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SOYBEAN PRODUCTION ON SMALL FARMS OF PERU

Fifth Interim Report of Progress

January 1-June 30, 1980

ICR-80-2

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

A. Statistical Summary

1. Project Title and Contract Number: Soybean Production on Small Farms--AID-[illegible]-c-1206

2. Principal Investigator, Contractor and University Address

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3. Contract Period: November 11, 1977-June 30, 1980

4. Period Covered by Report: January 1, 1980-June 30, 1980

5. Total AID Funding of Contract to Date: $752,805

6. Total Expenditures to Date: $735,031

7. Total Expenditures for Report Period: $159,023

B. Narrative Summary of Accomplishments

Action plans developed for 1980 were implemented. Plans call for the cultivation of 6,600 hectares of soybeans in 1980 with anticipated yield of 9,900 metric tons.

Compilation and analysis of data conducted in 1979 were completed. Experiments on cultivar evaluation, line selection and rhizobium inoculation were continued at the El Porvenir and Pichanaki stations.

Extension and applied research activities continued at a high level. Planning and evaluation activities continued in close collaboration with the National Soybean Coordinators. Advances were made in matters relating to financing and distributing seed, obtaining materials for seed beds and experimental plots, clearing of equipment from customs and subsequent distribution in the selva alta, the training of project staff and the initiation of an oilseed fund for bank loans to soya producers.

The program for soybean food processing, utilization and product development continued to progress. Industrial development of three food products (soy beverage and soy fortified bread and noodles) is at or near consumer testing/acceptance stage. More recently demonstration courses in the selva alta for home and village process levels have been developed and conducted with attendance by more than 100 persons.

Several economic studies were completed including micro studies concerning the costs of production, labor utilization and marketing. Several minor studies looked at uniform purchase price levels, economic justification for changes in purchase price levels, and economics of small-scale mechanization.

In-country and overseas training continued. Four Ministry staff returned from graduate studies at the University of Puerto Rico, Mayaguez Campus.

Report of Progress

A. Objectives

The general purpose of the Peru Soybean Development Project is to assist the Government of Peru (GOP) to expand the cultivation of soybeans in high jungle areas and to achieve increased consumption of soybean products. The project is designed to contribute to increased productivity, employment and income and to improve nutrition among the rural and urban poor. It aims at achieving self-sustaining growth in the production and consumption of soybeans and soybean food products thus increasing productivity and incomes among selected segments of the rural poor and increasing the national food supply while improving the quality of foods used by the rural and urban poor. The project will promote programs to increase small farmer production of soybeans in high jungle areas and the increased consumption of soy fortified food products by nutritionally deficient groups.

To achieve the goals of the project, six continuing objectives are to be addressed by the contractor: They are:

1. To assist GOP Ministry of Agriculture and Food (MAA) to develop and adjust comprehensive action plans in soybean research, production, processing and marketing in order to reach targeted production and consumption objectives.

2. To provide technical information and assist MAA in identifying appropriate soybean varieties through research, to develop agronomic practices that are transferable to small farm conditions and to identify soybean products and processes appropriate for Peru.

3. To assist in performance of periodic financial and economic analyses to measure the real or potential impact of project activities in the several project areas.

4. To assist in project evaluations in cooperation with MAA.

5. To perform in-country training as required by the project and to assist in the selection of candidates for academic training abroad.

6. To coordinate academic and short-term training in the United States and other appropriate locations.

B. Background

This report concentrates on activity conducted in the first half of CY-80 with an overview of accomplishments over the life of the project.

Four highly qualified soybean scientists in fields specified in the contract were recruited and placed in Peru in early CY-78. During the first two years of the project, useful information on soybean research and utilization was generated and disseminated to soybean producers and consumers in rural and urban areas. Recommendations on

appropriate soybean varieties were adopted by growers. Improvements in cultural practices led to improvements in yields in production areas. Economic data on costs of production were useful in assisting the MAA in establishing base prices. Short courses, workshops, and on-the-job training were used to upgrade the general skills of MAA personnel and soybean growers. Degree training, at the M.S. level, was pursued by four MAA staff at the University of Puerto Rico, Mayaguez Campus. Other MAA staff participated in short courses sponsored by INTSOY at the University of Illinois at Urbana-Champaign and the Instituto Colombiano Agropecuaria, Colombia.

Project core staff on assignment throughout the report period included:

1. Dr. Thomas M. Fullerton, Soybean Extension Agronomist and INTSOY Principal Representative.

2. Dr. Luis H. Camacho, Soybean Research Agronomist.

3. Dr. Alfred G. Harms, Agricultural Economist.

4. Dr. Alvin Siegel, Soybean Food Processing Specialist.

In addition, TDY support was provided by:

1. Dr. Michael E. Irwin, INTSOY Entomologist.

2. Dr. Robert M. Goodman, INTSOY Virologist.

3. Dr. James B. Sinclair, INTSOY Seed Pathologist.

4. Mr. Thomas A. McCowen, INTSOY Assistant Director.

C. Summary Report of Accomplishment by Objectives

The responsibilities and activities of each team member necessarily encompass more than a single contract objective. This section summarizes the work of the team as it applies to each of the specific contract objectives listed in Section A above.

Objective 1. Comprehensive Action Plans

As was reported in the Fourth Interim Report of Progress, action plans for research, production and utilization activity in 1980 were developed in the final quarter of CY-79. Plans call for the cultivation of 6,600 hectares in 1980 with an anticipated yield of 9,900 metric tons. This compares with 1979 performance in which 3,950 hectares under soybean cultivation yielded 5,900 metric tons, very close to the target of 1.5 metric ton yield/hectare. Area cultivated and yields have increased markedly since 1977.

Objective 2. Provide Technical Information

The project entered its third year established as a viable, useful cooperative enterprise linking research and extension organizations into a coordinated effort to produce and utilize a nontraditional crop. Through research and extension activities, the benefits of soya are being recognized by increasing numbers of Peruvians in both urban and rural locations.

1. Research

Compilation and analysis of data for experiments conducted in the previous report period were completed. Experiments on cultivar evaluation, line selection and rhizobium inoculation at the El Porvenir and Pichanaki experiment stations were conducted.

a. Cultivar trials harvested between December 1979 to March 1980

One variety trial composed of 15 tropical cultivars was planted at four locations during the second semester of 1979 and harvested between December 1979 and March 1980. Results were not available at the time the 1979 annual report was prepared; therefore, they are presented here. The trial was conducted in cooperation with: (1) Universidad Nacional Agraria de la Selva (UNAS) in Tingo Maria, (2) Tropical Soils Program in Yurimaguas, (3) Agricultural Experiment Station of El Chira in Piura, and (4) Agricultural Experiment Station of La Molina in Lima. The experiment was planted under rainfed conditions at the first two locations, and under irrigated conditions at the last two locations.

The check cultivars at each location were Improved Pelican and Jupiter which are commercial cultivars in both the selva and costal areas of Peru. The variation of yield response was very high in El Chira and Yurimaguas which showed C. V. values of 39 and 25 percent, respectively, and moderately pronounced in La Molina and UNAS with C. V. values of 19 and 18 percent, respectively. The high yield variability at El Chira station might have been caused by reported salinity problems of the experimental area, whereas soil acidity conditions (pH.5.5) might have produced a similar effect in Yurimaguas.

The average yield of cultivars at each location, and the overall mean of each cultivar, is presented in Table 1. Cultivars UFV-1 and Tunia yielded significantly more than the check cultivars at La Molina. At El Chira, cultivars CH-3 and Davis produced the highest yields and both were significantly superior to cultivar Improved Pelican. At UNAS, the average yields were very good in all cultivars with Tunia and Davis being top yielders and producing significantly more than the check cultivars. At Yurimaguas, Improved Pelican was significantly better than Jupiter; none of the high yielding cultivars at this location was significantly better than the check cultivar Improved Pelican. The combined analysis of variance showed high significant differences for locations, cultivars, and locations x cultivars.

The mean yield of the four locations indicated that cultivars Davis, Tunia, UFV-1 and CH_3 had a higher yield potential than the check cultivars Jupiter and Improved Pelican.

Table 1. Yield of Soybean Cultivars at Four Locations of Selva and Coast Areas

Cultivar	Yield Kg/ha				Mean
	La Molina	El Chira	UNAS	Yurimaguas	
CH-3	3,046	2,647	3,273	1,418	2,596
UFV-1	3,279	1,854	3,959	1,703	2,699
SJ-2	2,589	1,555	2,900	1,913	2,239
Hardee LS	2,723	1,052	3,965	1,853	2,390
Orba	2,522	1,471	2,867	868	1,932
IAC-2	2,737	1,736	2,937	1,663	2,268
Tunia	3,195	1,676	4,836	1,683	2,847
Caribe	2,426	1,727	3,695	628	2,119
Jupiter	2,455	1,643	3,630	1,333	2,265
I. Pelican	2,515	1,176	3,172	1,883	2,186
Acc 2120	1,788	1,269	2,902	1,936	1,974
Rillito	2,678	1,202	2,972	975	1,957
Williams	2,057	1,712	2,660	1,330	1,940
Davis	3,057	2,219	4,535	1,995	2,956
Bossier	2,819	1,869	3,059	1,323	2,267
Mean	2,660	1,654	3,424	1,500	2,309
LSD.0.05	690	920	952	532	392

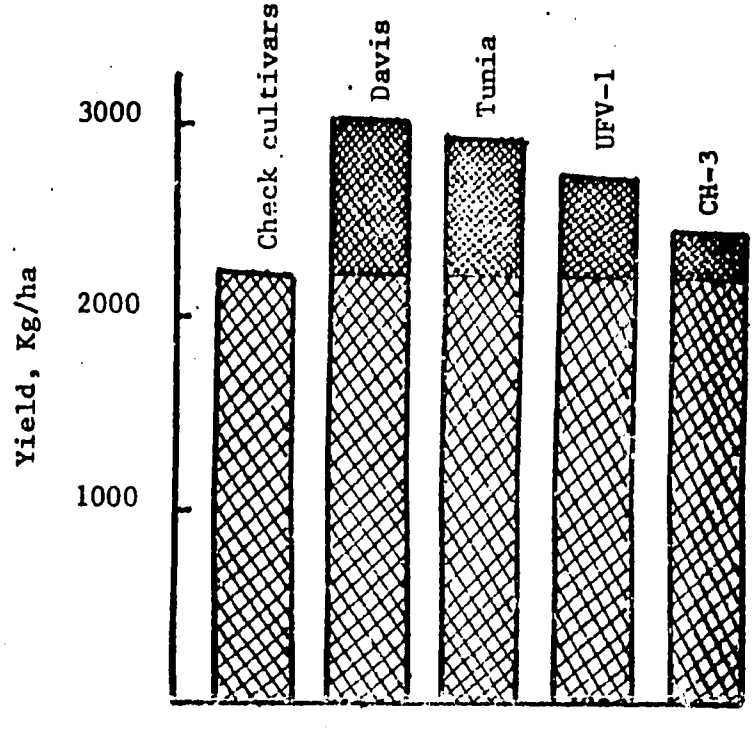

Fig. 1. Average yield of check cultivars compared with the best performers at four locations.

The comparison of the average yield of the check cultivars with that of the best performing cultivars is presented in Figure 1. The difference expressed in percentage was 33 percent for Davis, 28 percent for Tunia, 21 percent for UFV-1, and 17 percent for CH-3. Other data presented in a previous report also show Davis and Tunia as top yields in coastal and selva areas of Peru (see annual report, 1979).

Data on life cycle for each cultivar at each location are shown in Table 2. The earliest maturing cultivar at each location was Williams with a range of 78 to 100 days from plantings to maturity. The latest maturing one was Hardee LS with a range of 123 to 159 days from planting to maturity. Average life cycle was longer at La Molina than at any other location reflecting the effect of latitude and planting date on plant maturity. La Molina has a latitude of 12°S and planting was done on November 20, 1979. El Chira station is located at latitude of 4°-51'S and the experiment was planted on September 17, 1979. At UNAS with a latitude of 6°-17' the experiment was planted on August 7, 1979. Yurimaguas has a latitude of 5°-41'S and planting was on September 8, 1979. Comparing yield with maturity data in Tables 1 and 2, one can see that some cultivars have two highly desirable characteristics in commercial soybean production: high yield potential and early maturity. This is the case of cultivars Davis and Tunia which out yielded the checks by 33 and 28 percent, respectively, but were similar in maturity to Improved Pelican and significantly earlier than Jupiter. Although Davis may have some agronomic disadvantages, its use in breeding programs could lead to the development of adapted high yield/early maturing lines for soybean production in tropical environments.

Plant height was also measured in three of the four locations where the experiment was planted. Data of this trait are on Table 3. There were highly significant differences among cultivars at each location. The combined analysis of variance also showed significant effects of locations, cultivars, and locations x cultivars. Cultivar Acc 2120 was the tallest while cultivar Davis was the shortest. Short plant height has been the main disadvantage of Davis for its adoption as commercial cultivar in tropical areas in spite of its high yield potential. Average plant height of cultivar Tunia, a high yielder, was similar to that of the checks Jupiter and Improved Pelican.

Table 2. Life Cycle of Soybean Cultivar at Four Locations of Selva Coastal Areas

Cultivar	Days to Maturity				Mean
	La Molina	El Chira	UNAS	Yurimaguas	
CH-3	137	108	105	102	113
UFV-1	156	118	109	90	118
SJ-2	138	107	107	90	111
Hardee LS	159	142	123	124	137
Orba	136	95	94	77	100
IAC-2	143	110	109	91	113
Tunia	130	105	110	95	110
Caribe	156	101	108	124	122
Jupiter	156	144	118	92	127
I. Pelican	141	105	105	85	109
Acc 2120	135	125	118	83	115
Rillito	114	89	92	90	96
Williams	100	87	84	78	87
Davis	125	105	104	84	105
Bossier	131	104	105	91	108
Mean	137	109	106	93	111
LSD.0.05	3	7	6	21	3

Table 3. Plant Height of Soybean Cultivar at Three Locations of Selva and Coastal Areas

Cultivar	Plant height cm			Mean
	El Chira	UNAS	Yurimaguas	
CH-3	83	94	106	94
UFV-1	38	40	60	46
SJ-2	60	72	94	75
Hardee LS	59	64	92	72
Orba	54	70	68	64
IAC-2	66	80	94	80
Tunia	54	68	77	66
Caribe	44	71	110	75
Jupiter	59	75	87	74
I. Pelican	53	79	89	74
Acc 2120	110	111	119	114
Rillito	32	35	63	43
Williams	31	46	62	46
Davis	36	33	62	44
Bossier	35	42	75	51
Mean	54	65	84	68
LSD.0.05	14	13	10	8

b. Cultivar trials and breeding plots planted during the first semester of 1980

Cultivar trials and breeding plots were planted at El Porvenir and Pichanaki stations during the reporting period. The cultivar and line experiments at El Porvenir included the following: one experiment to evaluate yield potential of 16 tropical cultivars supplied by INTSOY, Illinois; one experiment to evaluate yield potential of 16 cultivars selected from trials conducted in Tingo Maria in 1979; one experiment to evaluate yield potential of 20 breeding lines selected at this station from segregating populations supplied by INTSOY, Puerto Rico, in 1978; one experiment to evaluate reaction to iron chlorosis of 24 lines and cultivars; and one experiment to select promising lines in five segregating populations in the F_3 generation. Results of these experiments will be consigned in a future report as they were not completed at the time of writing this one.

Cultivar and line trials planted at Pichanaki included: one experiment to evaluate yield potential of 16 tropical cultivars supplied by INTSOY, Illinois; one experiment to evaluate yield potential of 16 cultivars selected from trials conducted in Tingo Maria in 1978; one experiment to increase seed of segregating populations of crosses made by Ing. José Bruno of La Molina station. As in the preceding station, no data were available from these experiments at the time of preparing the present report.

c. Agronomic trials

One experiment to compare the response of soybeans to local and imported rhizobium inoculants was established at El Porvenir and Pichanaki stations during the first half of 1980. There were four local inoculants contributed by Dr. José Gómez of the Universidad de San Marcos, two imported brands of commercial inoculants (Nitragin and Urbana), and one check. All seven treatments were planted with and without addition of 50 kg/ha of nitrogen.

One experiment with soya and corn intercropped was designed and conducted by Ing. Homer Tuesta, at El Porvenir, to compare single and intercropped production systems with the two crops.

Data of the agronomic trials conducted during the reporting periods will be presented and discussed in future reports.

d. Plans for the period July-December, 1980

Field plans, seeds and inoculants have already been prepared for the experimentation cycle of the second semester of 1980 to be carried out at the experiment stations of Tulumayo in

Tingo Maria, Huarangopampa in Bagua, and El Porvenir in Tarapoto. These plans include cultivar and breeding line trials, fertilizer trials, and rhizobium inoculant trials. In addition, seed and inoculants will be supplied to other experiment stations dealing with soybean experimentation outside the project target area, such as La Molina, El Chira and Yurimaguas.

2. Extension

Extension and applied research activities continued at a high level during the first six months of 1980. Planning and evaluation continued in cooperation with the National Coordinators of the project, Ings. Rudolfo Vargas S. and Ricardo Villamonte. Advances were made in matters relating to financing and distributing seed, obtaining materials for seed beds and experimental plots, clearing of equipment from customs and subsequent distribution in the selva, the training of project staff and the initiation of the Ministry oilseed fund for bank loans to soya producers.

Not everything went smoothly, however. Some setbacks occurred through shortages of soybean seed or late delivery of seed in several regions. Failure to readjust the price of soya deterred many farmers from planting the crop. Although soya production in the Bagua/Jaen area, planting of a second rice crop prevented still a greater number of hectares being used for soya production.

a. Extension activities

Workshops, combination short courses/field days and installation of demonstration plots were emphasized in extension during 1979. Project personnel of the selva were highly involved in all aspects of these activities. In addition to stated objectives, the meetings and field work were intended to provide a model for continued and expanded use of these techniques by soya project extensionists with a minimum of input from Lima staff.

Considerable time was expanded in planning extension activities for 1980 during the above-mentioned meetings and with the National Soybean Coordinators in Lima.

Activities programmed for the work areas as a whole were as follows:

Demonstrations of practices, methods or results	252
Field days	119
Producer meetings	71
Producer visits	4,940
Short courses for producers	25
Regional coordination meetings	4
Publications	13
Radio announcements	37

Although information is incomplete for the first six months of 1980, it is anticipated that fewer activities were accomplished than programmed. Development of several events that were dependent on direct financing from Lima was not initiated to to unavailability of funds.

Events which were realized included coordination meetings patterned after the workshops of 1979 held in each of the four Agrarian Regions. Locations and dates of the meetings were:

Agrarian Region	Location	Dates
XI	Tarapoto	February 7, 8
VIII	Satipo	March 27, 28
VII	Tingo Maria	April 23, 24
II	Bagua	June 3, 4

Activities within each region for the ensuing soybean campaign were discussed. Participants met with representatives of the Agrarian Bank, ENCI, SENAMA, INIA and the Agrarian Zone. A summary of difficulties experienced during the past growing season as well as current needs was presented by project agronomists. Help in organizing and conducting the meetings was provided by the National Soybean Coordinators with support from the INTSOY extensionist.

A basic program goal has been the integration of research and extension components of the soybean project. Field days for extension personnel at the four INIA stations located in the project work area were programmed for 1980. The first of these events was held at the El Porvenir Station in early June. Extensionists were given the opportunity to observe field research in progress, question and discuss research objectives, observe improved cultural practices and advise research staff of problems encountered in commercial soya production. Farmers from various parts of the zone also attended. Logistic support was provided.

Demonstration plots were established with project staff in the selva principally in the area of weed control for instructive purposes. Film, seed, inoculant, herbicides, herbicide applicators and other materials were provided selva staff in support of extension efforts.

b. Applied research

Applied research was continued in collaboration with Ing. Homer Tuesta in establishment of weed control plots at the El Porvenir Experiment Station in March. The test involved minimum use of glyphosate for control of recuperated Cyperus rotundus L. following soil preparation. Differences in control between treatments were measured. However, the soya was affected by prolonged drought. Ing. Tuesta has harvested the test and is currently preparing the data for satatistical analysis. The study has been in progress for two years and will not be repeated.

Data regarding time required to apply and the amount of solution applied according to percent of ground cover by Impomoea using a touch-on herbicide applicator were studied with Ing. Antonio Sandoval on the Zona Agraria San Martin. The applicator used was found fast and efficient although too much solution was used according to the literature available. The herbicide utilized was 2, 4-D which is the least costly compound marketed in the selva. Herbicides applied through touch-on methods would greatly complement hand weeding.

Periodic conferences were held with Ing. Jose Morales on the seed conversation test in Tingo Maria. Seed was stored at three different elevations and tested periodically for germination over eight months. Results appear promising. Final data for the second year have been collected. The test will be discontinued.

Collaborated with Ing. Faustino of the El Porvenir Experiment Station in an attempt to demonstrate soya response to fertilizer treatments on a soil characterized by high pH. Treatments included applications of nitrogen, phosphorus and complete trace element foliar applications. The soya was highly variable in growth and color which was not related to treatments. The test was further confounded by drought. The test will be repeated since soils of this nature are common in the Tarapoto work area.

Other activities included:

Participation in meetings with North Carolina State University and INIA staff in relation to a Rhizobium course to be realized in Peru in June 1981.

Participation with Ministry, AID and INTSOY staff leading to construction of two hand-powered threshers. One of the threshers was tested by ministry staff in Satipo and found inefficient. The second thresher will be modified in Lima.

FENCOCAFE, the national coffee federation, is holding a series of meetings on improved management for producers. A section will be presented on diversification crops due to coffee rust and to supplement income from coffee production through inclusion of other crops, including soya. Arrangements were made for project staff to participate in these meetings when held in the soya areas of the selva.

Information from demonstration and research plots has been collected and analyzed for use in preparation of extension materials.

3. Utilization

The program for soybean food processing, utilization and product development is well underway. Research activities are based at the Instituto de Investigaciones Agro-Industriales (IIA), La Molina. Industrial developmental activities focus on the direct utilization of soybeans as a human food. Initial soybean food development work was geared to the commercial introduction of at least three food products, namely a soy beverage (in liquid and powdered form) and soy fortified bread and noodles. Technical advice and assistance have been given to various companies and individuals demonstrating an interest in promoting soy food products. More recently demonstration courses for the home use of soybeans have been developed and conducted in rural areas. Support, through lectures and demonstrations, has also been given to the Instituto Bircher Benner, Lima, in its Soybean Food Course. These, and other, activities have given an opportunity for creating an awareness of soybean food uses to improve the nutritional adequacy of deficient or marginal diets.

a. Commercial level processing of soybean food products

The development of an industrial (batch) process at IIA for a soy milk/soy beverage/milk replacer (referred to as SM-SB) reached the final stage of research during this reporting period. Extensive sensory analysis testing (taste panel) was conducted on a reconstituted soy (powder) product in comparison with a locally available cow's milk product.

Processing parameters for preparing a SM-SB from whole soybeans based on a simple direct process using available equipment has been defined. The most suitable locally grown variety for preparing this product is "Nacional." The formulation (10.1 percent solids) of a SM-SB based on the viscosity (7.7 cps) of cow's milk (powdered) resulted in an acceptable liquid product containing approximately 4.0 percent protein (N X 6.25). A yield of eight (8) parts liquid milk for one (1) part soybeans was realized.

A SM-SB product is prepared from dehulled soybeans. Dehulling is accomplished by preheating whole soybeans (100°C for 15 minutes) and subsequently passing them through two cracking rolls. A seed classifier separates the hulls from the cracked soybean cotyledons. A coarse flour is then prepared using a Fitz Mill. A 10 percent solid solution is prepared with water and a steam-jacketed kettle then blanches the ground soybeans at 90°C for 30 minutes. A fine slurry is obtained after two passes through a colloidal mill. This solution is further adjusted to a pH of 7.5. Two homogenization steps (first stage--3,500 psig; second stage--500 psig) produces the SM-SB. A spray drier can further be used to produce a powder.

Sensory evaluations of SM-SB were conducted with a 15-member adult taste panel at IIA. Soy products prepared from two locally grown varieties, Improved Pelican (IP) and National (N), were tested with cow's milk. Three milk preparations were evaluated as follows: 100 percent soy, 100 percent cow's milk, and 50/50 soy/cow's milk. The soy liquid preparations were formulated to contain solids contents corresponding to the viscosity of cow's milk. Two solids levels (5.8 percent and 10.1 percent), therefore, were tested. An hedonic scale was used to evaluate quality factors of sweetness, consistency, appearance, the presence of any foreign flavor, and overall acceptability.

Considering the soy samples, the scoring and distribution of responses for all quality factors gave a preference for the product made from the National (N) variety containing 10.1 percent solids (viscosity corresponding to cow's milk). Overall, although cow's milk scored higher on a point basis, the (N) soy sample was not significantly different from the cow's milk sample. Since a high number of panelists noted a sodium bicarbonate taste, it was recommended that the amount used in processing be lowered.

A very limited amount of activity was done in the area of soy fortified bread and noodles during this period. Full-fat soy flour is continuing to be prepared (industrial level) at a Lima cereal processing company.

The formulation and method for preparing popular soy bread has been developed. A 10 percent soy bread possessing acceptable quality factors can be prepared with a basic method (sponge) used in Peruvian bakeries. Similarly, acceptable soy fortified noodles (15 percent full-fat soy flour) have been developed. In both cases, the soy fortified products were prepared under commercial conditions. Stored soy fortified noodles (6 months) had both a lower water absorption and solids cooking loss than regular all-wheat noodles indicating a more durable soy noodle product.

The transfer of technology for these products is primarily dependent on the positive interest of the bakery and noodle industry to test market and adapt these applied processes for preparing soy fortified products.

b. Home and village level processing of soybean food products

An increased amount of time was devoted to promoting the direct home use of soybeans. These activities have included the participation in several courses and demonstrations of the preparation of various soy foods.

A four-week (40 hours) course in the "Home Production of Soybean Foods" was sponsored by the Instituto Bircher Benner, Lima. This private group sponsors programs in basic nutrition

education and food preparation. Improved recipes for soy milk, soy cheese, and various soybean dishes were presented to 100 participants. The nutritional importance of soybean foods was emphasized. Lectures and a conference on "Soybeans as a Human Food Source" were given by the author.

A series of demonstration courses were developed and held in the rural area (high jungle). Various basic, simple recipes for utilizing soybeans were presented. Major emphasis was given to soy milk beverage, fried patties using the residue from the soy milk preparation, a soy breakfast drink containing fruit, and soy-based weaning food. Information on the nutrient content of soybeans and other foods was provided.

A total of 110 adults attended the demonstration courses as follows:

Satipo, 3 courses (10 hours)--50 people
Pichanaki, 1 course (3 hours)--15 people
La Merced, 1 course (3 hours)--11 people
San Ramon, 1 course (3 hours)--34 people

Those in attendance included hospital dieticians, teachers, restaurant owners and wives of soybean producers. In addition, contacts were made with ministry nutritionists and personnel responsible for promoting extension health and food programs.

D. Complementary Activities

Plant protection specialists visited project sites in March-April 1980. Professor James B. Sinclair, during his March visit, noted that the three most important diseases of soybeans in Peru are "Machismo," pod and stem blight and stem canker, and yeast spot of seeds. Other diseases identified were: brown stem rot, Rhizoctonia web blight, bacterial blight, Phytophthora blight, purple seed stain, soybean mosaic virus, Pythium seedling blight, Fusarium seedling disease, anthracnose, charcoal rot, and Bacillus on seeds. Soybean mosaic is a disease especially important in the coastal region where infection by soybean mosaic virus (SMV) may be as high as 85 percent. Dr. Sinclair recommended that work on SMV be integrated into the pest management system being developed by Dr. Irwin (see below). SMV is a severe disease; it is insect transmitted and there is a history of cooperative research on SMV transmission by INTSOY scientists in plant pathology and entomology.

In April, Professors Michael E. Irwin and Robert M. Goodman reviewed the program of integrated pest management initiated in 1979 and followed up on the Sinclair observations. They confirmed its present and potential danger of SMV and recommended a research effort, in cooperation with soybean breeding and other plant protection disciplines, to prevent SMV from becoming a serious production problem in the future.

Dr. Irwin also reviewed the status of the project on integrated pest management of soybeans in the selva alta initiated in 1979 with the cooperation of entomologists from INIA and UNA, La Molina. Progress was noted in monitoring insect pest populations, assembly of equipment needed to establish baseline levels of arthropod pests and their natural enemies and determination of yield loss potential of a cerambycid stem borer, Grammopsoides rufipes, on soybeans.

Objective 3. Perform Periodic Financial and Economic Analyses

During the report period, the Agricultural Economist essentially completed his assignment, departing in August 1980. An overview of the work he initiated is appropriate for inclusion in this report.

1. Activities

During the period March 1978-August 1980 the Economist made an overall look of soybean production to establish a base study from which the efforts and accomplishments of the project could be measured and evaluated at the conclusion of the program.

The major emphasis of the work was directed to micro-economic studies concerning the costs of soybean production, utilization of labor in the production, and identification of problems encountered in the marketing of soybeans to the official governmental purchasing agencies in the areas of production included in the project.

Several minor studies were made concerning uniform purchase price levels throughout Peru, economic justification for increases in purchase price levels and economics and labor requirements of various threshing methods.

Attention was given to the construction of a small-sized soybean thresher at Tingo Maria.

Visits were made to all production areas of the project to make observations, collect data and consult with cooperating extension personnel.

Assistance was given at training courses in soybean production for extension workers and farmers and instruction in the collection and analysis of data was provided to counterpart personnel.

a. Overall look at soybeans in Peru

The paper "Soybean Production in Peru," April 1979, was prepared to look at the changes in the acreage and production of soybeans over the past several years and to examine the imports of soybeans and soybean products in relation to domestic production and to the production of competing products. Additionally, to study the costs of production in relation to the official purchase price levels and the role these price levels play as incentives for the rapid expansion of soybean production.

The most important incentives for the rapid expansion of soybean production are: the providing of extension programs for the education and training of farmers, the providing of physical resources to aid production, the providing of credit to facilitate the financing of the new crop, and purchase price levels to compensate for the risk and uncertainty involved in the production of a new crop and to adequately reward the entrepreneurs for their effort.

b. Costs of production and use of labor

The cost of production and labor utilization data was collected and analyzed for 1978 and 1979. The results were reported in "A Study of the Costs of Production and Utilization of Labor in the Production of Soybeans, Peru Soybean Project, 1978," August 1979 and "Costs of Production and Utilization of Labor in the Production of Soybeans, Peru Soybean Project, 1979," June 1980.

From a modest base of 13 farms from four areas in 1978, the scope of the study expanded in 1979 to cover all the areas in the soybean project with 63 farms.

Comparison of the costs for the two years shows a 64 percent increase in the cost per hectare and a 44 percent increase in cost per kilo. The net returns increased 122 percent. During this period the value of the sol depreciated 21 percent.

During the two-year period, the purchase prices received by the farmers covered the costs of production on the average but some losses were incurred under conditions of low yield and high production costs associated with high use of labor.

Usually, the farms with partial mechanization had higher per hectare costs but lower per kilo costs due to higher yield levels than the traditionally operated farms.

Comparison of the labor utilized for the two years showed a drop in the number of man days from 139 to 96 for traditionally operated farms and a drop from 102 to 75 for partially mechanized farms. Essentially the reason for the drop is the inclusion of additional areas in the study where labor utilization is less. In the same areas sampled in 1978, the decrease in man days was much less. The rainfall in these areas was less in 1979 which probably led to some decrease and the increase in labor efficiency from additional production experience may have had some effect.

c. Soybean purchases

Results of the study of soybean purchases by the official buying agencies for 1978 and 1979 were reported in "Analysis of Soybeans Purchased by EPSA, 1978" and "Analysis of Soybeans Purchased by EPSA and ENCI, 1979."

The volume of purchases increased threefold in 1979 compared to 1978, 1,143,216 kilos to 3,448,864 kilos. This increase is positive evidence of the efforts of the Soybean Project to promote the production of soybeans.

In Bagua and Jaen the buying station personnel were unaware of the latest Ministerial Resolution of 18 May 1977 which set 14 percent as the moisture level above which discounts of weight were deducted. Instead the level of the previous resolution of 12 percent was used which resulted in the deduction of 18,233 kilos of weight valued, at the then current buying prices, at S/. 1,270,399.

Some buying station personnel lacked the knowledge of the correct operation of the moisture meter. At Satipo the meter readings were not adjusted for soybeans by using the prepared adjustment tables which were printed in English. At Jaen the same condition existed because the tables had been lost.

Nothing is being done to assess the value of soybeans containing varying amounts of defective beans except to refuse to buy on the bases of visual inspection those lots which appear to be of lower quality. To determine the value, it is necessary to dissect the defective appearing beans in order to examine the inner contents. In most cases, the lower quality beans have value but need this type of examination to properly assess the damage and to determine an appropriate price. The problem of low-quality beans frequently appears in the areas of high or erratic rainfall during the harvesting and threshing operations.

Some complaints have been voiced by farmers at the slowness of the selling process at the various buying stations.

d. Development of a soybean thresher

The soybean thresher constructed at Tingo Maria did not perform as expected. Modifications have been made by installing V-belts and pulleys, changing the clean grain elevator, adding a feeding table, making more holes in the cleaning screen and installing an attached gas engine for power. Although hampered by many delays, the thresher modifications are almost completed and it should be ready to operate at the start of the harvest. The problems encountered emphasize the need for qualified engineering input in the design and construction of threshers.

e. Supply of credit for soybean production

A shortage of loan funds and high interest rates has held back a more rapid expansion of soybean production. For the present growing season the Government of Peru established a lower interest rate of 22 percent per annum for production loans in the areas of the Selva. Also, after much delay the special fund for the promotion of oilseed production became available at a lower interest rate of 18 percent per annun.

f. Training component

The Agricultural Economist participated in short courses for producers of soybeans and extension workers in Chiclayo, Tarapoto, Jaen, and Nuevo Cajamarca with presentations of costs of producing soybeans and labor utilization.

He worked with 15 production agents, 20 sectoristas and the chiefs of five purchasing stations in the collection and analysis of economic data.

2. Recommendations

a. A person, preferably with economic training, should be named to direct and continue the program of the collection and analysis of cost of production and labor utilization data. Actual data are needed to provide cost and production coefficients for budget preparations, information for extension programs to improve efficiency of production, information for economic analysis of alternate methods of production and effects of the introduction of new technology, and cost data to support official purchase price policy as long as such a policy is in effect.

Until now this work has been done in cooperation with production agents and sectoristas who work directly with farmers. The number and quality of the records depend upon the interest, effort and sincerity of these extension workers. An overall leader is needed to maintain and improve the efforts of the group.

The importance of actual data to gain the true picture of cost and labor utilization needs to be emphasized. The present practice of estimating costs tends to show conditions more favorably because it stresses the ideal cost, labor use, and yield response situations. On the other hand, some budgets have been prepared with exaggerated estimates, possibly to influence the official price level.

b. A person should be named to give leadership to the continuation of the survey of soybean purchases to further identify and locate problems associated with the marketing of soybeans at the first level. This position could logically be filled by someone in ENCI or by someone from the Direccion General de Comercializacion.

The data for studies of this type are generated at the buying stations and are readily available for collection and analysis.

The initial work done in this area points out the varying problems that are associated with varying climatic conditions of the different areas and the need to develop different programs to meet these specific problems.

c. The start that has been made in the Direccion General de Comercializacion to modify the standards and discount schedules for the purchase of soybeans should be continued with vigor to provide regulations that accurately evaluate the quality of soybeans and provide for equitable settlements between producers and processors. In this respect, the recommendations made by Paul Klinefelter, Consultant in Processing and Utilization of Soybeans, INTSOY, November 1978, provide a suitable basis from experience in the United States marketing system.

d. A short course for personnel involved in management and operation of the buying stations be developed covering the operation and maintenance of the testing, drying, cleaning and handling equipment. Instruction is also needed in determining the quality of the soybeans purchased and in the principles and practices of storage operations.

The logical locations for a series of these short courses are Bagua-Jaen, Tarapoto-Huallaga Central, Tingo Maria-Tocache, and San Ramon-Satipo in the areas of the soybean project. Another location outside the project area would be Tumbes in the North of Peru.

Objective 4. Project Evaluation

A Mission Evaluation was performed in May 1978 as part of USAID's evaluation schedule. In August 1979 USAID proposed that an outside evaluation be conducted, the results of which could form the basis for a decision on further INTSOY participation beyond November 1979. Subsequent decisions were taken at Mission level to conduct an in-house evaluation. In order to provide time to complete the evaluation, the TA contract was first extended to March 1980, then to June 1980. The Contractor is not aware that the evaluation has been completed.

Objective 5. Perform In-Country Training

Training activities were mentioned in Objective 2, and included training in both production and utilization. Production coordination workshops were held in Tarapoto (February 7-8), Satipo (March 27-28), Tingo Maria (April 23-24), and Bagua (June 3-4). Sessions were held with representatives from the Agrarian Bank, ENCI, SENEMA, INIA, and appropriate Agrarian Zone officials. The National Soybean Coordinators provided leadership in organizing and conducting the workshops.

In soybean utilization considerable effort was devoted to demonstrations and courses on preparation of various soy foods in the home. A series of demonstrations were held in rural areas of the selva alta. Basic, simple recipes for utilizing soybeans were developed. Major emphasis was given to soy milk/beverage, fried patties, a soy breakfast drink and a soy-based weaning food. Over 100 persons attended these demonstrations.

Objective 6. Coordinate Academic and Short-Term Training in the United States and Other Locations

Four MAA staff completed M.S. programs at the University of Puerto Rico, Mayaguez Campus, and returned for assignment. They were:

1. Homer Arnulfo Tuesto--Plant Breeding
2. Americo Celada Becerra--Soybean Production
3. Ontoniel Mendoza Rouas--Soybean Breeding
4. Gonzalo del Rio Escurra--Soybean Production

Planning for a second soybean training course in cooperation with personnel of the Instituto Colombiano Agropecuaria (ICA), Colombia, advanced. The second course will be open to soybean workers from Spanish-speaking countries of Latin America. Space for approximately five to eight participants from the Peru Soybean Development Program will be reserved.

E. Administration and Budget

The project is administered in Peru by Dr. Thomas M. Fullerton, Soybean Agronomist and INTSOY Principal Representative. He has developed excellent and effective working relationships with the MAA Coordinators and the USAID Project Manager. The team is backstopped at the UIUC campus by a quarter-time campus coordinator who links to the team members academic departments and to INTSOY administration.

Summary of Expenditures

	Line item	11/77-12/79	1/80-6/80	Total
1.	Salaries	$248,962	$ 77,208	$326,170
2.	Fringe	63,105	11,519	74,624
3.	Indirect Cost	85,162	27,927	113,089
4.	Travel and transportation	42,140	15,988	58,128
5.	Allowances	126,719	24,355	151,074
6.	Other direct costs	6,056	1,964	8,020
7.	Materials and supplies	3,864	62	3,926
	Total	$576,008	$159,023	$735,031

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