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PEANUT COLLABORATIVE RESEARCH SUPPORT PROGRAM PLANNING
(CRSPP)

Trip Report

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(with David Cummins)

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SENEGAL
Monday, January 26, 1981

We arrived in Dakar, Senegal, Monday, January 26th, at 0700. We were traveling on the airplane with Ben Stonner, USAID Senegal Project Development officer. He is working on the project paper for a project on farming systems in collaboration with Carl Eicher of Michigan State University. Carl Eicher had sent with Stonner two Michigan State University Rural Development papers on Farming Systems Research which covered some of the systems that we would be seeing in Senegal.

We proceeded to the AID office after checking into our hotel about 9:00. We met with John Balis, Agriculture and Food officer, and also checked in with Barbara Skapa, Agriculture and Food Office. They had made some arrangements for us to visit the Agriculture Experiment Station at Bambey on Tuesday. We proceeded to ICRISAT headquarters for West Africa located in Dakar. Dr. Claude Charreau, director of ICRISAT in Dakar, was in Ouagodaugou for the week. His secretary offered transportation to Bambey the following day. She also directed us to the offices of IDRC (Canadian) where we met briefly with Dr. Stewart E. Brown, Regional Program officer for Social Sciences in west and central Africa. Gordon McNeil, Agriculture Program officer, was also in ICRISAT Ouagodaugou along with Charreau. We set an appointment with Stewart Brown for Thursday after returning from Bambey.

In the afternoon we continued discussion with John Balis. Balis briefly outlined the situation regarding peanut production in Senegal. He observed that the northern part of Senegal is classified as the Sahel and that rainfall averages about 300mm in two and a half months. The rainy season topically starts in July and lasts through September. Moving toward the South, rainfall gradually increases up to about 1,000mm over a five month period starting in June and lasting up through October. This past year the rainy season was much shorter. There was only a 40 day period from the first rainfall until the rain stopped. Peanut production averages about 1.2 million hectares and about 1 million tons of peanuts. Again, this past year due to the drought the crop was estimated at only 500 thousand tons of peanuts.

Regarding consumption of peanuts the population of Senegal is five millon. Exports of peanuts average about 600 thousand tons in a normal year of 1 to 1.2 million of peanuts. That would mean that in some way approximately 100kg of peanuts are consumed per capita in Senegal.

Balis also described briefly the marketing system for peanuts. The government price paid to the farmer for peanuts is 50 FC/kg or 25¢/kg. The price in Dakar markets is somewhere near 400 to 600 FC. The market price is many times that of the government price but of course the government price is based on the export price of peanut oil and it has been fixed at about 50 FC for the past ten years. The local market this year will probably consume most of the peanut crop in Senegal.

He indicated that there has been a complete reorganization of the highly government controlled peanut market system since the turnover of government a year ago. The farmers are grouped into cooperatives which supply them with production inputs and gather products such as groundnuts at the local level. The former organization included several national organizations; one being

SONAR the national organization created recently which supplies the farmer and manages the seed stock for the following year. SODEVA is the Regional Society for Rural Development which operates in the groundnut basin. It is in charge of all production activities and insures technical and cooperative assistance for the growers.

The National Seed Service created in 1972 produced, controlled and looked after the seed stock. Its role is particularly important for groundnuts for which the annual requirements of recommended seed is somewhere near 100 to 130 thousand tons.

The marketing organization is organized or has been organized around the five peanut oil plants in the country. The plants collected the peanuts from the local cooperatives by truck and processed and exported the peanut cake and the peanut oil. The time of the recent reorganization of the Senegalies' government, this marketing organization was shut down. Now the cooperatives are reorganizing from the ground up to market the peanuts.

If the crop were a normal crop, there would be considerable difficulty this year in marketing 1 to 1.2 million without the help of the former organization. In the meantime considerable problems are expected in storage of peanuts until the cooperatives can market them. Also there will be many more problems in the proper storage of seed peanuts for the coming year. Production is expected to be low again next year; not because of drought but because of organizational problems and seed distribution.

On Tuesday, January 27th, we traveled to Bambey, the National Agronomic Research Center (CNRA) under the Senegalies Institute for Agricultural Research (ISRA) in Bambey, Senegal. We traveled courtesy of the ICRISAT offices in Dakar and arrived about 9:30. We met the director of CNRA, M. Mbodj, as well as the researchers dealing directly with peanuts: J. Gautreau, physiologist, Anoiaye, also a physiologist for peanuts and O. de Pins, the

peanut breeder. These last three gentlemen intertained us throughout the day until about 2200. We toured their facilities and discussed the problems of peanut research throughout the day. Dr. Cummins explained the objectives of the Peanut CRSP Program to the director of CNRA and to the peanut researchers. They were familiar in general with the program and exhibited a keen interest in developing a CRSP proposal.

We again reviewed the peanut situation. We were told that the short season 90 day maturity Spanish type peanuts were supplied to farmers in the North. Virginia type peanuts ranging up to 125 days maturity are supplied to the farmers in the South. There are not enough peanuts to supply more than one variety per farmer and if they want other varieties they have to produce, store and supply themselves. Again the major constraint is rainfall and the major objective of the peanut researchers is drought resistance. A second area is to breed resistance to certain diseases. Rust is a limited problem as is leaf spot. Rosette resistant varieties are being sought to cope with Aphid problems in the rainy areas of the south.

In 1981, as a result of the drought, seed supply is very short particularly the long season varieties. Regarding marketing the new organization is slow to replace the old one a price if fixed at 50 FC per kilogram. In 1979, the market price was 400 FC per kilogram. In 1980, it is now up to about 800 FC per kilogram, as a result of the drought. Normally 800,000 tons of peanuts are processed for 1981. This was the case in 1979. Sixty thousand tons are used locally. In 1980, probably less than 300,000 tons of peanuts will be processed for oil. After shelling, approximately 65 percent of the peanut remains for processing. One half of that goes into oil and the other half goes into peanut cake. Both are exported. For export purposes the alfatoxin levels must not exceed 50 parts per billion. If the peanut cake is to be exported to Eurpoe, this criteria must be met. Some have been rejected in recent years.

We met two entomologists and a crop protection specialist who showed us a couple of insects unique to West Africa that caused post harvest protection problems: a beetle which ate into the peanut and an insect which extracted 75 percent of the oil through its probiscus. These pests can be controlled, but observation and timing of insecticides are critica. Next, we toured the farm facilities with the agricultural engineer. We saw the equipment used for intensive farming: oxen drawn plow planter, cultivater and the lifter of the peanuts. These operations can all be done mechanically on intensive farms with approximately cleared and consolidated fields. It is dry season now and the only crops growing are the irrigated crops, primarily vegetables and fruits which grow well during the dry season when pest populations are very low. They are also doing some irrigation of peanuts to accelerate the production of the strains that they are breeding. We observed a photovoltake solar collector that is used to pump water to the drip irrigation system. After extensive tours of the farm facilities, incidentally they are pumping water on to these soils which has a very high pH they are trying some water from about 30 meters down which is very saline. The pH of the soils are normally around five and have some aluminum toxicity problems. After irrigation the pH is elevated to near 9.0. Water drawn from deeper levels (30 meters) is alkaline (calcium) and the soil pH is also elevated to 9.0. This creates other deficiency problems, iron and zinc in particular. After touring the facilities we set down once again to discuss the constraints and ways that the CRSP may function.

To summarize the constraints from the peanut researchers' perspective. Drought resistance: The strategy is to breed for water use efficiency in several locations over the spectrum of rainfalls. They showed us one current experiment comparing different varieties for the root structure. Proper culture practice is fairly common knowledge. They feel that the main problem is implementing those practices on the farmers' field.

Breeding for disease resistance is the second objective. Rust is not a very feasible research problem in Senegal because of the noncontaminated conditions. Contamination during the dry season or in the laboratory are possible approaches. So disease research will probably best be conducted in Ouagodaugou or other countries where rust contamination is present. Rust disease resistance research is important to Senegal because contamination is always possible and it could be a serious threat.

Third, aflatoxins are a serious problem. The researchers are not highly optomistic about breeding resistance for aflatoxins. They feel there is not sufficient genetic variation. This they admit may or may not be the case, however. They feel detoxification research is important.

Overall, the objective of drought resistant and disease resistant varieties is higher yields both in oil and amino acid content. We questioned the researchers about their judgement on the gap between experiment station yields and farmer yields. They claim that when it is possible to produce 2½ tons of unshelled peanuts on the station. Farmers are averaging something like one ton per hectare. They feel that a farmer using known practices with existing varieties could easily produce two tons per hectare. These known practices are particularly critical at the time of planting. They include 1) proper seed selection in advance of the first rainfalls. The seed germination rates can be pretty much determined by careful selection. 2) Proper fungicide treatment; the fungicide is provided to the farmer. If he mixes it properly, fungus problems should not occur. 3) If the farmer calibrates his sewing machine for proper spacing and distribution of seed, he should have optimum seeding rates. 4) The sewing machine should be regulated to recommend speeds and 5) the time of sewing peanut seed is particularly critical. The farmers are instructed to sew starting at six o'clock in the morning after the first

20mm rain. They claim that many farmers are not prepared to sew at this time, rather they are only starting to select their seed, to treat their seed and to calibrate their machines. Often times it is noon or even the second or third day before they get into the field with their sewing operations. This is disaterous for the peanut crop. The sandy soils lose five millimeters of the twenty millimeters during the first day. The second day they lose another five millimeters. The third day another five millimeters. The water holding capacity of the soil is very low somewhere in the neighborhood of 10 percent by weight. The next rains will not come for 10 or 15 days. 6) Fertilization is critical and they should be fertilized as recommended. The researchers contend that these practices were followed, yields would be 2,000 kilograms per hectare. Compared to cereal crops, the gap between state-of-the-art farmers (2,000kgs/hectare) and the experiment station (2,500 to 3,000) is very small. It would seem that peanut technology will have to improve dramatically if average peanut yields are to improve substantially.

The researchers felt that the CRSP would be most useful to them; 1) as a way to facilitate exchange of peanut breeding material and exchange of research methods with peanut researchers elsewhere; 2) more accurate and dependable screening methods and selection methods; 3) the development of laboratory technics for contamination research on drought resistant varieties, and dependable greenhouse facilities for evapotransportation research.

ISRA, South Central Research Station, Kaolock, Senegal
Thursday, January 29, 1981

We next visited the arm of ISRA which deals with experimental technics at the farm level. We arrived in Kaolock at about 1000 and met with the supervisor of the experimental units, Mr. Sapion Niang (ISRA, B.P. 199,

Kaolock, Senegal). Mr. Niang had spent three months in ICRISAT in India working on village study technics. The director of the center, Madicke Niang, was not available at the time. There are two experimental units (Thysee-Kaymor Son Borong and Korembidia). They have approximately 250 families in each unit. Each unit is staffed with a technical agent and three enumerators. All production data and farm input data including labor requirements are kept by these enumerators for a sample of households in the units. They are keeping records on consumption patterns as well. A lot of this project has been sponsored by IDRC. Mr. Niang asked us which of the two units we wanted to visit. We chose the Land Consolidation unit, which is 170 kilometers round trip toward the Gambian boarder. The second unit was specializing in irrigation and vegetable growing during the dry season. It would be about 300 kilometers round trip. In the Land Consolidation unit 67 hectares are planted to cotton, 780 hectares to groundnuts, 750 hectares to millet, 148 hectares to maize, and 58 hectares to sorghum. In 1980, the average yield was only about 400 kilograms of peanuts per hectare. Compared with more than 600 kilograms in 1979.

Two packages of practices were being implemented on selected farms, an intensive package on the consolidated plots and an ordinary package on the scattered plots. The consolidated plots were cleared of bush. They used more intensive equipment drawn by a pair of oxen and they were fertilized with phosphates as a reward for the clearing. The consolidation meant that farmers traded plots in scattered areas adjacent to other farmers in such a way that their own lands were located adjacent as much as possible. In the ordinary package plots tend to be located in various directions from the village and, therefore, made intensive practices almost impossible. People in the ordinary part of the project could voluntarily clear and consolidate their lands. They would be rewarded with fertilizer but not included in the

intensive cultivation practices. The ordinary package would use smaller equipment drawn by horses, donkeys or by hand. In both packages, immediately adjacent to the village, sorghum, millet and maize were grown for food. The family food supply was the responsibility of the women. Their fields were heavily fertilized by animal manures. Few cash inputs were used. The cash crops were the men's responsibility and they used oxen and cash inputs. For groundnuts, commercial fertilizers were applied at the rate of 150 kilograms of N, P and K per hectare (8-18-27). For the cash cereal crops again in the intensive package the farmers were supplied 100 kilograms of 10-21-21 and a hundred kilograms of Urea which were applied in equal amounts at the seedling stage and the last cultivation. The cash crop fields more remote from the village were rotated from maize and millet one year to groundnuts the next year to sorghum the third year and then back to groundnuts in the fourth year. Occasionally cotton would be grown. Cotton inputs were almost completely subsidized by the government. Under intensive practices the male of the family usually grew the cash crops with oxen. He used them to ploy, to plant, to weed, and to lift the peanuts. His average yield would be near 1,500 kilograms per hectare. Note that this is considerably above the average for intensive cultivation of about 800 kilograms per hectare. The great variation within the intensely cultivated farms is as explained by Mr. Niang due to the traditional practices of the younger children.

The males on these intensive farms are growing peanuts with yields of 1,500 kilograms during the drought year of 1980. This is not too far from the estimates of state-of-the-art yields expected by the experiment station. We were told 2,000 kilograms should be an easy goal of state-of-the-art farmers in Senegal.

Land holdong practices may constrain production. The Senegal farmer does not own his land. The government owns his land and the farmer only uses the land. If the farmer cannot use the land, it is redistributed or loaned to somebody who does want to use the land. No rent payments exchange hands. If land is vacated, the decision for redistribution is made through the local government by the Commune Rurale president. For this purpose, local government is organized within Regions and Departments into Communes Rurale or groups of villages. A council of village presidents report to the Commune Rurale president. If a family desires and needs more land due to the growth of the family, there appeal is made through their village president. Redistribution of available lands is done in this fashion without exchange of money or other property. This system of land holding encourages underutilization. Much land is seeded lightly with millet to demonstrate use. The crop may never be harvested. In a dry year when more intensive practices fail extensive cultivation yields an insurance crop. In the way families retain land for future needs or as insurance against crop failure elsewhere. An improved system of loaning underutilized land to more needy farmers could improve production.

The peanut farmer is provided inputs on credit, the fertilizer, the seed treatment and the seed. He pays back the seed after harvest at the rate of 125 kilograms for each 100 kilograms of seed supplied. For 100 kilograms of peanuts the farmer would receive 5,000 franks. Four hundred of those franks would go for shrinkage in inert material. Twenty seven hundred franks would go to repay inputs leaving the farmer with a gross of about 1,900 franks ($9.50) per hundred kilograms of peanuts. While the farmer receives production credit, he does not receive payment until some time after delivery of his crop. The peanuts must be transported to market and

processed before payment is made to the farmer. Consumption credit is not generally available to the farmer and little or no market alternative exists. Undetermined amount of peanuts apparently small but may be more significant than statistics show are marketed through the Gambia where private trading governs the peanut market. Therefore, immediate cash needs of the farmer must be met in other ways or he must subsist on his hand production. Delayed payment and reluctantly low farmer prices constrain production.

We visited one extended family of approximately 50 adults and many more children. The household showed some signs of specialization within the community. They were processing their own peanut cooking oil. The peanut meal leftover was used as a food mixed and boiled with millet. They had several bens of maize stored and they had three pairs of beautiful oxen, 800,000 franks per pair. This translates to about $4,000 or $2,000 per oxen. This family had cleared its fields of brush and were cultivating their cash crops intensively. They and approximately 50 hectares of peanuts and their yields were estimated about 1,400 to 1,500 kilograms per hectare during the drought year. The estimate for the female and children crops were considerably less. These farmers stored their own peanuts for seed. They did buy some seed from the cooperative, but for their own use and to sell or trade with other farmers they did keep some high quality seed. More important, they have different maturities among their peanut seed varieties. A variety of maturities provided them some insurance against the drought and, therefore, their yields were considerably higher than most parts of the country.

We visited the marketing cooperative. Peanuts were being accumulated in a huge pile at the cooperative and it was not known when they would be taken to the oil plant. The peanuts appeared to be of good quality, but one could

easily find damaged shells and moldy peanuts. Facilities at this cooperative included storage for seed and also peanut cleaning machines. After cleaning, they were weighed and the farmer was given a receipt. Payment would not be made until the peanuts were actually taken to the oil plant.

We made one more stop at the location of some irrigated vegetable plots. Some 22 women were growing vegetables on plots approximately 1½ meter by 3 meters each. The plots were located inside a protective fense and below a well dug for irrigation purposes. The water was transported at this time by hand down to the garden plots. Vegetables grown included onions as well as salad vegetables and cabbages of the type that would be consumed locally. They were in a position to market some of them, but they did not grow for markets in particular. For an initial effort, the gardens appeared in good condition and well maintained. Of course, the dry season is optimum for disease protection. Back at ISRA in Kaolock, we were not able to talk with the food technologist who is doing research on storage of seed nor the crop protection specialists as they were out of the office. We returned to Dakar by 1930 on Wednesday the 28th.

On Thursday, January 29th, our visits included a discussion with Lance Jepson of the USAID Food and Agriculture offic. We visited the office of Papa Ibiahima Thiongane, Director General of ISRA. At 1100 we visited Stewart Brown of IDRC and had lunch with he and his family. At 1500 we visited Mr. Lamie Diop, le Directeur de la Statistique, Bureau National Research, B.P. 116 Dakar, telephone 22.54.77. We also visited Mr. Kamara of the same office.(telephone 21.63.25). Then at 1630 we returned to USAID offices for a debriefing session with John Balis. This lasted until approximately 1900.

With Mr. Jepson we discussed potential CRSP research linkages. Two alternatives were identified. ISRA headquarters links the biological science research at Bambey experiment station with the farm level experimental units directed out of Kaolock. We also discussed the link between ISRA and the Ministry of Rural Development (RDA). ISRA activities include peanuts while USAID links with RDA are concerned with food crops exclusive of peanuts. Also, a recent IADS report to ISRA recommends that the sociology and economic section of ISRA headquarters be staffed and strengthened to facilitate the linkage between the experimental units and the biological research units. The CRSP could facilitate this linkage. It was concurred that our best linkage would be with ISRA.

Mr. Jepson also briefed us on the development of the first agriculture university in Senegal. The World Bank is supporting the development of one at Thiese with a B.Sc. in Agriculture. USAID has made committment to support this development. It will be done through BIFAD.

We proceeded to the ISRA office. The Director General was in Ouagodaugou with Claude Charreau (ICRISAT) and Gordon McNiel (IDRC). We left information about the CRSP with his assistant. We also briefed her on our trip to the Bambey and Kaolock stations and our interest in the possibilities of collaborative research agreements through his offices for these two sites.

With Stewart Brown of IDRC we discussed social economic research that have been undertaken in Senegal in the recent past. Of particular interest was a study of consumption patterns which IDRC helped finance in cooperation with the Bureau of the Census. The person in charge of the analysis, Monsieur Jean Marie Cardeau, engineer statistic economist, is in Luxembourg for an indefinite period. While this data is very detailed on 132 families in 20 different locations in the country, Stewart Brown cautioned us on the

non-generality of the data. For details he referred us to Mr. Diop whom we were to visit in the afternoon.

Brown and McNiel more recently have been backstopping the efforts of the ISRA experimental units in data collection. As indicated in the IADS report, the analysis of this data is in need of more support for social scientists. Mr. Diop again cautioned us on the generalizability of the consumption studies. He advised us that there would be a census of agriculture conducted in 1982 and that the census population for 1976 has been published for the region units, departmental units and for commune ruale units. In 1982, the village level data are to be publisehd for some 15,000 villages. For details of the consumption Mr. Diop referred us to Mr. Kamara of his office who is currently working on the data. Mr. Kamara explained that the consumption studies included 132 houses in 22 different villages and that there were nine passages. Each passage of each house was covered a one week period. All consumption behavior for that week was recorded for each household member. The data appeared to be very complete and all in the hands of Mr. Kamara who is currently continuing with the analysis. We secured a copy of the coding sheet for all the data. While the methodology publication is out of print, we were able to purchase one of the recent study summaries. This October 1980 publication (Volume 2) covers results on the budget series. No consumption data or analysis has been completed and published.

We returned to AID offices for a debriefing session with John Balis. We agreed that the priority constraints with regard to peanut breeding dictate medium to long term objectives. Shorter term CRSP objectives which get to the farm level faster were discussed. It was acknowledged that problems at the farm level may be very closely related to the farmers' lack of

access to a choice of peanut variety is best. This kind of practical short term objective might be accomplished through something similar to the all India rice improvement project design which called for testing recommended varieties under farm conditions throughout the range of rainfall patterns, under different soil and different infrasturcture conditions. Mini kit packages at the farm level is possible, but prior to that the researcher might best be served by a more complicated package tried on ten farms across the climate regions. Trials on new material with more and less positive evaluation for each region should be tried. This would provide the researcher with a test of his recommendations and an exchange of information and feed-back from the farmer level. This method of screening varieties through trials on farm would provide data which could be compared in countries throughout the region and provide a basis for dialog between researchers as to appropriateness of varieties. Farmer cooperators could have first opportunity to receive seed and multiply acceptable varieties for sale and distribution among other farmers.

The role of the female in producing food crops may need closer examination. In some instances the male is already close to the state-of-the-art in peanut production because of his cash crop incentive. The female on the other hand has many food production responsibilities and has fewer inputs left over for peanut production. Peanut production for food by females receives fewer inputs and lower yields result. It may be that increases in the inputs on the fields farmed by the females would be the most rapid way of increasing yields of peanuts.

LILONGWE, MALAWI
January 31 - February 2, 1981

When we arrived in Lilongwe, Malawi via Nairobi and Blantyre the afternoon of January 31, 1981, the USAID had made reservations at the Capital

Hotel. We contracted Daryl McCloud of the University of Florida AID project at the Chitidze Agriculture Experiment Station to make plans for the next day. Sunday morning, February 1, 1981, we were met by D. McCloud and Dr. Art Hansen, anthropologist and farming systems analysist on the project, and R. K. Phira a long time employee at Chitedze.

They accompanied us on a tour of village agriculture around Lilongwe. Most holdings were growing maize or peanuts. In some cases, maize and peanuts were intercropped on the same ridges, maize being spaced about three meters apart so they would not shade the major crop, peanuts. Intercropping was prevelant on the very small holdings where a man and his wife only had one or two acres. The bulk of the day was spent in a village where Mr. Phira had borrowed some land from a friend to plant the maize. He knows the family there very well. Mr. Phira has the use of a hectare of land. He has hired the cultivation done for planting. He is not paying any rent to his friend who has more land than he can crop. Mr. Phira did hire labor to ridge the rather heavy sandy clay loam. He paid 10 Kwacha ($12) for one week's work required to do the job. Then he paid another seven Kwacha ($8.40) for a person to be responsible for the weeding of the corn crop throughout the season. The corn crop was planted in early December when the rain started and it will be harvested at the end of the rainy season sometime in April. He also applied some fertilizer to his land, 200 kilograms of N, P and K at planting time. Fertilizer was placed at the side of each hill of corn. Three kernals of corn were planted per hill. Later he spread 200 kilograms of Urea top dressing on one hectare. For the total crop he expects to get about thirty six (36) 90 kilogram bags, or about 3½ tons. His expenses, the labor and the cost of fertilizer and seed, amount to about seven bags so he will have 29 bags profit. Of this he expects to

use about 12 bags for his family - wife and five children. He will still have 24 bags to sell at about K9 per bag for gross receipts of K216. Approximately K65 were his cost in production so he has about K150 ($180) clear profit plus 1080 kilograms of maize to eat. In addition, he will buy two bags or 180 kilograms of groundnuts to eat. These will be the staple foods for his family. He is alow growing some pumpkins in his maize field and his wife is growing a small garden including cassava, sweet potatoes and some maize. During the dry season this garden is located on the waterway. The fields are too dry to crop, but waterways which are too wet during the rainy season provide a garden spot for the families during the dry season. Vegetation is very lush at this time of the year as the waterways are saturated with water and cannot be cropped at the moment but the fields have enjoyed rains since late November or early December.

Tobacco in small allotments is also found growing everywhere. Not all farmers have tobacco allotments, however. The family who loaned the land to Mr. Phira is a very industrious young family. The man Frank Madson Cheka and his wife, Ray Jean Chideru, are less than 30 years of age. They have two small children, but the children, ages four and eight do not help in the fields. They have approximately one hectare of peanuts and one hectare of maize. In the dry season they have a garden along the waterway (dumbo). They work the two hectares of land entirely by hand and by themselves. The land is broken during the dry season. It is too hard to break by oxen. Throughout Malawi the land has to be broken with the hand hoe. They ridge the land and then wait for the rains. The ridges are about ten inches high and 85 centimeters apart on this family's farm. Their peanut field had been planted with one kernal every 15 centimeters. They had 115 rows and they were about 115 yards long. This figures out to about one hectare. The man and his wife said it took them one week to ridge all of the field

groundnuts and another week for the maize. The groundnuts were planted in early December after the rain started. No fertilizer was applied because the family did not have cash on hand. They did buy 80 kilograms of new seed. No additional inputs were used. When he has money he does apply potassium and phosphate. He said he expects to yield about K150. This estimate is based on the price that he received for peanuts last year which was 15 tembre per kilogram. Dividing 15 tembre into K150 suggests he expects about 1,000 kilograms of peanuts from his hectare of land this year. The government offering price for peanuts has gone up from 15 last year to 33 tembre for Grade A peanuts this year. But he is not certain that he will get that price until he actually receives payment. At the new price he should receive K250. He will keep some 90 kilograms of high quality peanuts for seed. He will also keep some lower grade peanuts for food and sell the export grade.

The peanuts are stored in bags inside a special house. They hang from the ceiling with open ventilation from the bottom. Peanuts that are being saved for seed are smoke treated to keep the insects out. The farmer shells and grades all of his own peanuts for market. With a shelling rate of 65% the farmer must grade approximately 650 kilograms of peanuts. They grade them on the farm into an A grade, a B grade and an X grade. The A grade are the large first quality peanuts for export (33 tembre or 40¢/kg). The B grade are medium large peanuts for local consumption (26 tembre or 31¢/kg) and X grade are small, damaged or cracked nuts (6 to 9 tembre or 10¢/kg). These are used for animal feed or crushed. Some of the grade X nuts may be selected for home consumption in addition to the 90 kilograms that they saved for seed.

The family does not extract oil from its peanuts; it does prepare the peanuts in several different ways for home consumption. On this particular day, the wife said they would eat pumpkin leaves cooked with peanuts. 1) The peanuts would be fried and crushed and then cooked with the pumpkin leaves. Both the peanuts and the pumpkin leaves provide protein, the pumpkin leaves being about 6 percent protein. Peanuts are 2) dried and roasted, 3) boiled fresh at harvest time. These are primarily confections and neither one of these types of food are as important 4) as the preparation of the peanut into a relish. The roasted peanut is crushed similar to peanut butter and it is mixed into a relish with vegetables and spices to be eaten with corn mush. The corn mush is the principal staple of all the families and it is served in a cold dough like consistency. The relish gives it a desired taste. The peanut relish and the crushed peanuts that are mixed with pumpkin leaves and other types of leaves are the two principal food uses of peanuts. Finally, 5) peanut oil is used in cooking. We priced 200 millileters of peanut oil at 50 tembre, 1 kilogram of shelled peanuts should yield about 500 grams of oil valued at 125 tembre. Compared with the farm price of 33 tembre per kilogram of peanuts. This is a very good market.

This family is a very hard working family. The two hectares they have take practically all the labor that they have. They are labor extended. They are land extended. There is really no more land for them to farm and they haven't got the labor to farm if they did have the land. The mother of the man has some peanuts, she is not able to weed it properly so she will not receive a very high yield. Her son would like to help her, but he really does not have the time. He will probably yield about 1,000 kilograms and his mother may yield less than 500 kilograms on her land. She cannot afford to hire anybody to weed. The rate of weeding is about 8 meters for 2 tembre, it would come out to approximately K25 for a hectare of land.

Weeding would return at least 2 to 1 on the investment if the cash was available.

The family will receive about K200 for its corn crop, about K250 for the peanut crop and maybe they will have some fresh produce to sell from their garden during the dry season. About $600 will be the entire cash income for the family during the year and this is one of the most industrious families.

This man and wife have built their own mud house in the past year. It's a square house rather than the traditional round house. It has windows so it's cooler for sleeping, but less secure. Some of the square houses have plugged their windows for security purposes. The house measures about 20' x 20'. It looks very clean and presentable from outside. As long as the new grass roof if kept repaired, the house should last at least five years, then they will have to rebuild. The cash outlay for the house is very small, perhaps a door frame and some paint.

The man of the house has been married once before and he has his child from that marriage with him now. He is farming land of his uncle. Traditionally he would go to the village of his wife and farm her land. This tradition is breaking down slowly as the men have more and more power through the production of cash crops and the ability to earn money when they go to South Africa to the gold mines. They bring back money to pay a bride price and that is what Frank Madson did. He asked where he could find a strong wife, one who would be able to work with him in the field day by day and produce lots of food. He found a wife who could do this and they have been very successful since 1974 or 75 when he returned from South African gold mines. They have just one child and hope to have one more child. The wife has no primary education. Her father could not pay for her school fees. The husband has only four or five years of primary education. But they speak and understand a little bit of English. Primarily they speak the local Chimbawa dialect.

They live in a village of about 25 houses and they are all related in some way.

Their only tools are the hoe, which is on a handle about 3 feet long with a 6 inch blade, and baskets of various descriptions to carry the grain and to use for cleaning and winnowing the grain. We then went to the old market in Lilongwe where we priced some of the impliments that farmers use. The hose would cost approximately 3 to 3½ Kwacha. The baskets, of course, range in size from K1 to K3. We bought some small, sweet bananas on the market, 2 for 3 tembre, less than two pennies a piece. Firewood is not plentiful. The government has several programs to grow firewood, mainly Eucalyptus, Acacia and Glacinia.

As we can tell from looking at this village, the land is very scarce, shifting cultivation is no longer feasible, very little land is left fallow from one year to the next, and the family has very little extra labor. They couldn't work extra land if they had it. Their only way of increasing productivity will be through increased yields, they will have to use better culture practices, improved seeds and appropriate levels of fertilizer and pesticides. Without fertilizer, maize may be expected to yield about 1½ tons per hectare. With fertilizer and proper culture practices it could yield up to 7 or 8 tons. Peanuts with minimum practices yield five to six hundred kilograms per hectare. The current variety should be able to yield 1,500 to 2,000 kilograms per hectare if properly cultivated. With new practices including proper planting of treated seed the first day after the first rains and proper fungicide applications, the Chalimbana variety could yield 3,000 kilograms.

Marketing for the farmer in Malawi is all through the government corporation, ADMARK. All the inputs are purchased through ADMARK. They may be purchased on credit, but credit is a very uninteresting institution for many

Malawi farmers who have been independent for centuries. Shifting cultivation required or demanded little or no inputs other than the land and the labor of the farmer. There has been nobody to borrow from in Malawi, so farmers have not become accustomed to buying inputs on credit.

ADMARK does pay cash at the time the produce is delivered and they do a very efficient job of marketing. About 24,000 tons of Chambala penauts were marketed with ADMARK in 1979. ADMARK monitors the grading done by the farmer on his peanut crop, and they monitor the aflatoxin levels. Aflatoxins are thought to be very low in Malawi peanuts. The grading process itself eliminates most of the chances for aflatoxin infection. The fact that ADMARK pays cash immediately does stimulate prompt marketing by the farmer.

The Chambala peanut shell appears to be somewhat resistant to alfatoxin infection. There is little evidence of damage of these large thick shells and, therefore, little opportunity for alfatoxins to enter the peanut at the time of harvest or until it is shelled.

On February 2nd we went to Bundi Agriculture College about 15 kilometers from Lilongwe. There we visited with Dr. O. T. Edje in the Crops and Soils Department. The college offers a B.Sc. degree. They presently have about 400 students enrolled. The farms are extensive and the practical experience of the B.Sc. degree student is extensive as well. Technically the degree is comparable to a B.Sc. degree in the U.S. The medium is English and students selected for U.S. universities do well.

Dr. Edje explained that Bundi college has the national mandate for dry bean research. Under this activity they are developing links with the Bean Cowpeas CRSP through Adams of Michigan State University. Dr. Edji did his M.Sc. at Michigan State University and his Ph.D. at Iowa State.

There is also a linkage being developed with ICRISAT at Bundi college for dry bean research. They have 2,000 lines of phaseolus beans there now.

They are doing a lot of work with intercropping, for example, maize and beans and maize and groundnuts. The genotype selection appears to be critical if the two crops are to be compatible. Maize and groundnuts intercropped with maize as the predominate crop can be expected to yield 7 to 8 tons and groundnuts up to 500 kilograms. The maize yield was not effected and there were some 500 kilograms of groundnuts that were cropped in addition to a normal maize yield. The maize was fertilized with 20 percent nitrogen and 8.7 percent phosphate at the rate of 300 pounds per hectare, and then top dressed with 300 pounds of 26 percent Urea, and the pH of soil is about 5.8 to about 5.9. Dr. Edje's philosophy of intercropping is that as long as the major crop is given full advantage and its yields are not reduced, the secondary crop underneath is a bonus to the farmer. Intercropping has been a tradition in Malawi for centuries, according to Dr. Edje. He is very interested in doing an intensive survey of cropping systems to be documented by photographs. To do this work he currently has a proposal in front of IDRC with Bruce Gopt in the Niarobi regional office for East Africa. He proposes a three month study touring farms by bicycle, identify why the farmers are doing what they are doing, and study the sociological practices as well as the agronomic practices of intercropping. Dr. Edje feels that these systems particularly on small farms should be improved rather than discouraged. He cited several advantages. For example, rosette incidence in peanuts is not so high if intercropped with maize. A common intercropping system is to plant the groundnuts early, and where the groundnuts fail to germinate phasiolus beans are planted. The beans mature and can be picked green before the groundnut crop is harvested. Pumpkins, climbing beans, and maize are a very common intercropping system. The village cultivars appear to be better adapted to intercropping as a result of their selection for this purpose over many many years. The method of placement as well as the rate of placement seems to be

important. Some farmers will plant groundnuts on the top of the ridge so they get an early start with the maize on the side of the ridge. This way both get sunlight at early stages.

Dr. Edje proposes to do this work in collaboration with the Ag Economist and the Rural Sociologist. Both of these persons were away from training at this time and we were not able to meet them.

Dr. Edje gave us a tour of the extensive intercropping research going on on campus. We then left for Lilongwe. Dr. Edji sends his regards to Dr. Okezie, President Morrison, and Dean Thomas who were visiting Bundi College in September.

On return from Bundi College we stopped at the US/AID office and visited with the project development officer, Bruce Gum. He was very receptive and interested and felt that the Peanut CRSP could be important to Malawi. At Chitedze we first visited with Dr. H. K. Mwandenere, Officer-in-Charge at Chitedze. He is a graduate at the University of Florida. They have just sent 12 of their staff members as students to the states; nine of them to the University of Florida and three of them scattered elsewhere. Only one, Rose Chikwana, is in the social sciences. She is a sociologist working on farming systems at the University of Florida. Art Hanson is currently filling in as the farming system specialist at Chitedze and will be developing the program there. Art has found lots of cropping system and crop production data in various offices. It has been processed for the minimum requirements of various AID and World Bank and other proposals. It has not been exploited to determine the utility of the various farming systems and he feels a lot could be done with the existing available data. However, methods of collecting that data are not readily available and documented. So basically the sociology program, as with respect to farming systems, will be starting pretty much from scratch. Apparently, there are no consumption studies underway.

Peanut research at Chitedze started in 1964 with the British Agriculture Research Council. Peanut breeding, agronomy, pathology were all a part of that mandate and these three areas are continued today with B.Sc. degree holders from Bundi occupying these positions.

Dr. Mwandemere indicated that the crop area planted to peanuts is probably increased this year in response to increasing prices. The other cash crop, tobacco, and that portion of the maize crop grown for cash has probably declined a little bit. He feels farmers are sensitive to these rather dramatic price changes and adjust rapidly.

The credit program through ADMARK is available to the farmers but they are slow to use credit on recommended practices.

The plant breeder's priorities are 1) yield potential; this is reflected in the work that Dr. McCloud is doing on partitioning the amount of growth in the leaf as opposed to the amount of growth in the nut. The reduced leaf growth will allow much denser planting and approximately double the planting density currently practiced.

The Chalimbana is an eating variety and used primarily for export. On the station they can get approximately 1,500 kilograms per hectare when all culture practices exclusive of fungicide sprays are observed. Most varieties adapted to Malawi are long season varieties, 145 days to maturity. 2) Because they are hand shelled, larger easily shelled nuts are a priority. 3) Acceptable varieties which are resistant to rosette are desired. Current resistant varieties are not acceptable because they are not easy to shell, but some of this resistance may be bred into the other varieties. The highest yielding variety is an oil nut. It is not desirable for eating but it can yield 3,000 to 3,500 kilograms per hectare with high management practices. They are not doing very much with the Spanish type peanut.

The pathologist spends about 2/3 of his time on peanuts and 1/3 on cassava and rice. The main system of protection is the use of sulfur dust on peanuts. In pesticides screening trials he has found Bravo fungicide to be very effective and economical on farm trials with Chalimbana variety. Use of Bravo is expensive. His figures show that it cost about K96 to equip the farmer and spray 1.6 kilograms each of six times on a hectare of peanuts. Rust is a particular problem where it is hot and humid along the lake. With spray, low management farmers double their 500 kilograms per hectare yields. High management farmers with about 1,500 kilograms per hectare get 2,500 to 4,000 kilograms with a spray program. On the average the farmer's expenses were K115 per hectare and returns of K215 per hectare. Previously 15 or 20 Kwacha of cash inputs were the maximums.

Credit is available for the farmer to buy and apply Barvo fungicide, but a seven fold increase in purchased inputs is a big jump. More likely a modified spray program will be adopted. Research on the critical timing of only two or three sprays might be helpful.

The pathologist observed that alfatoxin is not a great problem, unlike in Senegal where the lesser corn bover increased during drought and penetrated the peanut shell allowing the alfatoxin infection to enter. Also, the Chalimbana variety used in Malawi has a protective shell.

The plant physiologist along with Dr. McCloud showed us the partitioning experiments they were conducting to screne material for a high peanut to leaf ratio. With 45 centimeter rows the plant population is about double that on farms.

Dr. McCloud, in summary, felt that their number one objective is increasing yield through the partitioning of growth in the Chalimbana variety. He feels that the yield potential of the Chalimbana variety may be much greater than realized.

The second priority, particularly if the research could move into farmers' fields, will be with disease control. With the higher plant population disease may be more of a problem and may require more careful control. A minimum spray program may be optimum. Presently they are recommending six sprays starting at thirty days. This may be too soon. If they wait until the disease population has reached a higher level, they can still kill it back with one application. Maybe three applications will be enough, thus, cutting the cost in half.

Finally, research on alfatoxins particularly in the food partition may be necessary. Currently, there is no known incidents of cancer of the liver. With regard to the social economic research potentials they do have the cropping system analyst, Arthur Hanson, and they are trying to recruit a production economist. Their initial recruit, Tom Walker, has gone to ICRISAT in Hyderbad. There is some interest in relay cropping. Dr. McCloud feels that the "relay" aspect of so called "intercropping" is probably critical to the success of intercropping. He felt intercropping research to date has not adequately explored the relay characteristics of the crops involved. Once plant population is optimized and yields are optimized in peanuts, for example, there would be no sunlight leftover for another crop. Similarly, he feels once that the plant populations are optimized for maize there will be little or nothing leftover for a second crop. Thus, the farmer would not find it practical or economical to plant a second crop underneath maize.

This concluded our visit in Malawi and we went to the airport and returned to Blantyre, the next day to Kenya. Once in Nairobi Dr. Cummins proceeded to the Cameroons and I was met by Dr. Bishnoi of Alabama A&M and the Egerton Project. We visited the US/AID offices. We also made a visit to the University of Nairobi to meet Dr. Phillip Mabethi, Head of the Sociology Department. Dr. Bishnoi took me to Egerton.

I visited with Dr. Charles White, Chief of Party for the Egerton college AID project and was briefed on progress to date. They are very much on schedule with regard to construction and student training overseas. The presently have some 24 students overseas and they have scheduled some additional 12 students to go this coming year.

Dr. Bishnoi toured the campus with me and he introduced me to some 20 of the 25 SECID staff and faculty that are presently at the Edgerton campus. The campus includes a student body of nearly 900 students. They come from all parts of Africa. This is now considered, perhaps, the leading institution for a B.Sc. on the continent of Africa. They have a couple thousand acres of farmland for their field work and a faculty in staff of about 200 in total.

With Dr. Bishnoi and wife, Suki we returned to Niarobi the afternoon of February 4th. The morning of February 5th, I was called by Dr. Okezie who had arrived from Sudan on schedule.

KHON KAEN UNIVERSITY, THAILAND
February 13-17, 1981

On February 13th I arrived in Bangkok. At the AID office, I met with Mr. David Thomas and made arrangements to meet him in Khon Kaen on Sunday. The AID travel office assisted me with travel plans to and from Khon Kaen. At Ford Foundation, I asked for the people working with the cropping systems project at Khon Kaen and found that Ford was closing down the project and the people had been reassigned, namely Sam Johnson. Peter Weldon had also left the Ford Foundation and was out of the country until Tuesday.

On Sunday, the 15th of February, I proceeded to Khon Kaen and reached David Thomas, he invited us to his home where we met with Jim Bumgardner, a graduate student from Michigan State University working on a nonfarm rural employment project; Brian Burns, Peace Corps volunteer working on biogas generators; and Jureearat, AID staffer in Khon Kaen. We discussed agricultural

production and marketing generally and peanuts in particular. The AID staff had just completed a survey of farm households in the northeast. This is a part of the Northeast Rainfed Project Design. About 1,250 households were interviewed starting in October. The data was tabulated and ready for the design team to use in January. A lack of understanding of the potential for an integrated peanut industry in the Northeast has been identified as a constraint to increased peanut production. Jim mentioned that Merrill Menningay of the Michigan State Applied Economic Project at Kasetsart (APO 96346, San Francisco) would be a good contact. A study of the "Changmi Food Processing Industry: why it failed" by the Industrial Services Institute would be useful to peanut market research. A company which has been very successful in competing with traditional markets is that of Adam's Tobacco. This success story has not been studied but apparently the key to the success of Adam's Tobacco has been its provision of extension services, inputs, etc. to the farmers from whom it procures the tobacco. In a short period of time, Adam's Tobacco has built confidence in its farmer clients that is competative with strong traditional businessmen. Their methods have a lot in common with the traditional marketing methods employed by the traditional middle men of Thailand who have provided a credit and other services to farmers. In turn the farmers are very loyal in selling their crops in spite of prices to the traditional markets.

Very successful maize and cassava export industries have been built up through the traditional marketing system. Unlike Africa, there are no government marketing boards. Market prices prevail at all levels and the farmer has responded dramatically in these two instances to price offered by traditional markets.

Peanuts are a traditional crop in the northeast, but they have not enjoyed the export market. Peanuts have been primarily grown for home con-

sumption with very little market surpluses. Building a market based on domestic demand would necessarily be much slower than it has been in the case of maize or cassava for export. In recent years, the import substitution could provide a ready market for expansion of peanut production. There is potential and plans for a peanut processing plant in the northeast which sould produce oil and groundnut cake. This would be compatible with an increasing demand for peanut oil and also the need for animal feed. Both the native pork and poultry industry could use more protein.

Human nutritional status in the northeast has declined. Particularly the consumption of animal protein has declined. With the overfishing of the canals and streams, fish are almost absent from the diet today. Poultry diseases have ravaged the traditional supply of poultry and feed stuffs available for the raising of pigs have declined with the increasing population.

In an attempt to increase plant protein in the diet, an IDRC project on the home processing of legumes for food has been underway for several years. Peanuts and mug beans are the two traditional legumes in the diet. Few other beans are consumed traditionally.

On February 16th, I was accompanied to Khon Kaen University by David Thomas and Jureearat. We were met by Dr. Terd Charoenwatana, leader and coordinator of the cropping systems project and vice director for academic affairs at Khon Kaen University. Also meeting with us were Dr. Aran Patanothai, plant breeder, Dr. Viryia Limpinantana, physiologist, and Mr. Pitaksit Chayabuthi, agricultural economist.

Dr. Aran, as secretary of this research group, discussed the cropping system prevelent in the northeast. It consists of family farms which have lowland paddy, upland rainfed paddy or middle terrace paddy, and upland cash crops, primarily cassava rotated with Kenaf or potentially groundnuts. Cassava, which has been a very protitable crop, is planted in March during

the dry season. Being a ten month crop, it can be planted and then left until the family both plants and harvests the crops on the lower and middle terraces. Then the upland cassava can be harvested. As the rains start, the lower terraces are planted, if the rains continue they move up the middle terrace to plant more rice. If the rains are excessively heavy, they continue to plant rice on the upper middle terraces. Too much rain will wash out the crop down below, but they have an insurance crop in the middle terraces. In dryer years more than a million acres go unplanted in the middle terrace. Some of these are planted to peanuts and other field crops.

There are several systems and ways in which peanuts can be introduced into the cropping system. 1) Traditionally they are grown in the middle terrace along with the rice paddy. 2) They may be grown under irrigation in the dry season on the lower terraces. Currently, a small amount of area is irrigated for rice paddy. If water were properly managed, a very large area could be irrigated for groundnut production to the benefit of more people.

3) Of more immediate concern is the potential for intercropping peanuts with cassava on the uplands. As a monocrop it is believed that cassava depletes the soil of nutrients, but in theory it would fit well in an intercropping system with the nitrogen fixing peanut. The recommended system would include three rows of peanuts and one row of cassava, cassava being planted in March and the peanuts being planted in late March or early April. The peanuts could benefit from the open canopy for the first three months. They could also fit into the family labor requirements if it were a 90 day crop instead of the traditional 120 or 130 day peanut crop. This would mean harvest would fall half way between the planting and harvest of the paddy crop on the lowlands. With the French lobbying for reduced importation of cassava into the European Common Market, replacing part of the cassava crop with peanuts is a good insurance measure for the Thai farmer. If the market

be developed in the northeast for peanuts, a lot more peanuts could be grown on the middle terraces as well.

Regarding utilization of peanuts, peanuts are a traditional food in Thailand. First, it is directly consumed as boiled or fried confections. They are also ground and boiled with noodles. Third, ground peanuts are used as a sauce for barbecued prok (sati). Fourth, the northeast is famous for its peanut confections, particularly peanut brittle. Families very frequently eat the peanuts that they have saved for seeds. This amounts to 20, 30 or 40 kilograms of peanuts. This is particularly unfortunate because the price of peanut seed rises dramatically just at the time of planting.

Finally, vegetable oil consumption and imports are on the rise as animal fat availability is declining. Importation of peanut cake is increasing as the price of animal feed has increased. A greater production of peanuts are exported for seed as well as for food. Hand shelled, boiled and dried peanuts are exported to Hong Kong. Among lower income families in particularly there is a shift away from animal protein to vegetable protein. A medical university in Bangkok has developed a highly recommended and acceptable baby food made of rice bran, sesame and groundnuts.

Dr. Aran summarized the needs in peanut research. First is the need for an early variety for the upland cropping system, whether those varieties should be predominently for oil or for food has not been determined. Second, he emphasized the need for a variety resistant to the subterranian ants in the upland areas particularly the newly open lands. And third, the need for alfatoxin research. Dr. Aran discussed the two existing research projects dealing with peanuts, 1) the IDRC Semiarid Crops Project: peanuts, sorghum and millet, and 2) Ford Foundation's Cropping System Project. Recent annual reports for both of these projects were provided. Dr. Aran also provided data on peanut production and imports since 1969. It is attached to this report.

The Food Products Division, which has a project on home processing of legumes, was visited next. The red cowpea is the focus of the project because of its high quality protein. Twenty-five Thai dishes were identified; 14 main dishes and 11 sweet dishes. In two of these dishes they added ground red cowpea and found them all acceptable. These acceptable recipes were then subjected to substition for the cowpea by mung bean, peanut, rice bean and black bean. All but the peanut were found to be highly acceptable substitutes. The peanut, because of the high oil content, was not desirable in many instances. The researchers acknowledged that had the recipes been selected for peanut acceptability (probably fried dishes) they would have found many acceptable peanut recipes.

David Thomas noted that the CRSP would fit very nicely into the research program at Khon Kaen University. The university research effort could then better compliment the Northeast Rainfed Project. The timing of the CRSP would also be critical as the Ford Foundation project is just phasing out.

After a fine dinner in Khon Kaen, we toured the factory which makes peanut brittle. We found that the one small factory we visited imported some 12 tons of peanuts from Bangkok each year. They are good quality uniformed size peanuts which are purchased for about 20 Baht ($1) per kilogram. After the shelling and husking, they are retailed at 30 Baht per Kilogram. Peanut brittle itself is also sold at 30 Baht per kilogram.

Some of the peanuts are very likely shipped from Khon Kaen to Bangkok where they are graded and packaged and sent back to the northeast for the confection industry.

We returned to Khon Kaen University to talk with Charun Dayananda in Agricultural Economics about the marketing system and to Somsak Priebprom with the Department of Agricultural Economics of Kasetsart University, about labor requirements of farming in the northeast. Charun Dayananda identified

marketing as a problem particularly for peanuts. The system is very highly developed for the rice market and the cassava market, but surpluses of peanuts are scattered rather far and wide and there is no uniform marketing system which the farmer can depend upon. Peanuts are gathered together in small amounts and channeled to Bangkok where they are graded and grouped into larger bulk quantities. If the long proposed oil plant were to be errected in the northeast, considerable change in the marketing structure would have to be developed.

I tried to determine if peanut production were increasing relative to rice production. There caculations suggests that peanuts would be more profitable than rice if grown on a larger scale. They felt peanut production was increasing in some areas because of its comparative advantage, but in most cases the markets were a hinderance.

While peanuts appear to be a traditional crop with a bright promise in the northeast, growth of the peanut industry will require many changes in family labor systems, water management, cropping and farming systems, local markets and peanut consumption patterns. Water, land, labor and capital resources could be better utilized, particularly if the most acceptable varieties could be bred for higher yields. Larger market surpluses would facilitate development of an integrated market in the Northeast. The Peanut CRSP could support a very capable Khon Kaen interdisciplinary research team to analyze and seek solutions to these problems.

A return to Bangkok the evening of the 16th. The next morning I visited briefly with Dr. Ron Bowers of US/AID regarding my visit to Khon Kaen. I expressed my appreciation for David Thomas and Jurcearat taking their holiday (February 16) to accompany me on my Khon Kaen visit.

Of note, Dr. Bowers did mention that there is an inoculation plant being established in Bangkok which would process 200 tons of inoculum for legumes

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such as peanuts and soybeans. This should be a substantial boost to the legume industry in Thailand.

My plane departed from Bangkok at 11 o'clock on the morning of the 17th.