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TRIP REPORT - AFRICA

Date Submitted: October 19, 1973

NAME: D. Keith Whigham TITLE: Assistant Professor of Crop Production and Physiology

DIV: INTSOY

PERIOD OF TRAVEL (inclusive dates): July 28 - September 21, 1973

ITINERARIES: (Travel to Africa under Contract AID/CM/ta-C-73-19)
See Attachment A for detailed schedule within each country.

COUNTRIES VISITED: Morocco, Sierra Leone, Ghana, Nigeria, Kenya, Tanzania, Ethiopia, Egypt, Italy and England.

PURPOSE:

1. To investigate the level of soybean production and utilization research in each country.

2. To inform various institutions about the activities of INTSOY and how these institutions may cooperate with INTSOY.

3. To inspect the INTSOY variety evaluation trials in cooperating countries and discuss any problems encountered in soybean research.

4. To discuss future soybean production and utilization research activities in each country.

5. To discuss future cooperation between INTSOY and FAO with officials in Rome.

6. To observe facilities and current legume research activities at Cambridge University, the Plant Breeding Institute, and the University of Reading in England.

ORGANIZATIONS AND PERSONS CONTACTED: USAID officials, Ministry of Agriculture officials or their equivalent in each country visited. FAO, CARE, Faculty of Agriculture officials, and participants in the FAO/SIDA Seminar from several countries were visited (See attachment B for detailed listing).

RESULTS/ACCOMPLISHMENTS:

Morocco

1. Observed soybean nursery at the Rabat Experiment Station. Late maturing varieties appeared to produce highest yields. Irrigation is

necessary for soybean production. The soybeans were inoculated but few nodules were observed. March or April is the recommended time for planting soybeans. Soybean yields of 40 quintals/hectare have been recorded on research plots.

2. Traveled to the Sidi Allal Tazi Experiment Station and the Mnasra Station to observe soybean research. Water management was a problem and nodulation was very poor. The variety Clark appeared to be the best looking variety during the vegetative stage.

3. From discussions with Ministry of Agriculture and USAID officials it is clear that soybeans are important to Morocco and that soybean research activities will increase. USAID are planning to include soybeans in the new Food Crops Project for Morocco to be established in 1974.

4. INTSOY variety evaluation trials were requested for the 1974 season. USAID officials agreed to receive the materials and hand them to the Ministry of Agriculture.

Sierra Leone

1. Visited Njala University College and observed the location of the INTSOY variety trial to be planted in September, 1973. Discussed the planned trial with staff and agreed to provide additional inoculum.

2. Discussed the movement of seed through customs with CARE officials in Freetown. CARE has agreed to cooperate in clearing materials for INTSOY.

3. Discussed soybean production with an official of the Sierra Leone Produce Marketing Board (SLPMB). The SLPMB is in a position to produce soybeans when basic research has provided answers to variety selection and cultural practices. SLPMB asked for assistance in obtaining soybean seed for testing. Inquiries were made about the possibilities of training of local personnel in soybean production at the University of Illinois.

Ghana

1. Inspected INTSOY trial and other soybean research at Legon. INTSOY trial was well kept and the late maturing varieties appeared to be most promising during the long rains season. Stand establishment was better in INTSOY material than with seed from other sources.

2. An additional INTSOY variety trial was requested for planting in September, 1973 to screen varieties for adaptability to the short rains season.

3. The Ghana Commissioner of Agriculture inspected the INTSOY trial and asked that INTSOY continue to assist Ghana in their development of soybean production technology.

4. Traveled to the University of Ghana Research Station near Kpong and observed soybean research. Irrigation facilities are available at Kpong and soybean seed can be increased on this station.

5. Visited the Agricultural Development Co., Ltd. near Akosombo where soybeans are being introduced by the management for use by the local population of Chinese from Taiwan. Stand establishment and nodulation were current problems.

6. USAID/Ghana are proposing a food grain research program which will include soybeans.

7. INTSOY was asked to assist in obtaining soybean seed for multiplication in Ghana.

8. Presented a seminar on "Soybean Production and Utilization" at the University of Ghana, Legon.

Nigeria

1. Observed current legume research at IITA. Major emphasis (90% of legume research) is on cowpeas, however, IITA desire to cooperate with INTSOY on soybean research.

2. IITA would like INTSOY to screen the soybean germplasm collection for high temperature tolerance during germination.

3. Poor stand establishment observed in soybeans may be due to: (a) poor quality of seed at the time of harvest; (b) high soil temperature during the period of emergence; (c) low soil moisture, as a result of high soil temperature and poor moisture holding capacity, during the time of emergence.

4. Observed soybean research at Ahmadu Bello University, Zaria and stand establishment was not a serious problem. Dry weather during seed maturity and seed storage contributed to satisfactory stand establishment.

5. Bulk planting of soybeans were observed on the University Farm near Samaru. Root nodulation was acceptable and soybeans were being grown for the first time in at least six years.

6. The climatic environment of northern Nigeria is better suited for high quality soybean seed production than the Ibadan area.

Kenya

1. Observed soybean observation plots at the National Agricultural Research Station, Kitale. Varieties, Hill and Belgium Congo, are currently accepted as the best adapted at 6200 ft altitude. An INTSOY variety trial was requested for April, 1974.

2. The East African Plant Quarantine Station (EAPQS), Muguga, are screening the soybean varieties in the INTSOY trial for pests but the release of

clean seed will not be until early 1974. Even then less than 100 seeds of each variety will be available for research purposes.

3. The proposed plant quarantine regulations restricting the importation of soybean seed into Kenya without first being grown at the EAPQS are not legal. The local governments of the East African Community (Kenya, Tanzania and Uganda), must first approve such regulations.

4. Soybean research was discussed with the crop production staff of the University of Nairobi. INTSOY was requested to send a variety evaluation trial for testing in September, 1973 and April, 1974.

5. Discussions with various researchers indicate the Ministry of Agriculture are interested in extending soybean production, but soybeans only have a "Number 2 Priority" behind many crops with "Number 1 Priority".

Tanzania

1. Traveled to the University of Dar es Salaam, Faculty of Agriculture at Morogoro to discuss current soybean research. Local selections of soybeans show the most yield potential.

2. Visited the Ilonga Research and Training Institute and discussed soybean research. Extension staff are currently demonstrating soybean processing and utilization in local villages. UNDP are helping promote village processing of soybeans.

3. Soybean production is not expanding rapidly because the government has not established a guaranteed price at which the product can be sold by the farmer.

4. IITA are negotiating a USAID contract to provide a legume breeder to work on soybeans and cowpeas at Ilonga.

5. The Ministry of Agriculture have requested three INTSOY variety trials for testing at three altitudes beginning in December, 1973. The trials will be sent directly to the Field Trials Officer in Tanzania.

6. The Director of Research requested USAID/Tanzania to provide a team of scientists to design an implementation program for soybean production and utilization in Tanzania.

7. The Nutrition Unit of the Ministry of Agriculture/Division of Research requested future cooperation with INTSOY on processing and utilization. A visitation by an INTSOY food scientist would be desirable.

Ethiopia

1. The INTSOY variety trial sent to the Institute of Agriculture Research (IAR) for testing at Jimma had the instructions removed. Therefore, the seed was planted in observation plots rather than replicated plots. The late maturing varieties looked most promising at the Jimma site.

2. The current plant spacing within 60 cm rows for soybeans is 10 cm. Therefore, plant populations are about half as high as INTSOY recommends.

3. Visited the Gojeb Valley to observe soybean trials. Trial results looked rather disappointing probably due to early planting before the optimum date.

4. Observed legume research at the Agricultural Experiment Station, Debra Zeit and examined several soybean varieties being tested. Six varieties were recently introduced from Russia, but the early stage of development made evaluation difficult. Previous yield results indicate that medium maturity varieties do best at Debra Zeit.

5. The Awassa Experiment Station was visited and the INTSOY variety trial was examined. Medium maturity varieties appear to be best adapted for the Awassa environment.

6. The Ethiopian Nutrition Institute (ENI), sponsored by SIDA, have imported soybeans from the U.S. and are contracting farmers to produce soybeans. 1973 contract price is about $15 U.S. per 100 kilograms ($4/bu). Average yields for 1972 (1st year) were 11.6 quintals per hectare on contract.

7. FAFFA is an infant food made up of 18% soybean flour and is packaged and marketed by ENI. UNDP are providing ENI with processing equipment in 1974 so locally produced soybeans can be processed for FAFFA.

8. ENI desire cooperation with INTSOY on soybean processing and utilization. Visitation by INTSOY food scientist is recommended.

9. USAID/Ethiopia have prepared a Pulse Research Project. Soybeans are not included as one of the pulses at this time but could be added at the request of the Director General of the Institute of Agriculture Research.

10. IAR have requested four INTSOY variety trials for the 1974 plantings.

11. Presented an hour seminar on "Soybean Production and Utilization" at ENI.

Egypt

1. Presented a paper on "Fertilizing Soybeans in the Early Stages of their Introduction", by E. R. Leng and D. K. Whigham at FAO/SIDA Seminar on September 12, 1973. (See Attachment C).

2. With Dr. Leng, inspected the INTSOY/FAO variety trial at Bahtim research station near Cairo. Late maturing varieties look the most promising even though the trial was not planted until July. Date of planting trials on the same station indicated that April or May was the optimum planting date for soybeans. However, when the soybeans are properly irrigated a satisfactory crop can be grown from a range of planting

dates. White flies were prominent on the soybeans, but visible damage was minor. Nodulation was somewhat less than desirable.

3. Discussions with UNDP official indicate that the Ministry of Agriculture have microbiologists working on rhizobia of legumes. However, they do not have satisfactory strains for soybean inoculation. Information was requested for contacts in the U.S. who would cooperate and assist Egypt in establishing their own inoculum industry.

4. Soybean cultural practices research was discussed with Ministry of Agriculture officials. Research methods and objectives were outlined for production problems which must be tested under local environmental conditions.

5. Requests were received for INTSOY variety trials for testing near Aswan and Cairo in April, 1974. A special early maturity trial was also requested for the Cairo area.

6. Interaction with participants of the FAO/SIDA Seminar resulted in many requests for information and material about soybean production and utilization. FAO officials were collecting information from those participants who requested INTSOY variety trials for 1974. A summary of the requests will come from FAO at a later date.

Italy

1. Discussed cooperation between INTSOY and FAO on soybean research in the Near East and Africa where FAO Regional Projects are involved. FAO officials indicated a desire to expand their cooperation with INTSOY.

2. FAO suggested that INTSOY establish a mini-kit soybean trial for observation purposes in countries unfamiliar with soybeans. A favorable observation trial would be followed by a replicated variety evaluation trial.

3. FAO agreed to forward soybean seed requests from developing nations to INTSOY for action.

4. FAO will seek funds to help defray transportation costs for INTSOY/FAO cooperative trials.

England

1. Became familiar with soybean research activities at the Plant Breeding Institute, the University of Cambridge and the University of Reading.

2. Discussions with University of Reading staff indicated that the controlled environmental study results for soybeans compared to the INTSOY variety trial field data would be valuable for determining variety adaptability in developing countries.

3. Discussions were centered on the adaptability of soybeans for England's environmental conditions. Conclusions were that current varieties were not well suited to England's environment.

FOLLOW-UP ACTION REQUIRED:

Morocco

1. USAID/Morocco should include soybeans in the Food Crops Project to be initiated in 1974.

2. USAID/Morocco will inform INTSOY of the number of variety trials desired by the Ministry of Agriculture in 1974.

3. INTSOY shall provide soybean varieties trials upon request. USAID/Morocco will receive the material from INTSOY and pass along to appropriate Ministry of Agriculture staff.

Sierra Leone

1. INTSOY will provide Njala University College with fresh inoculum for soybean trials (completed).

2. INTSOY will cooperate whenever possible with Sierra Leone Produce Marketing Board to expand soybean production knowledge in Sierra Leone (presently assisting SLPMB to obtain soybean varieties for testing).

Ghana

1. INTSOY to provide soybean variety trial for planting in September 1973 (completed).

2. USAID/Ghana should include soybeans in the Food Grain Research Program which is being planned.

3. INTSOY shall assist Ghana in obtaining soybean seed for expanding their national soybean program (in progress).

Nigeria

1. INTSOY shall be represented at the IITA Grain Legume Improvement Workshop from October 29-November 3, 1973. (E. R. Leng to represent INTSOY).

2. INTSOY shall provide small quantities of soybean inoculum to the Institute of Agriculture Research, Zaria for use in May, 1974 soybean plantings.

3. INTSOY shall determine the feasibility of screening the soybean germplasm for temperature tolerance during germination.

4. INTSOY shall provide E. R. Duncan, Faculty of Agriculture, University of Ife, Ile-Ife, Nigeria information on preparation and uses of soybeans as a human food. (Completed).

Kenya

1. INTSOY shall provide the Faculty of Agriculture, University of Nairobi a soybean variety trial for testing in September, 1973. (Completed).

2. INTSOY shall provide two variety trials for testing in Kenya in early 1974. One shall be tested by the University of Nairobi and one at the National Agricultural Research Station, Kitale.

3. INTSOY shall continue to cooperate with the East African Plant Quarantine Station at Muguga to screen soybeans for seed born pests.

Tanzania

1. INTSOY shall provide the Field Trials Officer, Ministry of Agriculture, three variety trials for testing in December, 1973.

2. The Field Trials Officer shall prepare a proposal for the establishment of a USAID/Tanzania supported team to design a soybean implementation program for Tanzania.

3. INTSOY Food Scientist shall include Tanzania in visitation plans for Africa.

Ethiopia

1. INTSOY shall provide the Institute of Agriculture Research (IAR) with four variety trials for testing in April, 1974.

2. INTSOY Food Scientist shall include Ethiopia in visitation plans for Africa.

3. IAR officials should request USAID/Ethiopia to include soybeans in the proposed Pulse Project.

Egypt

1. INTSOY shall provide UNDP/Cairo with information concerning soybean rhizobia and inoculum preparation.

2. INTSOY shall provide FAO two regular variety trials for testing at Cairo and Aswan in April, 1974 and a special variety trial for testing at Cairo in February, 1974.

3. INTSOY shall attempt to fulfill all the 1974 variety trial requests from Near East and African countries submitted thru FAO.

Italy

1. INTSOY shall continue to work closely with FAO in soybean research activities.

2. INTSOY shall discuss the feasibility of establishing a soybean mini-kit program.

3. INTSOY shall attempt to handle all FAO soybean seed requests within the framework of the INTSOY contract.

4. FAO shall seek funds to defray transportation costs of INTSOY trial materials between the University of Illinois and FAO Projects.

England

1. INTSOY shall request that the Grain Legume Improvement Program of IITA include the standard INTSOY trial varieties in the material to be tested for daylength and temperature sensitivity at the University of Reading. (Completed).

OTHER REMARKS: Soybean production and utilization research in most African countries is only in the infant stages of development. Considerable effort must be put forth before the vast potential for both production and utilization can be tapped. INTSOY should make every effort to encourage and assist the African nations in their desire to produce and utilize the soybean.

ATTACHMENTS:

A - Detailed Itinerary
B - Persons Contacted
C - Paper presented at FAO/SIDA Seminar

DISTRIBUTION:

AID/W - 20 copies (sent Attn: Mr. George Parman)
University of Illinois - 15 copies (Internal Distribution)

ATTACHMENT A - DETAILED ITINERARY

Date	Activity
Morocco	
July 28 and 29	Flew from Champaign-Urbana to Rabat, Morocco via Chicago and Paris.
July 30	Met with USAID and Ministry of Agriculture. Examined environmental data to see of soybeans are adapted to the Morocco environment. Observed soybeans in a nursery at the Rabat Experiment Station.
July 31	Traveled to the Sidi Allal Tazi Experiment Station and the Mnasra Station to observe current soybean research.
August 1	Met with USAID and Ministry of Agriculture officials and discussed observations and the potential for future research activities.
Sierra Leone	
August 3	Flew from Dakar to Freetown. American Embassy arranged meetings with officials of the Sierra Leone Produce Marketing Board and CARE.
August 4 to 6	Traveled to Njala University College. Discussed soybean production with agronomists and observed the location where INTSOY trial will be planted in September, 1973. Returned to Freetown.
August 7	Depart from Sierra Leone to Ghana.
Ghana	
August 7	Flew from Freetown to Accra.
August 8	Visit to the Ministry of Agriculture and discussed soybean production and utilization with the Commissioner of Agriculture and his assistants. Visited INTSOY trial at Legon and observed soybean research being conducted by the University of Ghana Staff. Presented a seminar on "Soybean Production and Utilization".
August 9	Inspected INTSOY trial with the Commissioner of Agriculture. Travel to the University of Ghana Research Station and observe soybean production under irrigation. Visit the Agricultural Development Co. Ltd. farm at Akosombo and observe soybean production.

Date	Activity
August 10	Meeting with USAID agriculture officials to discuss soybean potential in Ghana. Depart for Nigeria.
Nigeria	
August 10	Traveled from Accra to Lagos. Visited the USAID Food and Agriculture Office.
August 11	Traveled from Lagos to Ibadan by automobile.
August 13	Met with the Director of ITA and staff members of the Grain Legume Improvement Program (GLIP) and discussed current soybean research. Attended a seminar about the Farming Systems Program of CIAT.
August 14	Visited with more GLIP staff as well as the project leader to the Cereals Improvement Program. Met with the head of the Department of Crop Science, University of Ife, Ile-Ife, Nigeria. Returned to Lagos by automobile.
August 15	Flew from Lagos to Kaduna and traveled by automobile to the Institute of Agriculture Research at Samaru. Met with School of Agriculture staff who are doing soybean research. Observed various research experiments in the field.
August 16	Discussed current research activities with the USAID/USDA PASA, Major Cereals Project Staff. Observed soybeans in the field at the University Farm near Samaru and discussed soybean production with the farm manager.
August 17	Discussed the potential for soybean production in Northern Nigeria with Dr. Ogborn of IAR. Traveled to Kaduna and flew to Lagos for connecting flight to Nairobi.
Kenya	
August 17	Flew from Lagos to Nairobi.
August 18	Traveled by auto to the Embu Agriculture Experiment Station, Embu and discussed current research activities and the potential for soybean production in the area. Traveled on to Kitale.
August 20	Observed current research activities at the National Agricultural Research Station, Kitale. Examined soybean nursery which is being screened for maturity dates at an altitude of 6200 feet.

Date	Activity
August 21	Flew to Nairobi. Visited with USAID/Kenya, Food and Agriculture Officer concerning the present attitude on soybean production.
August 22	Observed INTSOY soybean seed being screened for pests at the East African Plant Quarantine Station, Muguga. Discussed current quarantine restrictions on soybean importation with the Officer-in-Charge, EAPQS. Visited with the Deputy Director, East African Agriculture and Forestry Research Organization about soybean production in East Africa.
August 23	Met with USAID officials and University of Nairobi, Faculty of Agriculture staff and discussed soybean research. Flew to Dar es Salaam.
Tanzania	
August 23	Flew from Nairobi to Dar es Salaam.
August 24	Discussed INTSOY program and the USAID/IITA program with USAID/Tanzania Food and Agriculture Officer. Discussed soybean nutrition program with UNICEF and Ministry of Agriculture officials in Dar es Salaam and Morogoro. Discussed soybean research with University of Dar es Salaam, Faculty of Agriculture staff.
August 25	Visited Ilonga Research and Training Institute and discussed soybean production and utilization programs with staff. Returned to Dar es Salaam.
August 27	Met with the Ministry of Agriculture Directors and Chief Research Officer, and discussed the potential for soybean production and utilization in Tanzania. Reviewed observations with USAID/Tanzania officials.
August 28	Discussed soybean production in Tanzania with the Economics Officer of the U.S. Embassy/Tanzania. Departed Tanzania for Ethiopia.
Ethiopia	
August 28	Arrive in Addis Ababa from Dar es Salaam. Met with USAID Food and Agriculture Officer and Institute of Agriculture Research (IAR) officials.
August 29	Flew to Jimma and observed current soybean research, including INTSOY materials, at the Jimma Research Station. Discussed INTSOY program and Ethiopian soybean research with IAR officials. Drove to Gojeb Valley and observed soybean production on an experimental substation.

Date	Activity
August 30	Returned to Addis Ababa by automobile.
August 31	Drove to Debra Zeit and visited with Haile Selassie I University, Agriculture Experiment Station staff. Observed current soybean research in the field. Drove to Awassa.
September 1	Visited with Awassa Experiment Station staff and observed current soyean research, which included the INTSOY variety trial. Returned to Addis Ababa.
September 3	Visited the Ethiopian Nutrition Institute (ENI) and discussed soybean utilization with staff.
September 4	Further visitation with ENI staff and presented a seminar on "Soybean Production & Utilization".
September 5	Met with IAR and USAID officials before departing for Cairo.
Egypt	
September 5	Arrive in Cairo from Addis Ababa.
September 6	Registered at the FAO/SIDA Seminar, "Improvement and production of field food crops" for plant scientists from Africa and the Near East. Participated in seminar activities. Departed for Luxor by train.
September 7-8	Arrived Luxor. Visited Luxor and surrounding area which included a Government farm and intensive agriculture on irrigated land. Departed for Cairo by train.
September 9	Arrived in Cairo.
September 10	Participated in seminar activities and inspected INTSOY trial and other soybean research on the Agriculture Research Center at the Bahtim Field Station near Cairo.
September 11	Participated in seminar activities.
September 12	Presented paper on soybean fertility at seminar and participated in discussions. Met with Ministry of Agriculture officials and discussed soybean cultural practices research for Egypt.
September 13	Discussed rhizobia and inoculation problems with UNDP official. Department for Rome.

Date	Activity
Italy	
September 13	Arrived in Rome from Cairo.
September 14	Met with officials of the Plant Production and Protection Division of the UN/FAO. Discussed past and future cooperation between INTSOY and FAO. Observed soybeans grown at the Technical Institute of Agriculture in Rome.
September 15	Departed for London.
England	
September 15	Arrived in London from Rome and traveled to Cambridge by train.
September 17	Met with the Grain Legume Improvement Group of the Department of Applied Biology at the University of Cambridge. Observed current legume research and discussed their cooperation with IITA and other international organizations.
September 18	Visited the Plant Breeding Institute near Cambridge and discussed current research on soybeans and other crops.
September 19	Traveled by train to Reading.
September 20	Visited the Department of Horticulture at the University of Reading. Observed the facilities for controlled environmental growth studies and observed current research. Also discussed the cooperative project between the University of Reading and IITA to study the interaction of day length and temperature on soybean and cowpea development.
September 21	Departed for the University of Illinois.

ATTACHMENT B - PERSONS CONTACTED

Person	Position
Morocco	
Mr. Messaoui	Assistant Director of Research, Ministry of Agriculture
Mr. Bengelloun	Chief, Plant Breeding Station, Ministry of Agriculture
Mr. Bryssine	Legume Agronomist, Ministry of Agriculture
Mr. H. G. Seidel	Director, USAID
Dr. Carl Ferguson	Food and Agriculture Officer, USAID
Dr. Jamie Bell	Cereal Project Leader, USAID
Mr. Norman Ulsaker	Agriculture Economist, USAID
Dr. William Hall	Cereal Agronomy Research Advisor, USAID/CIMMYT
Mr. Sanford Anderson	Production Agronomist Extension, USAID/NEF*
Mr. William Davis	Production Agronomist Extension, USAID/NEF*
Mr. Lou Harper	Seed Technology Specialist, USAID/NEF*
Mr. H. Hanafi	Program Assistant, USAID
Sierra Leone	
Mr. C. L. Olson	American Ambassador to Sierra Leone
Mr. A. P. Larson	Third Secretary of the American Embassy
Mr. William Huth	Assistant Director of CARE
Mr. Richard LaRoche	CARE Field Representative
Mr. M. K. Suma	Deputy Managing Director, Sierra Leone Produce Marketing Board
Mr. Godfrey-Sam-Aggrey	Dean of Agriculture, Njala University College
Dr. Vincent West	University of Illinois USAID/Njala University College Agriculture Extension
Mr. M. T. Dahniya	Assistant Lecturer, Department of Agronomy, Njala University College
Ghana	
Col. G. S. Bernaski	Commissioner of Agriculture, Ministry of Agriculture
Mr. William Baffoe	Deputy Director of Agriculture, Ministry of Agriculture
Dr. D. K. Acquaye	Dean, Faculty of Agriculture, University of Ghana, Legon
Dr. K. A. Haizel	Senior Lecturer, Crop Ecology, University of Ghana, Legon
Dr. R. B. Dadson	Lecturer, Crop Science, University of Ghana, Legon
Dr. Paul Lamptey	Plant Pathologist, University of Ghana, Legon
Mr. Ed Khan	Officer in Charge, Kpong Research Station
Mr. Andrew Aryeetey	Research Officer, Kpong Research Station
Dr. Murkhgee	Plant Physiologist, Crop Research Institute, Kwada
Mr. James W. Ford	Food and Agriculture Officer, USAID/Ghana
Mr. Richard Hynes	Program Officer, USAID/Ghana

*NEF = Near East Foundation

Person	Position
Nigeria	
Dr. Russell Olson	Food and Agriculture Officer, USAID to Nigeria
Dr. H. R. Albrecht	Director, International Institute of Tropical Agriculture (IITA)
Dr. K. O. Rachie	Project Leader, Grain Legume Improvement Project (GLIP), IITA
Mr. W. Plarre	Visiting Professor, GLIP, IITA
Dr. A. Ayanaba	Soil Microbiologist, IITA
Dr. W. K. Whitney	Entomologist, GLIP, IITA
Dr. H. C. Wien	Physiologist, GLIP, IITA
Dr. R. A. Luse	Biochemist, GLIP, IITA
Dr. W. M. Porter	Plant Breeder (Cowpeas), GLIP, IITA
Mr. M. N. Harrison	Leader, Cereals Improvement Project, IITA
Dr. David Franklin	Systems Engineer, CIAT
Dr. E. R. Duncan	Head, Department of Crop Science, Faculty of Agriculture, Ife University, Ile-Ife, Nigeria
Dr. B. D. Barry	Cereals Entomologist, USDA/AID PASA, Institute of Agriculture Research (IAR), Samaru, Zaria
Mr. Isaac P. Mathew	Lecturer, School of Agriculture, Samaru, Zaria
Dr. James Ogborn	Weed Specialist, IAR
Dr. Stanley King	Cereals Pathologist, USDA/AID PASA, IAR
Mr. James Clifton	Acting Leader, Major Cereals Project, USAID, IAR
Mr. Douglas Couper	Farm Manager, University Farm, Samaru, Zaria
Kenya	
Mr. Harold Jones	Food and Agriculture Officer, USAID/Kenya
Dr. L. L. Darrah	Maize Geneticist, USDA/AID PASA, Kitale
Dr. John Kern	Sorghum Breeder, East African Agriculture and Forestry Research Organization (EAAFRO) Muguga
Dr. Fred J. Wangati	Deputy Director, EAAFRO
Mr. Njogo Njeru	Maize Agronomist, Embu Agriculture Research Station (EARS), Embu
Mr. A. M. Rubui	Maize Breeder, EARS, Embu
Mr. E. O. Omolo	Acting Senior Maize Research Officer, National Agriculture Research Station (NARS), Kitale
Mr. Mohammed Amiyu	Assistant Agriculture Officer, NARS, Kitale
Mr. Gordon Selley	Agronomist, Kenya Seed Co., Kitale
Dr. A. M. Gurnah	Lecturer, Dept. of Crop Production, Faculty of Agriculture, Univ. of Nairobi
Dr. C. L. M. VanEijnatten	Professor, Dept. of Crop Production, Faculty of Agriculture, Univ. of Nairobi
Tanzania	
Dr. W. H. Judy	Field Trials Officer, EAAFRO/Division of Research, USAID/USDA, Dar es Salaam
Dr. O. Hess	Food and Agriculture Officer, USAID
Mr. H. Lucius	Economics Officer, U.S. Embassy
Mr. U. W. Konig	UNICEF Program Officer
Dr. Eng. H. Podedoworny	UN/FAO Country Representative

Person	Position
Dr. J. Kreysler	Senior Research Officer (Nutrition), Ministry of Agriculture
Mr. G. A. Semiti	Director of Research & Training, Ministry of Agriculture
Mr. H. Kastiga	Director for Agriculture & Food Services, Ministry of Agriculture
Mr. Tenesi	Director for Administration & Planning, Ministry of Agriculture
Dr. J. Liwenga	Chief Research Officer, Ministry of Agriculture
Dr. Choudhery	Microbiologist, University of Dar es Salaam, Faculty, Morogoro
Mr. R. Finlay	Research Fellow on Intercropping, University of Dar es Salaam, Faculty of Agriculture, Morogoro
Mr. Mziray	Nutrition Section, Ministry of Agriculture, Division of Research, Dar es Salaam
Mr. Kateule	Nutrition Section, Ministry of Agriculture, Division of Research, Morogoro
Dr. Haule	Nutrition Section Ilonga Research & Training Institute (RTI), Kilosa
Dr. T. Rai	Legume Agronomist Ilonga RTI, Kilosa
Mr. Hepworth	Nutrition Section Ilonga RTI, Kilosa
Ethiopia	
Mr. Don Pope	Public Relations, Peace Corp/Institute of Agriculture Research (IAR), Addis
Mr. Eshetu Areda	Public Relations, IAR, Addis
Mr. Tekie Mehary	Entomologist, IAR, Holetta
Dr. N. R. Fadda	Project Manager, UN/FAO/IAR, Addis
Dr. Dagnatchew Yirgon	General Manager, IAR, Addis
Mr. Jack Spencer	Agronomist, UN/FAO/IAR, Jimma
Dr. Taye Bizuneh	Director of Haile Selassie I University, Agriculture Experiment Station, Debra Zeit
Dr. Don Schmidt	Pulse Project Leader, USAID/Agriculture Experiment Station, Debra Zeit
Mr. Alemu Mengistu	Trainee, Agriculture Experiment Station, Debra Zeit
Mr. Zewudu Oumer	Agronomist, IAR/Awassa Experiment Station
Mr. Metaferia Aboye	Field Assistant, IAR/Awassa Experiment Station
Mr. Yacob Negassa	Assistant Administrator, Ethiopian Nutrition Institute (ENI), Addis
Mrs. Belainesh Gebre-Hywot	Acting Head of Nutrition Department, ENI, Addis
Dr. Kesset Daniel	Head, Laboratory Section, ENI, Addis
Mr. R. L. Sweet	Food & Agriculture Officer, USAID/Ethiopia, Addis
Mr. Lars G. Haraldson	Administrator, ENI, Addis
Mr. Erwin Kopp	Food Technologist, ENI, Addis
Egypt	
Dr. Abdul Hafiz	Project Manager FAO Regional Field Food Crops Project, Cairo
Dr. W. M. Tahir	Cereal Improvement and Production Officer, FAO, Rome
Dr. D. M. Stewart	Plant Pathologist, FAO/UNDP, Cairo

Person	Position
Dr. A. Micke	Plant Breeder, FAO/IAEA, Vienna, Austria
Dr. N. C. Dastane	Agronomist, FAO/UNDP Lake Nasser Project, Aswan
Dr. B. D. Bhardwaj	Summer Cereals Specialist, FAO, Cairo
Dr. M. M. Hakam	Director, Legume Crops, Research Section, Field Crops Res. Inst., Giza, Orman, Cairo
Dr. Ali Abd-el-Aziz Ibrahim	Chief Specialist, Legume Res. Sta., Agric. Res. Center Giza, Orman, Cairo
Dr. A. Hadjichristodoulou	Cereal Breeder, Agric. Res. Institute, Nicosia, Cyprus
Dr. Konrad Mengel	Crop Nutrition, Landwirtschaftliche Forschungsanstalt. Buntehof, Germany
Dr. A. B. Joshi	Director, Indian Agricultural Research Inst., New Delhi, India
Dr. Amir Singh	Indian Agric. Res. Inst., New Delhi, India
Dr. A. Y. Allan	Maize Agronomist, ODA/National Agric. Res. Station, Kitale, Kenya
Mr. Egil Øyjord	Mechanical Engineer, International Assoc. on Mechanization of Field Experiments, NLH, Norway
Mr. A. Hagberg	The Swedish Seed Association, Svalov, Sweden
Dr. V. Stoy	The Swedish Seed Association, Svalov, Sweden
Dr. F. G. H. Lupton	Cereal Breeder, Plant Breedington Institute, Trumpington, Bambridge, England
Dr. Zdravko Martinic	Cereal Breeder, Faculty of Agriculture, Zagreb University, Zagreb, Yugoslavia
Dr. Seme Debela	Cereal Breeder, Institute of Agric. Res., Addis Ababa, Ethiopia
Mr. Mohammed Samii	Director, Seed and Plant Improvement Institute, Karaj, Iran
Mr. Nasser Ghanavati	Seed and Plant Improvement Center, Varamin, Iran
Mr. Ahmed Mokhtarzadeh	Agricultural College, Pahlavi University, Teheran, Iran
Mr. Omar Ali Ameen	Directorate General of Field Crops, Abu-Ghraib, Baghdad, Iraq
Mr. E. O. Omolo	Maize Breeder, National Agric. Res. Sta. (NARS), Kitale, Kenya
Mr. Nelson Nyamu	NARS, Kitale, Kenya
Mr. E. W. Mwenda	NARS, Kitale, Kenya
Mr. Njogu Njeru	Embu Agric. Res. Sta., Embu, Kenya
Mr. Ukat U. Ebong	Federal Dept. of Agric. Res., Moor Plantation, Ibadan, Nigeria
Mr. O. A. Ojomo	Inst. of Agric. Res. and Training, Min. of Agric., Ibadan, Nigeria
Mr. Tag El Sir Yassim	Agric. Res. Corp., Hudeiba Res. Sta., Ed-Damer, Sudan
Dr. Ali K. Kambal	Dean, Faculty of Agric., Univ. of Khartoum, Khartoum North, Sudan
Mr. Walid el-Malek	Head of Crops Res. Section, Min. of Agriculture, Damascus, Syria
Mr. John H. Monyo	Cereal Breeder, Faculty of Agric., Univ. of Dar es Salaam, Morogoro, Tanzania
Italy	
Mr. Felix Albani	Director, Plant Production & Protections Division UN/FAO, Rome
Dr. R. A. Peterson	Chief, Crop & Grassland Production Service, Plant

Person	Position
Mr. Mario Jalil	Senior Officer (Field Food Crops), Crops & Grassland Prod. Serv., UN/FAO, Rome
Dr. A. Brandolini	Summer Cereal Crops Officer, Field Food Crops, Crop & Grassland Prod. Serv., UN/FAO
Dr. J. Leon	Chief, Crop Ecology & Genetics Resources Unit, Crop Prod. & Prot. Div., UN/FAO, Rome
Dr. Eugenio Sparavatti	Seed Exchange Officer, Crop Ecology & Genetic Resources Unit, Crop Prod. & Prot. Div., UN/FAO, Rome
England	
Dr. A. M. Evans	Head, Grain Legume Improvement Group, Dept. of Applied Biology, University of Cambridge
Dr. John Hamblin	Legume Breeder, Grain Legume Imp. Group, University of Cambridge
Mr. J. H. C. Davies	Graduate Student, Legume Group, Univ. of Cambridge
Mr. G. C. Hawtin	Graduate Student, Legume Group, Univ. of Cambridge
Mr. D. J. Allen	Graduate Student, Legume Group, (Pathology), Univ. of Cambridge
Mr. G. Tobin	Graduate Student, Biochemical & Nutritional Investigations, Dept. of Applied Biology, Univ. of Cambridge
Dr. W. E. Tossell	Dean of Research, Univ. of Guelph, Canada
Mr. A. C. Jackson	Cotton Breeder, Imperial Cotton Corporation, Research & Training Institute, Ukiriguru, Tanzania
Dr. Ralph Riley	Director, Plant Breeding Institute (PBI), Cambridge
Mr. H. H. Rogers	Deputy Director, PBI
Dr. F. G. H. Lupton	Head, Cereals Dept., PBI
Mr. John Bingham	Wheat Breeder, PBI
Dr. E. S. Bunting	Maize Breeder & Minor Crops, PBI
Dr. M. H. Arnold	Head, Sugar Beet Dept., PBI
Mr. R. B. Austin	Head, Physiology Dept., PBI
Dr. R. J. Summerfield	Plant Physiologist, Dept. of Horticulture, Reading University
Dr. F. R. Minchin	Plant Physiologist, Dept. of Horticulture, Reading University

ATTACHMENT C

Paper presented at FAO/SIDA Seminar in Cairo, September 12, 1973

FERTILIZING SOYBEANS IN THE EARLY STAGES OF THEIR INTRODUCTION

Earl R. Leng and D. K. Whigham

INTSOY Program, University of Illinois, Urbana

Extensive cultivation of soybeans exists in only a few countries at the present time, but the crop is rapidly attracting attention in many other areas of the world. As a natural result of this interest, many questions arise as to selection of varieties, cultural practices, planting dates and rates, and other matters. Fertilizer requirements are of particular concern, especially in developing areas where commercial fertilizers often are scarce and costly. Where soybeans have not previously been grown, this type of information is particularly important, since development experience has shown that an appropriate "package of improved practices" is usually required for introduction of new or improved crop types to be successful.

This paper will concentrate on the problems of fertilizing soybeans in areas where they are newly introduced or not commonly grown. Such conditions are likely to differ in important aspects from the requirements in areas where the crop is well established. Also, this information is more important to participants in this seminar, since nearly all of them will be dealing with soybeans as a relatively new and unfamiliar crop.

We will present data and comments based on actual field trial experience in a wide variety of agroclimatic conditions, treating soybeans as a newly-introduced crop. The tables will present data from India and Ecuador, but they are reinforced with trial results from other areas.

For this discussion, we should concentrate on the "major nutrient" requirements of the crop. In rather extensive field experience in India and some other areas, we have seen no evidence of special micronutrient requirements in regard to soybeans. It is true that if deficiencies of zinc, boron, manganese, molybdenum, or other such elements are known to exist for other legumes, an additional supply of these elements for soybeans would be important. However, it is nearly always possible to obtain high yields if the major requirements for nitrogen, phosphorous, and pH level are met. Probably, commercial superphosphate fertilizer contains sufficient micronutrients to meet most requirements.

We should consider the major "nutrients" to be N, P, K and pH level. Where pH is 6.0 or above, soybeans usually will flourish if other requirements are met, and no deficiency of Ca or Mg will be found. At high pH levels (7.5 or above), there may be extra interference with P supply, but no other problem directly related to pH. Soils with levels of 5.5 or below usually require treatment with limestone for

best soybean growth. Both the soybean plant itself and its symbiotic Rhizobia appear to be affected adversely by low pH. In acidic latosols, in tropical and subtropical areas, aluminum toxicity appears to be a serious problem, although its effects on soybeans may not be as great as those on other crops. In any event, high yields of soybeans cannot be expected on highly acidic soils, and correction of pH with agricultural limestone is the appropriate remedy.

We are not presenting any data on K response because in extensive trials in India, and in a number of observations in other countries, there is little or no evidence that additional K is required for high levels of soybean yields. If a major requirement for this element is known to exist in a particular soil, modest levels of K fertilization would be appropriate.

Phosphorous, in liberal quantities, is almost a universal fertilizer requirement for successful soybean cultivation. We present here (Table 2) data from Jabalpur, India which clearly illustrate the prevailing situation, even on the reasonably-fertile "black cotton" soils of Central India.

Experience has shown that at least 80 kg/hectare, and often up to 120 kg or more, expressed as P_2O_5 equivalent, is the general requirement for P fertilization, if soybean production is to be at medium to reasonably high levels. For maximum production, unless the soils are very well supplied with available P, the requirement is likely to be higher. This need for P flows from the high content of this element in the soybean seed, necessitating renewal of the soil phosphorous supply if high yields are to be sustained. As mentioned above, P requirements are particularly acute in soils with high pH (and in fact also in soils with very low pH) since these reaction conditions tend to make soil phosphorous less available to the plants.

As is the case with most crop plants, an adequate supply of nitrogen is critic to good yields in soybeans. However, in contrast to the cereal crops, the soybean can be provided with all its needed nitrogen at a very low cost, through the activity of symbiotic Rhizobia in root cultures. What is mandatory for the attainment o successful soybean production is to insure that effective Rhizobial inoculation is established and maintained.

In Tables 1, 3, 4 and 6, we present data from India and Ecuador which clearly illustrate the need for effective inoculation if high yields of soybeans are to be obtained. Table 1 shows three major facts: a) that successful inoculation virtually doubles the grain yield, as compared to no inoculation; b) that even 120 kg/hectare of mineral nitrogen would not produce yields comparable to those given under good inoculation; and c) that addition of N fertilizer is not required if adequate inoculation is present. These findings are particularly important for the developing countries because nitrogenous fertilizers are in short supply and expensive the world over. Effective inoculant materials, on the other hand, are very cheap even if they have to be imported.

Table 3, presenting data from Ecuador, shows the same general facts in regard to yields, and also illustrates two additional points. First, all commercial inoculant materials are not effective, and some can be completely ineffective. Thus, it is important to use only materials of proven effect. Second, adequate inoculation not only increases yields, but also protein content of the grain. It appears to be significant that application of N in fertilizer may result in some increase in grain yield, but not in protein content of the grain.

Table 4 demonstrates the same facts, in regard to yield, as Table 3, except that the observations are from Central India. Here again, the existence of ineffective inoculant cultures is clearly shown, and data shown in Table 6 also illustrate the same fact. The latter table also demonstrates the possibility of domestic manufacture of effective inoculant in a developing country, since several of the effective cultures tested in this trial are of Indian manufacture.

We have included in this presentation, although it is not directly related to fertilization problems, the data of Table 5, which show the great importance of effective weed control on soybean production. This may prove to be as great or a greater limitation to production than fertilization. As shown, the better herbicides, such as Lasso, produced yields almost as high as those from completely weed-free plots.

In summary, the fertilization requirements for successful soybean cultivation in the vast majority of developing areas, where the crop is new, can be summed up as follows:

1. Correction of soil pH to reasonable levels.

2. Proper use of effective Rhizobia inoculant.

3. Application of 80 to 120 or more kg/ha of P_2O_5, as superphosphate or other readily available source.

4. Adequate cultural practices and weed control to enable the yield potential to be realized.

Table 1

Soybean Grain Yields (quintals/hectare)* as Influenced by Inoculation and Nitrogen Applications. Bragg Variety, Jabalpur, 1968-69.

Nitrogen	Inoculated			Not Inoculated		
kg/ha.	1968	1969	Average	1968	1969	Average
0	39.8	32.9	36.4	22.1	18.1	20.1
15	39.6	33.4	36.5	26.4	16.6	21.5
30	39.7	33.9	36.8	28.9	17.1	23.0
60	38.5	32.8	35.6	31.2	19.1	25.2
120	40.0	34.8	37.4	33.1	20.9	27.0

* One quintal = 100 kilograms

Table 2

Soybean Grain Yield (quintals/hectare)* as Influenced by Phosphorus Fertilization. Bragg Variety, Jabalpur, 1968-71.

P_2O_5	Year				Four
Kg/ha.	1968	1969	1970	1971	Year Average
0	26.8	23.9	23.8	26.3	25.2
40	32.4	25.3	28.3	29.2	28.8
80	35.8	26.1	28.3	30.6	32.7
120	-	-	29.1	31.2	-
160	37.7	26.7	29.8	-	-
320	37.0	27.8	-	-	-

* One quintal = 100 kilograms

Table 3

Results From Coordinated Inoculum Trials In Ecuador, 1970 With Americana Soybeans.

Treatment	Boliche[1] Yield (kg/ha)	Boliche[1] Nodules/ Plant	Boliche[1] % Oil	Boliche[1] % Protein	Portoviejo[2] Yield (kg/ha)	Portoviejo[2] Nodules/ Plant	Mean Yield (kg/ha)	Mean Nodules/ Plant
Nitragin Inoculant	2298*	31.0**	19.75	43.96*	3120*	23.5*	2709*	27.2**
E-Z Inoculant	2545**[3]	22.8*	20.25	44.54**	3160**	26.0**	2853*	24.4*
Urbana Inoculant	2412*	12.5	20.25	42.55*	2642*	12.8	2527*	12.6
Legume Aid Inoculant	2128*	1.0	21.30*	40.33	2609*	5.2	2369	3.1
Dormal Inoculant	1874	0.5	22.08*	38.91	2456	0.5	2165	0.5
Noctin Inoculant	1997	1.2	22.30**	37.88	2223	0.2	2110	0.8
N Fertilization, 100 kg/ha	1932	0.0	21.35*	39.91	2579*	0.2	2256	0.1
Control	2163*	3.0	21.22*	39.72	2272	0.0	2217	1.5
MEAN	2169	9.0	21.07	40.97	2633	8.6	2401	8.8
LSD (.05)	422	11.1	1.60	2.66	613	8.8	361	6.9

Trials at both locations were conducted in cooperation with the National Institute of Agricultural Research (INIAP at Boliche.

[1] 3°S latitude; 50 m altitude.

[2] 2°S latitude; 25 m altitude.

[3] The top ranking treatment in each category is designated by a double asterisk (**). Treatments not differing significantly from it are denoted by a single asterisk (*).

Table 4

Soybean Grain Yield (quintals/hectare)* as Influenced by Various Rhizobium Inoculants. Bragg Variety, Jabalpur, 1968-70.

Treatment	1968	1969	1970	Three Year Average
No Inoculum	18.6	18.0	16.3	17.6
"NITRAGIN" (U.S.)	37.5	36.3	30.6	34.8
Bragg isolate No. 1	22.8	-	-	
'Bombay'	19.1	27.7	-	
UPAU 2	-	32.5	-	
IARI 2	-	32.8	-	
IASC 2	-	-	30.9	
JNAU 1	-	26.9	-	
JNKVV	-	-	25.4	
SB-16	-	-	29.2	
Percent Increase "NITRAGIN" vs No Inoculum	102	102	88	

* One quintal = 100 kilograms

Table 5

Effect of Herbicides and Hand Weeding on Yield (quintals/hectare)*. Bragg Variety, Jabalpur, 1968-71.

Treatment	1968	1969	1970	1971	Four Year Average
Unweeded	29.3	9.9	22.5	29.4	22.8
Weed Free	37.4	23.1	28.5	38.0	31.8
Lasso 1L/ha., a.i.	34.1	15.0	28.5	36.5	28.5
Lasso 2L/ha., a.i.	34.6	12.3	28.8	37.6	28.3
Tok E-25 0.75 L/ha.,a.i.	36.2	11.1	28.2	34.4	27.5
Treflan 1L/ha., a.i.	31.4	12.1	28.0	-	-
EPTAM 2L/ha., a.i.	30.5	10.4	20.1	36.3	24.3
Hand Weeding - 2	29.2	11.0	27.7	36.0	26 0

* One quintal = 100 kilograms

Table 6

Number and Dry Weight (mg) of Nodules Per Plant at 30 and 60 Days After Planting and Bean Yields Per Hectare (Quintals)* as Influenced by Inoculation Treatments, Spring 1971, UPAU

Treatments	Nodule number at 30 days	Nodule number at 60 days	Nodule dry wt. at 30 days	Nodule dry wt. at 60 days	Yield per hectare** (quintals)
Control	0.0	0.0	0.0	0.0	6.79 c
E-188 (lignical)	2.5	22.0	14.0	147.5	21.34 a
E-188 (Peat)	17.0	34.0	62.0	187.3	25.37 a
E-188 (Sand)	0.0	0.0	0.0	0.0	8.92 c
FRS (Sand)	2.0	5.0	10.0	21.0	9.96 c
IACC-2	0.0	0.0	0.0	0.0	7.12 c
Iowa State	0.0	0.0	0.0	0.0	6.89 c
Mixed IARI	0.3	4.0	1.5	17.7	9.56 c
SB-1	0.0	2.5	0.0	11.6	15.75 b
SB-12	0.0	0.0	0.0	0.0	7.84 c
SB-16	3.3	8.0	14.1	24.0	16.12 b
UPAU-2	0.5	3.6	2.0	15.6	10.12 c
UPAU-3	0.0	0.0	0.0	0.0	7.87 c
NITRAGIN	5.1	33.0	21.0	198.6	25.87 a
S.E.M. ±					1.25
C.D. 5%					4.06
C.V. %					19.50

* One quintal = 100 kilograms

** Figures with identical letter are statistically not different from each other

TRIP REPORT - GHANA

Date Submitted: 5 December 1974

NAME: Les K. Ferrier

TITLE: Assistant Professor

DIVISION/UNIT: INTSOY/ Food Science

ITINERARY: Lagos, Nigeria to Accra, 28 July
Accra to Zurich, Switzerland 8 August
One week leave, Arrive Champaign, 16 August 1974
(See Attachment A)

PURPOSE:

1. To stimulate interest in attending the East African Soybean Workshop.

2. To visit scientists and others in Ghana who are interested in soybean foods.

3. To demonstrate some possible uses of whole soybean foods where facilities permit.

4. To gather general information on Ghanaian diets and nutrition which would assist in finding means of introducing soybeans into the diet.

ORGANIZATIONS/PERSONS CONTACTED:
Personnel from USAID/Ghana, the Ministries of Agriculture, Education and Health, the College of Agriculture, University of Ghana, the Food Research Institute, the Crystal Oil Mills Ltd, and the Tema Food Complex Corporation. (See Attachment B)

RESULTS/ACCOMPLISHMENTS:

1. Discussed the University of Illinois methods for utilizing soybeans directly as human foods, and the possibilities of growing soybeans in Ghana and incorporating soybeans directly or indirectly (via poultry) in Ghanaian diets with people from the organizations listed under Organizations/Persons Contacted.

2. Discussed the practical possibility of future production of soybean oil in Ghana by using expellers and solvent extractors with members of the Crystal Oil Mills, Ltd, and the Tema Food Complex Corporation. There was a strong desire to test soybeans for oil production on the part of both these organizations in order to see if the use of soybeans grown in Ghana as a source of oil was economically sound.

3. Presented two seminars and led discussions on the present and future development of soybeans in Ghana at the University of Ghana (Legon). The seminars and the discussions centered on the possible direct and indirect uses of soybeans in Ghana both for animal and human feed

and food, and for export. Initial reactions of the participants varied from enthusiasm and determination to complete skeptiscism about the acceptability of soybeans directly in the diet. Nevertheless, by the end of each session, most of the participants seemed to realize: (a) that the soybean has considerable potential for the future, (b) that the members of the College of Agriculture were going to push for nation-wide production in a few years, and (c) that they were being presented with some lead time for the development of plans, methods and foods which would be suitable for use in Ghana. It was interesting to note that the greatest optimism came from the production scientists and the strongest skepticism came from the Home Science extension workers. Pessimism seemed to be directly proportional to the closeness of the workers, to Ghanaian dietary habits and lack of experimental experience with soybeans.

FOLLOW-UP ACTION REQUIRED:

1. Send reprints and other information requested.

2. Provide general information to USAID on the feasibility of using the expeller process for extraction of oil from soybeans.

DISTRIBUTION:

AID/Washington - 5 copies (G. K. Parman)
USAID/Accra - 5 copies (James Ford)
INTSOY Executive Committee
INTSOY Staff

Attachment A, Itinerary - Ghana

Sunday, 28 July	Travelled to Accra from Lagos, Nigeria
Monday, 29 July	Visited USAID and discussed the East African Soybean Workshop and the soybean program in Ghana with Jim Ford, Food and Agricultural Officer.
	Mr. Ford expects to support the attendance of 3 members of the College of Agriculture to the EASW. He also expects to have 8 man-months of technical assistance for the Ghanaian soybean program next year. He hopes to have INTSOY manage this assistance through our USAID Basic Ordering Agreement.
	Arranged schedule.
	Visited Mrs. Dovlo, Home Economist, Food Research Institute and discussed the general food supply and dietary on Ghana. Discussed the uses of cowpeas and possible uses of soybeans in the diet. Most uses of legumes and corn are as a coarse flour or meal.
	Met Mr. D. Ramadan, World Food Organization, UNDP and discussed INTSOY and the University of Illinois methods for soybean processing. Mr. Ramadan stated firmly at the beginning of the discussion that soybeans, if grown in Ghana, should be exported and refined soy oil and meal imported. He may have changed his opinions during our discussion and the seminar and discussions that occurred during my visit.
Tuesday, 30 July	Visited the Department of Nutrition and Food Science, University of Ghana. Discussed some possibilities for soybean utilization with Dr. Dako (Department Head) and two faculty members. Soybean work here has been led by professor D. Fejer who returned to Hungary during my visit. No replacement for him was planned at that time. Professor Fejer's research was primarily concerned with the effect of variety on flavor (mostly reduced beany flavor) and acceptability in the traditional (Oriental) soybean foods. In general, soybean utilization seems to be a secondary interest of the department; funding for this work is also a limiting factor.
Wednesday, 31 July	Visited Mrs. S. Ababio, Principle Nutrition Officer, Ministry of Health and discussed dietary habits with respect to beans. We discussed the possibility of introducing soybeans into Ghanaian diets. She was enthusiastic in her response.

Thursday, 1 August — Visited members of the Home Science group in the Ministry of Agriculture. They suggested that there would be serious objections by Ghanaians to the long cooking time and also to the soybean itself since it is not a "traditional" food. Judging by their reaction and our own experience in the USA, acceptance of soybeans as a staple in the diet may be a long process.

Visited with Drs. Doku and Dadson, Crop Science Department, University of Ghana and arranged schedule for my seminars the following week. Discussed soybean utilization and research with Dr. David Acquaye, Dean, College of Agriculture.

Friday, 2 August — Visited Mrs. Oceansey and Miss Opoku, Ministry of Education and discussed the possibility of using soybeans in feeding of school children and teaching the uses of soybeans in Home Science courses at the public and high school level.

Visited Crystal Oil Mills in the company of Drs. Dadson and Doku. Crystal Oil Mills is a privately owned oil expeller plant with a capacity of 10-15 tons per day. It presently processes groundnut and palm kernel. Discussed the practically of using soybeans as an oil source, with the owner, Mr. Toft. Mr. Toft now plans to conduct a test as soon as feasible and preferably using a variety which may be grown in Ghana.

Monday, 5 August — National Holiday.

Tuesday, 6 August — Presented a seminar and led a very active discussion at the University of Ghana on Utilization of Soybeans in Ghana. The audience included university, industrial and government personnel.

Wednesday, 7 August — Conducted a similar second seminar and discussion.

Visited the Tema Food Complex and toured the oil expeller mills. The plant has a capacity of 150 tons/day. It is a two stage expeller process. The first stage is carried out with 2 expellers and the second stage with 6 smaller (30 ton/day) expellers. About 50% of the oil is expelled in each stage. The raw oil is exported for refining. The managers of this plant are also looking for alternate sources of oil. We discussed future development of soybean production and utilization in Ghana.

Thursday, 8 August — Flew to Switzerland.

Attachment B, Organizations and Persons Contacted - Ghana

Mr. James R. Ford
Food and Agricultural Officer
USAID/Ghana
c/o American Embassy
P.O. Box 1630
Accra, Ghana, West Africa

Mr. Haven North, Director, USAID
(same address)

Mrs. Florence Dovlo, Home Economist
Food Research Institute
Ministry of Health
P.O. Box M-20
Accra, Ghana

Mr. E. Bartels, Director
(same address)

Mrs. Shirley A. Ababio
Principal Nutrition Officer
Ministry of Health
Nutrition Division
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Accra, Ghana Tel. 65001

Mrs. Elizabeth Nettey
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Ministry of Agriculture
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Accra, Ghana

Mrs. Agnes Beecham
Senior Agricultural Officer
Home Science
(same address)

Mrs. Eleanor R. Ocansey, Head
Home Science Unit
Ministry of Education
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Accra, Ghana

Miss Theophilia Opoku, Head
Nursery and Kindergarten Unit
Ghana Teaching Service
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Mr. F. Boakye-Donkor
Planning Unit
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Mr. M.S.O. Nicholas
Director of Agriculture
Ministry of Agriculture
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Mr. Djavid Ramadan
World Food Organization
UNDP Office
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Dean David K. Acquaye
College of Agriculture
University of Ghana
Legon, Ghana

Dr. D. Y. Dako, Head
Department of Nutrition
and Food Science
University of Ghana
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Professor J. D. Watson
(same address)

Mrs. Joanna D. Nsarkoh
Department of Home Economics
University of Ghana
Legon, Ghana

Dr. R.B. (Bob) Dadson
Crop Science Department
(same address)

Dr. E. Victor Doku
(same address)

Mr. S. Yeboah
Food Production Corporation
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Mr. Kwasi Poku
Agriculture Production
Manager (Oil Mill)
Tema Food Complex Corporation
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Tema, Ghana

Mr. M. Toft, Managing Director
Crystal Oil Mills Ltd.
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