided to postpone making a decision on this extrusion/expelling project until more information becomes available. RONCO has prepared a report of the status of oilseed processing in Uganda (1989). When this report becomes available, USAID/Kampala will consider conducting a feasibility study.

Action:

1. Wait for RONCO's Uganda oil mill factory to be completed.
2. Decide if feasibility study is needed.
3. Determine if an extruder should be installed at Tororo.

Soybean Production: Soybean trials were observed at the following locations: Namulonge Research Station, Nakabanco Varietal Trial Center near Jinja and the Tororo District farm. The soybeans appeared to be very healthy, that is, free from disease and major insect problems. Dr. Gadi Gumisiriza, soybean breeder, said that many of the varieties he has received from the International Institute of Tropical Agriculture (IITA) had high yields, some as much as 3 MT/ha. However, these varieties are prone to lodging. Other varieties from INTSOY have lower yields but do not lodge. He expects to release a variety later this year. In addition, he is testing the effect of inoculum on Ugandan soybeans. Although yields can be very high when soybeans are grown at research stations, the yields tend to be much lower when grown by farmers. The Agricultural Officer in Tororo said that four counties in the district produced 5950 MT from 9925 ha, about 600 kg/ha (the number of hectares seems very high and may be incorrect).

Soybean Utilization: The main growing area for soybeans is in the area around the town of Jinja. At the Jinja market, whole roasted soybeans and flour were being sold. The soybean flour sold for about Shillings 200/kg. Soybeans are most commonly consumed in their roasted form, as a snack. The soy flour is bought by women to be added to cereals and fed to children as a gruel or pap.

Action:

1. Visit other areas, perhaps in the west and south, to determine how/if soybeans are used.
2. Determine if soybeans are used by hospitals or nutrition centers.

Oil Mills: Two oil mills were visited to determine their capacity and suitability for processing soybeans. The EMCO Oil Mill in Jinja is very large. It was built to produce oil from cottonseed. There is a large prepress. After passing into the prepress, the cottonseed is fed into small oil screw presses (Simon Rosedowns), each of which is equipped with a cooker. In addition to the oil extraction equipment, there is a soap factory and a facility that can produce double-refined oil. The factory has not been operating for a while. The manager said that the screw presses and other equipment were all in working order and that it only required raw material (i.e. cottonseed) for the factory to start up. The second oil mill was located in Tororo and owned by the South Bukedi Coop Union. The factory was built in 1988 by a company from East Germany. It contains cleaning equipment, a roller mill, four screw presses (total capacity 30 MT/day) and an oil refinery (capacity 12 MT/day). The Coop intends to crush cottonseed and sunflower seed. The factory was not operating because of the lack of raw material. Neither of these factories had been aware of the possibility of using soybeans as a potential raw material. In fact, the manager of one factory said he thought that it was not possible for the machines to process soybeans.

Africa Basic Foods: Some improvements have been made since my last visit in February 1989. The extruder has been fitted with a new shaft. The boiler was working. The factory manager said the company could now make texturized soy, a soy product that has a meat-like texture. We tried to make texturized soy on June 2 but were not successful. The company now has a storage area and a room for a small laboratory.

Action:

1. Determine equipment for the laboratory.
2. Plan to spend one or two days at ABF on my next visit.

Experiment in International Living (EIL): EIL has just completed the first phase of its work. It is waiting for approval to begin the next phase. It would like to use roasters in conjunction with an oil screw press to process oilseeds. This method will probably cause the oil to be black and unacceptable to consumers.

Action:

1. Obtain information about roaster available on the market (cost, capacity etc.).
2. Find two rubber gaskets for Dr. E. Rugumayo.
3. Get information about the Beilenberg press.

COUNTRY REPORT - IVORY COAST
(November 17-19, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

Robert Kidd, Food for Peace
James Washington, Training Officer

FAO

E. Tadesse, Program Officer
M. Dia, Representative

Direction et Controle des Grands Travaux (DCGTX)

Nicaise Ehoue Bleo, Ingenieur Agronome
Alain Munsier, Ingenieur Agro-Economist
Mamadou Cherif, National Seed Production

Ministry of Agriculture

Benoit N'Dri Brou, Ingenieur de Genie Rural, Directeur de
l'Office des Semences et Plants
Jean Claude Guyot, Representant de le Ministre de l'Agriculture

Centre Ivoirien des Recherches Technologiques (CIRT)

Abou Attier LeFry
Michael Lingani

Oaayode Odu Bakary, Directeur des Programmes de Recherche et de
la Formation, Ministry de la Recherche Scientifique

Koffi Goli, Directeur General d'IDESSA (Institut de Savannes)

DISCUSSION

Farms to produce soybeans, established in the early 1980s, yielded 1.8 mt/ha in the northwest area of Ivory Coast, but soybeans were not extended to local farmers. Currently there is no soybean production in Ivory Coast. Some oilseed crushing capacity exists. At least one mill has crushed soybeans produced at the agriculture research farms. A small amount of soybean cake is imported for livestock feed.

There is a possibility to replace imports with local soybean products. About 5,000 to 7,000 mt soybean meal are imported annually for animal feed. The sardine canning industry imports rapeseed oil for sardine canning. Wheat is a major import that could be partially replaced by soy flour. There may be less local market for refined or partially refined cooking oil as the supply of other preferred cooking oils is adequate.

Specific information on human nutrition was not available. Ivory Coast is in a more satisfactory economic condition than its neighbors and is not considered a less developed country (LDC). According to one official, Ivory Coast meets about 95 percent of its protein requirement. There may be need for home preparation of whole soybeans to prevent infant protein malnutrition.

A soybean production project has been initiated by the office of the President and developed by the Direction et Controlle des Grands Travaux (DCGTX). It is strongly supported by research, extension, marketing, and financial institutions.

The areas of Odienne and Touba in the northwest part of the country have been selected for an intensive farming and relocation scheme intended to produce yams, rice and maize, all in annual rotation with soybeans. Beginning in 1989, 24,000 hectares will be cleared and prepared.

Soybean marketing is not well defined in the proposed scheme. Industrial uses and import replacement as discussed are anticipated. Imported soybean meal sells for 90.000 CFA/mt.

The government of Ivory Coast is committed at the highest level to soybean production and there is little doubt that soybean production will begin in 1990. Researchers were enthusiastic about developing commercial food products from soybeans, especially technology using extrusion cooking. The government is able to provide support for soybean research and utilization.

Possible reasons for not having such a project in Ivory Coast must also be mentioned. Ivory Coast is not an LDC and there may be less justification for siting the project there from the standpoint of nutritional need. The government project views soybeans as an industrial crop and envisions centralized processing while the project proposed by FAO views soybeans as a food crop to be processed locally. This situation could create a possible conflict and competition for the available production.

ACTION

1. Ivory Coast should be considered as a possible site for the INTSOY/FAO Project.

Ivory Coast
10-21 June, 1989

Contacts

Direction et Controle des Grands Travaux (DCGTX)
Mr. Bleoue Nicaise Ehoue, Ingenieur Agronome
Mr. Alan Annunsier, Ingenieur Agro-Economist
Mr. Gbogou Lohoury Didier, Ingenieur Agronome
Mr. David Loue
Mr. Cesaroeo Antione, Directeur General

Yoplait (yogurt)
Mr. Roger Abinader, President
Mr. Serge Montreuil, Directeur

Novalim-Nestle
Mr. Jean-Louis Chaumeil, Directeur
Mr. Christian Laplace, Chef de Production

Trituraf Oil Mill (Bouake)
Mr. A. Rashid, Directeur Usine
Mr. Assagov Aime, Commercial Directeur

Societe Ivoirienne de Productions Animales (SIPRA) poultry
Mr. Roland Audren, Directeur General

Ministere de la Promotion de la Femme
Mrs. Reine Brigitte (Agbassy) Boni

FAO
Dr. Yossef Tadesse, Administrateur de Programme

Discussion

Ivory Coast was one of three countries selected as a possible site for the FAO/INTSOY extrusion project. When Dr. Root and I visited the Ivory Coast in November 1988, we were told that the government expected to begin a large agricultural production project in the northwest part of the country. Upon our arrival on June 12, we learned that on June 6, 1989, the African Development Bank (ADB) had agreed to lend the government 30 billion Fcfa (300Fcfa = US\$1.00) to finance this project. This discussion will cover the following topics: description of the project, site visit, visit to oil mill, other factories and a summary.

Project: The project title is Project for Development of Soybean Production in the Northwest. The goals include increasing and modernizing agricultural production by creating mechanized family farms. The project will be supervised by Direction et Controle des Grands Travaux, DCGTX, (direction and control of major projects). This group, DCGTX, is not under any ministry (agriculture or health) but rather, it reports directly to the President. The project will establish both large (80 ha) and small (14 ha) farms. Over its four-year life, farmers will be

trained in production, equipment maintenance and money management so that they can become independent. After four years, the farmers will own the land they farm. Production units are organized into modules, each consisting of one large farm (80 ha) and 12 small farms (14 ha each). There will be 49 farm modules each, near Odienne and also at Touba. At first, the modules will be located near the towns. However, as the project grows, the newer modules will move toward each other. For 1989, 16 modules have been assigned to 16 large-scale farmers and 192 small farmers. They will be required to sow soybeans each year on half their farm area. By 1993, soybean production should be about 12,000 ha. A 45 hp tractor will be provided for each 80-ha farm and every three 14-ha farms.

Site visit: A visit was made to Odienne to see the soybean seed farm and the new site for the module farms. The government has begun building a large agricultural research station at Odienne, to be used for training farmers. Offices, homes, kitchens, recreational areas and training facilities are in the process of being built. The seed farm is producing soybean seed for distribution to farmers during the next growing season. Fields are being cleared. So, although the project has just begun on paper, it is actually already beginning to take shape.

Oil Mill: The Trituraf oil mill in Bouake is one of the major oil mills. It produces edible refined cottonseed oil and cake. The oil is sold in the Ivory Coast. Most of the cake is exported (the cake is considered valuable because it is a source of foreign exchange); a small amount is used for poultry feed. The factory tries to operate 24-hour days for 300 days/year (it usually achieves 80 to 90% of this goal). The factory processed 120,000 MT of cottonseed in 1988 and has a goal of 145,000 MT for 1989.

Factories: The following food factories were visited: Yoplait, Nestle and SODEPRA. The Yoplait factory in Abidjan makes traditional yogurt and yogurt drinks. All of the ingredients except water are imported. The company has no interest at this time in making a soybean yogurt. Nestle, also located in Abidjan, makes three products: maggi cubes (a meat-flavored cube made by hydrolyzing cottonseed meal); Bonfoutou, a convenience food made from yam flour that when hydrated, resembles pounded yam (a popular food in West Africa); and Cerelac, a milk/wheat-based baby food. Nestle is building a food research institute at the Abidjan factory. The institute will be staffed by 16 food technologists and 2 agronomists. Its mission will be to develop commercial foods for Africa using locally grown materials. SODEPRA (Societe de Developpement et Production Animale), with factories in Odienne and Abidjan, makes animal feed, and raises poultry and cattle. In 1988, it manufactured 75,000 MT of poultry feed, which consists of about 6% imported soybean meal. SODEPRA imports soybean meal from Brazil at 80 Fcfa/kg (300 Fcfa = US\$1.00). It is not likely that the soybeans produced under the project mentioned will be sold at such a low price.

Summary: The situation in the Ivory Coast is rather unusual. It has been granted about the equivalent of US\$80 million to start an agricultural production project in which soybeans will be one of the major crops grown. The project will be under the control of the Grands Travaux (DCGTX), a group that has access to trained people and equipment that other groups and ministries do not have. Shortly before leaving the Ivory Coast, we met with the Director General of the Grands Travaux. The meeting, which could have been a simple 5-minute courtesy call, developed into 1 1/2 hours of conversation. Grands Travaux expects that the farmers will be harvesting their first soybean crop in November 1990. There is not yet any plan for using these soybeans in the Ivory Coast. The Director General saw a 21-minute video film that described the extrusion/expelling process developed by INTSOY. He would like FAO to immediately initiate two extrusion/expelling factories in the Ivory Coast.

Action

1. Work with FAO (Rome) to develop an extrusion/expelling project for the Ivory Coast.

COUNTRY REPORT - NIGERIA
(December 1-6, 1988)

ORGANIZATIONS/PERSONS CONTACTED

International Institute of Tropical Agriculture (IITA)
Dr. S. R. Singh, Director, Grain Legume Improvement Program
Henry Ogundipe, Food Technologist
Dr. Glen Hartman, Plant Pathologist
James Sentz, USAID Liaison Officer
Kim Atkinson, Head of Publications
Dr. Y. Jeon, Post Harvest Technologist

Institute for Agriculture Research and Training (IAR&T)
Dr. Peter Oyekan, National Soybean Coordinator
Mrs. Sidi Osho, Food Technologist

University of Ibadan
Prof. O. O. Tewe, Department of Animal Science

Dr. Mathew Eshalomi, Businessman

DISCUSSION

There is a potential market for soybean products in Nigeria, especially vegetable oil. Partially refined soybean oil has successfully been marketed for home use in Kaduna and Oyo states. Nigeria has at least 10 major oil mills all of which are producing at less than 60 percent capacity. Production of groundnuts for crushing has faltered and soybean is one of the logical alternatives. Nigeria has a growing commercial poultry industry held back, in part, by the lack of affordable animal feed. In some areas, such as northern Oyo State, soybeans are appreciated by families who cannot afford to buy meat or milk. In Oyo and Kaduna states, soybeans are sold in local markets for the same price as cowpeas. A study by IITA in 1987 showed that soybeans in Oyo State were more profitable to grow and sell than maize or yams.

The major traditional use of soybeans is for the cottage industry production of dawa-dawa (beef-like cubes added to stews). This industry is based in southern Kaduna State. Dawa-dawa from Kafanchan is sold as far away as Chad and Niger. Since the devaluation of the Nigerian currency, there is increased industrial processing of soybeans. Oil mills in Zaria, Funtua, and Gusau have crushed soybeans to produce oil and defatted cake. Feed mills in Jos and in Oyo State roast whole soybeans for poultry feed. The Baptist Mission at Ogbomosho uses soybeans successfully in the treatment of severe protein malnutrition in infants and have popularized the home preparation of soybeans. Health workers and home economists have developed at least 20 locally acceptable foods using soybeans. There are several mass marketed commercial baby foods made in part with local soybeans, including a Nestle product, manufactured and widely distributed in Nigeria.

The major soybean markets are in Benue State and southern Kaduna State. The price of soybeans has been extremely volatile since 1982 and is largely dependent on government policy.

There are well-established food technology departments at several Nigerian universities and in private industry. The University of Ibadan, University of Ife, and Ahmadu Bello University (Zaria) all have active and enthusiastic home economics departments. A number of locally acceptable dishes have already been developed using soybeans prepared in the home. There is a need now to expand extension of this home processing technology to other areas.

In 1987, IAR&T and IITA received a grant from the International Development Research Centre (Canada) to develop methods of increasing soybean utilization in rural households. The two institutes have conducted 50 demonstrations, mostly in northern Oyo State. They also manufacture and sell soymilk on a daily basis. The initial success of this project indicates that soybeans can become a significant food for Nigeria especially in areas where a strong local market exists for production beyond that which a farm family can consume.

There is enormous scope and several possibilities in Nigeria for a soybean production, transformation, and utilization using medium-scale technology as proposed in this project. The project is likely to attract private investment as well as capable and enthusiastic research support. Inexpensive protein-rich food products should easily find a market in both rural and urban areas.

ACTION

1. Nigeria is recommended as a site for this project. It is suggested that FAO, in cooperation with Nigerian research institutions, seek private sector support in Nigeria for this project.

COUNTRY REPORT - NIGERIA
February 11-18, 1989

Contacts

American Soybean Association (ASA)

Dr. Rene Ledesma, Director, Technical Services (Madrid)
Dr. Larry Beauregard, Associate Director (Madrid)
Dr. A. A. Fadeyi, Consultant (Nigeria)

United States Embassy

Alan Hemphill, Agricultural Trade Officer, USDA
Thomas Pomeroy, Agricultural Attache, USDA

Institute for Agricultural Research and Training (IAR&T)

Dr. Peter Oyekan, National Soybean Coordinator
Mrs. Sidi Osho, Food Technologist

International Institute of Tropical Agriculture (IITA)

Dr. S. R. Singh, Director, Grain Legume Improvement Program
Dr. Kenton Dashiell, Soybean Breeder
Mr. Henry Ogundipe, Food Technologist (soybeans)
Dr. Ivan Buddenhagen, Director, Maize Improvement Program
Dr. Ken Fischer, Assistant Director/Research
Dr. Natalie Hahn, Socioeconomist, Farming Systems

Business

Mr. Anil Ahluwalia, Managing Director, Sona Dairies
Mr. Hans Riedel, Director, Commerce Finance, Taraku Vegetable
Oil and Animal Feeds Mill Co.
Mr. Alex Demehin, Quality Control Manager, Food Specialties Ltd.
Mr. Olabisi Alao, Operations Executive, Moreson Nigeria Ltd.
Mr. Kunle Ogundipe, Assistant Production Manager, Vegetable Oils
(Nigeria), Ltd.
Mr. R. Ganachari, Director, MAZDA Industries Ltd.

Other

Mrs. E. N. Dike, Microbiologist, Federal Institute of Industrial
Research, Oshodi, Lagos (FIIRO)

Discussion

I was invited to lecture on the subject of soybean nutrition and processing at the Soybean Foods Production Workshop organized by the American Soybean Association (ASA) held in Lagos, Nigeria, from February 13-15, 1989. About 40 people from government and industry attended. The following subjects were presented: overview of soy flour concentrates and isolates; soybean production and utilization in Africa; nutrition;

extrusion/expelling processing; soymilk; green soybeans; processing of soybean oil; Oriental soybean foods; and home/village utilization.

Sona Dairies has purchased equipment to make soymilk from Alpha-Laval (Lund, Sweden). An Alpha-Laval engineer was in Lagos in December 1988 to commission the factory. Unfortunately, Sona has recently been forced to stop milk production due to the price increase of dry milk on the international market. The company is now reorganizing. In order to reduce the cost of production, Sona wants to find an alternative to the Tetra-pak which it feels is too costly to use. It is trying to import a machine from Holland that makes blow-molded plastic bottles. Sona Dairies is capable of mass marketing a product like soymilk. If the company is successful, it is possible that millions of people in Nigeria will accept soymilk as part of their diet.

IITA is still conducting research on soybeans. Dr. Osamu Nakayama is due to arrive from Japan soon to take up his duties as senior soybean food technologist. Mr. Henry Ogundipe is conducting research on the use of extruded soy flour produced using INTSOY's extrusion/expelling technology. Currently, IITA is working with a bakery in Lagos to evaluate the acceptance of soy/wheat bread as a commercial product. Dr. S. R. Singh, Director of the Grain Legume Improvement Program, has received the soybean processing equipment ordered from BAR Export Import. He will need to build a small pilot plant in order to properly use this equipment. Dr. Singh has agreed to coordinate the process of assisting African scientists to attend the Soybean Utilization Conference in China in August 1989.

Action

1. Contact Alan Hemphill and ASA (St. Louis) about funds for Mrs. Osho's visit to INTSOY, summer 1989.
2. Contact Dr. Ken Fischer about pilot plant for IITA.
3. Contact Dr. Michael Bassey about IDRC funds for China conference.
4. Contact Drs. Peter Oyekan and Sidi Osho about China conference.

Nigeria
9 & 10 June, 1989

Contacts

International Institute of Tropical Agriculture (IITA)

Dr. S.R. Singh, Director, Grain Legume Improvement Program (GLIP)
Dr. K.E. Dashiell, Soybean Breeder, GLIP
Dr. Osamu Nakayama, Food Technologist, GLIP
Mr. H. Ogundipe, Food Technologist, GLIP
Dr. Kitty Cardwell, Plant Pathologist, GLIP
Dr. H. Gasser, Director of Training
Dr. Rudolph Polson, Agricultural Economist
Dr. Gary Mullins, Regional Coordinator, East African Collection
Study of Cassava in Africa (COSCA)

Institute for Agricultural Research & Training (IAR&T)

Dr. P. Oyekan, Plant Pathologist
Dr. S. Osho, Food Technologist

Discussion

The Grain Legume Improvement Program (GLIP) at IITA has strengthened its soybean utilization program. Dr. Osamu Nakayama, a food technologist, from Japan recently joined GLIP. Dr. Nakayama has extensive research and industry-related experience in oriental soybean foods such as tofu. Mr. Henry Ogundipe, food technologist, is conducting research on the utilization of extruded soymeal in the Nigerian diet. Dr. Kenton Dashiell heads the soybean program. Drs. Oyekan and Osho at IAR&T have been successful in implementing the soybean extension research component of the IDRC project. They are producing soymilk for sale on almost a daily basis. Dr. S.R. Singh, director GLIP, feels that the IDRC soybean utilization project has been successful. A new pilot plant will be built at IITA. There will be sections for both wet and dry processing. Overall, soybeans are still increasing in popularity in Nigeria.

Dr. Wes Root, FAO consultant, was at IITA from May 21-26. He worked with Dr. Oyekan to write a production/utilization project for Nigeria while I was in Uganda. This project would involve INTSOY setting up an extrusion/expelling factory in Nigeria. The project is also being considered for Ghana and the Ivory Coast. Soybeans are an established crop in Nigeria, and Dr. Oyekan feels that Nigeria would be a good site for such a project. Unlike Ghana, soybeans are produced and eaten in Nigeria. It is sold in markets along with groundnuts, maize and other crops. Several companies, including Nestle, manufacture soy-based foods.

Action

1. Arrange visit for Dr. Dashiell to INTSOY mid-October.
2. Arrange for Dr. Osho to visit INTSOY as research scholar in 1990.
3. Contact Dr. Michael Bassey, IDRC.

COUNTRY REPORT - GHANA
(November 20-23, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

--, Assistant Development Officer

FAO

N. Doumandji, Deputy Regional Representative
Dr. S. N. Kassapu, Regional Science Technology Officer
A. Mboob, Senior Regional Plant Protection Officer
Dr. G. O. Idusogie, Regional Food Policy & Nutrition Officer
Hiroyuki Konuma, Program Officer for Ghana

Ministry of Agriculture

H. K. Quartey-Papafio, Director, Crop Services Department
J. A. Dampson, Assistant Director, Agro-Forestry
R. K. Owusu, Crop Services Department
Ibrahim Adam, Under-Secretary for Agriculture
Dr. E. Addison, Director, Crop Research Insitute
Commander S. Obimpeh, Secretary for Agriculture
F. Donkoh, Deputy Director, Extension
K. K. Eyson, Director, Food Research Institute
Dr. W. Annorse Plahar, Food Technologist, Food Research
Institute
Dr. R. Gyabaa J. Butler, Director General, Council for
Scientific and Industrial Research
Mrs. Rosetta Tetebo, Acting Head, Women Farmers' Extension
Division

International Institute of Tropical Agriculture (IITA)

Dr. M. A. Hossain, Crop Breeder

DISCUSSION

Oil mills in Ghana are underutilized. The following table gives estimates in metric tons/year for 1986.

<u>Oil Mill</u>	<u>Capacity</u>	<u>Production</u>	<u>Difference</u>
Tema Food	18,000	500	17,500
Crystal	7,500	7,500	0
Joaben	1,000	0	1,000
Tamale	Unknown	0	Unknown
Total	26,500	8,000	18,500

These mills are capable of producing soybean oil and defatted soybean meal cake suitable for animal feed but not for human food. Feed mills in Ghana use local fish meal as the protein source.

If the price of fish meal remains low, imported soybeans would not profitably compete as a protein source for animal feed. In the north, locally produced soybeans might be cheaper than fish meal transported from the coast. Poultry and swine industries are small and not well

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established.

The need for inexpensive edible protein is great. According to a national nutrition survey in Ghana in 1986, 7.7 percent of males and 4.7 percent of females among pre-school children suffered from severe protein energy malnutrition (PEM) and 2.1 percent of infants suffered from kwashiorkor. Overall percentage of malnutrition was 17.5 percent for infants 0-23 months. Nutritional problems were more severe in the forest zone and in the northern savanna. According to the FAO nutrition expert in Ghana, kwashiorkor is more prevalent now than in 1952 when it was first documented.

The Food Research Institute, based in Accra, has a well-trained and enthusiastic staff. The institute has done very little research in soybeans though one staff member studied soybean utilization for his doctoral research project in the U.S.A. The home economics department staff at the University of Ghana at Lagon near Accra are also interested in soybeans.

A plan is underway to inaugurate soybean production in some regions of the country including Cape Coast in the coastal central region. The Secretary of Agriculture for Ghana and the district commissioner in Cape Coast are committed to the project and have formed a national committee to carry out a production plan. The committee includes political representatives, research organizations, food technologists, and an IITA scientist. The proposed market is oil mills. Specific goals and plans have not yet been formulated and the price for soybeans has not yet been proposed.

Every office visited, including the Secretary for Agriculture (a ministerial position), expressed interest and support for soybean production and this proposed project. The need for additional dietary protein is critical, especially in the forest zone (central zone) and in the northern savanna. Well-trained staff exist for production research, food technology, and home economics.

So far, however, this enthusiasm has not produced a concrete plan. Marketing is a weak part of the intended scheme. Fish meal is an inexpensive component for animal feed compared to soybean. The ratio of extension agents to farmers is low. Much of the information received was relevant to the south while the situation in the north, where the project would logically be based, is unknown.

ACTION

1. Ghana should be considered as a possible site for a well-formulated project for soybean production.

Ghana
3-9 June, 1989

Contacts

Dr. Matthew Okai, Regional Agricultural Planning Economist, FAO
Dr. M.A. Hossain, International Institute of Tropical
Agriculture, Kumasi
Mr. Seth Apeadu, Agricare Ltd.
Mr. Samuel Tei, Agricare Ltd.
Mr. George Amankwa, Legume Breeder, Crop Research Institute
Mr. J.F. Koampah, Deputy Executive Director, Grain &
Legume Development Board
Dr. B.E. Ofori, Executive Director, Grain & Legume Development
Board
Mr. Martin Edi, World Vision

Discussion

Ghana was one of six West African countries visited by an INTSOY/FAO team in November-December 1988. In their report, the authors, Drs. Weingartner and Root, recommended with reservations that Ghana be considered as a site for a soybean processing and utilization project. The purpose of this second visit was to collect more information on soybean production/utilization and to discuss the proposed project with government officials.

Soybeans are not commercially produced in Ghana. Production is limited to the Northern and Upper Regions, where farmers grow small quantities of soybeans for home use. The Ministry of Agriculture, which is promoting soybean production, has started a seed multiplication program. The ministry's goal is to grow and then distribute about 30 MT of soybean seed for the 1989 or 1990 growing season.

Ghana is just beginning to use soybeans. In the north, soybeans are fermented to make dawadawa. Generally, soybeans are not sold in the markets. In June 1988, a weaning food project was started by the Catholic Church in Techiman. The weaning food is made by combining roasted maize (75%), groundnuts (10%) and soybeans (15%). In the first five months of 1989, the project produced and sold about 4.5 MT of weaning food to hospitals at a price of 120 cedi/500 gram bag.

In some countries, soybeans are processed commercially to produce edible oil and animal feed. The industries in Ghana have not expressed interest in using soy. Most, if not all, of the oil mills in Ghana are operating at less than 50% capacity. Some of the problems that oilseed crushers in Ghana face include the following: lack of oilseeds to crush, machines in disrepair, lack of capital to run the factory. According to the Ministry of Agriculture, there are seven animal companies and twenty poultry businesses in the Ashanti Region. Generally, soybeans are a minor component of poultry feed. Imported fishmeal (containing 65% protein and costing 200 cedi/kg) and local fishmeal (60% protein at 170 cedi/kg) are used instead of imported soymeal (48% protein at 190 cedi/kg), which is more expensive on a per kilogram protein basis. For example, in 1988, Agricare feed mills produced 20,000 MT of feed concentrate but used only

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380 MT soymeal. Darko Farms Ltd. is an exception. In 1988, it imported 1,000 MT of soybean meal to feed to 125,000 layers.

The Ministry of Agriculture has expressed strong support for a soybean production/utilization program for Ghana. The government held a soybean workshop in October 1988, which was attended by home economists. Ghana would be a suitable site for an extrusion/expelling project in the future.

Action:

1. Prepare a project document for Ghana.

COUNTRY REPORT - KENYA
(November 2-4, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

Mr. James Gingerich, Agricultural Development Officer
Mr. Cecil McFarland, Agricultural Development Officer
Mr. James Dunn, Agricultural Development Officer

Ministry of Agriculture

Mr. Moses Mukolwe
Mr. George Duer, National Agriculture Laboratory

International Development Research Centre (IDRC, Canada)

Dr. Ozzie Schmidt, Program Officer
Dr. Andrew Ker, Senior Program Officer

Ken Soy Company

Mr. Pafula Kiwanuka

DISCUSSION

There is a great need for an edible oil in Kenya. Last year, 50 million dollars' worth of palm oil was imported. There does not appear to be a strong government program for soybean breeding or utilization. However, officials in the Ministry of Agriculture (MOA) feel that soybeans have potential in Kenya. A detailed report written in 1986 by Mr. Helmut Schmidt, Farm Management Division, MOA outlines the economical and nutritional implications of using soybeans as a second crop in maize planting areas.

Ken Soy Company is trying to obtain equipment to produce soyfoods for human consumption: full-fat soy flour, soy ugali, and snack foods. He would like to buy the following equipment: extruder, hammer mill, oil screw press, filter press, degummer, and destoner. Mr. Kiwnuka, the owner and founder of Ken Soy, is a sales manager of an insurance company. He will need help from INTSOY and USAID/Nairobi to procure and install soybean processing equipment for his factory. Mr. Kiwnuka has about 550,000 shillings for this project. This is a good start (US \$30,000), but he will need more money if he is to have a complete factory for soyfoods.

Mr. James Gingerich is interested in the possibility of conducting a USAID/INTSOY soybean utilization workshop in Kenya in 1990. The economic section of USAID/Nairobi may be able to assist Ken Soy Company in obtaining U.S. made soybean processing equipment (the details of this assistance need to be worked out).

The International Development Research Centre, Ottawa, Canada supports research projects. We discussed the possibility of a future IDRC/INTSOY soybean utilization project in east Africa, possibly Zambia.

ACTION

1. Contact Gingerich USAID/Nairobi about next visit.
2. Contact Moses Mukolwe, MOA about INTSOY utilization course for extension workers in 1990.
3. Check oil screw press Qingjing Machine Works, Sichuan Province, PRC - Model GYL-95Y.
4. Develop training program for Kenya.
5. Contact Edgerton University, Department of Food Technology.
6. Send IDRC/Nairobi information on processing of tofu and tempeh.
7. Assist Ken Soy in making an equipment list for their factory.
8. Get an equipment pro forma for Ken Soy.
9. Contact ASA about solvent extraction plant for Kenya.

COUNTRY REPORT - KENYA
February 25-27, 1989)

Contacts

U.S. Agency for International Development (USAID)
Mr. James Gingerich, Agricultural Development Officer

U.S. Department of Agriculture (USDA)
Susan Schayes, Agricultural Attache

International Development Research Centre (IDRC, Canada)
Dr. Ozzie Schmidt, Program Officer

Companies

Mr. Pafula Kiwanuka, Chairman, Ken Soya
Mr. John Savage, Savage Holdings

Discussion

Ken Soya expects to have its loan application approved by the Central Bank of Uganda by April 1989. It will use the loan to purchase an INSTA PRO extruder, oil screw press, and cleaner/destoner. The company intends to make three soy protein foods: Uji/Soya (27% protein), Jr. Ugali (18% protein), and full-fat (or low-fat) soy flour. USAID may be able to help Ken Soya get a second loan to buy additional processing equipment.

Action

1. Check on extrusion equipment for Ken Soya.
2. Develop training program for Kiwanuka.
3. Telex Zambia information to Susan Shayes.
4. Inform Tom Brennan of meeting with John Savage.
5. Send Gingerich outline of topics to be covered for June 1990 in-country utilization course.

Kenya
2 & 3 June, 1989

Contacts

Dr. Ozzie Schmidt, Program Officer, International Development
Research Centre (IDRC)
Mr. P. Kiwanuka, Ken-Soy

Discussion

Ken-Soy has purchased an Insta-Pro (model 600) extruder. It plans to use it in conjunction with a Chinese oil expeller that is sold in Nairobi. Mr. Kiwanuka has made a prototype snack, which he is test-marketing. The response has been encouraging.

IDRC is expecting budget cuts, which will probably result in the Centre not starting new projects in Africa in 1990. It is beginning the second phase of an oilseed project. This phase will involve economic studies of oilseed production and be located at Egerton University.

COUNTRY REPORT - ZIMBABWE
(November 10-16, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

____, Acting Assistant to the Agricultural Development Officer

Ministry of Agriculture

Dr. Efrim Whingwiri, Department of Research
Mrs. Takawire, Department of Nutrition

International Institute of Tropical Agriculture (IITA)

Dr. D. M. Naik, Research Coordinator

International Crop Research Institute for the Semi-Arid Tropics
(ICRISAT)

Dr. Leland House, Project Manager
Mrs. Manel Gomez, Food Technologist

Commercial Oilseeds Producers' Association (COPA)

Mr. George Hutchison, Senior Executive
Mr. Robert McManus, Chairman

University of Zimbabwe

Dr. M. Benhura, Department of Biochemistry

South African Center for Cooperation in Agriculture Research
(SACCAR)

Dr. Martin Kyomo, Director

Nutresco

Mr. Jack Revolta, Managing Director
Mr. Roy Birchall, Production Manager

Lions Den Syndicate

Mr. Louis Uys, Director

DISCUSSION

During the 1988-89 growing season, Zimbabwe grew a record 120,000 metric tons of soybeans. Most of the production was from large commercial farms. However, a project sponsored by Kellogg Foundation and supervised by Dr. Efrim Whingwiri involving small-scale production and utilization of soybeans by farmers is progressing well. The Commercial Oil Processors' Association (COPA) is involved with soybean products, utilization and research.

Currently, most of the soybean crop is used to produce locally consumed vegetable oil and defatted soy meal used for animal feed. However, two companies, Nutresco and Lions Den, are trying to develop soy products for human consumption. Nutresco has, for the past 18 months, been developing new soy products. They have recently solved some major technical problems and may be introducing a new product line by July 1989. Lions Den is interested in utilizing INTSOY's extrusion/expelling technology to product a bland, light-yellow colored defatted meal suitable for human foods.

Dr. Lee House, project manager of the International Crop Research Institute for Semi-Arid Tropics (ICRISAT) in Bulawayo, is involved with production and utilization of sorghum and millets. He and the ICRISAT food technologist are interested in future collaboration with INTSOY to produce nutritious sorghum/soy-based foods. This may be accomplished by extrusion cooking.

ACTION

1. Contact French Oil Mill and Simon Rosedowns about equipment for Lions Den.
2. Contact Dr. Kyomo, Director of SACCAR.
3. Send extrusion/expelling paper to Dr. Benhura at the University of Zimbabwe.
4. Get extrusion equipment information for Lee House.
5. Contact Roy Birchal at Nutresco.
6. Contact D. M. Naik in Harare.

COUNTRY REPORT - ZAMBIA
(November 5-9. 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

Leroy Scherer, Acting Agricultural Development Officer
Allen Van Egmond, ZAMS Project Officer

Agricultural Development Corp. of Saskatchewan (AGDEVCO)

Dr. Barry Proud, Team Leader
Mr. Fred Javaheri, National Soybean Coordinator

FAO

Dr. S. Wadda, Representative

UNICEF

Mr. Aston Manyindo, Programme Officer

Soy Nutrients, Ltd.

Mr. Michael Galaun, Managing Director
Mr. Pramod Mahnot, Production Manager

Lee Yeast Company

Mr. Rashid Limbada, Managing Director

Liberty Biscuits (Ndola)

Mr. S. P. Chari, Production Manager

Luancha District

Mrs. Renati Schempp, German Volunteer, Soybean Utilization

DISCUSSION

Mr. Leroy Scherer has started the Zambia Agriculture Business and Marketing Service Project (ZAMS) and Allen Van Egmond is the project officer. The project will have a component to study small-scale oil processing. A marketing group with people from USAID and the Zambia Ministry of Agriculture will be formed in Lusaka by June 1989.

We also discussed having a soybean workshop in 1989 or 1990 which would be funded through the ZAMARE project. UNICEF/Lusaka has agreed to allow us to purchase (or possibly, give us) kitchen equipment through their UNIPAC equipment office for this workshop.

Two companies, Lee Yeast and Soy Nutrients, are manufacturing full-fat soy flour. The flour is currently used by the Zambian feed mills as a protein source for their feeds. Soy Nutrients, owned by Michael Galaun, wants to expand its product line to include soyfoods for humans. Galaun asked if INTSOY would send consultants to conduct a feasibility study of soyfoods for his company.

Mr. Fred Javaheri is the Zambia National Soybean Coordinator. He accompanied me on my visits to USAID, government officials, and soybean processing industries. Javaheri is also involved with a soybean home utilization project in Luanshya that is teaching urban women on low incomes how to prepare soybean foods using traditional cooking equipment.

ACTION

1. Contact Javaheri about soybean experiment.
2. Contact USAID/Lusaka about: (a) oil screw press equipment; (b) sponsoring two candidates for soybean workshop in China in 1989; and (c) ZAMS Project.
3. Contact UNICEF/Lusaka about kitchen equipment.

COUNTRY REPORT - BENIN
(November 27-30, 1988)

ORGANIZATIONS/PERSONS CONTACTED

FAO

Hans Page, Representative
Marie Jose Surpris, Program Officer
Maryvonne Verbanck, Administrative Officer

International Institute of Tropical Agriculture (IITA)
Dr. Hans Herren, Director, Africa-Wide Biological Control
Program

Catholic Relief Service (CRS)

Ange Tincbo
Vincent Abiola
Decla Hyacinthe Aouagour

DISCUSSION

The Catholic Relief Service (CRS) reports that soybeans are grown in small quantities throughout Benin. An FAO team currently in Benin to assess agricultural research does not believe that soybean is a popular crop. There is no estimate of soybean production in Benin. CRS has just completed an eight-year soybean production and utilization project.

In 1983, CRS began demonstrations of soy flour preparation to enrich the local porridge using one-part soybean flour to three parts cereal. As part of the project, mills were installed in 20 villages. The mills are still operating successfully, but now process little soybeans. An unsuccessful attempt was made, as well, to introduce soy yogurt and enriched biscuits. A soy/maize baby food is sold in a local supermarket. Soybeans are used for local maggi (beef stock cubes added to stews).

There is a current project with Quando Mill in Porto Novo to produce enriched bouillie, a thin potage traditionally eaten in the morning. It sells for 200-290 CFA/500 g. This is a joint venture between the mill, CRS, the Ministry of Agriculture, the Ministry of Health, and UNICEF.

The potential industrial use of soybeans is not known. There is no animal feed industry and the byproducts of oil seed crushings are reportedly not used. The local market price for soybeans is estimated at 100 CFA/measure of 800-900 g.

No appointments were made in advance of our arrival and the FAO officers were very busy. The only contacts made in Benin were FAO, IITA, and CRS. The FAO representative believes strongly that the scale, price and level of technology of the proposed project are too large for Benin. He suggested marketing research before any project of this scale could be considered and offered his help in organizing market testing in Benin. CRS has been discouraged by the local indifference to soybeans and has apparently not yet convinced rural people in Benin of the value of eating soybeans. There is little encouragement of private industry in Benin.

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The government is revolutionary and this is manifested in part by a frequent rotation of government officials. There is, therefore, some built-in instability in government operations.

ACTION

1. Benin is not recommended as a site for the INTSOY/FAO Project.

COUNTRY REPORT - TOGO
(November 24-26, 1988)

ORGANIZATIONS/PERSONS CONTACTED

USAID

Dennis Panther, Agricultural Development Officer

FAO

S. Alderighi, Representative

Catholic Relief Services

Nancy Mickelson, Directrice

Glassou Komi, Chef de la Division des Laboratoires, Direction de Nutrition et Technologie Alimentaire

G. Salami, Secretaire General, Comite National de la Campagne Mondiale de Lutte pour l'Alimentation/Action pour Le Developpement

Vasken Bakalian, Directeur Societe General des Moulins de Togo

Mme Segbor, Biologiste, Direction de Nutrition et Technologie Alimentaire

DISCUSSION

The Food Research Center prepares and sells baby food made from roasted soybeans (18%) and cereals. The center has not tried to commercialize the product or seek wider distribution, in part because of quality control and a short shelf life. The center is interested, as well, in creating a small-scale process for making soybean milk in sterilized containers. The center director is concerned about the importation of rapeseed cooking oil and would welcome the substitution of soybean oil.

A few large commercial swine or poultry farms are operating or planned, but so far the market for animal feed remains small. A flour mill in Lome sells wheat germ for the cost of haulage.

According to data gathered for the past four years by the Catholic Relief Service, about 30 percent of the children in Togo are below the 80th percentile for weight:age. In some years and seasons, this percentage reaches 50 percent in the Savanna. No data were available on the incidence of kwashiorkor.

The Food Research Center buys its soybeans from an agricultural research station for 300 CFA/kg. With maize selling for 45,000 to 60,000 CFA/mt, soybeans might sell at 100,000 CFA/mt as in other west African countries visited.

There is reportedly a strong organization within the rural development department concerned with women farmers and homemakers. According to its director, the organization gives advice on home economics research and extension services.

The Food Research Center has been involved with soyfood product development for four years. The staff is well trained and knowledgeable in soybean processing. One staff member has purchased a small oil press and mill for commercialization of animal feed. The center does not plan to commercialize the products already developed or to solicit venture capital to develop more food products.

ACTION

1. Togo is not recommended as an initial site for the project. There appears to be a lack of government interest and little likelihood of a market for soy products.

OUTREACH ACTIVITIES - ASIA

Country : Bangladesh

Institutions:

1. Mennonite Central Committee (NGO)
2. Micro Industries Development Assistance Society (MIDAS) - A Para State institution whose mandate is to foster small scale industrial development through project identification, project evaluation, techno-economic feasibility study, and facilitation of financial support.

Background :

MCC has been operational within Bangladesh as an approved NGO since 1972. One of their projects is the promotion of soybean production and utilization. They cooperate with local institutions such as Bangladesh Agriculture Research Institute, Bangladesh Agriculture University, and the Bangladesh Council of Scientific and Industrial Research, in the soybean development activities. The projected soybean production for 1989 is 700 tons and an increase up to 5000 tons is envisaged by 1990.

The soybean marketing and utilization channels are poorly developed at this stage. Some soybeans are used directly as roasted snacks, and raw soy flour is used by bakers in cookie manufacture. There is a shortage of edible oil as well as protein meal for the growing poultry industry. MCC participated in the INTSOY annual soybean processing short course in 1988. They identified the process of extrusion and expelling of soybeans as an appropriate technology base for promoting the utilization of soybeans.

MCC used the services of MIDAS for developing a project proposal for extrusion/expelling with assistance of INTSOY.

Current status :

MIDAS is working on the final report, and MIDAS/MCC will solicit private sector participation for project implementation.

INTSOY inputs (past) :

- provided training for ^{MCC}~~MIDAS~~ representative
- provided technology base
- assisted in preparation of project proposal
- made one site visit for technical consultation on the proposal

INTSOY inputs (future) :

- facilitate selection of appropriate equipment
- provide assistance in plant lay out
- assist in installation and commissioning
- provide training for technical personnel and technical backstopping

contacted USI(11)/Private Sector Division for some help.

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Country : Pakistan

Institutions:

1. Pakistan Council of Agricultural Research (PARC)- (Government)
2. Mojob's Low Cost Food Program (Private sector) - Local entrepreneur with restaurant and food service background interested in exploiting soybeans for food and feed purposes.

Background:

Soybeans have been introduced to Pakistan's agriculture in order to augment the oilseed sector. Production has been adversely affected by the lack of proper marketing and utilization channels. PARC concentrates crop production and not on post production aspects of soybeans.

The private entrepreneur in this case had recognized the potential for soybean utilization and made some efforts in this direction at his own initiative since 1982. He developed some local food preparations from whole soybeans, and demonstrated them before government and private audiences with considerable success. He had been in touch with PARC and the local USAID mission for support on the strength of the local policy for government/private sector joint venture promotion. Mr. Mojob was co-sponsored for the INTSOY soybean processing short course by USAID and INTSOY in 1988. The development of a proposal for a soybean utilization project was discussed at this stage with INTSOY scientists. Mr. Mojob prepared a broad proposal including processing by extrusion/expelling, product development, extension and publicity.

INTSOY representative visited Pakistan in April 1989, and discussed the proposal with PARC, USAID, and Mr. Mojob. Agreement was reached in principle that PARC would promote the project as a joint public/private sector venture with USAID support.

Current status:

The original proposal is being revised by INTSOY to suit the strategy for implementation as a joint venture with technical inputs from INTSOY.

INTSOY inputs (past):

1. provided training for private entrepreneur.
2. assisted in technical aspect of project preparation.
3. made one site visit for discussion on project formulation.

INTSOY inputs (future):

1. provide extrusion/expelling technology.
2. assist in project revision.
3. assist in equipment selection.
4. assist in plant layout.
5. installation and commissioning, and technical backstopping.
6. Training of personnel.

Country : India

Institutions:

1. Central Institute of Agricultural Engineering, Bhopal.
2. G.B. Pant University of Agriculture and Technolgy, Pantanagar.

Background:

The all India coordinated research project on soybeans, funded by USAID and the ICAR has a sub-project on soybean processing and utilization (SPU). The project based at Bhopal is concentrating on the development of small scale equipment and technologies for converting soybeans into food products. They aim at developing small scale soy processing industries on a de-centralized basis. The SPU project is looking at dry extrusion and extrusion/expelling as potential technologies for the project. They have requested INTSOY's assistance in specific aspects of the program.

Current status:

INTSOY continues to provide training for project personnel in specific processing aspects.

INTSOY inputs (past):

1. provided short term training for 10 ^{over the last 2 y-2y} scientists in extrusion, extrusion/expelling, utilization of low fat soy flour, utilization of defatted soy flour, soymilk and dairy analogs, and chemical analysis.

INTSOY inputs (future):

1. provide assistance in extrusion, and extrusion/expelling (short term consultancy has been requested).
2. provide assistance in oriental soy food processing (short term consultancy has been requested).

- To get the equipment running and going.

Country : India

Institution :

International Crop Research Institute for the Semi Arid Tropics (ICRISAT),
Hyderabad.

Background:

AT the invitation of ICRISAT, INTSOY participated in a meeting of consultants on the processing and utilization of legumes and the diversification of end uses, in March 1989. ICRISAT, Hyderabad, works on Chickpeas, Pigeonpeas, and Peanuts as mandate crops. The total traditional pulse crop production in the region of their interest is stagnant. While efforts in breeding are directed towards increased productivity, the center is interested in breeding for better utilization characteristics and finding ways of extending available supply.

Dry extrusion of traditional pulses with soybeans, to produce convenience products of high nutritional value has been one of INTSOY's dry processing research objectives. This fits well with ICRISAT's need. However, while using soybean as a base for such products, it is necessary to develop products that carry the flavor of the traditional pulses. This concept has been well received by ICRISAT, and their principal biochemist made a follow up visit to INTSOY for preliminary discussions on possible collaborative research.

Current status:

No active program, but further discussions anticipated.

*- new in the process here extrusion/replicate product which
fit taste and texture and is largely untried. Soybeans present
set of protein or taste. What products are less needed in
availability. This would enable soybeans to be more used
important in the diet.*

Country : Vietnam

Institutions:

1. Mennonite Central Committee (MCC)
2. University of Can tho
3. Bich Chi Food Processing Plant, Property of the Peoples' Committee of Dong Thap Province.
4. BAR Export Import INC., Seymour, Illinois.

Background :

The Bich Chi Food Processing Plant in the Dong Thap Province of Vietnam is currently processing a weaning food from rice. The university of Can Tho and the MCC are working with the Processing Plant to improve the current product and the processing line. The strategy is to install extrusion and expelling equipment which will provide a high quality low fat soy flour for fortification of the current rice based product. Improved quality assurance in the production line and diversification into other extruded products is also envisaged. The project has been approved and the money appropriated for equipment. BAR Import Export INC., is supplying the equipment. Some shipments of equipment have already been made.

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Current status:

The arrival of equipment at the site is awaited.

INTSOY inputs (past):

1. provided extrusion/expelling technology.
2. assisted MCC and University of Can Tho in project preparation.
3. Hosted Rector Khai and Professor Duong of Can Tho University on a study tour during project preparation.
4. Made one site visit to Vietnam for discussions and project formulation.

INTSOY inputs (future) :

1. assist in plant layout and installation.
2. commissioning of extrusion/expelling line.
3. cooperate in product development and quality assurance
3. training of personnel and technical backstopping.

Country : Sri Lanka

Institutions :

1. Sri Lanka Department of Agriculture.

Background :

The Sri Lanka soybean development program was initiated in 1972, and a broad project for a national level program was approved for funding by FAO/UNDP in 1975. The project was sub-contracted to INTSOY for implementation. Although there was inadequate emphasis on processing and utilization in the original project, this was soon corrected by way of a supplementary proposal which was funded by CARE and UNICEF. INTSOY was instrumental in the complete planning of a R & D pilot plant, selection of equipment, installation and commissioning. Several long term and short term consultants from INTSOY, developed a research program for developing products for home preparation, and industrial production. A program for training of personnel in soybean use was also developed. The soybean research center in Sri Lanka is recognized as an excellent facility in the region. INTSOY contract in processing and utilization was terminated in 1980 and the project continues to be handled by the local scientists. Dry and wet processing facilities were provided in the pilot plant at the initial stage. However, extrusion facilities were not provided at the time.

Current status :

Program completely indigenized. INTSOY continues to provide technical backstopping at request. INTSOY has used the R & D center as venue for its short course on two occasions. Sri Lanka Department of Agriculture has expressed interest in collaborative research with INTSOY, and a memorandum of understanding is being processed for this purpose.

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INTSOY inputs (past) :

- Establishment of the soybean food research center, and the soybean utilization program.
- technical backstopping after project termination.

INTSOY inputs (future) :

- technical backstopping at request.
- collaborative research if new MOU is signed.

APPENDIX 11
DESCRIPTION OF GROVE COUNTRY FOODS

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GROVE COUNTRY FOODS

Background:

Grove Country Foods was established in 1987 in Columbus Grove, Ohio by two Food Scientists who graduated from the University of Illinois, a local construction contractor/entrepreneur and a farmer/elevator owner. The goal was to take advantage of the specialized bean (dry beans and soybeans) handling facilities/experience already present in Columbus Grove which was owned by two of the partners as a source of raw materials to make food products from the soybeans (SRM SEEDS INC.). The two Food Scientists had previous experience in starting up and operating small food companies which did some soy processing and marketing.

Some funds were obtained from a State of Ohio "value added" program to purchase equipment and remodel buildings. In early 1989 an extrusion/expelling operation and a soymilk operation were initiated. In July the company beginning blending and canning a diet food on a contract basis for a company in New Jersey. The canning operation was initiated because it could provide a good cash flow and some of the products from the extrusion/expelling and soymilk operations could be used. A total of 80 people were employed by the company by the first of September.

Processes used and products made:

Extrusion/expelling - The extrusion/expelling operation at Grove Country Foods based on INTSOY research/development represents the first commercial application of the technology. The equipment was sold to them by Bar Export and represents the low capacity system (800 - 1000 pounds per hour).

The natural (crude) oil is just now being tested for use in the diet canning operation. They are exploring other markets in the food industry. The high protein flour is being packaged for marketing and use in the baking and food industry. They have not yet settled on the best market.

Soymilk - The soymilk operation is primarily based on the "Illinois Process" developed by INTSOY, but has several refinements. The equipment is automated and of excellent quality so that the price is relatively high compared to the systems applicable for developing countries.

The soymilk is being dried and tested for use in the diet canning operation. They are also making flavored and plain milk for testing several markets as well as soft serve ice cream. They plan to make yogurt from the soymilk in the future. The waste product (okara/soy whey) is being given to farmers to feed to swine. They want to experiment with drying the okara so that it can be used in some food products.

APPENDIX 12

POTENTIAL ROLE OF SOYBEANS IN MEETING NUTRITIONAL NEEDS IN AFRICA

POTENTIAL ROLE OF SOYBEANS IN MEETING NUTRITIONAL NEEDS IN AFRICA

The growing deficits in food supplies in most countries of Sub Sahara Africa, which reflect failure of food production to expand as fast as the population, are common knowledge. Inherent in this situation is an intensifying shortage of high-quality protein, particularly for young children whose needs for most essential amino acids are several times those of adults.

A recent overall analysis of protein supplied in the food of three African countries, adjusted for exports and imports, showed 73 grams of protein per person per day in Cote d'Ivoire, 66 grams in Nigeria, and 70 grams in Zambia.¹ In West Africa, one-third or more of this protein came from tubers and plantain and was of generally poor quality, particularly that from cassava, of which production is expanding relative to yams.

Analysis of the amino acid content of those countries' food supplies shows serious deficits, particularly in meeting the needs of small children (Table 1). In all three countries supplies of lysine, methionine, and phenylalanine and tryosine were inadequate for children 2-5 years of age and marginal for children 10-12 years of age. In Nigeria, leucine also was limiting, and in Zambia tryptophan.

This overall analysis understates the need. It is based upon total supplies, with no allowance for crops fed to livestock nor waste and losses in storage and in food preparation. Moreover, it fails to consider regional differences. The rain forest areas of both Cote d'Ivoire and Nigeria depend heavily on tubers and plantain, which are seriously deficient in high-quality protein. In the savannahs of those

¹Ayemou, Afla Odile, University of Illinois, 1989.

Table 1. Amino Acid Requirements, by Age Groups, Availability in Food Supplies of Three African Countries and in Defatted Soybean Meal

apparent food availability: food supply adjusted for crop/yr

Estimated

<u>Amino Acid</u>	<u>Requirement^a</u>			<u>Overall Availability in Food Supplies</u>			<u>Availability in Defatted Soybean Meal^a</u>
	Age	Age		Cote d'			
	<u>2-5</u>	<u>10-12</u>	<u>Adult</u>	<u>Ivorie</u>	<u>Nigeria</u>	<u>Zambia</u>	
	(Milligrams Per Gram of Protein)						
Histidine	19	19	16	-	-	-	26
Isoleucine	28	28	13	46	42	49	46
Leucine	66	44	14	74	65	102	78
Lysine	58	44	16	53	49	44	64
Methionine & Cystine	25	22	17	17	17	20	26
Phenylalanine & Tyrosine	63	22	19	44	34	42	88
Threonine	34	28	9	37	38	39	39
Tryptophan	11	9	5	11	13	9	14
Valine	35	25	13	50	45	50	46

solvent extraction

^aWolfe, Walter J. "The Protein Merits of Various Protein Food Ingredients." In Soy Protein and National Food Policy. F. H. Schwarz (ed.). Westview Press, Boulder, CO., 1988. P. 246. From FAO/WHO/UNU 1986 Amino Acid Requirement.

^bUnpublished data of Dr. Afla Odile Ayemou, University of Illinois, 1989.

countries farther north, the basic crops are grains, in which the deficiencies of amino acids are less.

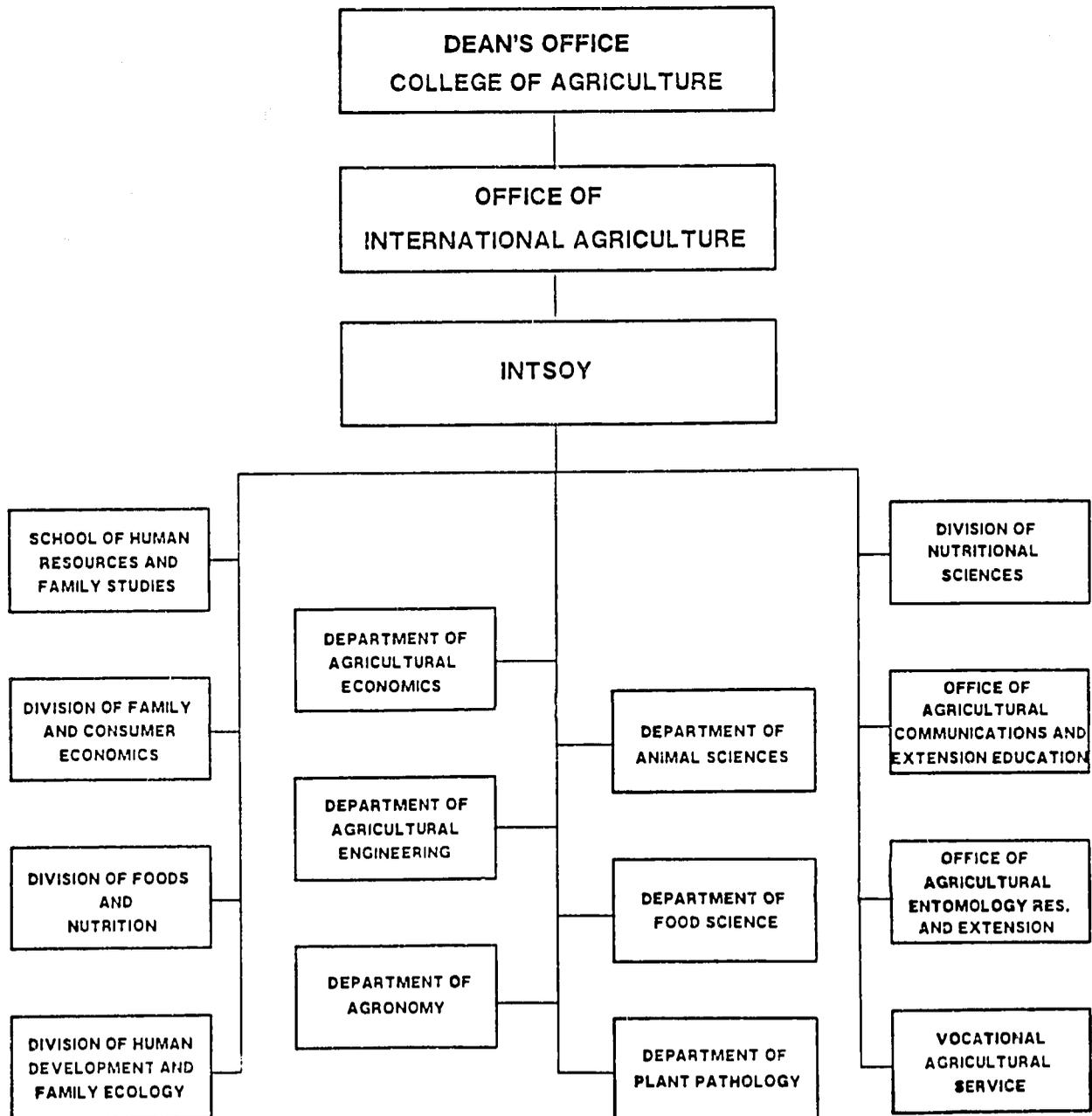
In the rapidly growing countries of Africa, about half the population is children under 16 years of age. Many of these children, like the women, get what food is left after the men have had their fill. For this reason also, the "average" supplies of amino acids shown in Table 1 may not apply to them.

The potential of soybeans to meet these inadequacies is evident when one examines the amino acid composition of defatted soybean meal (or flour). The amino acid content of that soybean product exceeds the highly demanding requirements of children aged 2-5 years for all of these essential amino acids except methionine, and materially exceeds the needs for all essential amino acids except methionine for older children and adults. When soybeans are consumed with cereals, such as corn, methionine is no longer limiting.

APPENDIX 13

INTSOY ORGANIZATIONAL CHART AND STAFFING

**ORGANIZATIONAL CHART
INTERNATIONAL SOYBEAN PROGRAM (INTSOY)**



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INTSOY STAFF

ADMINISTRATION

Harold Kauffman.....Director
Dee Buchanan.....Secretary

FOOD SCIENCE

Al Nelson, Professor Emeritus.....Research Program Leader
Wilmot Wijeratne.....Assistant Professor, Dry Processing
Karl Weingartner.....Visiting Assistant Professor,
Nutrition and Home & Village
Kukiat Tanteeratarm.....Post Doctoral Research Associate,
Wet Processing
Dan Erickson.....Data Management, General Operations
Firdousa Begum.....Analytical Technician
Scott Buchanan.....Pilot Plant Technician
Marise Galerani.....Academic Hourly
Steve Smith.....Academic Hourly
Dennis Clarke.....Academic Hourly

AGRICULTURAL ECONOMICS/BUSINESS DEVELOPMENT

S. W. Williams.....Economist

AGRICULTURAL COMMUNICATION & EXTENSION EDUCATION

Rob Wynstra.....Communication Specialist

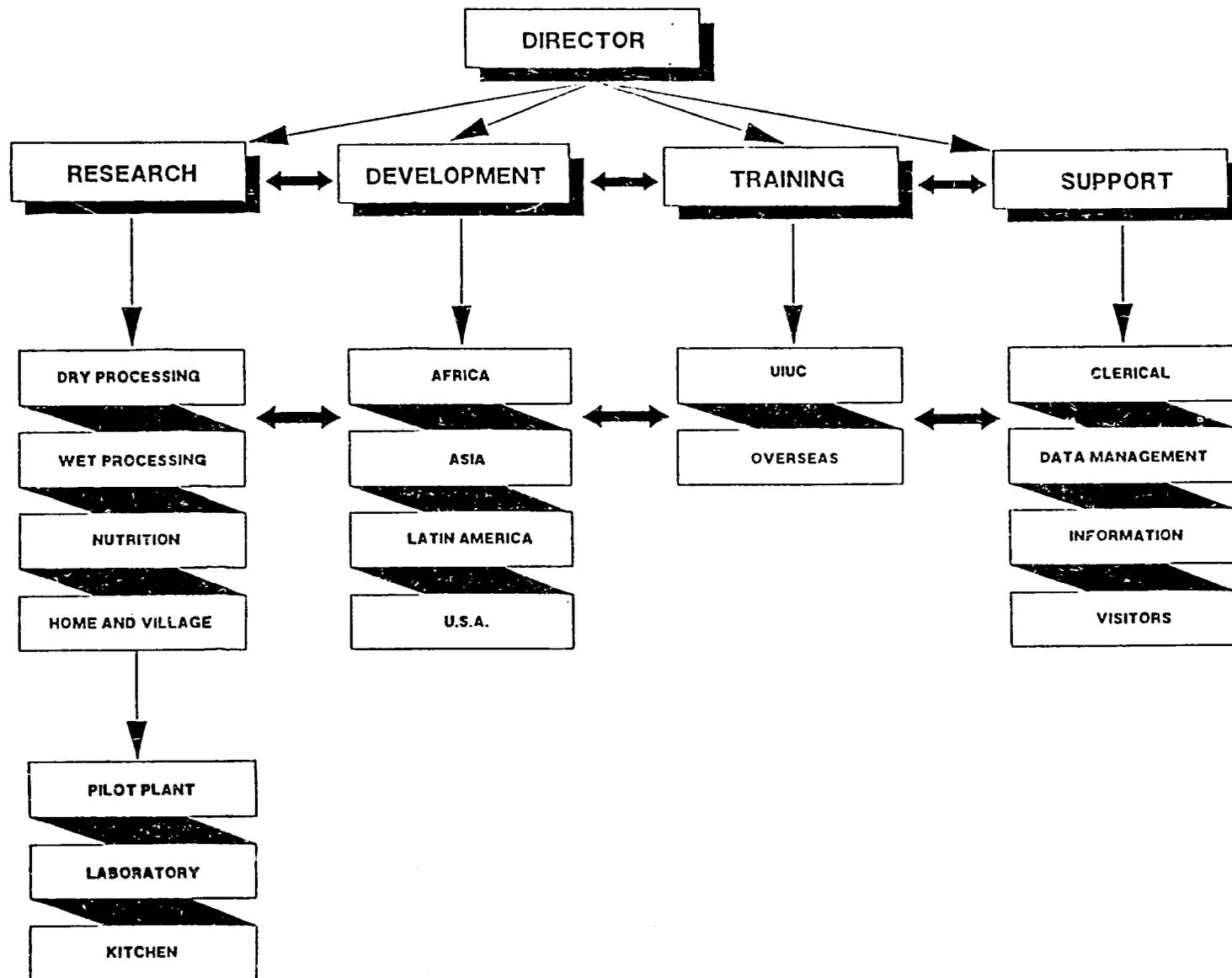
INTSOY Executive Committee Members

R. A. Easter..... Animal Science
J. F. Evans..... Agriculture Communications
T. Hymowitz..... Agronomy
M. E. Irwin..... Agricultural Entomology
S. H. Johnson..... Agricultural Economics
J. J. Nicholaides..... Office of International Agriculture
S. Y. Nickols..... Human Resources & Family Studies
A. J. Siedler..... Food Science
J. B. Sinclair..... Plant Pathology
H. E. Kauffman..... INTSOY

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INTSOY RESEARCH ASSOCIATES

AGRICULTURAL ECONOMICS	Sam Johnson Tony Soskins
AGRICULTURAL ENGINEERING	Errol Rodda
AGRONOMY	Richard Bernard Ted Hymowitz Emerson Nafziger Cecil Nickell Gary Pepper
ANIMAL SCIENCE	Robert Easter (swine) Carl Parsons (poultry)
ENTOMOLOGY	Michael Irwin Marcos Kogan
FOOD SCIENCE	John Erdman (nutrition) Ed Perkins (oil) Art Siedler L. S. Wei (Oriental Soyfoods)
HUMAN RESOURCES/FAMILY STUDIES	Susan Potter Leanne Birch
PLANT PATHOLOGY	James Sinclair



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APPENDIX 14
INTSOY FINANCIAL INFORMATION

SOURCE OF FUNDING FOR INTSOY PROGRAM

1985-1989

(\$)

Source	Amount	Percentage
S&T/AGR:	3,162,491	59.53%
COST SHARING/MATCHING FUNDS:		
State of Illinois-Facilities	1,400,000	26.35%
State of Illinois-Equipment	39,000	0.72%
State of Illinois-Personnel	135,000	2.54%

Total State of Illinois	1,574,000	29.63%
Private Sector-Equipment	150,000	2.82%

Total Cost Sharing/Matching Funds	1,724,000	32.45%
ENT-INS OTHER FUNDING:	335,000	6.22%
PROGRAM SUPPORT GRANTS:	89,930	1.69%
TOTAL FUNDS UTILIZED:	5,312,221	1

S&T/AGR	3162491
BI/OT	335800
PSG	89930
SOI	1574000
PS	150000

File: T-II-1.wkt; T-II-1.PRN

INTSOY SOYBEAN UTILIZATION AND RESEARCH
TOTAL EXPENDITURES
AID DAN4132-A00-5117
APRIL 1, 1985 THRU JULY 31, 1989

	1985	1986	1987	1988	1/89 - 7/89	PROJECTED 8/89 - 12/89	TOTAL
SALARIES & WAGES	\$308,199	\$371,114	\$276,082	\$268,862	\$182,257	\$104,863	\$1,511,377
FRINGE	\$35,704	\$40,768	\$31,023	\$27,768	\$18,885	\$19,115	\$173,263
INDIRECT COSTS	\$173,208	\$222,035	\$179,764	\$184,578	\$125,589	\$51,411	\$936,565
TRAVEL	\$30,555	\$30,441	\$30,549	\$40,033	\$20,437	\$15,563	\$167,578
EQUIPMENT	\$16,172	\$15,458	\$14,514	\$24,902	\$5,000	\$10,000	\$86,046
OTHER DIRECT	\$54,831	\$71,592	\$54,253	\$61,964	\$41,638	\$3,362	\$287,642
TOTAL	\$618,668	\$751,408	\$586,185	\$608,108	\$393,808	\$204,314	\$3,162,491

COST SHARING/MATCHING FUNDS
(Over Life of Project)

FACILITIES

Remodeling of Agriculture Bioprocessing Laboratory (State of Illinois)	\$1,400,000
---	-------------

EQUIPMENT

Extruders, accessories, supplies & service (INSTA PRO)	100,000
Expeller, accessories & service (BAR Export)	10,000
Rancimat Analyzer (ADM)	20,000
Gas Chromatograph (Proctor & Gamble)	20,000
Expeller (State of Illinois)	29,000
Analytical Equipment for Fiber & Protein (State of Illinois)	10,000

PERSONNEL SUPPORT (State of Illinois)

Office of International Agriculture - Nicholaides, McCowen, Santas, B. Irwin @ 5% = \$12,000/year x 4 years	48,000
Department of Food Science - Salary support of \$25,000/year x 2 years	50,000
Department of Agronomy - R. Bernard = \$25,000/year x 1 year	25,000
Department of Entomology - M. Irwin @ 5% = \$2000/year x 3 years	6,000
Department of Plant Pathology J. Sinclair @ 5% = \$2000/year x 3 years	<u>6,000</u>

TOTAL: \$1,715,000

BUY INS/OTHER FUNDING

1985	<u>USAID (MISSIONS/OTHERS)</u>		
	Pakistan	36,000	
	Jamaica	35,000	
	Madagascar	17,200	
	Guyana	3,000	
	<u>MISCELLANEOUS</u>		
	IBPGR	<u>15,000</u>	106,200
1986	<u>USAID (MISSIONS/OTHERS)</u>		
	USDA (Zimbabwe/Sri Lanka)	18,000	
	WINROCK (India)	3,375	
	<u>MISCELLANEOUS</u>		
	Short Course	26,400	
	FAO (Zimbabwe)	<u>20,000</u>	67,775
1987	<u>USAID (MISSIONS/OTHERS)</u>		
	Sri Lanka	17,500	
	Zambia	20,000	
	USDA	<u>15,000</u>	52,500
1988	<u>USAID (MISSIONS/OTHERS)</u>		
	S&T (for Sri Lanka)	16,000	
	WINROCK (India)	21,000	
	USDA (Korea)	1,350	
	Pakistan	375	
	<u>MISCELLANEOUS</u>		
	Short Course	13,000	
	Training (FAO-India)	4,400	
	Training (UNDP-Sri Lanka)	<u>12,600</u>	68,725
1989	<u>USAID (MISSIONS/OTHERS)</u>		
	WINROCK (India)	17,000	
	USDA (Trinidad)	5,000	
	Sudan	5,000	
	Pakistan	6,500	
	<u>MISCELLANEOUS</u>		
	Training (UNDP-Sri Lanka)	1,800	
	Training (Fulbright-Tanzania)	<u>5,300</u>	40,600
			<u>40,600</u>
	GRAND TOTAL:		335,800

PSE - Funds
Program Support Acct.

	<u>Balance</u>
March 1, 1986 - Feb 28, 1987	\$5,548. ⁰⁰
March 1, 1987 - Feb 29, 1988	21,352.92
March 1, 1988 - Feb 28, 1989	53,027.10
Total:	<hr/> 89,930.02

APPENDIX 15

S&T AGRICULTURAL PROGRAM GUIDANCE PAPER

F. Mentem

MEMORANDUM

March 29, 1988

TO: ST/AGR Staff
FROM: ST/AGR, David D. Bathrick 
SUBJ: ST/AGR Office Agriculture Program Guidance Paper (Attached)

Attached for your reference and use is the ST/AGR Office Agriculture Program Guidance Paper. Thank you for your constructive help and inputs during the extensive period of project reviews and meetings last year that lie behind this paper. Dr. Phillip Church deserves special recognition for his work in presenting drafts and incorporating comments. As mentioned in the February Office Staff meeting chaired by S&T/FA, this is an important document to help facilitate the implementation of the Agency's agricultural focus statement and should be read again by the staff.

I want to point out that the Guidance Paper is only one step -- though an extremely important step -- in defining our program within the context of the agriculture focus. As was said during the draft review exercise and retreats that for the first time the Office has a mutually agreed upon parameter for establishing program direction and project prioritization. Beyond this important contribution, the immediate operational use of this document will be the standard reference from which all projects will be evaluated and new projects are designed. Evaluation and design teams will be expected to relate the three criteria listed for the three elements of the focus statement and the cross-cutting program consideration to the project under review. Such a description will be written into all consultants' scopes of work related to evaluations and design work.

There are other activities which must be done, however, in the spirit of this basic watershed document in order to provide as with greater program focus and to provide the S&T research agenda to help the Agency implement projects supportive of the focus statement. Also underway or soon to be initiated are a number of subsector assessments which will provide us with the basis for more specific actions. The recently completed fisheries sector assessment is one example of this process. Future proposed studies relating to horticulture, livestock, and pest management will also be initiated.

Major tasks still confronting us include the establishment of a future office research strategy document based on an analysis of future technological constraints for LDC agriculture as they in relate to the issues outlined in the Guidance Message so that over time we have the most appropriate programs in place to assist the Agency in the implementation of the sector focus statement. This will receive the highest of priorities over the next several months so that a strategy document can be prepared by October at the latest. Dr. Cusumano is presently preparing an outline on this activity which will soon be shared for office review. In addition, we must continue the work already started related to the measuring of the impact of our program activities on the incomes, consumption and agriculture resource maintenance goals of the ARDN focus statement which has in varying degrees already been initiated.

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- 2 -

I thank you again for the thoughtful and collegial way the Guidance Paper was developed and approved. I welcome your ideas and suggestions on these important issues during the months ahead.

Attachment: a/s

cc: S&T/FA:WFurtick

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BUREAU FOR SCIENCE AND TECHNOLOGY
OFFICE OF AGRICULTURE

AGRICULTURE PROGRAM GUIDANCE PAPER

Contents

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II.	Guidelines for selecting ST/AGR program activities	3
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	o Criteria based on increasing incomes	5
	o Criteria based on improving food availability	5
	o Criteria based on maintaining and enhancing the natural resource base	6
III.	Measuring the impact of ST/AGR program activities	7

S&T/AGR AGRICULTURE PROGRAM GUIDANCE PAPER

I. Introduction - The S&T Office of Agriculture Mandate

The focus of the Agency's agriculture, rural development and nutrition program is to increase the incomes of the poor majority and to expand the availability and consumption of food while maintaining and enhancing the natural resource base. It is the responsibility of the S&T Office of Agriculture (ST/AGR) to implement the Agency's agriculture focus through the management and direction of its centrally funded science and technology portfolio in production agriculture - crops, livestock and fisheries - and natural resources. S&T/AGR fosters new scientific and technical breakthroughs relevant to developing countries' needs and provides technical support and information to missions and LDCs to support this process.

The purpose of this paper is to have a management tool to assist program officers in better directing their projects to address the goals of the Agency's agriculture focus statement.

In addressing the goals of the Agency's agriculture focus, S&T/AGR strives to develop:

- o A progressive agricultural sector that is productive, sustainable and environmentally sound; and,
- o Human and institutional capacities within LDCs that will sustain a dynamic agricultural production and marketing system.

To carry out this mandate, S&T/AGR:

- o Mobilizes the expertise of U.S. universities and U.S. Government agencies to conduct research and provide technical assistance;
- o Manages A.I.D.'s technical and scientific relationships with the International Agricultural Research Centers; and,
- o Supports the strengthening of national research capability in LDCs and of international research networks linking scientists in developed and developing countries and in international research centers.

To implement the Agency's agriculture focus S&T/AGR works with other offices within the Bureau for Science and Technology, the Agency's Regional Bureaus, PPC and BIFAD, A.I.D. field missions, other U.S. government agencies, PVO's and other private sector groups, other donor agencies, international organizations, and LDC institutions. It is through these linkages that the Office supports the introduction of improved technologies into developing country agriculture and supports these collaborating offices in addressing other important constraints, eg., the availability of credit, markets and agricultural services, which are within their respective mandates.

Within A.I.D., the ST/AGR Office works to enhance the impact of the Agency's regional programs by strengthening their technological underpinnings. Its technical staff and the reservoir of current and past relationships with the U.S. scientific community make up the Agency's principal resource for addressing production agriculture problems.

The emerging realities of global agriculture present a new science and technology agenda in which S&T/AGR is particularly well-positioned to furnish leadership. Examples of activities that make up that build on past programs and make up a future agenda include: 1) improved natural resource management; 2) sustainable agricultural systems ; 3) food and agriculture price, trade and related sector policies; 4) post-harvest food preservation and utilization; 5) techniques for improving technology diffusion; and 6) increased animal protein from livestock and fisheries; and biotechnology applications to genetic improvement.

Given the range of demands for improving the scientific and technological underpinnings of Agency programs, well-defined guidelines are critical for wise use of the declining budget resources available to ST/AGR. The purpose of this agriculture program guidance paper is to assist S&T/AGR in the use of its program budget to implement the Agency's agriculture focus.

Specifically, this program guidance paper:

- 1) summarizes the criteria employed by ST/AGR for prioritizing, designing and directing the initiatives it supports for advancing agricultural technology development; and
- 2) describes the measurement procedures that ST/AGR follows in monitoring and assessing the impact of its portfolio of agriculture technology initiatives.

II. Guidelines for selecting ST/AGR program activities

In support of the Agency's agriculture focus statement ST/AGR selects its program activities according to their contributions to both increased incomes and food supplies as well as their role in stabilizing and enhancing the resource base for sustaining agricultural activities.

ST/AGR employs a number of periodic internal and external reviews of its agriculture science and technology portfolio to assist the Office in setting priorities among the range of crop, livestock, fisheries and related agricultural resources activities that it sponsors. The purpose of these peer group and external advisory reviews is to identify constraints to the sector's development that could be addressed through the generation of new technological solutions. In addition, ST/AGR conducts management reviews to consider project applications to the revised focus statement.

ST/AGR also has underway and soon will have a series of technical sub-sector assessments in the areas of: a) livestock production; b) fisheries resource management; c) biotechnology (biodiversity and plant genetic resources), d) pest management; e) sustainable agriculture production systems; and f) systems approaches to the transfer of improved agrotechnology. These assessments will form the basis for the future direction of the ST/AGR portfolio and extensions of this Guidance Paper.

One additional promising long-run approach to assist in the crafting of the ST/AGR portfolio is the pioneering and on-going research priorities setting exercise within the framework of the international agricultural research centers (IARCs) which form the core of the international agricultural research system today. The relatively advanced tools of analysis now employed by the CGIAR system to examine research needs within a global context can prove useful to donors like A.I.D. ST/AGR will work with the CGIAR research priority setting process to develop complementary research initiatives that ST/AGR would directly fund using the unique set of US institutional resources, eg., BIFAD universities and other international centers such as AVRDC, IFDC, IMMI, ICIPE, ICLARM, which AID has helped develop and support.

The ST/AGR has identified a series of criteria which at this juncture form the basis for the direction of its programs. These criteria will also serve as scopes of work for office technical staff and external advisors and consultants charged with the design or implementation of the ST/AGR projects and activities. For ST/AGR, these criteria form the principal decision-making mechanisms to guide and manage its project portfolio.

Selection criteria employed by ST/AGR that cut across all program activity areas and relate to the role of the S&T Office of Agriculture include:

- o The extent to which the problem constrains achieving the goals of the Agency's ARDN focus and Strategic Plan;
- o The scientific merit of the program as reflected in its conceptual and technical soundness and scope for providing information to be used to solve development problems of priority concern to the Agency.
- o The extent to which other donor agencies and national governments are addressing the issue;
- o The extent to which AID can exercise the intellectual leverage to facilitate the flow of resources from other US, LDC, developing country and international institutions;
- o The nature of A.I.D. Regional Bureau program priorities and their needs for improved technological underpinnings and ST/AGR funded support services in their grant and loan assistance programs at the field mission level;
- o The scope for A.I.D. to work through the U.S. scientific research community and international scientific networks to contribute to research and training activities in developing countries; and
- o Possible benefits to U.S. agriculture.
- o Relationship to and compatibility with other S&T Bureau programs

The above cross-cutting selection criteria serve to assure that the ST/AGR program avoids duplication of efforts by other ST Offices (particularly in the areas of nutrition, forestry, energy and natural resources and rural development) and by other donor agencies. They are also used by the S&T/AGR Office to implement its program in such a fashion as to provide the intellectual leadership to leverage other donor efforts as well as its own in support of the Agency's agriculture focus.

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These cross cutting criteria are still too broad to enable selection of on-going and future project activities with regard to their agriculture focus contributions. More specific criteria will also be employed by the ST/AGR Office.

Criteria around which the ST/AGR Office will formulate its agenda for increasing incomes are:

- a) the current and potential importance of the crop or animal products in LDC consumption and trade;
- b) the number of actual and estimated potential producers or laborers who stand to benefit through employment, lower costs and higher incomes;
- c) potential savings in land, labor, capital and other production resources that could be allocated to other agricultural activities or contribute to sustaining incomes by improving the natural resource base;
- d) the technical and economic feasibility of the innovation;
- e) the strength of future market growth and income earning potential of a new or improved enterprise;
- f) whether the adoption of improved technologies is within the grasp of limited resource farmers given available local institutional (eg. credit) support;
- g) the extent to which a new or improved enterprise spreads the income benefits through its employment of labor and services;

ST/AGR Office criteria for selecting program initiatives that expand the availability and consumption of food will be:

- a) the contribution of the new technology to improvement of food consumption by utilization of more nutritional crop, livestock or fish products or through the introduction of varieties with better storage or processing capabilities;
- b) the degree to which technological constraints limit LDC farmer diversification into new crop, livestock or fisheries enterprises which offer special nutritional benefits;

- c) the value of crop, livestock or fisheries products that are currently lost in post harvest handling and marketing;
- d) the relative contributions to increased food availabilities from equal investments made in post-harvest loss reduction and in crop yield increases;
- e) the scope for improving consumption from new product utilization techniques;
- f) scope for private sector participation in the provision of services and development of new food products for consumers.

In constructing its science and technology agenda for maintaining and enhancing the natural resource base the S&T Office of Agriculture considers the following criteria:

- a) the contribution of new crop, livestock or fisheries technologies to the increased efficiency in natural resource use and maintenance of long-run productivity;
- b) the impact of increased efficiency of purchased inputs in crop production on cultivatable lands makes to resource use;
- c) the contribution to the preservation, maintenance and restoration of natural (biological and physical) resources including biological diversity of plant and animal genetic resources;
- d) the potential areas of coverage and the replicability of those improved crop cultivation and livestock or fisheries management practices that contribute to better natural resource use; and,
- e) the contribution that interdisciplinary approached make to resource conservation and development, agrotechnology transfer and protection of the environment.

III. Measuring the impact of agriculture program activities

The ST/AGR office must have ways to measure the impact of its program in achieving the Agency's agriculture focus goals. Experience suggests that no single yardstick or set of indicators is feasible for a a priori measurement of the impact of the diverse range of specific science and technology initiatives found in the agricultural sector. The common denominator must be the present and/or potential impact that the proposed technological advancement would be reasonably expected to have on achieving the goals of the Agency's ARDN focus.

As outlined in the previous section on guidelines criteria the point of departure is the economic importance of crop, animal and fisheries enterprises measured in terms of production, number of participating farmers, value of output or other related economic measure of contribution to national product. Adjustments can then be made to take into account potential output likely under the new set of production yields and costs expected from removal of one or more production stresses.

S&T/AGR will undertake systematic economic analysis during the period of project design to assess the potential pay-off achieving the goals of the Agency's agriculture focus. This analysis is also essential to establish benchmarks and baseline information against which future project performance can be measured. In some cases analysis of the developmental impact of the new technology will become a research activity of the project itself, for example when there is a need for direct on-farm validation to get realistic measures of productivity, costs and returns.

ST/AGR is improving the monitoring of its agricultural science and technology program by strengthening the capacity of staff and contractors to build clear and quantifiable measures of performance into the design of the projects it sponsors. Best estimates of achievement dates will also be included. The emphasis is on introducing clear and rigorous analysis into on-going and new ST/AGR project activities to permit systematic assessment of the contributions of project outputs to ARDN focus objectives.

In this regard, the sustainability of the natural resource base for agriculture will be one particular concern to which the ST/AGR Office will be addressing the attention of its project officers and counterparts. Considerable work must be done at the outset on development of realistic and viable ways to inventory the natural resources used in agricultural production and to monitor changes in that inventory that result from the introduction of new agrotechnologies and management practices.

The ST/AGR Economic Policy Division will exercise a more active staff role in support of the Agriculture Production and Natural Resources Divisions in the monitoring the impact of program activities. EP Division economists sit on all project committees currently and will contribute directly to the design of economic impact analysis components and to the assessment of economic impact data as part of project design, implementation and evaluation. Impact on U.S. agriculture of ST/AGR programs will also be given explicit attention.

The ST/AGR Office will also draw on the Agency's own development indicators and tracking system, directed by the PPC Bureau's Center for Development Information and Evaluation (CDIE). S&T Bureau technical agricultural staff have already been at work with CDIE to develop appropriate indicators for the agriculture sector and for the hunger and income components of the Agency's Strategic Plan.

These indicators provide intermediate measures of program impact such as the area planted to improved crop varieties or the number of livestock vaccinated against specific diseases for which new technological solutions have been facilitated by ST/AGR programs. ST/AGR has already worked with CDIE to introduce improvements of these intermediate measures into the data tracking system.

Finally, the ST/AGR Office is linking up with regional bureaus and field missions where appropriate to utilize the agriculture performance indicators with which they are working and to which centrally funded research projects are making a contribution. It is the regional bureaus and field missions which provide much of the data to the CDIE tracking system that ST/AGR will be using to monitor the performance of its program activities as well. Most performance monitoring of the ST/AGR agriculture research portfolio will be country or region specific even though there are also possible worldwide "spill-over" benefits.

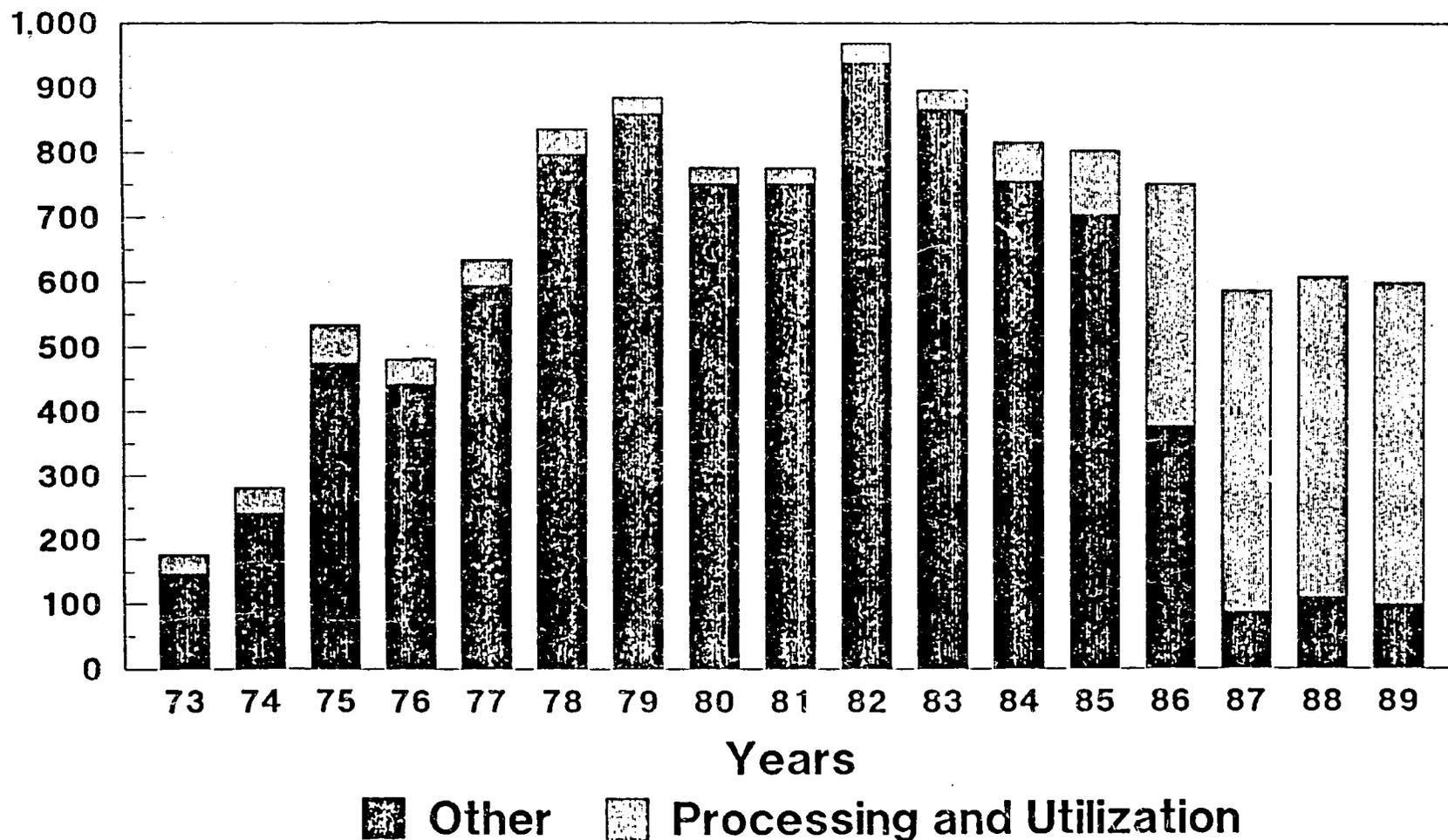
APPENDIX 16

BUDGET ALLOCATIONS - SOYBEAN PROCESSING UTILIZATION

Budget Allocations

Soybean Processing and Utilization (\$1000)

Funding



APPENDIX 17
RESEARCH PROJECT PLANS

INTSOY Nutrition Projects

Extrusion/Expelling Soy Products

- A. Cholesterol Study: Soy foods made using extrusion expelling will be fed to human subjects at the Danville Veterans Administration.
- B. Cholesterol Study: Hamsters receiving high cholesterol diets will be fed soy flour.
- C. Metabolizable Energy: Determine if extrusion/expelling affects the M.E. in poultry rations.
- D. Protein Quality: Protein Efficiency Ratio (PER).
- effects of wet heat on protein quality

Other Studies

- E. Addition of Soy to ¹²⁰⁰⁰⁰Zambian Diet: Protein Efficiency Ratio (PER).
- F. Mineral Bioavailability: Effect of removal of phytic acid and/or fiber on zinc and iron availability.

RESEARCH PROJECT PLANS

DRY PROCESSING - (Wilmot Wijeratne)

1. Scale Up of Extrusion/Expelling
2. Effect of Process Variables on Quality and Stability of Flour
3. Texturization
4. Increased Rumen Bypass Protein
5. Co-Extrusion of Traditional Legumes with Soybeans
6. Extrusion Parameter for Cereal/Soy
7. Use of Expelled Soy Oil in Food Applications
8. Shelf Life of Expelled Soybean Oil
9. Bleaching and Deodorization of Expelled Oil
10. Low-Fat Soy Flour in Bread Spreads

WET PROCESSING - (Kukiati Tanteeratarm)

1. Scale Up of Commercial Soymilk Process
2. Scale Up of Commercial Tofu Production
3. Tofu - Derivatives from New Process
4. Tempeh in Spices, Soup Mixes, etc.
5. Utilization of Okara in Food and Feed
6. Ice Cream - Formulation and Flavors
7. Yogurt - Texture, Solids/Protein, Flavor, pH Control, Culture Preparation

GREEN SOYBEANS - (Danny Erickson, Kukiati Tanteeratarm, Karl Weingartner)

1. Effect of Variety and Time of Harvest on Quality of Green Soybeans

PROJECTS SPECIFIC TO AFRICAN COUNTRIES - (Karl Weingartner)

1. Quality of African Soybeans
2. Composition of Soybean Leaves
3. Product Development for Africa

NUTRITION - (Karl Weingartner)

1. Nutritional Value of Extruded Soy Flour (Rat Studies)
2. Nutritional Value of Extruded Soy to Poultry
3. Nutritional Value of Extruded Soy to Humans

HOME AND VILLAGE - (Karl Weingartner)

1. To be determined

RESEARCH PROJECT PLAN

TITLE: Scale-Up Extrusion/Expelling Process
IN CHARGE: Prof. A. I. Nelson/W. Wijeratne
COOPERATOR: K. Tanteeratarm/BAR
TIMETABLE: Ongoing

OBJECTIVES:

The concept of soybean processing by extrusion/expelling has received wide interest from developing countries. The paper published in the journal of the AOCS reported the results of pilot-scale studies. The process has to be scaled up to reasonable level for small-scale industries.

COMMENTS:

The heart of the process is extrusion and expelling. The INSTA PRO Models 600 and 2000 extruders have to be matched with suitable expellers so that the process can be made continuous. In the past, several expellers have been used (Simon Rosedowns Mini-40, Chinese ZX-10, Chinese ZYB-78, Hander EX-100) with varying degrees of success.

From the previous experience, it appears that expellers with screws having continuous flights perform better than those having interrupted flights. Also, the extraction efficiency is better at lower rates of throughput in the expeller. As capacity increases, the amount of pressure that can be applied in expelling becomes less. As capacity increases, the RPMs of the screws become lower. None of the expellers studied so far have capacity to match the 600 extruder. Therefore, the search for higher capacity expellers is urgent. The experience gained so far will be beneficial in predicting the type of expellers that may work with extruded soybeans.

After identifying expellers that work on extruded soybeans and have sufficient capacity, the maximum possible oil yields under continuous operation at the required capacity should be determined. It has already presented problems when the information obtained from the pilot-scale work has been applied by prospective entrepreneurs in the evaluation of commercial-scale operations. Larger expellers from India, China and the United States will be investigated.

RESEARCH PROJECT PLAN

TITLE: Effect of Extrusion/Expelling Conditions on the Quality and Stability of Low-Fat Soy Flour

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

This project will be an extension of the research already done and published on extrusion/expelling. It will provide in-depth information on the process in terms of the effect of process variables upon the quality and stability of low-fat soy flour. The study may be useful to fine-tune the extrusion/expelling process when it becomes commercial.

COMMENTS:

The following aspects will be investigated:

1. Effect of initial moisture content on oil yield.
2. Effect of extrusion temperature on oil yield.
3. Effect of initial moisture content and extrusion temperature on the rate of inactivation of trypsin inhibitors.
4. Effect of various levels of residual oil in extracted cake on the stability of low-fat soy flour.
5. Effect of initial moisture content of beans and the extrusion temperature on the amino acid profile and PER of low-fat soy flour.

RESEARCH PROJECT PLAN

TITLE: Texturization
IN CHARGE: Prof. A. I. Nelson/W. Wijeratne
COOPERATOR: K. Tanteeratarm
TIMETABLE: Ongoing

OBJECTIVE:

Investigate the possibility of texturization of simple raw materials using cooking extruders.

COMMENTS:

Conventional approach to texturization of soy protein calls for solvent extracted meal or soy concentrate with high NSI and also medium shear extruders with external temperature control. No studies have been done to explore the potential of cooking extruders and simpler raw materials for texturization. Currently produced textured soy products are priced close to that of animal products, and as such, the textured soy is out of reach of the most needy people. Simplification of the texturization process may bring down the cost of products and make the technology more affordable to the less developed countries.

The following aspects will be investigated:

1. Evaluate the texturization capability of the INSTA PRO extruders using conventional raw materials.
2. Investigate the possibility of texturization of raw materials at higher oil content than is conventionally used.
3. Investigate the possibility of texturizing expelled soy flour by suitable modification of the functional properties of the protein fraction.

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RESEARCH PROJECT PLAN

TITLE: Extrusion of Soybeans for Increased Rumen Bypass Protein
IN CHARGE: Prof. A. I. Nelson/W. Wijeratne
COOPERATOR: K. Weingartner/Dept. Animal Science
TIMETABLE: Planned

OBJECTIVE:

To increase rumen protected protein by the extrusion processing of soybeans.

COMMENTS:

It is claimed that conventional expelling of soybeans result in meal having a high content of rumen bypass protein which is desirable in feeding ruminants. Apparently, the increase in the bypass protein may be related to the prolonged heat treatment of the beans during conventional expelling and consequent effects on the protein fraction. If this is so, we may gear up extrusion cooking to impart the necessary degree of thermal treatment.

The following aspects will be investigated:

1. Determine the process variables in extrusion that will deliver high degree of thermal treatment on a consistent basis.
2. Evaluate proper heat treatment that will result in the required change in rumen bypass protein. This will be possible by collaboration with animal nutritionists.
3. Investigate chemical treatments in combination with extrusion for protecting protein in rumen.

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RESEARCH PROJECT PLAN

TITLE: Co-Extrusion of Traditional Legumes with Soybeans

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

Traditional legumes are an integral part of the diet in many developing countries. The flavor of traditional legumes can improve the acceptability of soy-based products if these flavors can be successfully imparted. The extrusion of blends of soybeans and traditional legumes is one approach.

COMMENTS:

Traditional legumes of developing countries will be blended in various proportions with soybeans and/or cereals and extruded using INSTA PRO extruders. The minimum requirement of the legumes necessary for imparting flavor will be determined. This information will be used in the development of a number of products with potential for wide application in developing countries.

Initial work on soy/peanut indicates that as little as 15 percent peanuts in soy will extrude well and retain a predominant peanut flavor. This work is of interest to ICRISAT (Hyderabad) according to our recent discussions with them.

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RESEARCH PROJECT PLAN

TITLE: Determination of Extrusion Parameters for Cereal/Soy Expanded Products

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

To determine the extrusion parameters for cereal/soy expanded products.

COMMENTS:

The operating parameters for the INSTA PRO extruders in the processing of cereal/soy blends has not been documented, particularly for rice and lesser known staples. The processing of cereal/soy blends in the extruder on a continuous basis is more complicated than the processing of straight soybeans. This was apparent from our previous experience with the 2000 and 600 model extruders. It is, therefore, important to carry out systematic studies to determine the following:

1. The screw configurations that are suitable for processing corn/soy and rice/soy blends (and other cereals) in order to facilitate continuous operation without temperature creep. The behavior of the extruder will be dependent upon the blend composition and moisture content.
2. The moisture and process temperature relationships for obtaining expansion from given blends of corn/soy and rice/soy.
3. The effect of blend composition on the expandability of the product during extrusion. Initial work with low-fat soy flour as the soy ingredient indicated that it imparts better expansion properties to the blend than full-fat soy flour. It appeared that the reduced fat content in the low-fat soy flour may not be the sole reason for improved expansion.
4. The effect of moisture and/or steam injection during extrusion on the properties of the expanded products. Equipment for accurate metering of moisture and steam into the mixing zone of the extruders needs to be installed.

This study will be particularly important for both training and outreach in extrusion projects. This information in combination with the experience in processing straight soy may eventually develop into a brochure on the use of INSTA PRO extruders for processing soy/cereal products. This project involves the study of a number of variables pertaining to the equipment and ingredients.

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RESEARCH PROJECT PLAN

TITLE: Use of Expelled Soy Oil in Food Applications

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Planned

OBJECTIVE:

Investigate the performance of crude and degummed soybean oil from extrusion/expelling on selected food applications which offer potential for utilization of oil on a large scale.

COMMENTS:

Although considerable amount of work has been done on the use of flour from extrusion/expelling, little has been done on the use of oil in food applications. This type of work will strengthen the commercial application of the process.

The following specific investigations will be done - others can be added to the list as necessary:

1. Deep-frying applications - select suitable test products and evaluate the performance of the oil relative to standard frying fats. The foaming characteristics of oil, rate and extent of oil absorption by the product, color properties, and sensory properties of the fried products will be investigated.
2. The stability of oil during repeated use will be investigated in comparison with standard frying fats and oils.
3. Use of crude oil in salad dressings.
4. Stir-frying applications.

RESEARCH PROJECT PLAN

TITLE: Shelf Life of Expelled Soybean Oil

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

Study the storage stability of crude oil, degummed oil, and bleached oil produced by extrusion/expelling. Evaluate the effect of food-grade antioxidants on the extension of storage stability.

COMMENTS:

Some work on the storage stability of the oil has been done. These studies were based on objective methods of evaluation such as the peroxide value. The practical value of studies on storage stability is to the extent that they relate to the sensory characteristics as perceived by the consumer. There is no direct correlation established between such parameters as peroxide value and the sensory properties of oil. Therefore, a detailed study on storage stability of oil must be based on actual sensory evaluations. It will be useful to study subjective and objective quality criteria together in order to investigate possible correlations between them.

Initial studies have shown that degumming results in increased rates of peroxide formation. However, without sensory evaluation, it is not possible to determine a critical or even a general level of peroxides at which the oil may show deterioration in sensory characteristics. The use of food-grade antioxidants is possible even on small-scale processing operations if they can be shown to bring about significant improvements in shelf life.

This project will study the different grades of oil with regard to stability with and without added antioxidants. Standard methods of sensory evaluation of oils will be used along with some objective measurements. Attempts should be made to carry out studies at accelerated temperatures and room temperatures such that temperature dependence of the deterioration can be established. This will enable future studies to be done at accelerated temperatures and extrapolation to room temperature conditions.

RESEARCH PROJECT PLAN

TITLE: Bleaching and Deodorization of Expelled Soybean Oil

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

It has become apparent that the natural color of the expelled oil is objectionable to certain consumers who are accustomed to fully refined vegetable oils. Initial work on bleaching of degummed oil using activated earth has been satisfactory. This work needs to be pursued.

COMMENTS:

The processing of oil involves standard procedures for degumming and bleaching. This is normally preceded by alkali refining. The alkali and the bleaching agent impart objectionable odor to the oil which is removed subsequently by deodorization. Commercial deodorization involves steam stripping under high vacuum over extended periods of time. A relatively simple procedure for bleaching and deodorization is needed if this type of refining is to be used in a small-scale operation on extrusion/expelling.

RESEARCH PROJECT PLAN

TITLE: Low-Fat Soy Flour in Bread Spreads

IN CHARGE: Prof. A. I. Nelson/W. Wijeratne

COOPERATOR: K. Tanteeratarm

TIMETABLE: Ongoing

OBJECTIVE:

To develop a bread spread from blends of conventional peanut butter and low-fat soy flour.

COMMENTS:

Peanuts are more expensive than soybeans. Peanut butter is a product that has wide appeal. Soy flour, when properly processed, has little flavor of its own. However, it can take on the flavor of the ingredients with which it is blended. Hence, there is potential for using low-fat flour as an extender to expensive peanut butter. The product can be a good carrier for soybeans and a concentrated source of calories for the children.

Initial work done on blending commercial peanut butter with low-fat soy flour has shown promising results. This work will be extended.

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RESEARCH PROJECT PLAN

TITLE: Dairy Analogs

IN CHARGE: K. Tanteeratarm

COOPERATOR: W. Wijeratne

TIMETABLE: Planned

OBJECTIVE:

Scale up process for making ice cream and yogurt.

COMMENTS:

Study on ice cream -

1. Formulation
2. Flavors
3. Product improvement and development

Study on yogurt -

1. Texture versus solids/protein content
2. Flavor and pH control
3. Culture preparation
4. Other products

RESEARCH PROJECT PLAN

TITLE: Soymilk
IN CHARGE: K. Tanteeratarm
COOPERATOR: W. Wijeratne
TIMETABLE: Ongoing

OBJECTIVE:

1. To improve soymilk flavor
2. To scale up soymilk process
3. Test low lipxygenase varieties for soymilk and derived products.

RESEARCH PROJECT PLAN

TITLE: Oriental Soyfoods

IN CHARGE: K. Tanteeratarn

COOPERATOR: W. Wijeratne

TIMETABLE: Ongoing

OBJECTIVE:

Product development on:

1. Tofu and its derivatives
2. Tempeh (spices, soup mix, etc.)
3. By-product utilization (okara, cake flour into food or feed)

RESEARCH PROJECT PLAN

TITLE: Green Soybeans

IN CHARGE: D. Erickson

COOPERATORS: K. Tanteeratarm, K. Weingartner, W. Wijeratne

TIMETABLE: Ongoing

OBJECTIVE:

To determine the effect of variety and the effect of time of harvest on quality of green soybeans.

COMMENTS:

Several varieties of soybeans will be harvested at different stages of maturity in order to evaluate the effect of harvest time on flavor. Also measure the relationship of solids content to (a) maturity, (b) color, (c) texture, and (d) flavor.

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RESEARCH PROJECT PLAN

TITLE: Quality of African Soybeans

IN CHARGE: W. Weingartner

COOPERATOR: K. Tanteeratarn

TIMETABLE: Ongoing

OBJECTIVE:

To determine the quality of select African soybeans.

COMMENTS:

Check the quality of soybeans that have good agronomic qualities.

Analysis

Protein
Minerals
T.I.
Ash
Oligosaccharides
Crude Fiber
Phytic Acid
Oil (content, FFA, Peroxide, Iodine, Saponification #)
Tenderness

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RESEARCH PROJECT PLAN

TITLE: Composition of Soybean Leaves

IN CHARGE: K. Weingartner

COOPERATOR: K. Tanteeratarm

TIMETABLE: Planned

OBJECTIVE: Determine the nutritional value of soybean leaves.

COMMENTS:

Treatment

1. Raw Leaves
2. Cooked Leaves

Analysis

Protein

Phytic Acid

Crude Fiber

T. I.

Ash

Oil Content

RESEARCH PROJECT PLAN

TITLE: Product Development for Africa

IN CHARGE: W. Wijeratne

COOPERATOR: K. Weingartner

TIMETABLE: Planned

OBJECTIVE:

Develop nutritionally adequate foods using food staples common to Africa.

COMMENTS:

Foods

Soy peanut
Cassava
Rice
Cowpea
Corn

Method

Preparation by extrusion and extrusion/expelling.

Formulation into baked products in kitchen.

RESEARCH PROJECT PLAN

TITLE: Nutritional Value of Extruded Soy Flour

IN CHARGE: K. Weingartner

COOPERATOR: W. Wijeratne/J. Erdman (Food Science)

TIMETABLE: Planned

OBJECTIVE:

To determine nutritional quality of extruded/expelled flour.

COMMENTS:

Product

1. Extruded Soy Flour
 - a. 250° F
 - b. 280° F
 - c. 310° F
2. Extruded/Expelled Flour

Test

Protein Efficiency Ratio

Rats

RESEARCH PROJECT PLAN

TITLE: Value of Extruded Soy to Poultry
IN CHARGE: K. Weingartner
COOPERATOR: A. Nelson, W. Wijeratne, C. Parsons (Animal Science)
TIMETABLE: Planned

OBJECTIVE:

To determine nutritional value of extruded soy flour to chicks.

COMMENTS:

Products

1. Extruded Soy Flour
 - a. 250° F
 - b. 280° F
 - c. 310° F
2. Extruded/Expelled Flour
 - a. 280° F

Tests

Metabolize Energy

Protein Value

Nitrogen Balance

RESEARCH PROJECT PLAN

TITLE: Nutritional Value of Extruded Soy to Humans

IN CHARGE: Prof. A. I. Nelson/K. Weingartner

COOPERATOR: W. Wijeratne

TIMETABLE: Ongoing

OBJECTIVE:

To determine nutritional value of extruded soy products to humans.

COMMENTS:

Soy Products

1. Soy Isolate
2. Whole Soybean Extruded/Expelled Cake

Foods Which Will Contain Soy

Bread

Cookies

Pasta

Ice Cream

RESEARCH PROJECT PLAN

TITLE: Home and Village Processing

IN CHARGE: Prof. A. I. Nelson

COOPERATOR: K. Weingartner/W. Wijeratne

TIMETABLE: Planned

OBJECTIVE/COMMENTS:

Previous work done has found application in a number of countries such as Sri Lanka. The project will receive new direction and planning in the light of field experience already gained.

APPENDIX 18
EXTRUSION COOKING AND OIL EXPELLING

This method further produces a high-quality natural oil requiring little further processing. Oil from the expeller is:

- Passed while still hot through a screen to entrap the coarse sediments.
- Allowed to stand overnight for cooling and sedimentation.
- Decanted, leaving the sludge.

The clear, light-colored oil is free of any off-flavor and is generally comparable to refined and partially hydrogenated oil in stability. It would be suitable for use in developing countries where there is commonly little or no refining of vegetable oils used for human consumption. The oil could also be an important natural product for the U.S. health food industry.

Omega-3 in Soybean Oil

A number of recent reports indicate that dietary Omega-3 fatty acids have a beneficial effect on cardiovascular diseases. Raw soybean oil contains an average of 7 to 8 percent naturally occurring Omega-3 in the form of alfa-linolenic acid. In most cases, the Omega-3 is partially destroyed during the normal refining process. The exact amount that is lost depends on the degree of refining.

The highly stable oil from extrusion/expelling, however, retains virtually all the Omega-3 found in raw soybeans. The content in soybeans is much higher than corn, coconuts, palm kernels, and sunflowers, all of which have less than one percent.

The only common food crop that has more Omega-3 than soybeans is rapeseed, which has 20 percent. On the other hand, fish oil averages about 20 percent Omega-3.

Increasing Omega-3

University of Illinois germplasm experts, however, have already identified several soybean varieties with contents in the 12 to 13 percent range. Through genetic engineering, it may be possible to develop new varieties with an Omega-3 content equal to or higher than that of fish oil.

The soybean oil from the extrusion/expelling process could easily be made into salad dressing and mayonnaise. Therefore, the relatively high Omega-3 content in soybeans creates tremendous potential for marketing the oil made using this new concept.

Benefits

This new combination of extrusion and expelling technology has tremendous potential for:

- Developing value-added products with high market potential as health foods.
- Increasing decentralized processing of soybeans in regions where production is as small as 3,000 to 5,000 hectares.
- Opening up soybean processing to many individual farmers and entrepreneurs interested in marketing high-quality edible oil, along with animal feed and protein-rich soyfoods.
- Promoting new economic activity which should result in both improved human nutrition and higher demand for soybeans and processed soy products.

Contact us for further information about INTSOY programs and publications.

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Extrusion Cooking and Oil Expelling



International Soybean Program
College of Agriculture
University of Illinois

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Limitations of Standard Processing

In recent years, mechanical oil extraction equipment for processing soybeans has been almost completely replaced in developed countries by large-scale solvent extraction facilities. The solvent process, in which oil is leached from flakes using the petroleum product hexane, can easily remove at least 99 percent of the available oil from soybeans. The protein meal by-product provides large quantities of cheap animal feed and the base for numerous food and industrial uses.

This technology, however, has proved generally unsuitable for individual farmers and entrepreneurs in the United States and for many smaller developing countries. A large solvent extraction plant costs about \$20 million to build. Anything less than a daily volume of 200 tons of soybeans is considered uneconomical for even the smallest facility.

Mechanical Expeller Alternative

On the other hand, a mechanical screw press expeller costs from \$5,000 to \$50,000, depending on its size, and can operate efficiently using the smaller quantities of soybeans available on individual farms and in developing countries. Use of this alternative processing technique, however, has been limited by several technical problems.

Because soybeans have a relatively low oil content compared to other sources such as peanuts, coconuts, or palm kernels, conventional methods of expelling produce low oil yields. Running the soybeans through the expeller several times increases oil yields but also causes overheating of the meal or cake, resulting in a brown color and scorched flavor. It also produces darkening and deterioration of the oil.

The Extruder as an Aid to Expelling

But, according to recent research at INTSOY, these problems can be overcome using relatively small-scale extrusion cooking equipment to condition the soybeans before expelling. The extruder produces heat by friction under pressure. A screw transports the ingredients through a series of restrictions within a cylindrical chamber, finally forcing the material out through a die.

The extruder offers a convenient way of cooking the beans and breaking down the oil-bearing tissues in a fraction of the time required for conventional conditioning methods. The beans remain in the extruder system for less than 30 seconds at a temperature of about 275 degrees F. The short cooking time at high temperature is:

- Adequate to satisfactorily destroy antinutritional agents such as the trypsin inhibitor.
- Not so long as to damage important nutritional components such as protein.

INTSOY Research

The results of INTSOY research clearly indicate that expeller efficiency can be greatly enhanced by using hot extruded material in a nearly fluid state. High temperatures in the extruder release the oil, producing a semi-fluid state. At temperatures higher than 300 degrees F, however, the material tends to scorch.

At about 275 degrees F, there is a clear increase in the oil recovery rate when the extruded material is immediately fed into the expeller. As the extrudate cools, there is a drastic reduction in oil recovery regardless of the original extrusion temperature.

Advantages of Extrusion-Expelling

The results of combining the extruder and expeller into a single operation include:

- Oil yields approaching 75 percent with only a single pass through the expeller.
- Production of a high quality natural oil.
- Large increases in the rated capacity of expellers.
- Production of a partially defatted, protein-rich meal.

Food Products from Extrusion-Expelling

A major objective of INTSOY's research effort is to produce a low-fat cake or meal suitable for food uses. Results indicate that the combination of extrusion and expelling produces both a natural edible oil and a high-quality meal with a color close to that of the raw material. The meal can be used in number of food products including:

- A partially defatted soy flour suitable for breads and tortillas.
- Weaning foods
- Beverages
- Products for general protein fortification

Processing Advantages

This method also makes the milling process easier. Whole soybeans, for example, cannot readily be ground into flour by conventional milling equipment such as plate and hammer mills because of the high oil content, thereby limiting the production of full-fat soy flour in most developing countries. The partially defatted cake produced by the combination of extrusion and expelling, however, grinds very well in conventional hammer mills.

APPENDIX 19

SOYMILK AND DAIRY ANALOGS

Making Dairy Analogs

The soymilk from this process is a bland product suitable for making a number of dairy analogs:

Soy Yogurt—Yogurt is a tasty and nutritious product made by fermenting cow's milk to form an acidic gel. Soy yogurt is less acidic than regular yogurt and should have widespread consumer appeal. The steps for making soy yogurt using the same culture as the one used for regular yogurt are as follows:

- Manufacture the soymilk.
- Formulate the soymilk with sucrose and dextrose.
- Pasteurize and homogenize.
- Inoculate and incubate.

The culture must be carefully maintained. The temperature and time of incubation should be carefully controlled. The soymilk must be properly pasteurized to prevent contamination. A small amount of added sugar promotes the fermentation. The use of different sugars or sugar mixtures produce somewhat different flavors in the final product.

Soy Ice Cream—This product is prepared from the soymilk and added vegetable oil. It is formulated and manufactured as in the conventional dairy ice cream process. The soy ice cream stores well and has good melt-down characteristics.

Developing Commercial Products

An excellent soymilk containing more than 5 percent protein has already been prepared using this scaled-up method. At that concentration, about 10 kilograms of dehulled soybeans are needed to produce 50 kilograms of soymilk.

This product contains about 10 percent total solids. That compares to cow's milk which has 10 to 12 percent solids, including about 4 percent protein. This soymilk should be nearly ideal as a base for commercial soft-serve ice cream products.

The okara or residue from the commercial process can be used immediately in baking or dried for later use as a high-fiber flour. The okara contains about 8 percent protein on a wet basis or about 40 percent on a dry basis.

Benefits

The equipment used in this research is relatively inexpensive and widely available. It could be easily linked into a commercial soymilk operation with a volume of 100 to 200 liters per hour. With a larger roller extractor, the capacity could be expanded to as much as 600 to 800 liters per hour.

The new commercial-scale process being developed by INTSOY therefore represents a major step toward effectively meeting the huge world-wide need for soymilk. The benefits should include the following:

- A soymilk plant producing 100 to 800 liters per hour would be much less expensive than the available turn-key operations.
- Smaller processing plants that prepare pasteurized products for local rather than nationwide distribution would not need costly aseptic packaging equipment.
- The moderate cost for this type of operation could be particularly important for promoting soymilk in areas where there is a strong need for a high-protein beverage but only a limited amount of investment capital.

Contact us for further information about INTSOY programs and publications.

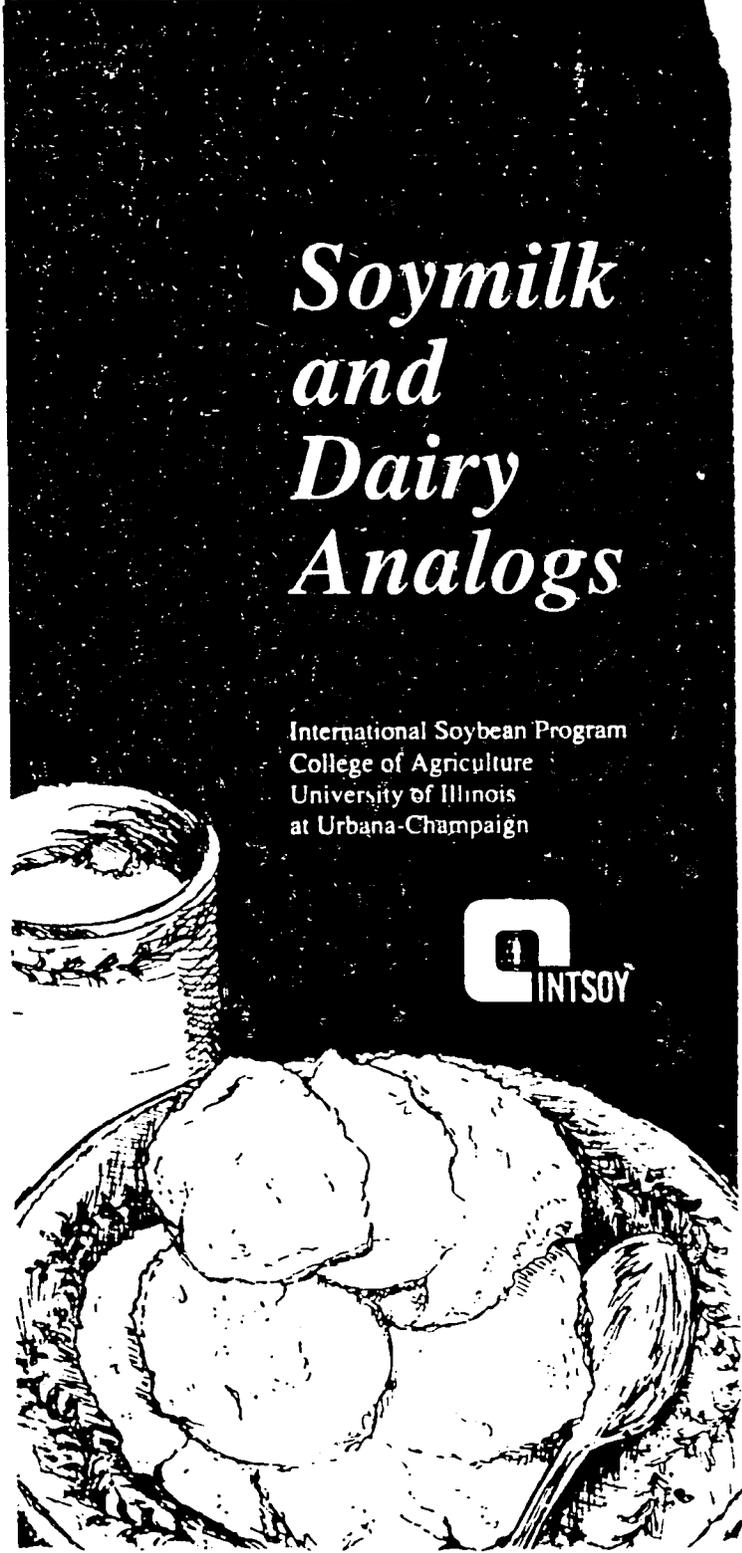
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Soymilk and Dairy Analog

International Soybean Program
College of Agriculture
University of Illinois
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Advantages of Soymilk Products

One of the simplest methods for converting soybeans to a high-quality food is to produce a beverage known as soymilk. This product contains virtually the same amount of protein as cow's milk and is free of cholesterol and lactose. Soymilk is especially important for people who are allergic to the lactose in cow's milk.

Although less serious in the United States or Europe, the inability to digest the milk sugar lactose occurs widely in developing nations. Rates from 40 percent to almost 100 percent have been recorded among population groups in Asia, Africa, and Latin America.

Because soymilk contains no lactose and is relatively inexpensive, it offers an attractive alternative to cow's milk for hundreds of millions of people in developing countries, as well as many people in developed countries.

Soymilk Acceptance Problems

Soymilk has been a staple in the Orient for many centuries. It is traditionally made by soaking the beans, grinding them with water, cooking the slurry, and then filtering to remove the sludge.

Unfortunately, the traditional soymilk has a distinctive beany flavor which is unacceptable to most consumers outside the Orient. This objectionable flavor results from the action of an enzyme when raw soybeans are ground and exposed to moisture.

The acceptability of soymilk has been further complicated by the unjustified tendency to compare it with cow's milk. Thus, in producing a widely acceptable soymilk, it is essential to carefully control a range of factors, including flavor, color, viscosity, and freshness.

Improved Soymilk Processes

Several of the problems associated with soymilk were solved as early as 1970 with a beverage developed by food scientists at the University of Illinois. The product is made by cooking and grinding the beans in a way that inactivates the enzyme responsible for causing the objectionable beany flavor.

The Illinois process utilized the whole soybean and produced a soy beverage with bland flavor, excellent suspension stability, and good taste characteristics. Serious acceptance problems ensued, however, because the product tended to leave a chalky feeling in the mouth. Patent restrictions further limited use of this process in many less developed areas.

INTSOY Home And Village Processing

Recently INTSOY has developed a new, inexpensive method to prepare soymilk at the home and village level. This small-scale preparation process in simplified form is as follows:

- Drop whole, raw beans directly into boiling water containing a small amount of sodium bicarbonate and blanch for 5 minutes.
- Drain the water, add the partially blanched beans to fresh boiling water containing sodium bicarbonate, and cook for 5 more minutes.
- Drain the blanch water and grind the beans along with additional boiling water in an electric blender or hand grinder.
- Stir the slurry well and filter with a finely woven, moist cheesecloth. Squeeze out as much milk as possible.
- Simmer the filtrate for 20 minutes.
- Add sugar and flavoring and pour into holding containers.

Heat treatment is the most important step. It is absolutely necessary to hydrate and thoroughly heat raw soybeans before grinding into a slurry to prevent development of the typical beany flavor. This process adequately destroys the antinutritional Trypsin inhibitor.

Boiling times longer than recommended will reduce the amount of protein in the final product. The concentration of solids can be easily adjusted according to the final use of the soymilk.

New Commercial Process

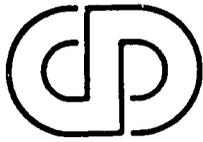
Commercial soymilk processing equipment with an average capacity of 2,000 liters per hour is currently available for purchase with aseptic packaging from several sources at a cost of several million dollars. At present, however, there is a lack of available equipment and proven processing techniques for producing sterile product in volumes larger than the home level and less than 600 to 800 liters per hour.

A major focus of INTSOY research is on scaling up the improved soymilk processing techniques from the laboratory to the medium commercial scale. In simplified form, the process is as follows:

- Clean and size whole soybeans.
- Dry the beans by forced air in an oven.
- Split the hot beans in a dehuller roller.
- Separate the hulls and the cotyledons using an air blower.
- Blanch the dehulled soybeans in a steam kettle.
- Grind blanched beans on a continuous basis along with boiling water in a hammer mill.
- Continuously extract the soymilk from the ground slurry using the roller extractor from an adapted tofu machine.
- Pasteurize and homogenize the soymilk.

Long blanching times lower the recovery of nutrients. Very short cooking times are inadequate to destroy the enzyme that causes the beany flavor.

APPENDIX 20
INCOME MULTIPLIER MODEL



Understanding Your Community's Economy

COMMUNITY DEVELOPMENT SERIES

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ocal government leaders across Kansas and in rural America have rediscovered the need to work with private firms and pursue community-based economic development. In fact, in the Great Plains states, economic development is the hottest issue on the public agenda because of the drop in oil, field crop prices, and foreign competition with U.S. manufacturers.

Many people will gladly share their simple recipe. They often mention the possibility of manufacturing products using local agricultural commodities or manufacturing hi-tech products. But the recipes are only partial answers and simplistic solutions to complex problems.

Static Model

First let's start by building a model of a community's economy. For simplicity, let us compare it to a rain barrel. In this static model, money flows into and out of the rain barrel, but nothing is happening in the barrel itself. The water level in the barrel will rise and fall, depending upon the volume flowing into and leaking out of the container. This water line represents the prosperity of the community.

From Figure 1 we can learn the following:

A. Money flows into the barrel two ways:

1. When products are sold to an outside customer (exported) then local firms *earn* new dollars. In addition, when local people commute to out-of-town jobs their wages are new dollars.

2. When dollars are brought in from outside sources by the city and county governments and by community citizens then new dollars flow into the barrel. These are *captured* dollars. These unearned dollars can come from social security and other retirement payments, interest, rent and dividend from outside investments, grants from higher governmental agencies and foundations, and from investors from other states.

CREATING ECONOMIC OPPORTUNITIES

B. Money flows out of the barrel five ways:

Static Rain Barrel Model

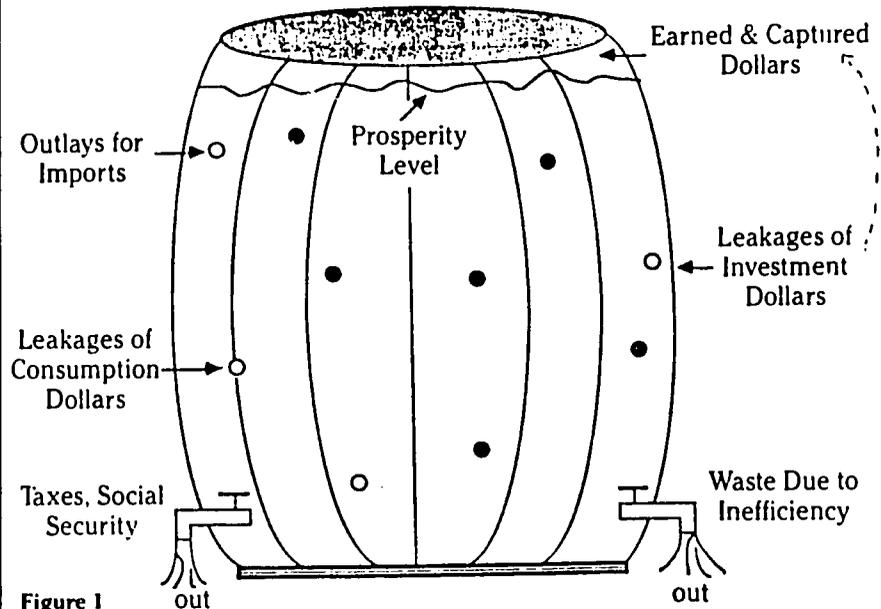


Figure 1

<ol style="list-style-type: none"> 1. Local firms buy (import) their needs from outside sources. 2. Local households go out of town to buy goods and services. 3. Local firms and employees pay taxes and social security to higher governmental units. 4. Community citizens, local firms, and local government hold assets such as land, buildings and human skills that are underutilized and are not generating a flow of income. Or, local investors spend time and dollars on local ventures that don't pay off. 5. Community citizens invest their dollars in outside ventures instead of local business opportunities. Also, when people die their estates are often dispersed to parties living outside the area. Both of these are examples of capital leakages. 	<p>The idea that the local economy is stimulated by the dollars earned from exports is often called Economic Base Theory. This theory suggests that the way to expand the local economy is to sell more goods and services to outside customers. Many types of economic activity can be part of the economic base that earns these exports dollars. The types of industries most often considered are the goods-producing ones such as agricultural production, mining, forestry, fishing, and manufacturing. However, any industry and any firm can become an exporter. When a motel serves the traveling public, that motel earns outside dollars. If a newspaper sells printing services to an out-of-town customer, it also earns outside dollars. It is important to look at the potential export markets of all local firms.</p> <p>Other ideas suggested by this simple rain barrel model focus on plugging leaks. One way to plug leaks is to provide locally those goods or ser-</p>	<p>vices currently being purchased outside the area. This may be a product bought by a local firm to use in its production process or purchased by many local households to consume. This idea is called import substitution.</p> <p>Another way to plug leaks is to encourage people to invest their savings locally. This keeps the money circulating in the economy and adds to the productive capacity of the local economy. Using the barrel illustration, the dimensions of the barrel can be expanded by investments in new buildings, equipment, and public infrastructures.</p> <p>Finally, if we put the inefficiently utilized local resource to work more productively, this plugs a leak. For example, if a building on Main Street is empty or partially unused, it can be put back into service by the private sector as a marketing cooperative for local crafts people. Another example would be to use an empty building as a recreation and exercise center.</p> <p>In summary, from this simple model we learn that new dollars must be either earned or captured from outside sources. We also learn that if we can plug the leaks going to outside businesses and if we can avoid the inefficient uses of local resources, the rain barrel may be able to fill up faster than it empties out.</p>
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Here are some other examples of ways to bring in outside dollars:

Industry	Examples
<i>Construction</i>	Building a new highway when the investment capital comes from outside sources.
<i>Transportation</i>	A truck terminal which services cross-country traffic.
<i>Utilities</i>	An electric power plant which sells to a regional market.
<i>Wholesale</i>	A firm which buys locally produced fruit, warehouses it and sells it to retailers all over the country.
<i>Retail</i>	A regional shopping center.
<i>Finance</i>	A concentration of banks serving a large region.
<i>Insurance</i>	A regional or national headquarters of a large insurance company.
<i>Government</i>	All federal, state, and regional offices.
<i>Business and Personal Services</i>	A convention center.
<i>Professional Services such as Medical and Education</i>	A medical center which attracts people from a multi-county area or a university.
<i>Entertainment Services</i>	An amusement park which attracts people from other states.

Dynamic Model

Now let us put this economy in motion. Instead of a rain barrel which has inflows and outflows only, imagine the barrel's contents in motion. If a motor stirs up the water, the water level will rise with the speed of the motor.

One can compare the speed of the motor with the speed of the local economy. When all firms, households, governmental units, and other producing and consuming entities are functioning at full capacity, the level of prosperity is high. When the productive forces slow down, the level of prosperity drops. The "motor"

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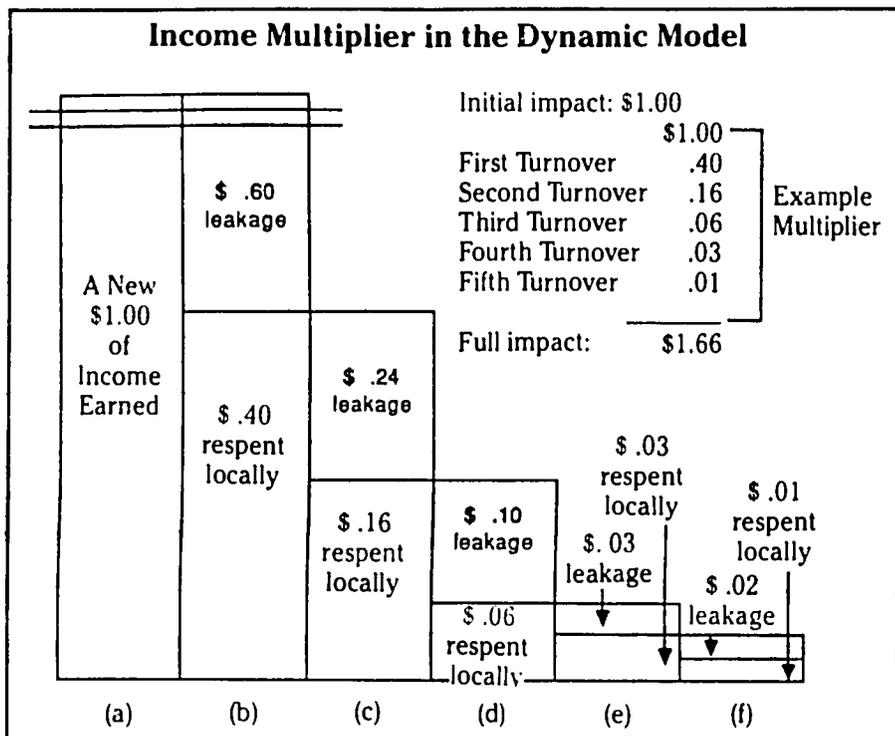


Figure 2. Source: *Community Economic Analysis*, page 19.

is driven by the economic activities of production, consumption, and reinvestment.

Most people are familiar with measures of this dynamic model. One is the **turnover** of the dollar as it passes from one firm to another and from local firms to local households. Another related concept is the **multiplier** which can be expressed as an income multiplier, an employment multiplier, or an output multiplier.

In Figure 2 we see a new dollar enter the local economy and turn over five times. Each time it turns over, some of that dollar leaks out. The leakage is dependent on the proportion of all local household budgets which is spent or invested locally in the community. Also, the leakage and the resulting income multiplier are dependent upon the portion of a dollar earned by local firms that becomes income to local households. This will depend on the profitability of local firms as well as their purchasing patterns. Do they buy labor locally or do they hire people who commute into town to work? Do they buy their supplies locally or do they import them? Local households receive

income as a result of this multiplier effect. We call this **making** new income. Another way to look at this is through the following formula:

$$IM = \frac{1}{1 - (PCL \times PSY)}$$

Where:

IM = Income multiplier

PCL = The proportion of new, after-tax household income that is spent locally. This can range from .30 to .90 in rural Kansas communities.

PSY = The proportion of household income spent locally which remains in the area's economy to support other households. This usually ranges from .25 to .60 for non-metropolitan communities.

For example, when the proportion spent locally by households (PCL) is 80 percent or .80 and when the proportion of an earned dollar that becomes income to local households (PSY) is 50 percent or .50, then the income multiplier is the following:

$$IM = \frac{1}{1 - (.80 \times .50)}$$

$$IM = \frac{1}{1 - .40}$$

$$IM = \frac{1}{.60} = 1.66$$

In summary, when we put the static rain barrel model into motion by adding in the production activities of such groups as the local businesses, local governments, and schools, we add a dynamic element to the model. These decision-making units combine local resources such as land and buildings with non-local resources such as borrowed money and new inventions to make products and services sold both at home and away. The results of the community's dynamic element is the creation of new income within the community to support local households, i.e., *making* it. The key questions are: (a) how efficient and competitive are these units of production, (b) where do they buy their resources used to make goods and services, and (c) how much money leaks out of the community from household budgets, and (d) how much local money is being reinvested locally.

More Concepts

But even these concepts are not complete enough for local community leaders. They need one more set of ideas.

All the local firms together produce a gross community product (GCP). Just as the United States has a GNP, a city can have a GCP. This GCP is the sum of a year's economic activity which in turn is the total of all producers' output, using local resources and outside resources.

Local firms will respond to changes in internal and external markets. However, their ability to react to changes in markets will depend upon

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the availability of resources such as investment capital, skilled workers, and the know-how to produce at costs that are competitive.

These constraints can be overcome by discovering new local resources, bringing in new outside resources, or creating new ways to combine resources. Some new ways to combine resources will be created when new inventions are developed, new innovations are adopted and new institutions are formed. An example of a new institution is a county-wide economic development committee.

Finally, the people who combine resources must be put into this model of community economic development. Gross community output will be diminished if these producers are receiving outdated or incorrect information and if they are not able to keep up with change because they lack education and training. This can result in local firms losing their share of markets to competing firms in other communities.

In conclusion, there is no simple recipe for economic prosperity. However, there are some helpful concepts that identify important variables which need to be considered by community leaders. Three of the most usable concepts are:

**EARN IT
CAPTURE IT
MAKE IT** } Dollars to support
a community

These three avenues of economic development can be pursued using the following five strategies:

1. Retaining and expanding existing firms

2. Improving local linkages between local buyer and sellers
3. Creating new businesses
4. Capturing outside dollars that are unearned
5. Bringing in outside firms

The first strategy is both an "earning it" one and a "making it" one. When a local firm is oriented just to markets outside the community, this strategy is an "earning it" one. But when a local firm is oriented towards a local market, this strategy is a "making it" one.

The second strategy is a "making it" strategy. The idea is to increase the flow of dollars between local buyers

and sellers which will lead to a higher income multiplier.

The third strategy can be either an "earning it" strategy or a "making it" strategy. If the new firm wants to sell to outside markets then the strategy is an "earning it" one. If the new firm wants to sell to local customers then the strategy is a "making it" one.

The fourth strategy is obvious; it's a "capturing it" strategy for bringing in unearned dollars.

The fifth strategy is usually an "earning it" strategy. Most often outside companies enticed to open a branch in the community will be oriented to markets that are beyond the local community.

For more information on how community development can be stimulated, send for the following literature.

- **"Strategies For Economic Development,"** David L. Darling, Jr., Cooperative Extension Service, Kansas State University, (L-732) June 1985
- **"Setting Community Economic Goals,"** David L. Darling, Jr., Cooperative Extension Service, Kansas State University, (L-714) February 1985
- **"Is Your Community Ready For Tourists?,"** Kenneth B. Albright, Cooperative Extension Service, Kansas State University, (L-444) March 1984
- **"The Social Action Process: Selling Ideas & Programs,"** Robert L. Johnson, Cooperative Extension Service, Kansas State University, (MF-859) April 1987
- **"Analyzing Your Market,"** David L. Darling, Jr., Cooperative Extension Service, Kansas State University, (L-745) August 1986
- **Community Economic Analysis: A How To Manual,** Ron Hustedde, Ron Shaffer, and Glen Pulver, North Central Regional Center for Rural Development, Iowa State University, 108 Curtiss Hall, Ames, Iowa 50011 (*Send for this publication at the above address.*)

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COOPERATIVE EXTENSION SERVICE, MANHATTAN, KANSAS

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