CONTRACT NO.: AID/DSAN/XII-G-0149

TECHNICAL REPORT
OF
INTSORMIL SORGHUM PROGRAM TEAM
TO
HONDURAS
MARCH, 1981

I. INTRODUCTION

A team from INTSORMIL (Sorghum/Millet Collaborative Research Support Program) visited Honduras March 15-20, 1981 to survey sorghum production and research, and to discuss research needs and potential collaborative efforts with the Honduran Ministry of Natural Resources, the Panamerican Agricultural School, and the Institute of Anthropology and History. No autonomous sorghum research organization exists in Honduras.

Members of the INTSORMIL team were:

Dr. Bill DeWalt (Kentucky) - social science, anthropology.

Dr. Mary Futrell (Mississippi State) - social science, nutrition.

Dr. George Teetes, entomology, general agriculture

The team visited personnel of the AID Honduras Mission in Tegucigalpa, the Escuela Agricola Panamericana at El Zamorano, the Ministero de Recursos Naturales in Tegucigalpa, and the Instituto Hondureno de Antropologia e Historia in Tegucigalpa. Contact also was made with personnel of CARE and Food for Peace and a field trip was made by one team member to the Choluteca area where most of the sorghum in Honduras is grown. Discussions were held with these groups on collaborative efforts directed toward attainment of mutual missions in regard to research. The need to develop "Memoranda of Agreement" for proposed cooperative research was addressed and there was concurrence from all parties that this would be possible. A draft "Memorandum" was prepared and signed by Dr. DeWalt of INTSORMIL and the Director of the Institute of Anthropology and History for the Social Science aspect of the research.

The team proposes to prepare and obtain signatures on Memoranda of Agreement with the Ministry of Natural Resources and the Panamerican Agricultural School.

The following observations and suggestions for follow-up action are presented.

George L. Teetes
Bill DeWalt
Mary Futrell

II. OBSERVATIONS BY INTSORMIL TEAM

While the team visit was brief and unexpected by the Honduran AID Mission, the objectives of the trip were carried out. The team's most important observations are presented in the following notes:

1. Background on the country.

Honduras is an undeveloped country with rugged and varied terrain, a predominantly rural aspect, and an Indo-Hispanic culture. The Republic of Honduras is in the middle of five republics comprising the Central American Isthmis between Mexico and Panama. Roughly triangular in shape, the country has a 459 mile coastline to the north on the Caribbean and narrows in the south to 89 miles at the Gulf of Fonesca on the Pacific Ocean. It is bounded on the west by Guatemala, the southwest by El Salvador, and the east and southeast by Nicaragua. Honduras has an estimated land area of 43,277 square miles, is second largest of the five C. A. Republics and ranks 14th in size among all Latin American Nations.

Honduran topography is exceptionally rugged. The country is crossed from east to west by the Central American Cordellera making it the most mountainous of the five republics. The highest mountain peaks are in the Southwest. Lowlands are in the northern and eastern coastal plains, a narrow southern coastal plain, and the river valleys. Although neither an accurate map nor an inventory of natural resources exists, government estimates list 63.6% of the land surface as mountainous and 34.4% as plains and valleys. The rugged topography and lack of surface transportation divide Honduras into numerous small, isolated localities.

The climate in Honduras is generally typically tropical. Seasonal differences are not marked by variations in temperature as much as rainfall. The rainy season usually begins in mid-May and continues through the middle of December with heavy rains ending about mid-September.

Honduras' population is estimated at about 3 million and population distribution is uneven. It is concentrated in a rough crescent beginning at the south coast, running through Tegucigalpa (capital city) and Camayagua, to San Pedro Sula, and then eastward along the north coast through Tela to La Ceiba.

Although few Hondurans possess great worth, a wide gap exists between upper and middle class groups on the one hand and the poorer rural and urban population on the other. The middle class is growing in the population centers and consists principally of professionals, merchants, business persons, and government employees.

Honduras is largely an agricultural country with about 70% of the population dependent on agriculture for a livelihood. Basic staples in the diet are corn (usually prepared as tortillas) and red beans. Meat and fresh vegetables are added to the diet as one progresses up the economic scale. The abundant bananas (minimos) and plantains (machos) are enjoyed by all social classes.

2. Sorghum Production and Varieties.

Most small farm owners are largely basic grain producers. In southern Honduras the variability of rainfall has led farmers to seek to reduce the risks associated with planting corn, their principal crop, and assuring some sort of crop production even in times of drought. As a result corn and sorghum are planted together on a large number of small farms. If the rains come, the corn grows rapidly and the slower growing sorghum is partially choked out. If the rains fail, the corn withers but the sorghum requiring less water, continues to grow. In either case the farmer has a crop, but must accept reduced yields.

Tall, photosensitive, low yielding "local or native" varieties (called maicillo) are most commonly used by small farm owners (campesinos) who are

usually organized into small cooperatives or communal farms (asentamiento campesino).

Recent experiments with new varieties of sorghum have identified several new, improved varieties which are considerably better suited to the conditions found in the south of Honduras than older, more commonly planted, native varieties. One such variety, Lujosa-S-1, can be harvested in 100 days, as opposed to about 280 days for presently used varieties. The rapid maturation of this variety allows farmers to plant their corn alone, allowing maximum corn yields if the rains come, and still have time to sow the sorghum over the corn if they do not.

However, the use of such varieties has been associated with increased susceptibility to pests (especially post-harvest) and have been largely abandoned.

Honduras has been producing between 35-40,000 M.T. of sorghum per year since 1971-72. Production in the 1960's averaged approximately 10,000 M.T. higher per year than it was in the 1970's. Unlike most other countries, sorghum is basically a small farmer crop in Honduras. Yields are relatively low and net returns very similar to those for corn. It is estimated that about one-fourth of the area planted uses improved technology. Total production has exceeded domestic demand at times. Approximately 8,000 M.T. were exported to other C.A.C.M. countries in 1976. It is anticipated that, as yields increase and prices become more favorable, sorghum use for poultry, swine and dairy feed will increase accordingly. Because of its high substitutability for corn (approximately 90-95% in animal rations) the demand projections, program considerations and policy implications will be tied closely with corn. It substitutes for corn in the drier areas. More than half of the production is in the southern region and the rest is in other areas of long dry seasons. Virtually none is produced in the northern and eastern regions.

3. Uses of Sorghum.

Sorghum in Honduras is used for food and feed. For food, sorghum is commonly used in mixtures with corn for tortilla production. However, sorghum is also consumed in a variety of other preparations. Corn is the preferred grain, but becomes expansive and unavailable during parts of the year. Sorghum is a ready substitute, particularly in southern Honduras, but there is uregent need for improved varieties with higher yields and more pleasing food properties.

4. Pests of sorghum

Based on observation and discussions, the most serious insect pests of sorghum in southern Honduras are the sorghum midge, beet armyworm, and fall armyworm. Both midge and armyworms are serious production constrains and will increase in severity as new sorghum varieties are introduced. Insect pests of grain in storage are a major concern and a solution to this problem should receive high priority.

The major sorghum diseases are apparently downy mildew and rust. Either of these are presently less severe than insect pest problems, but will inevitably increase as susceptible varieties increase in use.

There appeared to be little concern about weed pests of sorghum. However, weeds were common and abundant in all observed sorghum fields. There appears to be some lack of knowledge concerning the severity of weeds in reducing sorghum yields, especially during the three weeks following sorghum emergence.

Birds are persistant pests and will surely need to be considered as a constraint to sorghum production. Bird resistant, high tannin, sorghums are unacceptable because sorghum grains are used to make tortillas

and brown grains give a very dark product that is unacceptable.

5. Social and nutritional aspects.

All parties agreed that there was need for determination of patterns of production marketing and consumption of sorghum. It was apparent that these characteristics are not well understood. This area of research will be further addressed in the recommendations of this report.

III. ITINERARY AND DISCUSSIONS HELD

March 14, 1981 Futrell arrived Tegucigalpa

March 15, 1981 DeWalt and Teetes arrived Tegucigalpa

March 16, 1981

Met with and received a briefing at the AIDH mission from William Janssen, Harry Wing and John Kelly. Our arrival was unexpected, but we were well received. Interesting points made during the briefing included the following:

(1) sorghum is mostly grown in southern Honduras and used for food when corn is not available.

(2) the government of Honduras is in a transitional stage awaiting an election, and this may be a constraint in our activities for a while because of political activities and personnel turn-over.

(3) it was strongly suggested that we contact Antonio Silva of the MNR.

(4) agronomic research in Honduras is splintered or decentralized and the bulk of the sorghum research is a spin-off of a nutrition project headed by Ray Baum of the Mission.

(5) it was strongly suggested that we visit the Panamerican Agricultural School at El Zamorano.

(6) we were cautioned to make sure we did not mislead anyone into thinking that we had a lot of money to offer.

(7). the briefing was very helpful in establishing our strategy and identifying contacts. We spent the rest of the morning with the gracious assistance of Nelly Kearn, attempting to make contacts and making appointments.

After lunch we talked with Ray Baum who worked on a sorghum and soybean project that the AIDH mission had run. He briefed us on the failures and successes of the project and gave us several good leads to people working on sorghum research in Honduras. Some points of interest during our discussion were as follows:

(1) the soya project had been very successful and profitable and was picked up by the Ministry.

(2) the sorghum project was not successful, although new varieties of (Tortillero or Sietal) sorghum produced good yields, sorghum pests and post harvest losses (up to 75%) due to weevil damage while the grain is stored caused the farmers to go back to using native varieties.

(3) sorghum is a low risk, low input crop, but improved varieties were not insect resistant.

(4) for the first planting in the spring (May), corn and sorghum are planted in the same hole; if rain comes the corn outgrows the sorghum, if not the sorghum grows; for the second planting (October), only sorghum is planted.

(5) some sorghum research is being conducted at Camayagua, an area where some sorghum is grown on marginal land.

(6) currently there is no sorghum research being conducted at the La Lujosa Experiment Station near Choluteca, but that is a good research location.

March 17, 1981

Met with Ing. Agr. Rigoberto Nolasco who has worked extensively on sorghum in the Choluteca area. He is currently on study leave to learn English and will soon be coming to the States to study English; after which he plans to obtain an M.S. degree at Texas A&M. Items of interest discussed during our visit were as follows.

(1) Nolasco reviewed what his sorghum research had consisted of; primarily fertilizer testing, variety evaluation, insect (midge and stored grain pests), and disease studies.

(2) he had also worked at the Olancho Experiment Station, where the research was more on mechanized production. He confirmed that sorghum is a crop of the subsistance farmer in southern Honduras and the Choluteca area would be the best place to work.

(3) when asked his opinion of the research areas where INTSORMIL could lend assistance, Nolasco mentioned the following:

(a) variety testing - for food quality and insect resistance

(b) social science aspect - production and consumption patterns

(c) drought research

(d) insect (midge, fall armyworm, stem borers) research

(e) disease (downy mildew, cercospera) research

(f) intercropping - farming systems

After lunch we rented a car to drive to El Zamorano to the Escuela Agricola Panamericana and met with Dean Jorge Roman and various faculty members including Mario Contreras, Pablo Paz, Keith Andrews and Adolfo Jurado. Finally, we were able to see Director Simon Malo, after dinner at the school. Below are listed some of the more important items addressed during our discussions. Considering the fact that we arrived at the school without prior notice, we were very graciously received.

(1) the school is primarily an educational institution, but some research is conducted; the school has 6,000 hectares of land; there are 300 students and three departments (Hort., Agr., An. Sci.); there are 26 full-time professors (7 with Ph.D, 9 with M.S. and the rest are Ing. Agr.); there are plans to expand the school to 500 students, and to a four year program. (see appendix for additional information on the school).

(2) the faculty with whom we talked expressed a willingness to establish cooperative research especially in the areas of social science studies, variety testing and breeding, seed production, entomology, plant pathology, and food quality.

(3) it was necessary for us to make clear the fact that INTSORMIL did not have large sums of money, but that our programs were intended to compliment the school's activities and not adversely effect them in any way.

(4) the faculty was very interested in professor exchange, and a possible graduate student exchange program.

During our visit with Director Malo some of the important topics of discussion were as follows:

(1) what the school has most to offer is continuity (not susceptible to political changes)

(2) the Director was not interested in handouts or grants, but made clear the fact that the school must benefit from a relationship with INTSORMIL: that any cooperation must not detract (time or money) from the educational program.

(3) the attitude of the school's Board of Directors was that adaptive or applied research was acceptable as long as it does not tap educational resources.

(4) the Director expressed a willingness to establish a cooperative relationship between the school and INTSORMIL: he suggested that some facilities might be made available and that they could assist us in hiring labor and purchasing certain needed equipment.

(5) all in all the visit with Director Malo was a good one; we were well received with a considerable amount of interest.

(6) it was suggested that Dr. Malo and his staff think about our discussions; we would correspond and prepare a memorandum of intent to cooperate.

Malo stated that it would be necessary for him to review a written proposal which he would also discuss with the school's Board of Directors. We agreed to prepare the proposal.

March 18, 1981 Teetes returned to U.S.A.

The remaining part of the report deals with activities of Bill DeWalt and Mary Futrell.

Appointments were made for Thursday to visit Antonio Silva, the head of research in the Ministry of Natural Resources and Jacobo Caceres. Ray Baum also made an appointment for the team to visit with Richard Weddle, the new (6 months) Regional Director of MNR in Choluteca. Calixto Chacon is the Sub-director.

DeWalt then talked with Michael Schwartz who is in the Development Division. Mike is the person in the A.I.D. mission who deals with economics and marketing. He related what little he knew about the Choluteca area. Mostly discussed was the agrarian reform in the country. He provided several leads to follow in terms of obtaining published social and economic data in Honduras. He provided several A.I.D. publications on the agricultural sector, and said he would be pleased to make some calls next time INTSORMIL personnel were in Honduras--if a week or so advance notice was given. He mentioned that it would be easy to call the national leaders of campesino organizations to get us letters of introduction to villages in the Choluteca area.

Soon after leaving Mike, Rigoberto Nolasco arrived with the information he had promised. The Mission made a copy for us. Futrell met with John A. Massey, Head of the Nutrition Division, A.I.D., Honduras. He supplied a copy of "Assessment of the Public Health Sector of Honduras (1975-1985) USAID, June 28, 1980", which gives the current status of nutrition in Honduras. He set up an appointment with Margaret Gorecki of CARE. In the afternoon, Futrell visited with Margaret Gorecki in the CARE office. They are feeding

75,000 children every day. Food from the PL-480 Food for Peace Program donates the following to the feeding centers; WSM(wheat, soya mixture), rice, wheat, flour, oil and powdered milk. They were interested in indigenous foods such as sorghum and assistance with their nutrition education.

DeWalt went to the Instituto Hondureno de Antropologia e Historia to see the director (Gerente) Licensiado Vito Beliz Ramirez. There was pleasant conversation about projected work. He is very interested in cooperating with INTSORMIL for two reasons. First, he wants to eventually establish a degree program in anthropology in Honduras. He thinks that if he can get some cooperation and expressions of interest from anthropologists in the U.S.A. that he will be able to do this. Second, he is attempting to establish local museums of anthropology and history. While he admitted the Choluteca area would not be his first preference for anthropological work, he said he would be interested in having work done there. He said INTSORMIL research could form the basis for the beginnings of a museum there. His first preference is for work among Indian groups like the Jicaques who unfortunately do not grow sorghum.

He was presented a draft agreement to which he quickly responded favorably. In the absence of a bilingual secretary, a typewriter was secured to type the agreement to have signed. DeWalt spoke by short wave radio with Kenn Hirth, the archaeologist from Kentucky who is directing the archaeological work that will precede construction of the El Cajon hydroelectric dam in the center of the country. The agreement (after typing) was left for Beliz to sign.

March 19, 1981

The appointment with Richard Weddle had to be cancelled.

DeWalt visited with Jim Pease. Pease is on an A.I.D. contract doing a small industry survey. He is an agricultural economist from Michigan State. Some of his work was done in the south so the area was discussed and he suggested several contacts.

He said Peter Hughes-Hallett is a good source on sorghum in the south. He is an agronomist who has been in Honduras since 1970, working for a long time with the Radio Schools Program. He directed "campesino" agronomists in Choluteca and also conducted some experiments with growing sorghum in the highlands. One thing determined was that sorghum does not grow well in the highlands and applications of fertilizer do not substantially increase yields.

Pease mentioned that it would be good to talk with the Cotton Co-op because he said cotton production is expanding in the south, pushing sorghum on to more marginal lands.

Pease suggested that we talk with the Peace Corps. They have had volunteers doing sorghum experiments and doing nutrition surveys in the south. He also mentioned the Save the Children organization in Pespires as having worked on storage problems.

Futrell met with Santiago Valladares, the Food for Peace Officer in the Nutrition Division of USAID, Honduras. He explained further the amount of malnutrition among the children of Honduras and the need for research on sorghum as food, as it is used as a crisis crop to carry over the people until the corn crop matures.

DeWalt and Futrell met with Ing. Antonio Silva and Dr. Jacobo Caceres C., who are in El Programa de Investigacion Agropecuaria, Ministerio de Recursos Naturales, Tegucigalpa, D.C., Honduras. Ing. Antonio Silva is the head of research and supervises Dr. Caceres. The meeting was very profitable, and they expressed an interest in cooperating with INTSORMIL. They were interested in the plant disease work, insect pests, new varieties of sorghum, grain storage, food surveys and the sorghum tortilla food quality program.

They suggested the best place to begin work was Choluteca. Caceres is recently back from the U.S. after completing his Ph.D. at Mississippi State University.

Caceres reported on the structure of research in the Ministry. He said that there are 8 regional directors for MNR in the country. Each of them has all of the divisions that the central administration has and the regional centers have generally operated independently. Silva is the national research coordinator and is beginning to reorganize things so he has more control. One thing they are doing is an inventory of the various projects going on at the various centers.

They reported many of the same things the team had heard before about sorghum. Silva said that from his perspective the two major needs are (1) to obtain improved seeds that have a shorter growing season; and (2) to have varieties that can be disseminated to small farmers rather than hybrids. He said hybrids would probably not be adopted because of the expense. Of course, he also emphasized that the varieties must taste good and should be resistant to post-harvest losses.

Silva said that although sorghum lags behind corn, beans, and rice in production that he sees it being extremely important. For one thing it is grown in areas of densest population. For another, it is becoming more important to many as a food because a burgeoning poultry industry is making corn more of a cash crop. Silva emphasized the importance of increasing grain production--he said in 1980 the country imported 100,000 quintales of grains.

In terms of larger-scale production, they reported that the departmento of Olancho used to grow lots of sorghum. The problem of downy mildew has meant that almost all the area formerly in sorghum is now planted with corn.

They also mentioned that the Swiss mission is working on basic grain storage problems. At the moment they are just inventorying storage techniques but their plan is to design better storage facilities.

Silva mentioned that he had done some work with Elmer Johnson on high altitude sorghum. Finally, Silva said it would be nice to cooperate with INTSORMIL because CIAT provides them expertise in beans and rice, and CIMMYT is good for corn, but they also need a group to work on sorghum.

Both welcomed an agreement and said they thought there would be no problem signing one. Caceres said he would bring it up with the Minister tomorrow. The team agreed to get a draft of an agreement to them for discussion in a few weeks.

After lunch DeWalt returned to the A.I.D. offices. He talked for well over an hour to Bill Janssen. Janssen was pleased to hear about the progress the team had made. He said Honduras is being swamped by Title XII people. His comment was that most of them come down here on junkets, buy a few baskets in the market, and go home. He was clearly impressed with our success in getting to see the right people and doing the right things.

He responded to DeWalt's inquiry about whether INTSORMIL should sign an agreement with the Ministry by saying that it wouldn't hurt. At the same time he reiterated that E.A.P. should be our first priority.

Janssen mentioned several times that our project should have some money to spend in LDCs for things like hiring local assistants, providing honoraria to people who might write up a piece of research done for us, paying someone to maintain an experiment field, and the like. He was told that INTSORMIL would have some such money but he clearly didn't think it was enough.

He said he sees the sorghum CRSP as the one that has lots of relevance for Honduras, though he said small ruminants and cowpeas were also relevant. He has some doubts about Title XII but views it as a good concept and is

committed to make it work. But, at the same time, he is not going to tolerate people coming down on junkets, just wasting his time. He wanted to be sure that this team would be the only team from the INTSORMIL CRSP and that there would not be another one from other universities a few weeks from now. He was assured that we were the representatives and that a trip report would be made to all members of INTSORMIL. He also was informed that Earl Leng would notify him before any team members came to Honduras.

Janssen said A.I.D. was about to sign a contract with Kansas State's Food and Feed Grain Institute to do a grain marketing study in Honduras. He suggested that we should hook up with them when they get their feet on the ground. Richard Phillips and Bob Julian are the contact people at Kansas State.

Janssen then suggested some places to stay around Choluteca until a more permanent location is found. In general, the assessment is that the team made a good impression and INTSORMIL will receive considerable assistance from the Mission.

Nelly Kearn finished the Spanish translation of the agreement with I.H.A.H. so DeWalt took it over there. Vito Beliz and DeWalt signed the original; their copier was broken so a copy of the agreement in Spanish was not obtained. Licenciado Belitz did promise to send a copy; in addition, he had already sent the English original to the hotel. Fernando Cruz, the head of Ethnology at the Institute had already left for the day and contact was not made with him.

DeWalt briefed Harry Wing on the team's progress. Wing was quite pleased with what had been accomplished. He agreed we should make E.A.P. our first priority but should go ahead with a possible agreement with the Ministry of Natural Resources. Wing said that if we let them know when we are planning to arrive they will make the necessary contacts so that we can see everyone who

needs seeing. Wing said he had never experienced such a run of bad luck as we hit (i.e., everyone being out of town or otherwise occupied) but that it seemed everything had worked out.

March 20, 1981 DeWalt returned to U.S. via Mexico for a few days.

Futrell went by bus to Choluteca. She spent the entire day visiting areas where sorghum is grown for human food. She observed the variety grown, the methods of storage, and the methods of food preparation. In several homes, she observed the preparation of tortillas made from sorghum alone and from a mixture of sorghum and corn. In March, the corn becomes scarce on the market, and quite expensive. At this time, the people begin to mix corn and sorghum. This mixing practice continues into April, and in April and May sorghum tortillas or cracked sorghum is eaten until the corn crop is ready to eat. She also observed the making of sorghum balls, where the sorghum is popped and mixed with the local brown sugar. They were very similar to the American popcorn balls in flavor. The people expressed a need for help in storage techniques and for assistance with varieties of sorghum that would produce a lighter-colored tortilla. (The present varieties of sorghum used for tortillas in Honduras produced a dark-hued tortilla, which is certainly not pleasing to the populace.)

March 21, 1981

Futrell returned to the U.S.

IV. SUGGESTIONS AND RECOMMENDATIONS

The brief time available to make contacts limited the capacity of the INTSORMIL team in developing definite actions to be taken. The following items (except 1 which is very firmly advanced) are presented as suggested cooperative actions in regard to research by INTSORMIL in Honduras. As no automous sorghum research organization exists in Honduras, and as the proposed areas of research and cooperation by INTSORMIL in Honduras varies considerably in nature, the site visit team recommends that attempts be made to develop

agreements with three organizations (an agreement has already been signed with one of the organizations).

1. INTSORMIL-INSTITUTO HONDURENO DE ANTROPOLOGIA E HISTORIA COLLABORATION

It is proposed, and an appropriate memorandum has been signed by INTSORMIL and IHAH to enter into a collaborative working arrangement by which each provides the talents and facilities it can best furnish.

The University of Kentucky agrees to carry out an anthropological study of farming systems in the Choluteca region. Focal aspects of the research will be centered on social and economic aspects of sorghum production. Especially important areas are expected to be the study of farming strategies, agricultural technology, marketing arrangements, and household consumption at the village level. Preliminary research will begin in June and continue until mid-August, 1981. Long-term research over a longer period of time is projected to begin in 1982. Close collaboration with IHAH is anticipated in order to insure that results are useful to both IHAH and INTSORMIL. INTSORMIL researchers involved will be Dr. Billie R. DeWalt and Dr. Kathleen M. DeWalt of the University of Kentucky. (See Appendix - Draft Research Prospectus for Socioeconomic Studies of Sorghum-Producing Villages in Central America).

2. Nutritional Improvement of People Consuming Sorghum in Honduras

INTSORMIL is most interested in collaborative work related to food (sorghum) utilization. We suggest that the closest possible contacts be developed between the Escuela Agricola Panamericana and/or the Ministry of Natural Resources for this purpose. INTSORMIL, especially scientists from Mississippi State University, is concerned with the development of a general research approach which can deal with agronomic, economic, social, and nutritional factors which are involved in the introduction of improved

varieties of grain sorghum in small scale farming systems. The area chosen for study is to be one in which grain sorghum is of considerable importance as a human food. Honduras has been selected as a feasible area because here, especially in the southern part, sorghum is regularly produced. An annual production in excess of 69,000 metric tons is found and regularly produced. More than 44,000 farms regularly grow sorghum for human consumption. Another criterion is that the area to be researched is one of small farms with an emphasis on subsistence farming with households forming the units of production and where community values are relatively homogeneous. It is assumed that this study is goal-directed in that it is concerned with the potential improvement of the quality of life, particularly in regard to nutrition.

Social data collected will be fairly comprehensive. It will include community leadership and social status, including the social status position of farmers who grow sorghum; the population of the community (or area under study); the composition of work groups related to farming activities; household and family structure and size; sex roles and decision-making patterns and attitudes and values related to farming, food and manual labor. Values and beliefs associated with food will include beliefs about nutrition value, status foods, a hierarchy of preferred foods, the hot-cold dichotomy, taboos and ceremonial usages. The focus will, of course, be on the role of sorghum foods in the over-all diet.

The collection of nutritional data and information concerning food habits will be a relatively complex undertaking. The nutritional status (specific nutrient deficiencies) of low income sorghum consumer will be used as a yardstick for assessing agricultural development progress. This study will be conducted in the same villages where the sociologist, agronomist and other scientists are conducting research. This will be conducted in conjunction with local health services and local persons will be trained to detect signs

of malnutrition. Simple methods of assessing malnutrition by simple arm measurement, weight, height, and head circumference will be used. Also, the presence of anemia, infant mortality, and infant feeding practices will be recorded. Nutrient intake of households will be recorded and analyzed. If severe malnutrition is found to exist, intervention programs such as weaning foods, education programs, etc. will be devised.

Data will be compiled on consumer preferences of grain to be used by the agronomist in the breeding program for persons involved in quality testing and toxicology studies. Methods of preparation will be compiled, and all recipes standardized as to measurements. Other work in Honduras will be specifically related to the quality and digestibility of the sorghum tortilla. Preliminary methods of preparation have already been recorded so that work in this area can begin immediately. Close cooperation is planned with Lloyd Rooney from Texas A&M, who has developed a sorghum tortilla and would like it tested in countries where the tortilla is a major part of the diet.

3. Crop Production

There is need for improved sorghum varieties with higher yields, shorter maturity times, and acceptable food qualities and characteristics in Honduras. Several INTSORMIL Institutions are vitally interested in cooperating with the Panamerican School and/or the Ministry of Natural Resources in establishing cooperative research with regard to improving sorghum production. It is recommended that INTSORMIL enter into an agreement with EAP and/or MNR to formulate and establish mutually beneficial program of sorghum improvement research.

Also, it is recommended that a research scientist be hired by INTSORMIL and stationed in the Choluteca area. Texas A&M University is interested in taking the lead in this respect. An available Ph.D degree sorghum breeder is available for such an assignment.

4. Sorghum Pest Research

The INTSORMIL team was made aware on several occasions that new sorghum variety development and implementation in Honduras has been constrained because of insect and disease problems associated with them. Insect and disease research must accompany varietial improvement research. It is recommended that an entomology and plant pathology graduate student exchange program be implemented with thesis research conducted on site in Honduras. One entomology graduate student has been identified as a potential candidate for such an activity. It is recommended that the graduate student exchange program be tied to the crop production activities described above (3).

5. Other activities

Other areas of interested cooperation will surely be identified as time passes and the programs identified above are implemented. It is suggested that agreement memoranda be prepared to allow inclusion of new research opportunities.