1 Guatemala ICTA 1 [illegible]
Evaluation 2/78 [illegible]
by F Mann + D Dougherty.

I. FINDINGS

A. With regard to place of AID assistance in overall ICTA program.

1. ICTA's practical problem-solving approach to research, and its concentration on crops, produced primarily by small farmers is consistent with the congressional mandate and the USAID development strategy in Guatemala.

1a. We consider that if the technical assistance staff provided to ICTA under the AID project had not been made available, the institutional development and technical progress of ICTA would have suffered greatly. We are convinced that this assistance has been critical to the ability of ICTA to sustain a rate of progress and development as an institution of the Public Agricultural Sector. Without AID assistance, we consider that ICTA probably would not be in its present position of being able to justify to the GOG continued and expanded budget support, or to provide justification for consideration by BID for a major plant and equipment loan for improving and expanding physical facilities for agricultural research in Guatemala.

2. AID assistance is provided for the major crop improvement programs of ICTA, and provides not only criticval technical expertise in program design and implementation, but also provides important stafford program stability and continuity.

3. There is evidence that ICTA is recognizing both at the national and field levels the importance of strengthening linkages with farmer groups and the extension service. Some alternatives are being tried on an ad hoc basis for developing closer ties with farmer cooperatives and DIGESA field staff.

AID assistance in corn, sorghum and bean research is oriented largely toward variety improvement. In part because of the high quality of the technical assistance being provided by AID in variety improvement, a greater imbalance is becoming apparent in the ability of ICTA to adequately link information generation to the information transfer process (both forward and backward linkages). At this stage of ICTA's institutional development, it appears that relatively more technical expertise is needed to assist in improving the system of forward and backward linkages between the information generation and information transfer processes. The effectiveness of technical strengths in variety improvement thereby can be enhanced even more. A similar conclusion can be drawn with regard to the relatively slow progress of work in improved agronomic and cultural practices as compared to variety improvement.

4. It appears that ICTA has been quite successful in attracting capable Guatemalans to work with programs receiving AID assistance. Furthermore, in-service and external training activities appear to be appropriately oriented

and reasonably well-planned. Nevertheless, a critical constraint to 1) the long-run viability of ICTA programs receiving AID assistance, and 2) the timing of the phase-out of that assistance, is the rapid turnover of Guatemalan technical personnel (reportedly 20% annually).

An important factor contributing to this turnover is the wide dispartiy between ICTA salaries and those salaries offered by the private sector. Despite the relatively high level of public service commitment of ICTA staff and the very positive professional environment with ICTA, professional staff are attracted to the private sector by salaries that at times are more than double what ICTA can pay. ICTA is acutely aware of the problem, and within the framework of its organic law, is proposing to the GOG a technical pay scale system that can better compete with the private sector. Even if ICTA is successful in obtaining approval for this pay scale adjustment, it is likely that they will continue to be at a disadvantage, in competing with private sector salaries. To counter such a competitive disadvantage, ICTA in part can rely upon public service commitment and their ability to provide highly satisfying professional research opportunity. Nevertheless, ICTA can expect continually to be faced with a turnover rate significantly higher than that which would be expected under US conditions. The level of resources dedicated to training for ICTA staff should reflect this competitive disadvantage.

5. One of the apparent strengths of AID (and other) external technical assistance to ICTA lies in the fact that ICTA's organic law permits expatriates to occupy line positions. Thus, instead of the traditional TA "counterpart" relationship which often does not permit a foreign expert to become directly involved in technical policy and budgeting decisions, in ICTA, foreign technicians can be so involved without being required to operate through the medium of a Guatemalan counterpart who may not be adequately qualified to hold the position he is in. While in the initial stages of institutional development, this allows foreign expertise to have a more effective impact on program design and execution, it increasingly becomes a disadvantage when a stage is reached that a Guatemalan is technically qualified for a position presently held by an expatriate, but who nevertheless could profit immensely by the greater experience of that expatriate as he (the Guatemalan) gains experience. Under normal circumstances, the Guatemalan technician moving out of that position usually would be expected to move up to a higher position, thereby keeping his expertise within the institution. In the case of an expatriate a "phase-out" plan should include a period of time in which he "steps aside" and functions as a sort of "staff advisor" to the Guatemalan (now technically qualified) who takes on the technical responsibilities vacated by the expatriate.

6. The relationship that has been developed in ICTA between AID assisted commodity programs and the work being carried out with Rockefeller Foundation assistance in socio-economic research, considerably enhances the ability of

ICTA research to respond more effectively to farmers' production problems.

The integration of socio-economic and commodity research has not yet reached a stage where all interested commodity specialists and socio-economic workers are measuring their effects in terms of the impact they may have on the entire set of activities of the family farm and household. The importance of this integration is especially pronounced in the altiplano because of land scarcity and surplus family labor. Associated cropping is an important means whereby the farmer attempts to more intensively use the land available to him and at the same time to more effectively utilize the family labor supply. This association of activities also includes livestock on a large number of small farms throughout the country.

Up to the present, the socio-economic team has done some work with associated cropping in the Chimaltenango region. However, their farm record activities continue to be limited to only a part of the family's farm household production/consumption activities. We found little evidence of integrated efforts on the part of the commodity groups and the socio-economic group to deal with constraint alliviation within a whole farm/household context. It appears to us important to move to this stage of integration as rapidly as possible in order to maximize the inputs of individual commodity line specialists toward more efficient utilization of all factors of production available to the small farmer.

The AID inputs to ICTA commodity programs should pay special attention to this problem by focusing more specifically on cross-commodity integration.

7. ICTA's emphasis on basic grains, and AID's relative focus on basic grains, appropriately recognizes that these crops will continue to be a major part of small farmer production in Guatemala for many years. Nevertheless, both ICTA and AID also must recognize the need to improve small farmers' incomes (both in kind and cash) beyond that which can be achieved through improvement of basic grains production alone. To address this latter need, it appears that relatively more resources should be provided by external donors to assist ICTA in mounting more effective research programs in fruit (both tree and small fruits) and vegetable production, and in selected types of animal production. In addition, serious consideration should be given to the allocation of research resources for determining the production potential of other crop and livestock alternatives that might have a comparative advantage under Guatemalan conditions. Some possibilities would include soybeans, peanuts, lupines, pidgeon peas, broomcorn, small animals, etc.

8. Although the level of installations and equipment in the various experiment stations we visited provide the minimum facilities required to permit present levels of research activity, considerable need for improvement and expansion of buildings and equipment (including irrigation structures

and equipment) is being felt. Additionally, availability of staff housing, meeting miminal family needs at or near the stations would permit more efficient use of staff time. ICTA presently is developing a plan, with BID technical assistance, for a comprehensive experiment station development program throughout the country. It is our opinion that execution of such a plan is extremely opportune at this point in ICTA's institutional development. Further, it appears that financing of such a plan would be appropriate for BID. AID should seek to assist ICTA in technical assistance and training that would be complementary to such BID assistance, and which would not be likely to fall within the type of assistance generally provided by BID or other external donors.

B. With regard to AID assistance in corn research program.

1. The technical expertise being provided is of high quality.

Largely as a result of this expertise, the corn program can be characterized as dynamic and of high professional quality.

2. The program concentrates on variety improvement and is working both on the south coast (on parcelamientos) and the central highlands, the two major ~~on-or~~ producing areas in the country.

3. On the south coast, an innovative approach to providing heterotic response has been designed and initiated. This approach utilizes a system of half-sibling and full-sibling crosses (as compared to the conventional system of in-bred lines).

The resulting lines, when combined, not only carry the selected improved characteristics, but also give hybrid vigor. This allows more rapid release of improved seed than would be possible under a conventional hybrid system. This system is an intermediate step between the development of composite varieties as practised by CIMMYT and full hybridization as is the practice in the U.S. The approach, while allowing more rapid release of improved lines, sacrifices the full effect of hybrid vigor achieved from crossing fully in-bred lines. Nevertheless, as one continues the half-sib/full-sib crosses, the system continually moves to homozygosity (full in-bred) thereby achieving improved hybrid vigor.

Use of this system requires that the farmer renew his seed each year. Given the familiarity of small farmers on the south coast with imported hybrids and annual seed renewal, the approach being used appears to be superior to either the CIMMYT or the "full hybrid" approach since it permits considerable output response from the combined effort of variety improvement and hybrid vigor in the short run (less than 5 years) which could not otherwise be achieved.

4. In the highlands, emphasis is on selections within the local native (criollo) lines, since tests indicate that they are of superior yield potential and stability when compared to the so-called improved imported lines.

Some apparent problems with criollo varieties are narrow adaptability to micro-climatic variations on long-growing season (not permitting second crops) and tall plants (resulting in lodging.) It has been found that great variability exists in criollo lines, which suggests that considerable improvement can be achieved through careful selection. This is the approach being taken in the highlands variety improvement work.

5. Two highly qualified corn breeders are being provided to ICTA through the AID project.

Improvement in agronomic and cultural practices presently is being achieved through use of Guatemalan expertise, plus whatever assistance the corn breeders can provide. Research to date demonstrates that use of fairly conventional improved agronomic and cultural practices result in significantly increased yields of criollo varieties in the highlands, while on the coast there is only limited (or inconsistent) response to fertilizer (at least in some major producing areas), and problems with insect damage are serious. These facts suggest that economical and significant increases in corn yields both on the coast and in the highlands might be achieved in the short run by bringing to bear appropriate outside expertise on these problems. For the Highlands, this impression is re-enforced by the apparently greater acceptance by small farmers of changes in agronomic practices than in the use of improved seed. For the Coast, insect damage is so severe and present practices for reducing such damage is so unreliable and expensive as to call into question the long run economic feasibility of corn production on the coast. Immediate expertise is needed to assess viable alternative measures for alleviating this constraint. A properly qualified entomologist with adequate experience in integrated pest control methods could assess the prospects for economically viable alternatives for management of the pest problem, and design and supervise implementation of programs for testing such methods. Although a Guatemalan entomologist will return from Ph.d training in 1978, we believe the assistance of a more experience pest management specilist would be more helpful.

6. The corn breeding program appropriately assigns high priority to increased yield potential as a major goal with improved nutritional characteristics being introduced in a manner consistent with that goal. The breeding program appears to us to achieve a proper balance between these objectives.

C. With regard to AID assistance in sorghum research program.

1. The development of improved sorghum varieties and production methods is focused upon sorghum production for human consumption. In this regard, the research is entirely consistent with the congressional mandate and we consider it to be appropriate for USAID assistance.

2. Substantial areas in the eastern part of the country appear to be more adapted to the production of sorghum than to corn (or any presently produced alternative crops). Significant areas (the departments of Chiquimula, El Progreso and Zacapa) appear to be potentially well-adapted climatically to sorghum production but are not presently producing significant amounts. This is because sorghum production in Guatemala has been traditionally based upon photo-period sensitive varities. The introduction of adapted non-photoperiod sensitive varieties could have an enormous impact on small farmer incomes in these areas by reducing the growing season to better fit rainfall patterns.

3. We found evidence to indicate that the ICTA program (under supervision of the sorghum production specialist funded by the AID project) had progressed well in the selection of high yielding varieties of improved nutritional quality adaptable to the area. Major characteristics being selected for are photoperiodism, anthracnose and midge resistance, weathering, digestibility, appearance and nutritional quality. The program has successfully introduced two genetic mutants in selected varieties which confer high lysine and improved protein properties to the breeding lines. We conclude that the characteristics being selected are consistent with small farmer production needs, and that significant progress has been made.

4. The sorghum program especially suffers from high turnover of Guatemalan staff as discussed under the general findings. Because of this, a self-sustaining sorghum program cannot be achieved before 1981, even assuming reasonable staffing stability from now on.

5. Although a specific objective of the sorghum program is to determine improved cultural and economic practices, or to adapt sorghum varieties that have superior yield response to existing practices, it appears to us that more relative emphasis should be applied in this area.

6. Consistent with the general finding that ICTA programs should achieve greater balance by allocating more resources to testing possible new crops for small farmers, we feel that more emphasis should be given to testing the production and economic potential for forage sorghums and broom corns. The sorghum program is contemplating some work in this area, a move which we endorse.

D. With regard to AID assistance in Bean Research Program

1. While the present researchers have been associated with the bean program in Guatemala only a short time, we believe that both men reflect a level of competence and dedication to the program which augers well for significant research progress. The scientists displayed a broad understanding of research objectives and their orientation was consistent with what we believe to be AID objectives in this area.

2. Present activities and plans in bean research are concentrating on (a) screening of varieties of bush beans, for single and successive crop production in the Oriente, Zacapa, and Chimaltenango areas, and (b) selection and breeding work with local varieties of pole beans that are grown in association with corn and other crops in the Highlands. The orientation of present work and plans appears to be consistent with small farmer production needs in the major bean production climates of Guatemala.

Progress has not been as rapid as in the corn and sorghum programs, partly because of the more limited knowledge base worldwide and lack of highly responsive varieties, but also because of lack of continuity of expatriate expertise, in addition to the problem of lack of continuity of Guatemalan personnel (described above). This has restricted the rate of progress that might otherwise have been expected. If personnel stability can be maintained in the bean program for a 3-5 year period, it can be expected that substantial progress will be achieved both in variety improvement and in agronomic and cultural practices both for the Oriente (and Zacapa), as well as for the Highlands regions.

E. With regard to AID assistance in vegetable research program.

1. The focus of this work has been primarily with warm climate vegetables produced in the Zacapa region. Some work has been done with varieties and time of planting of garlic in the Highlands, and some potatoe work is being done on variety testing and multiplication of clean seed. In 1977 some field trials were carried out in Chimaltenango with cole crops.

In view of (a) the limited range of adaptability of garlic in Guatemala, and (2) the relatively larger, non-traditional, irrigated farmers producing warm climate vegetables in the Zacapa Valley, combined with the fact that considerable potential for expansion of cool climate vegetables production exists for traditional small farmers in many areas of the Highlands, we consider that relatively more research resources should be allocated to cool climate vegetable research as compared to warm climate vegetables and to basic grains research, both in terms of AID assistance and in terms of ICTA priorities. This would complement planned AID assistance in providing substantial funding to the GOG and agricultural cooperatives for developing fruit and vegetable marketing systems that will help to assure the highland small farmer a stable outlet for quality vegetables and fruits.

Work with cool climate vegetables probably would give greatest emphasis to agronomic and cultural practices, and would require very close integration with highlands research activities in corn, wheat and beans, since much vegetable production would likely be carried out in association, or in succession, with these crops.

Such work also would need to take into account the possible complementarity between vegetable production and some types of animal production.

2. Work on potatoes to date has been limited to some efforts to assist in providing improved varieties of clean seed. Given the importance of potatoe production in the Highlands and the potential for expansion, combined with the difficulties presently encountered in the production and distribution of disease-free seed, a relatively high pay-off could be expected for additional technical resources being dedicated to potato seed variety screening; introduction and preservation of clean seed, and improved agronomic and cultural practices in potato production, including work related to potato production in association, and in succession, with other Highland crops.

3. In addition to the potential for expansion of cool climate vegetable production by small farmers in the Highlands, both tree and small fruit production holds considerable promise for expansion in many highland areas. We consider that a research program to improve nursery stocks and varieties, as well as agronomic and cultural practices (complementing the AID assisted marketing program referred to above) could provide important technological improvement that would improve incomes of many small farmers in the Highlands in the medium/long term.

F. <u>With regard to AID assistance in other ICTA activities:</u>

1. The AID project provides funding for the technician occupying the position of technical director of ICTA. This position is well-staffed and is key in terms of providing overall guidance in the planning and execution of research programs. It could also be an important position for influencing the integration of research of the various commodity groups and in assuming the proper mix of commodity specialists in research related to associated and successive cropping. Nevertheless, while this position requires a high level of administrative capability and an understand of research procedures, it does not necessarily require an in-depth expertise in any particular discipline or line of enquiry.

In the early stages of ICTA institutional development, an experienced expatriate in this position assisted in lending stability to research thrusts and a sense of technical expertise guiding research development that might not have been possible with a Guatemalan as Technical Director. However, at the stage of ICTA institutional development expected to be achieved in 1978, it appears to us that scarce external technical resources should be used therafter to make available to ICTA in-depth specialized technical capability and experience not yet available in Guatemala.

Thus, it would appear to be advisable to shift the AID funded position of technical director to that of a highly trained research specialist in an area of expertise of high priority to ICTA program expansion.

2. We agree with may ICTA staff members that work in associated and successive cropping is an important research area for small farmer production in the Highlands, and successive cropping is important also for small farmers on the South Coast. It is our judgement that the appropriate integration of specialties and crops cannot be achieved merely by seeking cooperation among the various crop research teams. Rather we consider the work in this area to be sufficiently important to justify establishment of a production research team that is specifically charged with research in associated and successive cropping.

3. ICTA has a small zootechnic production team which has done some work in swine production and presently is doing some work on summer silage feeding to dual-purpose cows on the South Coast. Although neither AID nor other donors are providing direct assistance in the program area, we consider the role (both actually and potentially) of large and small ruminants, swine and small animals, to be sufficiently important in the economy and well-being of the small farm family in much of Guatemala that it should receive significantly increased priority in terms of future ICTA programming and in terms of external assistance to ICTA.

Small animals are especially complementary to production of vegetables and, as soil and water conservation and land-use intersification become more important activities to protect the productivity capacity of Guatemalan agriculture, forage production will become more important as an alternative use for lands now rotating from cultivated crops to fallow.

4. The AID project allocated $10,000 annually to be used for contracting materials analysis with INCAP to support the breeding work aimed at improved nutritional quality of new varieties of basic grains. ICTA entered into an arrangement with INCAP whereby they placed three of their own staff in the INCAP laboratory to carry out the analyses. INCAP provides laboratory facilities and supplies. In return, ICTA makes some purchases of lab equipment and materials for INCAP, and makes the results of their analyses available to INCAP for their own purposes.

Although the present arrangement may have had compelling reasons for its initiation in the past, it is our judgment that a more businesslike contractural arrangement should be explored, whereby INCAP carries out the analyses.

ICTA could continue to secund a technician to INCAP if they feel that such a personnel linkages are important to sustain the appropriate relationships between ICTA and INCAP.

According to information we have received, ICTA's monetary contribution to this relationship has been at the level of about $14,000 dollars annually for payment of materials ($4,000) and of personnel working in INCAP are estimated at nearly $10,000. In contrast, the value of the analyses conducted in INCAP are estimated at nearly $40,000. With this disparity in costs and reimbursements between the two agencies, it is difficult to see how this relationship can continue in a stable manner into the future. Nutritional analysis is a critical element of ICTA's variety improvement work and should be based upon a nature and stable institutional relationship unless ICTA is planning to absorb such work into its own functions (a move which we do not endorse).

5. Considering all long-term participants for training outside Guatemala from 1973 to date (including those in training during 1978), about 25 percent in numbers of ICTA's present professional staffing level will have been trained to the MS level or above in the first 6 years of ICTA's existence. If there were no staff turnover, a continuation of this rate would add about 3-4 post-graduate level technicians to ICTA's staff each year. However, even with only a 10% turnover in professional staff each year, only 1-2 post-graduate professionals would be added annually to ICTA staff. With an anticipated professional staff expansion of 10% per year to 1983, and a continuation of the present level of long-range participant training, the post-graduate professional staff would number only about 20% of total professional staff. An acceptable level is considered to be at least 50%. We consider that ICTA will need to send for MS/Ph.D training at least 10 technicians per year in order to achieve a 50% equilibrium of MS/Ph.D's within their professional staff. That rate of training would achieve equilibrium in about 10 years. Unless ICTA is able through improved salary scales, to achieve a turnover rate as low as 10% (it presently is 20-25%) it training rate will have to exceed that suggested above.

We also conclude that ICTA will have to approximately double its rate of short-term specialization training (outside Guatemala) to maintain a fully specialized professional staff (at the Ing. Agronomo level). They also will need to double the number of in-country trainees (annually) to maintain a fully trained sub-professional staff.

6. There is concern in ICTA for improved seed multiplication and distribution. Considerably more work needs to be done in this area. BID has provided a grant to ICTA for equipping a small seed processing plant, and is providing one technician to give technical advice. To date, some work has been done with corn and sorghum seed multiplication and distribution. A National seed plan is in the development stages. This plan is to be based on the concept that ICTA should be responsible for foundation seed development and production, DIGESA should be responsible for licensing and certification, and the private sector should do the multiplication and distribution of certified seed. The Agricultural Public Sector needs to organize a concerted effort to stimulate private sector interest and organization for assuring a continuing supply of improved seed for all important crops.

II. RECOMMENDATIONS

A. USAID should reassess the time horizon established in the present project for assistance to ICTA. This assessment should recognize that institution building is a long-term process. Considering the fact that a full complement of planned expartriate expertise was not on board to work with ICTA until 1976, process towards institutional viability of ICTA has been excellent. However, it is our judgment that for the period from 1979 to 1981, ICTA will require expaneded expatriate assistance, not less, and that a complete phase-out of long-term assistance should not be expected for several years. It is likely that if progress in ICTA's development continues at the present rate, necessary expatriate expertise beyond 1983 could be provided in large part through short-term exchange arrangements, especially from the International Research Centers.

Part of the reason for requiring continued and expanded expatraiat expertise is because ICTA (perhaps correctly) initiated activities on a very narrow base, i.e., essentially limiting its activities to basic grains research. In order to respond to the technology improvement needs for achieving GOG (and USAID goals) of improved output, productivity and incomes of small farmers, ICTA must expand its scope of research as rapidly as possible into (1) associated and successive cropping systems, (2) horticultural and fruits production, (3) large and small animal production, (4) cropping alternatives (potential new crops), (5) farm management and small farm production planning, and (6) techniques of technology transfer to large numbers of small farmers.

In implementing an extended program of assistance based on the reassessment proposed, USAID should seek to complement assistance being proposed by BID, Rockefeller Foundation, and other external donors, as well as services provided by the International Research Centers. The specific recommendations that follow are based upon information now available as to actual and proposed assistance by other external donors.

B. In terms of adjustments in the present technical assistance provided under the AID project to ICTA, we recommend the following1/:

1. Overall Program: Maintain at least the present level of technical assistance to ICTA through the 1981 crop season. If additional funding becomes available, expanded assistance is recommended (see later section).

2. Corn Program: That one of the two positions be extended only through the 1978 crop year, and the other position at least through the 1980 crop year.

1/ These specific recommendations assume that ICTA will reduce significantly the staff turnover problem through salary adjustments, and will expand external participant training.

3. Sorghum Program: That the positions be continued at least through 1980 crop year.

4. Bean Program: That the two positions be continued through the 1979 crop year, after which one position (that of the breeder) be continued at least through the 1981 crop year.

5. Vegetable Program: Continue the present position working with warm climate vegetables through the 1978 crop year, and replace with a cool climate vegetable production specialist (the latter position should be staffed as soon as possible) to continue at least through the 1982 crop season.

6. Technical Director: Terminate position at end of 1978 crop year (to be replaced by a qualified Guatemalan).

C. Although organizational emphasis on the concept of crop specific program teams apears to have been appropriate for the initial years of ICTA development, there are convincing indications of the need to begin giving relatively more emphasis to the formation of a wider range of support discipline (disciplinas de apoyo) teams that can work across commodity lines. Further, as ICTA expands its geographic coverage, it appears that production research team organization might better be based on type of agriculture (e.g., semi-arid, highlands, humid coastal, etc.) in terms of area or regional climatic and soils characteristics, rather than on a particular crop.

Such an organizational focus also would be consistent with the decentralization of technical planning and administration now taking place in ICTA. This is not to suggest that crop research teams be eliminated, but it does suggest that at least some of the pruebas de technologia groups should begin to be up-graded into multi-disciplinary research teams, and that disciplina de apoyo teams might be expanded and strengthened. Crop research teams then would tend to specialize in variety improvement work.

Our recommendation for testing this point of view (which was shared by several of the ICTA staff which we interviewed) would be (1) to create a multi-disciplinary team for research on production alternatives (new crop and livestock alternatives) for the drylands areas of the Oriente. This team would place emphasis on the place of new crop and livestock production alternatives and improved agronomic and cultural practices of present crops, in the farming system related to these alternatives, (2) to create a pest management disciplina de apoyo team that would work with the various production research teams throughout the country, and (3) to create a multi-disciplinary research team to work with associated and successive cropping in the Highlands.

Specifically we recommend immediate assignment of the following specilists who can encumber personnel slots suggested for phase-out in "B" above.

Pest Management Research Program

Open one new position (Entonologist/Pest Management Specialist) as soon as possible (with expected arrival date being the end of 1978 crop season) and provide for later short-term TDY assistance of a plant pathologist, with integrated disease control experience. This position could replace one of the corn technicians, and would supplement the expertise of the new Ph.D Guatemalan entomologist who is to return in 1978.

2. Multi-disciplinary Semi-Arid Regions Production Research Program

Open one new position (Production Agronomist with specialization in semi-arid agriculture) to be staffed by the end of the 1978 crop season and continue at least through 1982. This position could replace the Technical Director's position.

3. Cool-climate Vegetable Production Research Program

As discussed above, the present warm climate vegetable production research/promotion position should be closed out at the end of the 1978 crop season and a cool climate vegetable production research program should be initiated.

D. In addition, we recommend the following new programs that need expatriate expertise (in the priority listed):

1. Associated and Successive Cropping (Highlands) Production Research Team:

One position for a production agronomist with appropriate specialization, beginning in 1979 and continue for at least 4 years.

2. Expanded Farm-Management and Production Planning (socio-economic) Research Program:

One new position (in addition to the present Rockefeller position) to concentrate on farm records and analysis (economics of production and economic policy) of the whole farm/household firm. Position to begin in 1979 and continue for at least 4 years. Under an agreement with CATIE, a ROCAP funded soils specialist is being secunded to ICTA as part of the Central American cropping systems project. The ICTA technical Director does not feel that this obviates the need for the position called for here. We agree.

3. Highland (and Oriente) Fruit (both tree and small fruits) Breeding/Production Research Program:

One pomologist, also with agronomic and cultural practices experience, beginning in 1979 and continue for at least 4 years.

E. Participant Training:

Assure sufficient funding (from all sources) to ICTA to send at least 10 Ing. Agronomos (or equivalent) annually for Masters/Ph.D training in the U.S. AID and ICTA should seek ways in which candidates can receive three or more months of intensive full-time language training either in Guatemala, or in the U.S. under special programs such as those at New Mexico and Boulder, Colorado.

F. Nutritional Analyses:

ICTA and INCAP apparently have not yet evolved a formalized long-term institutional relationship. If this is the case, we recommend that they carry out a special review (perhaps with AID or other outside participation) of their present arrangements with a view to designing the structure and extent of such a long-term institutional relationship.

III. PROJECT HISTORY AND PLAN

The present project was developed with the benefit of the experience gained from, and as a more focused continuation of, assistance provided under a previous project entitled "Agricultural Development (Production)" which began in 1971. 1/ That project had as its objectives, improvement in the capabilities of DIGESA in agricultural extension, and assistance in the establishment of an agricultural research institute responsive to small farmer production technology problems.

The Research Institute, as a legal entity, was created by Guatemalan Law in April, 1973. The final revision of the Agricultural Development Project (in late 1973) provided specifically for assistance to ICTA in the form of four long term technical specialists and short-term expertise in seed production and certification, and plant pathology, as well as other areas to be identified. The long-term specialists were to provide expertise in Grain, Horticulture and Bean production and in research coordination. Highest priority was to be given to assistance in Basic Grains production.

One long-term technician in each of Horticulture and Bean production arrived in Guatemala in July, 1974, and a specialist in sorghum production already working with DIGESA was shifted to work with ICTA in 1973. The research coordinator did not come on board until July, 1975, after the present project PROP was approved.

The present project PROP was submitted by USAID to AID/W in December, 1974, and was approved in April 1975. The three technician positions staffed under the previous project were absorbed under the new project, and the unfilled position also was included. That position was filled in July, 1975.

1 / Project No. 520-11-190-197.1

The present project called for three positions in addition to the four funded under the previous project. The three new positions included two specialists in Corn, one in breeding and one in corn production technology, and a research coordinator with special expertise in "organizational and implementation of multi-crop, integrated research and extension program." The new project also altered somewhat the position description for two of the four on-going positions. The horticulture production technician was described as a specialist in research and extension programs aimed at crop diversification with emphasis on vegetables.

The on-going research coordinator specialist was to play a role similar to the new research coordinator position. Additionally, 12 MM of TDY specialists were included for the life of the project.

The bean specialist who came on board in July 1974 left in December, 1976. Until February, 1977, four positions remained unfilled until the corn production specialist came on-board. Then, in March, a bean pathology specialist arrived, and a bean breeder arrived in June, 1977, as coordinator of the bean research program, apparently filling one of the research coordinator position. In July, 1977, the corn breeder arrived, thereby completing staffing of the new project, (more than two years after the project PROP was approved.)

The new project also provided funds for a contract between ICTA and INCAP for carrying out nutritional analysis on lines and varieties being developed in the research programs. In addition, it called for funds for the purchase of three pick-ups and some other small equipment required in crop research 1/, as well as funds for purchase of library reference materials. Finally, 10 years of graduate training in the U.S. and/or Mexican institutions were included in the project. 2/

IV: PRESENT STAFFING AND ACTIVITIES

Seven technicians now are providing services to ICTA under the AID project. Positions and dates of assuming their duties are:

1. Sorghum Program Coordinator (until 1977, this technician was Regional Research Coordinator for the Oriente	- 1973
2. Horticulture Program Coordinator	- July, 1974
3. Technician Director (until July, 1977 this technician was Regional Research Coordinator for the Coast)	- July, 1975
~~4. Corn Program Geneticist~~	- Feb., 1977
5. Bean Program Pathologist	- March, 1977
6. Bean Program Coordinator	- June, 1977
~~7. Senior Corn Specialist~~	- July, 1977

1/ A list of equipment actually purchased is shown in Table III-A
2/ Training actually accomplished is shown in Table III-B

These are all line positions, i.e., none are advisory. In each case, these technicians have played a major role in program design and execution. In the case of sorghum, corn, and beans, emphasis is on screening and testing of imported and native varieties, and breeding activities designed to develop superior varieties in terms of yield, nutritional value, and other characteristics considered necessary for improvement of small farmer output productivity and incomes. Although some work has been done, and is continuing, on improved agronomic and cultural practices, this appears to have second priority both in terms of emphasis by AID funded technicians and by ICTA as a whole.

V. PLACE OF AID PROJECT IN ICTA PROGRAMS

ICTA efforts are oriented principally toward increasing the productivity and incomes of small and medium farmers.

The responsibility for generating and promoting the utilization of technology at the farm level lies with the technical unit of ICTA. A part of this unit is organized by programs along commodity lines, with major emphasis on basic grains. There are individual programs for corn, beans, wheat, grain sorghum, rice, warm climate vegetables and animal production (pork and dual purpose bovines).

For each of these commodity programs, a research team has been formed which is responsibile for research planning and implementation for that commodity. These teams work across regions and operate through eight experiment stations located in five of the eight agricultural regions of the country.

Within each experiment station (called Centros de Produccion), there are one or more Technology Validation teams (Prueba de Technologia) that execute experimental trials on the stations, as well as on plots of land of farmers (Ensoyos de Finca). In addition, they provide advice to farmers who cooperate in farmers tests (parcelas de Prueb) designed to validate technology generated in experimental trials. These Technology Validation teams work in specific geographic areas, but work with experiments and tests for all crops being researched in that geographic area. These teams are not separate research groups, but rather, they execute the research activities agreed upon by the various Crop Research teams and the Director of Experiment Station serving that particular geographic area. The Technology Validation teams are under the administrative control of the Experiment Station Director for the region in which they are located, but collaborate closely with, and are under the technical guidance of the Coordinator of the Crop Research team and his staff for the experiments and tests for that crop. There presently are eight Technology Validation teams attached to the various research stations.

In addition, ICTA has organized five "Support Discipline" teams (Disciplina de Apoyo) that work across crop lines and across regions. These teams provide in-depth expertise in their particular discipline in support of the various crop (and animal) research programs, as well as carrying out their own research activities where such work does not conveniently fit into a particular Crop Research program. These five support discipline teams are:

1. rural socio-economics
2. soils management
3. training
4. communications
5. registered seed production

To the extent which these teams have their own experiments, studies and tests, they operate through the regional staffs attached to experiment stations, and utilize the same system of station experiments, farm experiments and farmer tests.

At the central office level, centralized services of management and programming, budgeting, experiment stations coordination and technical program management are provided. These services recently are being decentralized to the regional levels, under the administration of a Regional Director, who also is the Director of the experiment stations in his region.

AID technical assistance is being provided directly to four of the major crop research programs (corn, sorghum, beans, and horticulture) and, through these programs, to the experiment stations and Technology Validation teams.

All AID funded technicians are in line positions (not advisory) in ICTA. In beans, sorghum and horticulture, an AID funded technician is the Coordinator of each of these crop research programs. Another AID funded technician is in charge of pathology work in the bean research program. Two AID funded technicians are assigned to the corn research program as the senior specialist and the program geneticist. The seventh AID funded technician is the Technical Director (Director of the Technical Unit) of ICTA.

The four crop research programs for which AID funded technical assistance is being provided are the major research programs in ICTA. That assistance is critical to the technical progress of these programs. In addition, as Technical Director, the other AID funded technician is playing a key role in research funding allocations, research organization, technical staff deployment and research priorities and scope for all ICTA research activities. These inputs are key elements, and are so recognized by ICTA, for the institutional development of ICTA.

In addition, AID funds are financing nutritional analysis of seed lines, selections and improved varieties being developed in the crop research programs. Since a major objective of variety improvement research in ICTA is to maintain and improve nutritional levels and quality as yield potentials are increased, this funding serves as a critical input to a core element of ICTA's research objectrives.

Seventeen out of twenty-nine ICTA professional staff sent for MSCI/PHD training outside Guatemala since 1973 have been financed with AID funds. Thus, nearly 2/3 of all advanced long-term training for ICTA staff relies on AID funds. Since the long-run viability of ICTA, as a major component of the Public Agriculture Sector (SPA) concentrating on imporvement of small farmer output, productivity and income, depends to a large degree on developing and maintaining a well-trained technical research staff, this AID inpuit serves a major purpose in achieving GOG-agricultural development goals.

VI. RELATIONSHIP OF AID PROJECT TO OTHER ASSISTANCE

Developmental assistance programs of several other agencies and foundations are related directly or indirectly to the assistance provided by AID in support of ICTA's crop production programs. Among the agencies which impact closely with the program are: the International Agricultural Research Centers, Rockefeller Foundation, Interamerican Development Bank and ROCAP.

A. International Agricultural Research Centers:

Four International Research centers are involved to varying degrees in crop production programs and contracts funded by AID. Two of these, ICRISAT and CIP, have only peripheral influence, while CIAT and CIMMYT are directly involved in contracts with ICTA, and provide AID-funded personnel to staff ICTA's programs in corn and beans. While the CIP and ICRISAT inputs are at present marginal, they may be expected to play a greater role, if and when ICTA expands its potato production program, and as the sorghum production program develops greater maturity and research diversity.

The relationships with CIAT and CIMMYT are more directly of influence to ICTA programs becaust of the AID funded contracts for four technicians, and in the direct provision of short-term backstopping expertise. The assistance through these two centers is summarized below:

CIMMYT: The International Center for Improvement of Corn and Wheat (CIMMYT) provides leadership to ICTA's corn improvement program through a contract with ICTA funded by AID. CIMMYT has provided two well-trained and experienced specialists to this program, as well as backstopping to assure adequate provision of CIMMYT's materials and breeding lines. The AID funded contract can and does bring to bear CIMMYT's extensive experience and leadership to the Guatemala Project as needed.

CIAT: The Center for Tropical Agricultural (CIAT), like CIMMYT, has a direct relationship to ICTA's program, providing leadership to the Bean Improvement Project through an AID funded contractural relationship. As with the CIMMYT team, high quality expertise is being provided by CIAT. With a bean breeder, and a plant pathologist versed in disease resistance techniques, ICTA is in a position to derive maximum benefit from facilities available through the International Center.

In summary, the decision by AID and ICTA to solicit and fund a direct relationship with these two international centers has resulted in access to a far greater level of relevant experience and expertise than might otherwise have been available to the projects. At the same time, it should be mentioned that CIAT and CIMMYT are among the more mature of the Internationa Centers and, in this regard, should be expected to be in a position to provide such services. As ICTA's programs develop and the other centers gain experience, greater collaboration can be expected with other international centers.

Without the AID funded technical assistance and participant training, ICTA would not have the technical capability for the type of mutually suppor tive inter-action being realized between ICTA and the International Centers.

B. Rockefeller Foundation

The Rockefeller Foundation has provided professional staff to ICTA since its creation in 1973, to assist Guatemalan management in planning, developing and implementing a viable and functional organizationsl structure and in planning and implementing an effective experiment station network.

Professional management experts have been provided through CIAT with Rockefeller Foundation funds:

1. Technical Director (3/73 to 1976)
2. Adjunct Director as a staff advisor to the General Manager (3/73 to present)
3. General Director of Experiment Station (10/74 to present)
4. In addition, and under the same contractual arrangement, Rockefeller Foundation has provided an agricultural economist as the coordinator of the Socio-Economic "support discipline" team from October, 1974 to the present.

This Rockefeller assistance has provided critical management support, (and in the case of socio-economic research, technical support) to ICTA during this formative stage. This has contributed greatly to the ability of ICTA to effectively utilize the technical expertise funded by AID. By the same token, AID funded technical expertise has provided an essential input for ICTA that permitted progress in organizational and institutional development, thereby giving substance to the Rockefeller input.

C. Interamerican Development Bank (BID)

To date, BID assistance to ICTA has been limited to grant funding of 1) equipment and technical assistance for strengthening the ICTA registered seed multiplication program, and 2) logistical and staff costs related to in-service training activities for new ICTA staff. These have been important contributions in terms of overall ICTA program balance and should serve to make AID funded inputs more effective.

BID is presently providing Guatemalan technical assistance to ICTA in the development of a long-run plan for experiment station development and research program expansion. It is expected this may lead to BID loan funding for physical facilities and equipment components of the plan, and perhaps for some technical consultant assistance. AID funded technical assistance to date has contributed substantially to the institutional development of ICTA to the point where it now is in a position to make effective use of such expanded capital development resources.

D. ROCAP

Under an agreement between CATIE and ICTA, a ROCAP-funded soils specialist recently has been assigned to work with ICTA in cropping systems research. Although this expertise will cover only one part of expatriate expertise needed by ICTA to expand research in Highlands associated and successive cropping, it will serve as an important complement to possible future expatriate expertise in production agronomy and cultural practices.

VII. REVIEW OF PROJECT PROGRESS AND PRESENT STATUS

A review of project implementation shows that three out of seven of the technical positions provided for were delayed two years before they were filled. This has resulted in slower project progress than was anticipated in the PROP. Nevertheless, the positions were staffed with exceptionally capable technicians, which should result in superior progress in the future. Our observations of progress and present status of each activity (or ICTA program) receiving AID assistance are summarized below.

A. SUMMARY OF OBSERVATIONS ON AID INPUT TO ICTA's CORN PROGRAM

In our view, excellent progress has been made by the AID funded CIMMYT technicians in the relatively short time they have been at work (two seasons). They appear to have complementary personalities and expertise, and work well together. Their approach to the problem of improving the quality and yield of corn in the Highlands, as well as on the Coast, is realistic and reflects a program perspective compatible with AID's mandate and interests. We felt the scientific competence and level of effort of both technicians was excellent.

1. Research on the Coast

The research in corn production improvement on the coast emphasizes a rapid integration of improved genotypic characteristics through the development of partial hybrids between improved families of lines developed primarily at CIMMYT. This innovative approach allows relatively rapid production and dissemination of improved germplasm combined with a reasonable level of heterosis resulting from crosses of sibling and half-sibling family lines. First year data provided appears to substantiate the validity of the approach. Having had the advantage of only, two growing seasons to date in which to conceptualize and implement a plan of action in Guatemala, we anticipate continue improvement and progress in developing the research program.

Aside from genetic improvement of corn, there are two major constraints to improvement of corn production in the coastal areas. The most significant of these constraints is severe insect infestations and damage which occurs at nearly every stage of growth of the plant. Seed maggots, fall army worm, Diatria, Spodoptera and Heliothis are troblesome. The control of these pests is adversely compounded by the fact that insecticide applications to cotton, which also is grown in the vicinity, are heavy and occur throughout the growing season. As many as 60 insecticide applications are reportedly made on cotton during the growing season. This has probably resulted in insecticide resistance in the local insect populations thereby reducing the effectiveness of insect control of corn by insecticides. So was reported that the cost of insecticides required to obtain adequate control of corn insects approached $60 per hectare.

Because of ther high cost of control and the great potential for reducing yields of corn, we feel that efforts should be made at once to study the feasibility of reducing cost of production through proOper application of integrated pest management procedures.

Al La Maquina another major obstacle in the path of significantly increasing yield of corn is the lack of response of corn to fertilization. Because of this lack of response, present ICTA recommendations for corn in the area do not include fertilization. The cause, whether it is a soil component which blocks uptake of fertilizer in the plant or on entirely different reason, is not presently known. We believe that until this problem is seriously addressed, the full potential of improved corn varieties at La Maquina and vicinity cannot be reached. Lack of fertilizer response in other areas is not as severe as in La Maquina but is often inconsistent or lower than expected.

2. Research in the Highlands

Research on improving yield and quality of corn in the Highlands differs significantly from that under way on the Coast. Here, corn of the indigenous varieties cultivated by the inhabitants of the region for hundreds of years, has yielded over 150 bushels per acre intrials. Planting of so-called "improved" varieties from CIMMYT cannot approach this level of yield in most micro-climates.

Major emphasis on varietal improvement in the highlands is placed upon the selection of improved lines from among the native varieties. Although criollo (native) varieties are fitted to a large number of micro-climates peculiar to the Highlands, variability is high not only between but within micro-climates. This is believed to result from the fact that the farmers plant different types of corn in close proximity for use in special religious and cultural activities. This variability should provide the means to select improved lines of criollo corn. Selection and improvement will be slower here than on the Coast because of the unusually long growing season. Since corn in the highlands requires 9-10 months to mature, only one generation per year of selection and evaluation can be conducted.

While selection of improved types holds promise in the highlands, other improvements in yield and efficiency of production may provide significant progress. It appears to us that more intensive research in improving agronomic and cultural practices, especially work on plant populations, more efficient utilization of land area and careful adjustment of associated cropping practices, can be expected to produce significant pay offs.

B. SUMMARY OF OBSERVATIONS ON AID INPUT TO ICTA's SORGHUM PROGRAM

AID SUPPORT TO ICTA's sorghum program has been in progress only since late 1977 when the regional research coordinator for the Orient assumed the duties of Coordinator of the Sorghum Production research Program under provisions of an amendment of ICTA's contract with Texas A&M University.

The sorghum production program concentrates most heavily on development of sorghum varieties and hybrids for human consumption of high yield, nutritional quality, disease and insect resistance, and consumer acceptance.

Much progress is evident in the sorghum program even in the short period since AID funded TA has been available, the Guatemalan climate is unique in providing an opportunity of growing up to four generations per year. This enables rapid selection and evaluation of sorghum lines and development of improved varieties within a two-year period.

Backstopping by the contractor (TA&MU) has been very good, in the proving of genetic materials. Of particular interest are high lysine lines derived from Texas and Ethiopian sorghum crosses. Varieties now being developed will contain two high protein mutants designated as P721 and SC 1030-5, both identified at Purdue University.

Resistance to anthracnose also is required for sorghum varieties released in Guatemala and the improvement program is introducing genetic material conferring this resistance to sorghum for local production. Greatest effort however, is being expended in improving productivity and yield.

All local sorghum varieties are photo-period sensitive and, regardless of when planted, normally bloom in th region on about November 15th which is too near the dry season to permit full maturity without severe drought stress. The new varieties being developed from Texas and Ethiopian crosses are photoinsensitive and normally bloom about 60 days after planting. With the capability of eliminating phot-period sensitivity, a significant breakthrough should be possible in providing improved quality and yield of sorghum under Guatemala rainfall conditions in semi-arid areas.

In screening local photo-period sensitive sorghum varieties this season, the researchers found four heads which bloomed on October 15, almost a month earlier than others in the area. These may form the basis for a step forward in shortening the growing season for photo-period sensitive criollo varieties.

Major constraints in the sorghum improvement program in order of priority or severity are (1) inadequate salary scales to retain competent technicians (mentioned elsewhere in this report), (2) damage caused by sorghum Midge, (3) weathering of the grain, (4) plant disease (particularly anthracnose) and (5) photo-periodicity problems in the Oriente.

Yield trial results to date are convincing evidence of the progress already made and of the high potential for further improvement of grain quality and yield in this program.

C. SUMMARY OF OBSERVATIONS ON AID INPUT TO ICTA's BEAN PROGRAM

A bean breeder and a bean pathologist are provided to ICTA by CIAT through AID funding. We conclude that both technicians are well trained and experienced in their respective disciplines and have a firm grasp of research objectives.

The ability of the technicians to draw upon the contractor's services and facilities appear to be an important asset to the research. Both men are familiar with CIAT's operations and depth of technical expertise, and we saw evidence of their capacity to extract materials and other assistance from CIAT's backstopping facilities.

It is important to note that both scientists have been in the Guatemalan bean program for less than one year. The Breeder began work under contract only in June of 1977 and the pathologist in March of 1977.

Research is based primarily on the improvement of bean yields through a plant breeding and selection process. Because of the incidence of a number of bean diseases, careful attention is being given to the incorporation of disease resistance in improved bean varieties.

In the Oriente, emphasis is on production potential of bush bean varieties grown alone. Here the emphasis is on selection and development of high yielding bush-type beans carrying disease resistance. However, the bean research team also sees a potential role for pole beans in some Oriente associated-cropping situations, and will be testing that alternative.

In the highlands, emphasis is oriented toward increasing the yield and quality (including disease resistance) of pole-type beans; at the same time, however, work continues in the highlands to utilize bush beans where their characteristics are complementary to the farming system.

The extended growing period for beans in the highlands makes the growing of pole beans (which have an indeterminate growth habit) much more productive in terms of yield. Comparatively, pole type beans will produce more than twice the yield of bush types under highlands.

Associated systems of corn and bean production can be both an asset and a liability in terms of increasingh yields of beans in the highlands. First, bean production is, for the farmer, very much of secondary importance compared with corn. Also, pole bean populations in traditional practice are limited to a ratio of the corn population. Nevertheless, some data has shown that in the absence of accompanying bean plantings, the yield of corn may be reduced as much as 10%. Significant progress may be made in modifying cultural and agronomic practices which will allow greater relative emphasis in bean production, while at the same time maintaining or improving corn yields.

D. SUMMARY OF OBSERVATIONS ON AID INPUT TO ICTA"S HORTICULTURE PROGRAM

AID funded assistance to ICTA for improving production and yield of horticultural crops is heavily structured toward the export marketing of warm climate vegetables. Concentrated effort is in the Zacapa area but with limited work in cool climate vegetables such as the cole crops, potatoes and garlic in the highlands. Excellent progress has been made in selection of commercial warm climate vegetable varieties adapted to the Zacapa area, and production techniques are being fine tuned to the requirements of the export market. Emphasis has been on melons, onions and tomatoes, with some work on green peppers. Progress also has been made in the practical training of ICTA personnel in the application of these techniques. We observed semi-commercial plantings of melons (cantaloupe, honeydew types and watermelons), tomatoes, green peppers, and onions at the station in El Oasis, and experimental trial plantings of brussel sprouts, broccoli and cauliflower in San Jeronimo. We also visited several cooperating farmer's fields.

The area surrounding the El Oasis station appears studded with commercial vegetable crop plantations, and although we did not visit these plantations, the intensive plantings seemed to be of high quality and thrift, indicating professional production management.

In terms of training, one Ing. Agronomo sent to Monterrey for Master's training returned without completing his studies. It is planned to send another in 1978.

The Horticulture Program has received good backstopping from the contractor, Texas A&M, in terms of provision of materials, especially in high temperature set tomato lines. Backstopping from the International Vegetable Center has been minimal. However, backstop assistance from the International potato center (CIP) is growing, and has prospects of being substantial if the Horticulture program begins to give more emphasis to Highland potato production. There is now a cooperation agreement between ICTA and CIP, and a Guatemalan technician is scheduled to go to CIP for short-term training in seed and potato storage.

E. SUMMARY OF OBSERVATIONS ON PROGRESS AND PRESENT STATUS FOR OTHER AID INPUTS

1. Research Coordinator/Technical Director

One technical position was originally staffed as a regional research coordinator in July, 1975. In mid-1977, the techinician in this position was made acting Technical Director by ICTA and at the end of 1977, this was formalized by contract amendment, and the technician was made Technical Director of ICTA. His period of tenure has been a critical period in that ICTA, with BID technical assistance (GUATEMALAN), has been designing a long-term institutional development plan. The AID-funded technician, as Technical Director, has been able to play a critical role in this planning process. It is our observation that he has performed in an outstanding manner and has gained the confidence of ICTA general management and the field staff during this period. However, we feel that when this process is completed and the plan accepted, AID-funding of this position should terminate and ICTA should fill the position with a GOG-funded professional.

2. Commodities

Funds were provided for equipment purchases including vehicles and equipment for research field work. The purchases were made and the equipment appears to be effectively utilized. Table III-A shows the purchases made to date.

3. Nutritional Analysis

Funds were provided for contracting with INCAP to do nutritional analysis of lines, selections and varieties in the various crop breeding activities. ICTA chose to use the funds to pay for personnel which they stationed in INCAP laboratory facilities to carry out the relevant analysis, and to cover some of the operating expenses of such analysis. Although this arrangement appears to have functioned adequately to date, we feel that ICTA should re-examine its existing relationship with INCAP to determine if the existing arrangement, or some alternative arrangement, best suits the long-run stability of nutritional analysis as critical components of the various crop breeding programs.

4. Participant Training

The RPOP estimated a total of ten man years of participant training outside Guatemala for the life-of-project. According to information supplied by ICTA, seventeen participants had been (or were being) sent for training with AID funds from 1973 through 1978. We feel that this increase in training over the PROP estimate was well advised. We estimate that, given the present rate of staff turnover and staff expansion, and assuming the 50% of ICTA professional staff eventually should be trained to the MSCI/PHD level to reach an appropriate technical equilibrium, ICTA will need to send at least ten professionals per year for MSCI/PHD training to achieve that technical equilibrium within 10 years. It would appear reasonable for AID to fund at least 50% of these over the next several years.

VIII. CONTRACTUAL RELATIONSHIPS WITH ICTA FOR PROVIDING AID-FUNDED TECHNICIANS

AID-funded technicians are provided to ICTA through direct ICTA contracts with four different institutions. A review of these contracts suggests that three of the four (Texas A&M, CIMMYT and CIAT) contracts are well-placed in terms of their backstopping capability in providing both breeding materials and short-term technical expertise. The other contract (with Servicios Tecnicos del Caribe) appears to be a contract of convenience. The essential details of the evaluation of these contracts and the job responsibilities of the technicians provided thereunder are briefly described below.

A. CONTRACTUAL RELATIONSHIP BETWEEN ICTA AND CIAT

1. Contract History and Scope

AID funding was provided to ICTA to secure the professional services of bean pathology and production specialists. Initially ICTA contracted for the services of a pathologist/Bean Production Specialist with Mississippi State University in 1974. This person resigned in December, 1976. In February of 1977, a new contract was signed between ICTA and CIAT under which CIAT provided the Pathologist/Bean Production specialist. This contract was amended in June of 1977 to add an Agronomist/Bean Production specialist to serve for the 11 months remaining in the present contract or until April 30, 1978. Both positions were filled in the first semester of 1977.

2. Plan of Work

The plan of work of the Bean Production/Pathology Specialist is to identify and select indigenous bean varieties exhibiting qualities of resistance or high tolerance to plant disease and to work closely with plant breeders to incorporate this resistance or tolerance in varieties which may be released to farmers. Also, he will evaluate and utilize all available plant breeding materials including those developed by CIAT, and maintain close contact with other scientists conducting similar work throughout the world.

He will assist ICTA to develop high yielding varieties resistant to plant disease, desired by the consumer and readily accepted for production by the farmer in terms of growth, production and harvesting. Varieties to be developed must also be synchronized with local production cycles to facilitate cultivation within the farmers' cropping system.

While the plan of work of the Agronomist/Bean Production specialist stated in the contract is nearly identical to that of the Pathologist, it does suggest a broader range of activities. In addition to the activities described for the Pathologist above, the Agronomist is charged with gaining a comprehensive knowledge of bean production in Guatemala, particularly in the different phases of industrial development of the crop. Presently, the incumbent of this position is designated by ICTA as Coordinator of the Bean Program. This leadership role is only implied in the ICTA/CIAT contract.

B. CONTRACTUAL RELATIONSHIP BETWEEN ICTA AND CIMMYT

1. Contract History and Scope

From funds provided by AID, a contractual agreement between ICTA and CIMMYT was signed in May of 1976. CIMMYT agreed to provide the services of two corn breeders to assist in ICTA's corn production program. CIMMYT also agreed to provide ICTA access to its consulting services, training capabilities, breeding materials and on-site backstopping. The contract was amended in November 1977 to extend the life of the arrangement through April of 1978. The positions were filled in February and July, 1977.

2. Plan of Work

The plan of work outlines the responsibilities of the two professionals and describes their role in the ICTA corn production program. The specialist are assigned responsibility for introducing improved characteristics to native varieties of adaptability, yield capacity, nutritional quality and other desirable characteristics. This work is carried out in the Highlands, as well as on the South Coast. Parallel with the above and in cooperation with INCAP, the corn breeding program is charged with incorporating the opaque-2 characteristics to some or all varieties or hybrids developed under the program. In addition, the corn breeding production specialists collaborate with the ICTA program to produce basic seed from new materials generated in the breeding program. Training ICTA personnel in the skills and techniques required for corn improvement is an integral part of the program.

C. CONTRACTUAL ARRANGEMENT BETWEEN ICTA AND TEXAS A&M UNIVERSITY

1. Contract History and Scope

Under an earlier AID funded contract, Texas A&M University (TA&MU) assisted ICTA in formulating both short and long-term plans for institutional and agriculture research development. The present contract dated July 1, 1976 calls for

provision by TAMU of three specialists in the fields of Horticultural Crop Production Research, Basic Crops Research and Plant Pathology Research on Beans. Termination date of the contract is June 30, 1979. Since the initial contract in 1976, three amendements have been ratified. They first fulfilled the requirements in the original of showing satisfactory evidence of progress and authorized continuation of the contract to June 30, 1977. There was also mutual agreement to change the role of the basic crops research specialist from coordinator of the basic grains programs to Coordinator of the Sorghum Production Program. The second amendment, dated May 25, 1977 eliminated the services of the Bean Production Specialist and indicated ICTA's intention to secure this specialist from other sources. The third amendment effective July 1, 1977, on the basis of satisfactory progress, extended the terms of the original contract through April 30, 1978.

2. Plan of Work

At present the plan of work for the Basic Crop production specialist and the Horticultural Specialist are as follows:

A. Crop Production Specialist

Serves as coordinator of the Grain Sorghum program to develop, conduct and implement research to select improved sorghum varieties and design improved cultural practices. Particular attention will be devoted to maturity dates, high yields, insect and disease resistance, associated crops, food and nutritional quality and farmer acceptance. He is expected to provide his knowledge of experimental design and statistivcal analyses to ICTA programs especially in Region VI, serve as advisor and lecturer in ICTA's in-house training programs and consult with the Technical Director of ICTA regarding the annual plan of work.

B. Horticultural Production Specialist

Charged with the development of production, criteria for horticultural crops such as garlic, onions, melons, tomatoes, cucumbers, etc. Emphasis is on varietal selection, improved cultural practices and harvesting procedures which can be most effectively utilized by the small and medium sized farmers. Production is aimed at the local as well as the export market for fresh and processed vegetable crops.

The specialist is to conduct production oriented research on the above crops and provide professional guidance and direction to counterpart horticultural production research technicians. He also is required to assist in development of a system for the maintenance of horticultural crop seed stocks.

D. CONTRACTUAL RELATIONSHIP BETWEEN ICTA AND SERVICIOS TECNICOS DEL CARIBE

1. Contract History and Scope

AID provided funds to support a contract between ICTA and Servicios Tecnicos del Caribe beginning July 1, 1974. Servivios Tecnicos provided the services of a technician to serve as Production Agronomist/Coordinator of Research Teams. In this role, the technician directed the activities of ICTA's programs in the areas of La Maquina and Nueva Concepcion and the Technology Testing Program of Region IV.

By contract amendments in July 1975, January 1976, January 1977, and March 1977, the technician's length of service was extended to April 30, 1978.

A recent amendment dated January 2, 1978 expands the role of this technician in ICTA, and designates him to assume the duties of Director of the Technical Unit of ICTA under the direct supervision of the Gerente General.

2. Plan of Work

The current plan of work, outlining the duties of the Technicial Director is summarized below:

A. He directs the technical-scientific and administrative activities of the research programs in corn, beans, rice, sorghum, wheat, vegetables and swine. He similarly directs the activities of the support disciplines of socio-economics, soil and water management, communication, seed production, validation of technology programs, etc.

B. He directs the preparation of the operative plans of the programs and disciplines, and directs and approves preparation of the budgets of these programs.

C. The preparation and approval of the final report of the Institute's technical programs and disciplines for presentation to the General Manager are also under his direct supervision.

IX. PROJECT ACCOMPLISHMENTS COMPARED TO PLANNED PROGRESS

Table IX - A compares the planned schedule of inputs and outputs under the AID project with the actual accomplishments for the period 1975 -1978.

In general, inputs were delivered in accord with planned goals, except that there were delays of more than two years in staffing of corn breeders and there was an interim periodof four months when the bean program coordinator positions have been changed since the original project plan, to eliminate the regional research coordinators and add a bean specialist, a sorghum specialist and a technical Director (position originally funded by Rockefeller). Further,

the anticipated IDB seed program loan has been delayed, but is planned to be included as a part of a comprehensive financing plan for general facilities and equipment up-grading and expansion at all ICTA Experiment stations.

In terms of outputs, initial seed production and improved plantings generally exceeded planned outputs, but fell considerably behind plans for 1977. This is due to the unrealistic projections for expansion included in the project plan. Field experiments and tests for improved corn varieties in the highlands for exceeded those planned.