AGRICULTURAL RESEARCH PROJECT 621-11-110-107
EVALUATION

By

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May 1976

CONCLUSIONS AND RECOMMENDATIONS

ACRONYMS

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Agricultural Research Project 621-11-110-107 Evaluation

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The evaluators discuss their scope of work and methodology and review: (1) the research strategy, methods, inputs and outputs; (2) the research program, manpower resources and development and administration; and (3) the sector goal and project purpose. After considerable delay the project was started up in 1973, short of programmed inputs but with a scientifically sound approach. Due to the astuteness and good fortune of the scientists the project has produced highly significant outputs in its first two years' operation. The project is progressing well in spite of the fact that the project staff provided for in the basic Project Agreement is 80 percent complete. Recommendations include: (1) draft a statement of goals and objectives of the agricultural research service; (2) devise a system of planning, budgeting and implementation that harmonizes with national crop development purposes, inputs and procedures and those of the regional research institutes; (3) place more emphasis on the development of manpower for the research program; (4) place more emphasis on informal, on-the-job training of research colleagues; (5) continue the development of high lysine maize and short-season maize; and (6) include sorghum and millet research in the project.

CONCLUSIONS

After considerable delay the project was started up in 1973, short of programmed inputs but with a scientifically sound approach. Due to the astuteness and good fortune of the scientists the project has produced highly significant outputs in its first two years' operation. The project is progressing well in spite of the fact that the project staff provided for in the basic Project Agreement is 80 percent complete.

RECOMMENDATIONS

1. Draft a statement of goals and objectives of the agricultural research service to be used as focal points in planning.

2. Devise a system of planning, budgeting and implementation that harmonizes with the national crop development purposes, inputs and procedures and those of the regional research institutes.

3. Place more emphasis on the development of manpower for the research program.

4. Place more emphasis on informal, on-the-job training of research colleagues.

5. Assume the responsibility for training extension trainers in the use of project outputs and provide the inputs, including an extension training specialist, to do it.

6. Upgrade and integrate the research support services at the Illonga Station.

7. Continue the development of high lysine maize.

8. Continue the development of short-season maize as a partial response to the needs of farmers in areas of limited rainfall.

9. Include sorghum and millet research to the project, staffing the activity with either an agronomist or a plant breeder-agronomist at first and adding the services of an entomologist when the need becomes evident.

10. Add the services of an agricultural economist (production) to provide economic analysis of the programs and outputs of the project.

RESEARCH PROJECT EVALUATION TEAM

SCOPE OF WORK

A. GENERAL OBJECTIVES.

Reassess the project goal and purpose to determine their continued validity in light of the present economic circumstances and the agriculture production situation within Tanzania. This assessment should include an examination of the relationship of this project and other USAID, other donor, or Tanzanian undertakings to determine the extent to which this project reinforces, duplicates, or is coordinated with other efforts and is consistent with overall Tanzania sector objectives. This review should also include an examination of constraints to project development and interrelationships with other organizations necessary to successful comprehensive project development.

Validate the design and structure of the project as formulated in the revised Project Paper (No. 4) currently in AID/W (approval is to await the conclusion of the evaluation), with respect to the internal consistency, adequacy of resources in relation to requirements, and effectiveness of project in reaching the objectives at the output, purpose and goal levels.

Evaluate performance individually of major project agents, i.e., contractors, TanGov, and USAID, and analyze effectiveness of each in moving toward expected results for these project components.

ACRONYMS

ARI	Agricultural Research and Training Institute. ARIs at Ilonga, Ukiriguru, Lyamungo, Mlingano, Mbeya (now redesignated The Ujole Agricultural Centre), Mtwara and Tumbi.
CIMMYT	International Maize and Wheat Improvement Center.
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics.
PP	Project Paper, an AID project proposal document, 1975 to the present.
PROP	Non-Capital Project Paper, an AID project proposal, 1968-74.
REDSO	Regional Economic Development Service Organization.
OPEX	Operational Executive. A United Nations term for the subvention of personnel to a recipient government.
INSOY	International Soybean Program, University of Illinois, Urbana, Illinois.
NARS	National Agricultural Research System.
EAAFRO	East African Agriculture Research Organization.
INSOY	International Soybean Program, University of Illinois, Urbana, Illinois.

B. SPECIFIC TASKS OF TEAM.

1. Examine and comment on all aspects of research operations, including:

a. Maize breeding and agronomic programs,

b. Legume breeding and agronomic programs, and

c. Extension (field trials) efforts and effectiveness this activity.

d. Systems for dissemination research results to extension workers/farmers.

2. Examine and comment on the overall agriculture research manpower requirements and the impact the USAID participant training program is having on these needs. Should the participate program be implemented through the contract or handled through the Mission? Should it be expanded?

3. Review the need for research planning and coordination in Tanzania and comment on what the project should be doing in this regard. Is an overall plan required? Role of project personnel in this?

4. Review the system of research administration.

5. Examine the physical research facilities, equipment, and the land at the Ilonga, Dodoma, Ukiriguru and othe Research Stations that U.S.

technicians may be affiliated with. Comment on their condition, and their use by the contract team. What additional equipment is needed?

6. Examine and comment on the contractor's and TanGov's capability and capacity to expand into research for additional food crops such as sorghum, with a recommendation of what institution would be suitable to carry on this component of the project.

7. Examine and comment on the financial and administrative project support by contractor, TanGov and USAID, include TanGov's financing plans for next Five Year Plan.

8. Review and comment on project coordination with other donors and with other USAID projects.

9. Prepare an updated PAR (review FY 1975 PAR dated February 21, 1975).

10. Prepare a revised logical framework matrix (using log frame of PP Revision No. 4 as basis) reflecting any changes recommended.

C. 1. Areas of competence for team members include a plant breeder, agronomist, an experienced research administrator, and a Team Leader fully familiar with AID evaluation procedures. Also one senior officer from the Research Division of the Ministry of Agriculture whose expenses will be paid by USAID.

2. For more complete review of Research Station operations and village research trials efforts (due timing of growing season) the optimum dates for evaluation are changed from February to period between March 15 and April 15; however we believe only two weeks required for evaluation and an additional three or four days in Dar es Salaam to prepare a draft report.

Method, Procedure.

A. Method.

The AID Logical Framework (Logframe) method was used. This approach assumes that the Logframe method was used in designing the project. Where it is not the case, as with this project, a Logframe matrix or summary is extracted from the basic project document (Project Paper - PROP or PP).

The Logframe design method begins by identifying and addressing a national sector goal to be reached over a certain period. The next step is to identify one or more sets of conditions which are essential for the achievement of the goal. One set of conditions is singled out and addressed as the purpose for a specific project. It is assumed initially through analysis, then planned that the outputs of the project will result in the achievement of its purpose, given certain assumptions. Finally, with the identification of the project's outputs, the inputs necessary to produce those outputs are prescribed.

In the evaluation process, it is asked, To what extent and how well did the planned inputs yield the planned outputs, to what extent did the outputs contribute to the purpose of the project, and to what extent did the project purpose contribute to the national sector goal?

The intended means of judging progress toward the achievement of outputs, purpose and goal is the observation or review of verifiable indicators.

The professional authoritarian approach was taken. The means of validation of judgment was that two involved persons with opposing views agreed on the state of existence of the item in question.

B. Procedure.

1. Review of project documents.

Each team member was provided a complete set of project documents from the Fiscal Year 1971 PROP to the Fiscal Year (FY) 1977 Project Paper revision proposal at least a month in advance.

2. Issues paper.

Upon arrival in Dar es Salaam the team was given a list of special issues concerning current and future implementation of the project. These issues were assigned to the team members according to their respective areas of special expertise.

3. Extraction of the Logframe.

A Logframe summary of the FY 1971 PROP was extracted for use as the point of departure in the narrative evaluation.

4. Briefings.

In Washington the team was briefed by the AID Evaluation Division and the Office of East and South African Affairs. At the Mission they were briefed by the Director, Assistant Director, Program Officer, Food and Agricultural Officer, Project Officer and the EAAFRO Research Project Officer. They were briefed by the Ministry of Agriculture Director of Crop Production Division and Coordinator of Crops Research. They were also briefed by the Deputy Director of the National Maize Production Project.

5. Field review.

Field program, procedures, inputs and outputs were reviewed at Ilonga, Iringa, Mbeya, Njombe, Mwanza and Ukiriguru. This included inspections of the operations of the Msimba Seed Farm and the Tanganyika Wattle Company Seed Farm with special concern for purpose: goal linkages. At the same time, a special inquiry was made of the linkages and/or common interests in this project with the National Faculty of Agriculture, EAAFRO, IITA and CIMMYT.

6. Program review.

A special review was made of the national agricultural research program and administrative procedures.

C. Contributors

The Honorable James W. Spain, U.S. Ambassador to Tanzania

Vernon C. Johnson, Director, U.S. AID Mission to Tanzania (USAID)

David Masanja, Director, Crop Development Division, Ministry of Agriculture (MinAg)

John Liwenga, Chief Research Officer, Crop Development Division, MinAg.

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Dr. Richard L. Podol, Assistant Director, USAID

Jack H. Francis, Program Officer, USAID

John M. Cornelius, Food and Agriculture Officer, USAID

Staley L. Pitts, Project Officer, USAID

Ira J. Johnson, Jr., Management and Finance Officer, USAID

Paul Duffield, Project Coordinator and Senior Adviser, IITA Contract to the Project

Donald Muir, Deputy Director, National Maize Production Project

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Sheldon Sandager, Farm Manager, Msimba Seed Farm, Ilonga, AID contract

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A.E. Temu, Legume Agronomist, Mbeya

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Ms C. S. Muhalet, Maize and Legume Agronomist, Ukiriguru

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M. L. Kyomo, Dean, Faculty of Agriculture, University of Dar es Salaam, Morogoro

J. H. Monyo, Head Crop Science Department, Faculty of Agriculture, University of Dar es Salaam, Morogoro

E. Rowland, Acting Managing Director, Tanganyika Wattle Co., Ltd., Njombe

Carl Edwards, Agronomist, Tanganyika Wattle Co.

D. Exhibits

1. Documents.

a. FY 1971 PROP.

b. Project Agreements and Amendments to date.

c. Maize Research Coordinating Committee Report 1974/75.

d. Agronomy Findings, ARTI, Mbeya, 10/10 1975.

e. Termination Report, Michael Colegrove, 1973-1975.

f. Annual Report, Grain Legume Research Program, 1974/75.

g. The Uyole Agricultural Centre (Establishment) Order, 1975.

h. The Uyole Agricultural Centre Agronomic Research Program of Work.

i. Agricultural Research Project 107 Program of Work (1976, 1977).

j. Evaluation Report, Seed Multiplication Project 621-11-130-092, February 23, 1975.

k. Project Paper (proposed project revision) August 1975.

l. Cable, DAR 5107, Sorghum Component of Research Project.

m. Draft Project Paper, Sorghum Element, March, 1976.

n. Director of Agricultural Research Institutes in Tanzania (with special emphasis to crop research).

o. Apparisal of the National Maize Project for Republic of Tanzania World Bank Report 897a-TA.

p. Agricultural Research Needs of Tanzania, April 1971, USAID/ Washington.

q. Reorganization of the Ministry of Agriculture McKinsey Association Report Volumes I and II.

r. Crop Development Division Annual Reports for:

ARI Ukiriguru	1973/74
ARI Lyamungu	1974
ARI Mlingano	1973
ARI Ilonga	1972
ARI Kilombero	1972/73

s. Soil and Fertilizer Use Project Outlines, October 1975, FAO/UNDP.

t. National Soil Service Soil Fertility Section Work Plan, 1975/76. FAO/UNDP.

2. Facilities and Operations.

a. Dar es Salaam - Offices, Ministry of Agriculture.

b. Ilonga -

(1) Offices, laboratory, library, personnel housing.

(2) Maize breeding nursery, disease nursery (streak) fertilizer trial.

(3) Cowpea disease pot test, disease nursery, IITA collection, Tanzania collection, yield trial, insecticide trial, inter-cropping (with maize).

(4) Mung bean, India collection, yield trial.

(5) Lupin yield trial.

(6) Soybean select collection, yield trial.

(7) Maize village trial - variety, fertilizer and weed control. (2)

(8) Soybean village trial (2).

(9) Cowpea village trial (2).

c. Msimba Seed Farm -

(1) Foundation seed fields of maize, soybeans seed provided by ARI.

(2) Seed processing system.

d. Iringa -

(1) Soybean trial: innoculation with and without phosphorous.

(2) Maize: fertilizer, variety, progeny.

(3) Cowpea: insecticide trial.

(4) Sorghum: EAAFRO varities.

(5) Village maize trial.

e. Mbeya -

(1) Plant pathology laboratory.

(2) Maize intercropping (cowpeas).

(3) Cowpea collection, yield trial.

(4) Soybean trials.

(5) Maize weed control trials.

(6) Mung bean collection.

(7) Lysine yield trial.

(8) Wheat trials.

(9) Millet trial.

(10) Maize: village fertilizer and variety trial.

(11) Training plots, classrooms.

f. Njombe, Tanganyika Wattle Co. -

(1) Maize selection plots: disease and stalk strength.

(2) Hybrid maize seed production.

g. Ukiriguru -

(1) CIMMYT maize collection.

(2) IITA cowpea collection.

(3) INSOY soybean collection.

(4) EAAFRO sorghum varieties.

(5) Sorghum fertilizer trial.

(6) Bulrush millet.

h. Morogoro

University library.

Review of the Research, Strategy, Methods, Inputs and Outputs

(Loyd Tatum)

A. Crops Addressed.

1. Maize.

2. Food legumes including cowpeas, soybeans, pigeon peas and french beans (*Phaseolus vulgaris*).

3. Sorghum and millet.

B. Strategy.

1. Maize.

Maize breeding is currently quite appropriately concentrating on the very high priority and immediate objectives of establishing and carrying out recurrent selection in composite populations for the intermediate and low elevations, leaving the high altitude niche for the EAAFRO and Kenya selections and hybrids which have been determined to be well adapted in the Tanzania highlands. This will enable the Tanzanian breeding program to concentrate on the needs of the less fortunate maize growers at low and intermediate altitudes where moisture shortage and diseases have been serious problems. As the training program progresses and the project becomes more fully staffed it will be appropriate to investigate fully the potential of hybrids in the medium and low altitudes.[1/] The high lysine selection program should be continued with greater emphasis.[2/] The program of experiment station and village trials is well-conceived and appears to be effective. It should be continued as is. No changes are recommended in the procedures for introducing new varieties nor for production practices.

1/ See notes, page 9

It was noted that a short-season composite had been identified and advanced which on the daily basis yields as well as the top yielding composites in the program. Although some first impression resistance to these short-season composites may be expected, they promise a great contribution to certain low-moisture or droughty areas. Granting that there is a limit beyond which maize cannot be adapted, it is recommended that work on the short-season composites be continued for use in certain of the drier areas that can be identified by village trials and from long-term weather data. This recommendation is based on the following propositions:

a. It was represented to us that maize is preferred over sorghum as the main energy staple. For this reason maize is planted in the marginal moisture zones much to the loss of the grower

b. Wnile high lysine maize is a reality, high protein sorghum remains an experimental project.

c. A yet undetermined amount of damage to sorghum and millet may be expected from Quela quela.

2. Food Legumes.

These crops are being evaluated and germ plasm assembled and screened for pest resistance. Any resistance identified will be bred into good agronomic types. High yield and disease resistance should continue to be the primary considerations. Varieties with multiple disease resistance

together with good agronomic characteristics are needed. Management practice for maximum economic yields will be developed. Variety and production trials with the various crops in the important ecological zones should continue. The trials should include those on research stations as well as trial-demonstrations on farmers' fields.

3. Sorghum and millet.

The program presently consists of growing selections from the EAAFRO project in Serere, Uganda. This should continue but the priority of these crops is such that breeding and production work with them should be initiated in Tanzania. Since a considerable body of information is now available regarding production practices, an effective package can be recommended immediately or fairly soon; however, there remain many unanswered questions. 3/

4. Soil and crop management.

Intensive work is needed on means of providing nitrogen to the maize crop through legumes, fallows and other means. The magnitude of residual fertility that can be recovered by subsequent crops should be evaluated. Evidence of serious erosion was seen at several locations, thus we urge that practices such as the use of mulches of crop residues or other reduced tillage practices be investigated at locations in addition to Mbeya. We urge that the maize agronomist position be filled to provide attention to these and other high priority problems without diverting or diluting the efforts of the breeder-agronomist from variety improvement. 4/

C. Outputs.

Project outputs are of two types. One consists of contributions to institutional development, such as trained manpower and improved administrative systems, which were reviewed in Annex D. The other consists primarily of demonstrating the merits of certain varieties and getting them into production with a set of recommended practices, which were reviewed below.

1. Maize.

Varieties now available for high elevations include Ukiriguru Composite A (UCA) and Hybrid 613 (H613) where moisture is adequate as in Ilonga and Katumbili in the drier high areas. Ilonga Composite A (ICA) and Tuxpeno (ICT) are adapted to medium to low elevations. Seed of H613 is produced by the Tanganyika Wattle Company. Seed of the others, which are composites, are produced by the National Seed Farms. The recurrent selection procedures used on the composites will provide a new selection of each for increase each year when the program is in full operation. Sustained improvements are expected in stalk strength, disease resistance, plant height and ear height. Similarly, recommendations of production practices will become more precise each year as additional trials are conducted. Progress on the maize breeding and agronomy programs during two years is considered commendable.

2. Grain legumes.

Varietal trials with cowpeas, soybeans, pigeon peas, green grams, French beans and lima beans have been conducted. Fertilizer, spacing and date of planting results are available. Some of the major problems were

identified and some acceptable varieties identified and placed in a seed bulking program. Collection of local cultivars and requests to other institutions for their collections were initiated to obtain useful germ plasm. The plantings at Ilonga identified two serious virus problems in cowpeas. In screening 246 varieties to cowpea mosaic virus a good source of resistance was found. Crosses are being made to transfer the resistance to the susceptible but otherwise desirable SVS-3 line. The rate of progress on grain legumes is commendable.

D. Personnel.

1. Maize.

The project is now staffed by one AID-supported breeder-agronomist, assisted by Tanzanians who have been trained under the project. There is urgent need to fill the maize agronomist position which was vacated by Dr. Colgrove in October 1975.

2. Food legumes.

There are presently agronomy and breeder-plant pathology positions in the project which are satisfactorily filled. No change is recommended.

3. Sorghum and millet.

A breeder-agronomist position should be established to initiate a variety adaptability survey and an improvement program in these crops. 5/

4. Production economist.

There is an immediate need for this position as several production packages are nearing completion and need evaluation before being recommended. 6/

5. Plant protection specialist.

There will be need for crop protection research, especially against plant diseases, insects and birds on sorghums and millets at a later date. Since (a) the significant maize diseases appear to be well in hand by the present maize breeder and (b) a plant pathologist is assigned to the legume program, an entomologist is recommended. 5/

D. Facilities, machinery, equipment, etc.

1. Machinery and instruments.

Needs of the project have been listed by the coordinator. Some grant and loan funds apparently are still available. These and new allocations should be used to provide for basic needs of the project. Some of the major items are a sprinkler irrigation system, 3 tractors, 3 disc plows, 3 disc harrows, 3 planter-fertilizer machines, 8 farm wagons, 1 Jeep Wagoneer, 1 Jeep pickup truck, 6 Jeeps, 20 heavy duty bicycles, 6 platform scales, 1 level-transit and 3 hygrothermographs. In addition to these commodities the irrigation potential for the project at Ilonga should be expanded by adding two shallow wells and a reservoir. 7/

2. Service buildings.

One 20m x 20m building is required for seed drying, processing, and packaging, fertilizer storage and temporary machinery storage.

Renovation of existing building for long-time germ plasm storage and short-time storage of ton lots of varieties going into production. Insulation, moisture barriers, air conditioners, dehumidifiers and shelving will have to be installed. 8/

3. Integration of services.

A policy needs to be developed covering integration of facilities and equipment into the over-all station operations. This no doubt will be difficult but seems essential if a viable project is to be left when the expatriate staff departs. 9/

E. Other donors.

Several other donors have had important roles with the project.

1. Ford Foundation.

The Ford Foundation funded a maize agronomist for the first two years of the project as well as equipment purchases and participant training as the project was getting started.

2. Tanganyika Wattle Company

The Tanganyika Wattle Company, a wholly owned subsidiary of the Commonwealth Development Corporation, Ltd., London, provides land and services for breeders seed multiplication under isolation. This organization also produces seed of the hybrids from EAAFRO. These perform very well

in high altitudes of Tanzania and relieve the project from having to conduct a breeding program for this zone.

3. Nordic aid program.

The Scandinavian project at Mbeya is conducting applied research on crop production at high altitude. They are demonstrating the potential of maize, using hybrids from Kitale, Kenya, with adequate fertilizer, weed control, early planting and other good practices. The results are quite striking as very high yields are obtained. They are doing work also with legumes and other crops. The collaboration of the Nordic group in the project is commendable. For example, they provided a vehicle for supervising village trials.

4. EAAFRO.

EAAFRO develops high-yielding maize hybrids and varieties adapted to high altitudes, which perform well in high parts of Tanzania. Its project on the maize streak virus problem will supply basic information from Muguga, Kenya. EAAFRO is establishing a streak screening nursery in Tanzania lowlands which should provide information and service to the project. EAAFRO is establishing a lysine and protein laboratory which should service the Tanzania breeding work for greater nutritive value. It coordinates an East African Maize Variety Trial which facilitates exchanges of information and germ plasm. EAAFRO conducts a sorghum and millet improvement project in Serere, Uganda and has produced many selections which are well adapted in Tanzania.

NOTES

NOTES

1. This recommendation is made with full awareness of the principle of continued improvement of composites through recurrent selection. It has been established that the hybridization of maize increases its yeild efficiency by approximately 15 percent. The principal improvement through recurrent selection is as applicable to the hybrids through parent lines as it is to the composites.

Obviously at the present, the program does not have the manpower to mount an effort to develop one or more hybrids for the medium and low elevations. However, the long-range plans should aim for the farmers of these regions to have access to the more efficient hybrids. The work on composite lines now underway will not be wasted as these lines can be incorporated in the hybrid development program.

2. It has been established empirically that with the exception of Vitamin A and minerals, high lysine maize is very nearly a perfect human diet. Swine nutritionists say that it performs 95 percent as well as the best swine ration that can be formulated at the present. The hog's digestive system is identical to that of the human. The classical experiment conducted by the Rockefeller Foundation in Cali, Colombia in 1967 stands: in this case a 21 month-old child achieved complete recovery from clinical malnutrition in 21 days on high lysine maize, vitamins and water.

The PROP recognizes a generalized protein deficiency in the diets of the interior population and advances the proposition that if it is to be

removed it will be through the increased consumption of plant protein. This in no way discounts the corresponding energy deficiency that probably exists in the rural diet during the majority of the months of most years. What it says is that pregnent women, lactating women and children under six years of age cannot ingest a sufficient volume of ordinary maize, sorghum, millet or rice to supply the body's minimal requirements for normal functions and growth. The PROP and the project correctly addressed the problem through activities to improve the efficiency of cowpea production and develop a soybean "production package", along with improving maize production and quality (latter referring to developing and advancing one or more high lysine lines.

In the course of the review it was revealed that the project has identified one or two CIMMYT/high lysine maize populations which appear to be quite well adopted environmentally to the medium elevation zone. However, there appeared to be some reluctance to develop and extend these lines, at least with the same amount of effort envisioned for the common composites. The reason for the low priority was based on the fact that the high lysine lines underyield the common composites by at least five percent and that the difference represents an unnecessary sacrifice in yield.

A fallacy is seen in the above analysis: it does not compare the lysine production of the two types. A valid comparison would match the yield of, say a hectare of high lysine maize with a comparable hectare

(from the standpoint of yield potential) of a combination of common maize and soybeans calculated to balance a perfect swine ration, for example.

Once the consumer has the common cereal grain and legume grain the problem remains to get them consumed in balanced proprotions. This could be managed for urban populations quite handily by blending soy-flour into maize flour. It could be managed in subsistance diets by every rural family recognizing the seed for the consumption of legume grain and simply growing, cooking and eating all they want. This is a much more complex proposition. In its villagization program, Tanzania has a unique opportunity to significantly improve the nutritional status of its rural population in a very short period in areas where maize will grow . The proposition is to supply 100 percent high lysine maize seed to resettled villages. This presupposes development of reliable lines and demonstrations of nutritional superiority. Ideally, when a village is created or resettled its members would be given a supply of high lysine maize for subsistance while they make their first crop (of high lysine maize)in the new location. Afterward they would be provided new seed at the appropriate intervals.

Local comparisons of high lysine maize with diets built around common maize could conceivably be made by the Illongo school of human nutrition. They could in turn conduct pilot demonstrations preparatory to a regional campaign, should it prove to be appropriate.

3. In 1975, TANGOV requested technical assistance in implementing development research on the sorghum and millet crops, and this request was sent to AID/W for review and inclusion in a new PP, where it remains pending. The purpose of this effort would be to provide improved varieties and crop management practices for farmers living in areas which are normally or marginally too dry for reliable maize production.

Although the rainfall and related moisture data were not examined, there were sufficient empirical observations made in the course of the review to support the conclusion that sorghum and millet should be included and developed in the national food crop program, thus in the agricultural research program. Specifically, this conclusion is based on the following propositions:

a. There are areas in Tanzania which due to the limtied amount and/or variable patterns of rainfall maize production using the presently available varieties is a high risk enterprise and it probably would be somewhat risky using the shorter season composites, whereas sorghum production is a relatively smaller risk enterprise (observed at Ukiniguru, although some maize varieties yielded along with sorghum with a severely restricted moisture supply). While this reinforces the recommendation above to continue work on the short season composites, it also suggests the need for sorghum as a diversification crop as insurance against complete crop failure in the case of low rainfall or drought.

b. Although weather patterns were not consulted in the course of this review, we were told by agronomists and others in poisitions to be adequately informed that a large, triangular area extending from the north to the southeast does not receive suffucient rain to support maize production.

One informant said that this area is inhabited by approximately four million people.

c. In the course of the review we observed sorghum in areas where there was no maize grown and millet in areas where no sorghum was grown, which suggests progressively drier zones. There can be little doubt that these farmers have as valid reasons for growing these crops as do those who grow maize.

At Iringa an area of relatively favorable rainfall we observed approximately twenty EAAFRO project sorghum selections which were developed at Serere, Uganda. All selections appeared to the well-adapted to the area and relatively high-yielding. At Ukiniguru, a much drier area which was experiencing droughty conditions, we observed a much larger collection of the EAAFRO lines, all of which appeared to be environmentally well-adapted and relatively high-yielding. At the Illonga seed farm we observed one variety in multiplication for certified registered seed. Since these selections were performing uniformly well under widely different environmental conditions which were different to their original environment and since sorghum is known to have a wide spectrum of adaptability, we feel reasonably confident in concluding that the present EAAFRO selections constitute an adequate base on which to build a sorghum program in Tanzania.

As is nearly always the case, at least two activities should be started at the same time. One is to run competitive yield trials of the EAAFRO selections and any other promising cultivars that may be known to be the implementers. The other activity is to develop a crop and soil management

system that enhances sorghum production. Emphasis should be placed on supplying nitrogen by rotating with grain legumes. Since sorghum may be grown in areas generally too dry for soybean production and possibly too dry for cowpea production, the shorter season, drought-tolerant species should be evaluated. Pigeon peas treated with peanut innoculant should be a prime candidate.

Unfortunately, there is nothing comparable to the EAAFRO sorghum work in progress that is applicable to millet. As a beginning, both the ICRISAT material and Kansas State University material should be screened for adaptability and yield. The primary agronomic concern in the near term should be in defining the geographic areas where millet may be expected to be a more efficient corp than sorghum and corn or to define the place of millet in diversified enterprises. At the same time there is a need to develop crop management systems for millet which include planting, nitrogen supply and weed control.

4. We noted in the course of the review that a FAO/UNDP project to classify Tanzanian soils as to their land use potentials. The project includes establishing and operating a laboratory for soil fertility analysis. The UNDP project and the USAID project might be highly complementary to each other through coordinated planning and the exchange of information. The soil classification effort requires measured yield responses to derive yield coefficients for the soil management units identified, which may be available from the village trials. Conversely, the research activity requires the

services of a soil chemistry laboratory from time-to-time, which the UNDP project should be able to provide. With close coordination of the two projects some very useful generalizations on crop adaptability and management might be derived in a very few years.

5. The Mission proposed four personnel positions - plant breeder, agronomist, plant pathologist and entomologist for the sorghum and millet program.

While recognizing the appropriateness of the inputs from these disciplines in any crop improvement program, we recommend starting the program with the assistance of one expatriate scientist, who would be designated coordinator, and adding the others as the need is demonstrated. The coordinator should hold the Ph.D. degree in either agronomy, plant breeding or plant physiology. Ideally he would be farm-reared, hold one degree in agronomy and one degree in plant breeding.

In initiating the sorghum program the coordinator would probably make a final screening of the current EAAFRO selections and nominate from one to four for seed multiplication. At the same time he would screen the available millet material and work toward placing one or more lines into seed multiplication.

The concurrent task, which should be implemented in collaboration with the food legume section, would be to develop a crop rotation program which would include a good nitrogen-fixing food legume in the first year and sorghum or millet in the next.

As the program develops there is likely to be a need for an entomologist to assist with the selection for resistance in the sorghum breeding program that may develop.

This recommendation is based on our conviction that the EAAFRO sorghum work to date is highly applicable to Tanzania. Due to the pressure that the project exerts on the Illonga station in terms of additional personnel, housing and working facilities, it seems advisable to hold the project force to the minimally essential level, especially in the beginning. Whether the project headquarters can be fully and harmoniously integrated into the Illonga station, which under the present implementation plan is critical to achieving the project purpose, appears uncertain.

Going beyond the scope of our mission, which was limited to evaluating the work already done and appraising pending program proposals we searched for alternative ways and means of implementing the sorghum and millet program. It appeared to us that the University at Monogoro had at least some professional capabilities and physical facilities that could be used to implement the sorghum and millet program. Should this have proven to be the case we would have recommended the following strategy:

a. The Ministry of Agriculture Crop Development Division would expand its research program to include sorghum and millet development parallel to maize and food legumes. USAID and the Ministry would renegotiate the project to accommodate the expansion. The position, Sorghum-Millet Research Coordinator, would be established under the supervision of the Chief Research Officer of the Crop Development Division.

b. A national sorghum-millet research advisory committee would be established along the lines of the national maize research committee. Through the deliberation of this group, a national sorghum and millet research program would be proposed and designed.

c. The implementation of the program would be contracted to the University on an annual basis, subject to renewal upon evidence of satisfactory service.

d. The implementation would be assisted and supervised by the Sorghum Millet Research Coordinator.

Besides relieving some immediate pressure on the Ministry of Agriculture, hopefully in the long-run the participation of the University in the program would improve the quality of their graduates who are the Ministry's prime source of professional personnel. Even though it may be impractical to implement such a scheme at the present, the idea may be worthwhile for future consideration.

6. The original PROP called for an agricultural production economist, who has not yet been provided. This position should now be restored and filled for the following reasons:

a. Although the project group has achieved research results that are highly significant scientifically, they have limited meaning in terms of returns to farmers operating under greatly varying conditions. It is impossible to generalize from a single vantage point due to differences

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Experts must inform leaders

THE ASP National Executive Committee yesterday directed agricultural experts to furnish leaders with the necessary information to facilitate implementation of plans.

The committee also directed the ASP Department of Agriculture to compile such guidelines in the form of a book.

The guidelines would then be distributed to members of the Revolutionary Council, and will be kept by offices of the committee that supervise the implementation of agricultural projects at division, district and regional levels.

For the past two days, the National Executive Committee has been receiving and discussing reports of sub-committees of the Revolutionary Council responsible for the supervision of the implementation of development programmes.

The sub-committees that tabled their reports yesterday come from Aati, Kusini, Mjini and Magharibi district in Zanzibar.

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in costs of delivered inputs and delivered outputs. Therefore at the present farmers may accept the outputs of the research simply on the basis of appearance, which may be misleading.

b. The government has appealed to the Research Service to "put in a book" the practices recommended for farmers of the various regions in order that this information may be included in the National Plan. Without a production economist the project's contribution to the book would have to be limited.

c. The national planners also need data for guidance in elaborating a national food policy.

7. This sizeable project was superimposed upon an ongoing program at the Illonga station. Land for rainy season activities was not a problem. For the dry season breeding work, which is essential, the station assigned its total irrigation potential, which was limited. There was no farm machinery available so the Ford Foundation provided one tractor unit. Although the irrigation supply was marginal, the total effort was sufficient to start up. Now, with the implementation of legume work, the necessity of expanding the maize work and the sorghum-millet proposals, it is necessary to increase the farm machinery inventory and the irrigation capabity.

8. The project plan calls for converting the present warehouse into a controlled-climate, seed warehouse and erecting a larger structure for equipment storage fertilizer storage and seed processing. The need was obvious and in our opinion, the plan is sound.

9. The project maintains and controls a farm machinery and equipment inventory that is separate from the station's inventory. Although this arrangement contributes to the assurance of short-term outputs - that is, it assures beyond doubt that the project has first call on certain equipment essential to its operations, there is the possibility that the arrangement may work against the achievement of the project purpose (Annex E, page 3).

The reasons that may be assumed for the arrangement are:

a. The station does not have the operable equipment to service its activities other than maize and food legume research.

b. The station does not have the capacity to maintain the equipment already on hand.

c. Therefore, if certain equipment is brought to Illonga specifically to implement the maize and legume work it can best be made available for the purpose if controlled by those crop coordinators.

d. Admitting that some time in the future, the station will have to assume control and maintenance of this inventory, such a change can just as easily be made further down the line.

This argument supports the priority for delivering the best breeder seed possible to the seed farms as rapidly as possible. However, it discounts the value of the service that should be provided to the project by the station, such

as, particularly, maintenance. Further, the present arrangement tends to identify the project as a tenant rather than a part of the station.

At the present the station does not have the capability of providing adequate maintenance. Further, being short of equipment overall, the station management would no doubt assign project equipment to other uses, even in conflict with project priorities from time-to-time if this were possible.

The solution seems to lie in the following approach:

a. A station program which includes the project and all other activities which address the national agricultural sector goal.

b. Adequate equipment, fuel, lubricants and maintenance to implement the total program.

Review of the Research Program, Manpower Resources and Development and Administration (M. B. Russell)

A. Organizing and Administering a National Agricultural Research System.

A national agricultural research system (NARS) refers to a set of institutions and a group of activities designed to supply the information base for a continuing flow of improved production technology for the agricultural sector of a nation's economy. To perform its role effectively the NARS must be effectively linked with many other elements of the nation's economic, intellectual and social fabric. Thus it must interact with the scientific community both nationally and internationally, with the agricultural education and extension institutions, and with the public and private agencies and organizations that supply goods and services to farmers and those which purchase and use products from them. It must also maintain functional ties with the consuming public and with the governmental agencies which formulate regulations and public policy affecting agriculture.

The size, organizational structure and program content of the NARS should reflect the nature and stage of development of the nation's agriculture, the national economic and development goals, and the amount of resources and trained manpower that can be allocated to it. Its structure should be such as to provide for appropriate regionalization of research and for the orderly growth of the system as the needs of the country change and the manpower and resources that can be assigned to it increase.

A NARS should serve the major parts of the nation's agriculture with high priority being given to those crops or products needed to meet national food needs. It can be characterized best by describing both its "anatomy", i.e., its structure and its "physiology", i.e., its functional activities. Such a national agricultural research system for crops can be shown schematically as a two-dimensional matrix consisting of research performing units as columns and coordinated national research programs as rows. For Tanzania the units are the nine Agricultural Research Institutes (ARI) and the Programs are the activities planned and conducted by the 11 crop research coordinating committees. Figure 1 shows a 9 x 11 matrix within which the entire national crop research work of Tanzania can be planned, managed and evaluated.

Figure 1.

PROGRAMS	UNITS				
	Ilonga	Mbeya	Mtwara	Ukiriguru	etc.
Cotton					
Maize				X	
Wheat		Y			
Food Legumes	Z				
Oilseeds					
Tea					
etc.					

Each of the 99 cells in the matrix represents the work of a particular national Program that is conducted by a particular ARI. Thus cell "x" contains the maize work at Ukiriguru, cell "y" is for the wheat work at Mbeya and cell "z" is used to define the effort devoted to food legumes at Ilonga.

It is obvious that not all of the 99 cells are used, that the sums at the bottom of each column represent the total research effort devoted to each crop and that the grand total of the rows and columns is the total national crop research effort.

Use of the two-way array of units and programs provides a logical basis for program planning and evaluation, for budget development, staff deployment and for the development of facilities. The two-way array also helps to clarify the responsibilities of the administrators of the rows (the Program coordinators) and of the columns (the research directors of the Institutes).

The main responsibility of a Program coordinator is to insure that all of the research done on his crop is relevant to the objective of improving the production efficiency of that crop, thus he looks at the overall national production problems and needs and develops with his colleagues a program of research designed to solve the problems and meet the needs. The research so planned will, of course, be conducted at one or more of the ARIs. Therefore the program coordinator must meet with the heads of the Institutes involved and develop a mutually agreed set of activities covering the work to be conducted on that crop at each Institute.

The research director of each Institute has the responsibility of developing a balanced program of research on the important crops of his region. Therefore he negotiates with the Program coordinators for each of those crops so that the total crop research effort at his Institute best meets the need of that region.

It is clear that this two-dimensional allocation process applies to funds, technical and support staff, land and facilities. It also requires that the work to be done be divided into discrete parts which are then distributed among the appropriate cells of the 9 x 11 matrix. For the purpose of this discussion these discrete parts are called "Projects".A/ Thus a "Project" becomes the basic unit for defining the coordinated research Program for a particular crop and at the same time it is the basic unit for defining the total work conducted by a particular ARI.

A/ For the purpose of this paper the terms Program, Project and Plan (note capitalization) will have the following specific meanings:

Program denotes a continuing set of activities conducted to meet a group of stated objectives. It involves the work of scientists and support staff working in several institutions and perhaps supported by funds from more than one source. Program statements outline the long-range strategy for improvement of a particular crop. Programs are implemented though a changing sets of Projects.

A Project is a constituent element of a Program. It defines a set of activities to be performed by a given group of scientific and support staff working at a particular place using an identified set of facilities, land and funds. Each Project will normally operate for a 3-5 year period and usually will involve many experiments or other activities the details of which are specified in a set of Plans.

The Plan is the working document of the individual scientist and contains specific information concerning the how, where, when, what is to be done in conducting the work outlined by the Project. It is developed for each cropping season and for each experiment.

The terms Program, Project and Plan constitute a hierarchical set of documents used to describe and define the work conducted by the staff of the NARS. In general they are developed by, and then reviewed, evaluated and sanctioned by different persons in the organizational hierarchy of the NARS.

Programs are formulated by the coordinators of the national coordinating committee, are then reviewed and sanctioned by the Director of Research of the Ministry of Agriculture. Projects are formulated by individual members of the national coordinating committees in close consultation with the Director of the Institute at which the work is to be conducted. The individual Projects are integrated into the national Program by the coordinator. Plans are formulated by the scientists who will perform the work with advice and assistance as needed by the Project leader at the Institute where the work is to be conducted.

It is important to the effective coordination of work and the smooth functioning of the system that the scientific and administrative staff at all levels in the system be involved in the development of the Plans, Projects and Program documents. This gives each individual a better understanding of his role in the system and an awareness of where his work fits into the total national research effort.

The nature of the NARS can best be specified in the form of a set of institutional goals and program objectives. As a guide for the developmental planning and overall coordination of the system there should be prepared by the

directors of the nine ARI's a set of Institute Goals giving the specific purposes for which each institution exists and showing how these goals relate to the regional and national development needs. In addition a set of Program Objectives should be prepared by each of the national coordinating committees giving the objectives of each of the national research and training programs that are to be conducted at the various institutes.

The interaction of the statements of Institute Goals and Program Objectives provides the basis for the establishing of priorities and the distribution of effort among the various cells of the NARS matrix. This technique provides a logical basis on which to plan facilities and assemble staff for the institutes and to examine the question of emphasis and balance among regions and among commodities and various other programmatic activities. It is suggested therefore that the Ministry of Agriculture be encouraged to develop the set of Institute Goals and Statements of Program Objectives as a basis for future planning, organization and administration of a National Agricultural Research System for Tanzania.

The Institute:Program matrix emphasizes the need for continuing interaction and cooperation between the Program coordinators and the Institute directors. This is particularly true in the planning and evaluation of Projects, in the recruitment and evaluation of staff, in the development of budgets and in the planning of facilities. As an example, both the Program coordinator and the Institute director should participate in the evaluation

of persons assigned to each Project included in his respective Program or Institute. In a similar fashion budget requests, plans to create new potitions, and the development of new facilities should be prepared and justified by both the Institute director and the Program coordinator concerned. It is this continuing interaction between the directors and the coordinators that ensures that the system remains focused on both the regional development needs as specified by the Institute Goals as well as on the national production requirements as detailed by the Program Objective statements.

It is suggested that the Ministry of Agriculture be encouraged to develop procedures for planning, budgeting, personnel management and program and institutional evaluation, that involve the continuing interaction between the Institute directors and Program coordinators to ensure that all administrative actions reflect awareness of both the Instiute Goals and the Program Objectives.

B. Project Organization and Administration.

Since its initial approval in June 1971 the Agricultural Research Project has been plagued by delays. A contract with IITA to execute it was finally signed in December 1973. By December 1975 each of the four organizations most directly involved with the project experienced two or more changes of the persons having administrative responsibility for initiating and managing it. During that critical initial 24 months it was handled by three different USAID project managers, two different research directors in the Ministry of

Agriculture and by three different administrative heads of the Ilonga Research Station. The IITA also underwent major changes in its administrative personnel during that period.

Work on the project began in November 1973 with the arrival of two CIMMYT maize scientists (one funded by Ford Foundation). A food legume agronomist joined them at the Ilonga Station in December 1974 and the legume breeder arrived in September 1975. Unfortunately the post of team leader to be located at the Ministry headquarters in Dar es Salaam was not filled until September 1975, nearly two years after the arrival of the project scientists stationed at Ilonga. Thus, during the critical first 20 months the project staff at Ilonga had to launch the research, training and development activities without the essential administrative support that had been planned.

Because it was a new project involving several agencies which had not previously worked together there were no established procedures or channels of communication and no operational infrastructure to support the project scientists in the field. Therefore it was necessary for them to spend an inordinate amount of time and effort on administrative and "housekeeping" duties without the benefit of existing channels of communication or established lines of authority and responsibility. Hence, it is not surprising that frustrations, delays and misunderstandings developed which, in some cases, further complicated and delayed the building of efficient

and harmonious working relations among the team scientists and personnel of the other organizations involved in the project. Had this situation continued it would have made it unlikely that the project would have been able to achieve its purpose. Fortunately the situation has changed markedly since the arrival of the team leader in Dar es Salaam in September 1975 and the administration of the project has shown marked improvement. Better working relations have been developed between the project staff, USAID, the Ministry of Agriculture, IITA, and other organizations conducting related work in Tanzania. Insert The field staff at Ilonga is now receiving the kind of administrative and logistical support that will permit them to devote their full attention to the research, training and development activities in their respective fields of specialization.

C. Manpower Development.

The shortage of qualified staff is a major handicap to the development of productive, problem-oriented, national research programs for maize and food legumes. For that reason the Agricultural Research project is giving major emphasis to the development and training of Tanzanians in modern crop research and production techniques. To date ten have completed the six month CIMMYT training program and three have returned from the analogous program at IITA. In addition five individuals have completed BS training programs and have joined the project team. I held personal interviews with four of the young men who have completed such programs, and I also observed what they and others like them are doing in the field research program.

Insert: Procedures are being developed and used to improve technical and fiscal reporting to expedite the acquisition of commodities, schedule trainees and staff the project.

I was impressed by their enthusiasm and by the amount and quality of work that they were doing. As these young men gain more experience and in-service training, I am confident that they can assume an increasing amount of responsibility for planning and evaluating research in addition to conducting the experiments. This should be encouraged by the expatriate staff who should fully utilize the many opportunities for informal on-the-job training of both the research and support staff with whom they closely work. 4/

I also had extended discussions with five senior Tanzanian administrators who have direct responsibility for planning and managing research and related education and training activities. These proved to be well-educated and dedicated individuals but with only limited experience in administering research and training programs. They all had a good understanding of the need to improve program planning, coordination and evaluation and seemed anxious to have assistance in the development of procedures and methods for such activities and for such other administrative tasks as budgeting, facilities planning, staff development and evaluation. Each of them also recognized the need for developing a more adequate set of supporting services, such as transport and machinery maintenance, analytical facilities, library and publication services, assistance in land development, facilities planning and maintenance.

A productive research system requires dedicated and experienced personnel to perform the necessary administrative and support services as well as to plan and conduct research. Therefore it is suggested that serious consideration

be given to ways in which the Agricultural Research project can assist the Ministry to upgrade and strengthen these important parts of the national research system.

Because it is the critically important input to the development of a productive food crop research and training system it is recommended that greater emphasis be given to the manpower development and training component of the Agricultural Research project. To that end it is recommended that a more comprehensive staff development plan for the national agricultural research system be developed in consultation with the Manpower Development Division and the Research Section of the Crop Production Division of the Ministry. Such a plan should set forth the division of responsibilities for various aspects of the training and development of staff and of mechanisms for closer coordination of the training activities performed by the various institutions and agencies. 5/

It is generally recognized that an intimate operational linkage must be maintained between the research system and the organizations that transmit the improved technology and the goods and services to farmers. At present the linkage between the maize research program and the seed production system is well established and seems to be working well. The linkage to the extension services is less well developed, although it is recognized that a very large training program must be developed if the village-level extension

workers are to be capable of assisting farmers to adopt improved sets of production technology. At present only a very small number of Tanzanians have acquired the skills and practical experience in maize and food legume production methods that are required to organize and conduct the kind of training programs needed to upgrade the extension field staff. This small cadre of production-trained individuals is also needed to expand and strengthen the maize and food legume research and seed production programs. Therefore a policy-level decision is needed to define more clearly the extent of training role to be assumed by the research organizations and staff. 6/

Given the newness of the project and the shortage of equipment, supplies and trained Tanzanian staff with which to cooperate, the size and quality of the field research program on maize and food legume crops is very good. The experiments are well designed, the plots are well laid out, adequately labeled and well managed both on the experiments stations, research institutes and in the village level trials. More efficient operations and reduced coefficients of variation can be expected as the land development work and equipment on the stations are improved and as greater experience is gained in site selection and management of the village level trials is acquired. It is important therefore that continued effort be devoted to land-shaping, irrigation and field plot management at the experiment stations and Institutes and to increase the quantity and adequacy of maintenance of vehicles and equipment used for the on-site experiments and village level trials. Continued attention should be given by the expatriate project staff to utilize

fully the many opportunities for informal on-the-job training of their Tanzanian counterparts and associated professional and support personnel. 4/

Although problems of funding by the host government developed during the earlier stages of the project those were largely the result of the absence of a team leader and the breakdown of communication between the agencies involved. Since the arrival of the team leader these problems have been largely resolved and at present funding by host government is reasonably satisfactory, although opportunities still exist to simplify the procedures and reduce the delays in obtaining approvals and release of funds. Based on the information supplied and the observation made in the field it appears that the funds allocated to the project are adequate and are being used in accordance with project needs.

In the course of the review the question was raised, whether to provide an expatriate training officer through the contract. The need for this position is based on the assumption that this project is to assume a greater role in maize production promotion. The World Bank maize production project has provision for a substantial training effort. If the agricultural research project is to play a significant role in organizing and conducting maize

and food legume production training programs a training officer should be added to the team. In addition the number of trainees and the funds for equipment, supplies, and operations provided by the project should be revised upward. If on the other hand the training function of this project is limited to that of staff development for the maize and food legume research program, the additional post of training officer is not justified. 6/

D. Providing Technical Assistance in the Improvement of Administration.

The PP amendment, submitted in August 1975 and pending approval, states

> "The Research Coordinator on the team will provide assistance and backstopping for the field team in his role as team leader, and additionally, will provide the Crop Development Division with technical review of research plans, programs and proposals, technical review of manpower requirements and development plans, technical review of organization and staffing plans, and technical review of existing and projected research facilities. He will prepare documentation and provide assistance for selected participants to be trained under the project."

However, this has not been given to the incumbent as his job description and he has received no indication that his counterpart in the Ministry is looking to him for this kind of advice and assistance beyond the maize and food legumes research projects. The team leader is now providing the technical reviews and advice listed above for the national maize and food legume projects. He has not been invited by the Ministry to consider the broader issues concerning the organization and administration of the total national agricultural research system. 7/

1. The concept of viewing the research system as a two-dimensional matrix for the purposes of planning, budgeting, manpower development and facility development was firmly accepted by the chief research officer.

2. The drafting of national and regional goals and objectives implies a cooperative effort on the parts of the chief research officer and the institute directors. Bearing in mind that no doubt much of this is already underway, the following process is suggested:

(1) Derive from the National Plan or other appropriate sources targets for consumption, income, income distribution, and savings. We have addressed this in part in the goal statement of the project (Annex E). We have proposed that the purpose of the research service is to provide the technology and genetic material required to achieve the national goal (Annex E, page 3).

(2) Extract from those targets feasible and appropriate performance targets for the respective agricultural enterprises or crops, as well as income and income distribution, by region.

(3) Assess the past performance of the respective crops and earnings by region, exposing the differences that may exist between past performance and targets.

(4) Propose an equation or program that would meet the targets. This would no doubt include the National Maize Project and other elements of the current program (Annex E, page 7).

(5) Derive from the above proposition the kinds of technology and genetic material presently not known to exist which is required to validate the above equation or render the program scientifically feasible. In AID jargon these become the system's"output" targets.

(6) Derive from the "outputs", scheduled in a timeframe, the "inputs" required to produce them.

The exercise should be carried out in consultation with everybody concerned, including the responsible people in the national planning office and farmers. The people consulted would serve at once as collaborators and as a forum. The result should be a national research program squarely addressing national goals, with broad representation.

3. The matrix concept assumes:

(1) That each program coordinator feels a national responsibility for the role of his program (maize research, for example) in contributing to the national goal and the regional institutes are facilities for the implementation of his program.

(2) That each institute director is responsible for bringing about all the research required for the achievement of regional goals.

(3) That the sum total of the institutes'participation in any one program equals the sum total of that national program.

(4) That the sum total of national programs implemented by one institute equals the sum total of that institute's regional research activities.

Then the planning and budgeting process would require each program coordinator to work with the pertinent institute directors in designing and budgeting for the program in question. As a rule funds would be allocated to institutes to implement certain projects.

Personnel positions would be described in terms of grade, minimal qualifications, duties, responsibilities and loyalties with respect to assignments and supervision.

Program-funded positions and candidates to fill them would be originated by the chief research officer and accepted or rejected by the appropriate institute director, provided that the position is resident at an institute. Where this is the case the institute director would be responsible for the administrative and service support as well as the general conduct of the incumbent. The institute director would be held responsible for all activities within his domain.

External evaluations on the order of this one should be planned at two to five year intervals.

4. Obviously in starting up their activities, the program coordinators had to do most if not all the professional level field work themselves. Even if they had Tanzanian field assistants, they were relatively

inexperienced. As the programs become established the coordinators acquire more and more diverse responsibilities, which allows them less and less time in any one experiment. This forces more and more responsibility on the junior scientists and forces the coordinators more and more into the role of supervisors. This should be encouraged with supervisory visits concentrating more and more on the improvement of professional methods and techniques. Basically, this amounts to making sure that the junior scientist understands the purpose, hypothesis and procedure of the experiment, making him fully responsible for it, then periodically reviewing his work with him. In this connection it was noted that the Illonga Institute Library did not have current subscriptions to the major scientific journals pertinent to project research work. Each young scientist should be provided membership in a professional society representing his discipline. The discussion of the articles in those journals would provide excellent forums for informal training.

5. The current draft project work plan includes lists of scientists required to implement the maize, food legume and sorghum and millet research programs over the long-term. These and other manpower requirements of the research system should be registered with the manpower development project in order to insure more perfect response from that project. The manpower development activity would be expected not only to take into account the requirements of the research service in the overall projections but to initiate training programs to

enhance the abilities of the graduates of its program.

6. The issue of who trains whom for what purpose revolves around three observations:

(1) There is a general concern in AID that the outputs of its research projects are put to productive use, thus the Agency insists on rather clear linkages of "outreach" arrangements with production activities.

(2) The National Maize Project anticipates a significant effort to train trainers in the extension service to make use of the research project's maize program outputs, but not the food legume program outputs. Even though the maize project is using a CIMMYT consultant, its training must be classified as itinerate insomuch as it is just that and therefore not institutionally dependable in the long-term.

(3) There is a fairly common institutional feeling (the international institutes, for example) that those who develop technology should advance it into the realm of dissemination by packaging it for teaching and teaching the first round - that is, train the trainer.

(4) We encountered a proposal that the project undertake a training program, which if it did would require the services of a training adviser.

Upon first inquiry it was learned that the project training program was aimed at village trial supervisors. We recommend against this narrow a definition, since it was not demonstrated that a sufficient number would be required to justify the expense of establishing a training facility. On the other hand, considering that the institutes are already in the training business, it seems appropriate that they take on the responsibility for the first-round dissemination of their technology, much the same as they do their genetic outputs. After all, they deliver breeder seed in ton-lots.

7. In the review of the draft report the Senior Research Officer stated that in the urgency of immediate problems in the maize, legume and sorghum programs since the project coordinator arrived, the matter of working out a plan for strengthening overall research administration had been neglected, largely due to the fact that it is not season-specific, as is crop research. He stated that it is the full desire of the Crop Develop Division to enlist the advice and assistance of the project coordinator in strengthening the administration of the program and that this oversight will be corrected.

Review of the Sector Goal and Project Purpose
(Lloyd Clyburn)

A. Sector Goal

1. Goal Statement

The Second Five Year Plan, 1971 - 1975, called for the production of "agricultural commodities to meet national needs..., both internally and for export." This was paraphrased in the Fiscal Year 1971 PROP as,

> "increasing the quantity and improving the quality of the food available to Tanzanians and developing additional export crops."

This established the goal of self-sufficiency in the food staples with an unspecified surplus of those or other crops for export. It also established a sub-goal of improved nutritional quality of domestic food to an unspecified degree. Subsequently, with severe reductions in production resulting from drought in 1973-74 and from disturbances in production inherent to the villagization program, the export element was dropped from the national sector goal, restricting it to self-sufficiency in the staples with the sub-goal of higher nutritional quality.

The National Maize Production Project, which began in 1975, used the goal of self-sufficiency in maize by 1979, since revised to 1980. In the (World Bank) project paper this was stated as 900,000 metric tons, which would have equalled the 1972 crop estimate. Since then the goal has been stated as self-sufficiency with 100,000 metric tons carry-over. (The AID Seed Multiplication Project uses the goal figure of

900,000 metric tons of maize by 1980, probably taken from the Maize Production Project, and should be revised for consistency).

2. Measurement of Goal Achievement

The target of 100,000 metric tons carryover seems adequate for maize. In quantifying the improvement of the nutritional quality of the national food supply it seems that the national strategy might consist of these three elements, the success of which could be easily measured:

(a) The development and improvement of adapted, high-lysine maize varieties would be continued, and the Maize Production Project would strive for all-high-lysine variety villages. Each village growing only high lysine maize with an output of self-sufficiency or better could be equated to a village on a near-perfect diet.

(b) The development and improvement of food legume varieties that yield significantly better than the presently existing varieties. The extent to which these new varieties replace the present, traditional varieties might indicate improved nutritional quality of the food in subsistence agriculture.

(c) The soybean crop could be developed, then bought and milled by the National Milling Corporation (NMC). The NMC could fortify its maize flour with soyflour. This would improve the diet of the urban sector, and it could be quantified over time.

3. Means of Verification

The maize target can be verified by NMC stocks. If they should adopt the policy of fortifying maize flour with soyflour, this would be observable as a record. Estimates of the improvement in rural nutrition would likely have to be extrapolated from estimates of increased production of high protein commodities which could in turn be derived from estimates of crop and variety substitutions flowing from the project.

B. Purpose

1. Statement of Purpose

The purpose of the project, as derived from the PROP may be stated:

> Within the limits of applied science, provide optimal technology and genetic material to those Tanzanian institutions serving farmers in increasing food crop production, with special reference to cereals and food legumes.

The statement remains valid.

2. Conditions That Will Indicate that the Purpose Has Been Achieved

The project is designed to yield outputs that together with continued financing will support the purpose as an institution. The following conditions should exist at the end of the project:

a. The research outputs would be annual, up-to-date in comparison to world progress, adequate in variety and quantity to meet goal requirements and promptly distributed to those engaged in supporting food production.

b. There would be established an adequate number of scientific and technical positions in the research institutions to carry out the purpose, and these would be filled by Tanzanians adequately qualified by world standards by training and experience.

c The national agricultural and rural development research entity would maintain in writing and practice a national agricultural research program which addresses the sector goal in particular.

d. There would be linkages between the research entity and the national planning entity to assure adequate agro-economic guidance in national planning.

e. There would be adequate funds provided by the National Treasury to support the program of the research entity on a current basis.

f. The administrative procedures of the research entity would be such that all of its transactions would be approximately current with its needs and plans.

3. Progress Toward Achievement of Conditions

a. The Crop Production Division of the Ministry of Agriculture and Cooperatives has established national, coordinated research programs for maize and food legumes.

b. A National Maize Research Coordinating Committee, which includes virtually all scientific and administrative interests in the crop, was established by invitation in 1975, and there is evidence that it will be the pattern for the involvement of external entities with common interest. Among others, the committee included the directors and/or other representatives of the ARI's, Tanganyika Wattle Company, Tanzania Seed Company, Seed Multiplication Project and EAAFRO. There may be a need for further formalizing the proceedings of this committee in order to assure continued interest and participation.

c. Although the project has completed only two years operations, its outputs have been put to use in shaping a long-range maize breeding policy.

d. The project has provided the Seed Multiplication Project approximately one and a half tons of breeder seed of varieties identified as proven in project research. A ton of maize breeder seed was produced in 1975. Theoretically, this should yield 450 tons of foundation seed in 1976, which could yield 90,000 tons of seed in 1977, which with perfect distribution would supply the national requirement. Of course the actual achievement will be far short of this due to: (1) the variety released is adapted to only two of the four ecological

zones, and (2) there are not yet enough seed growers to turn out this quantity of certified seed. Hence some of the Seed Multiplication Project output will go directly into farmers' production.

e. The Chief Research Officer has plans to revise his annual reporting system along commodity lines to facilitate its use in planning.

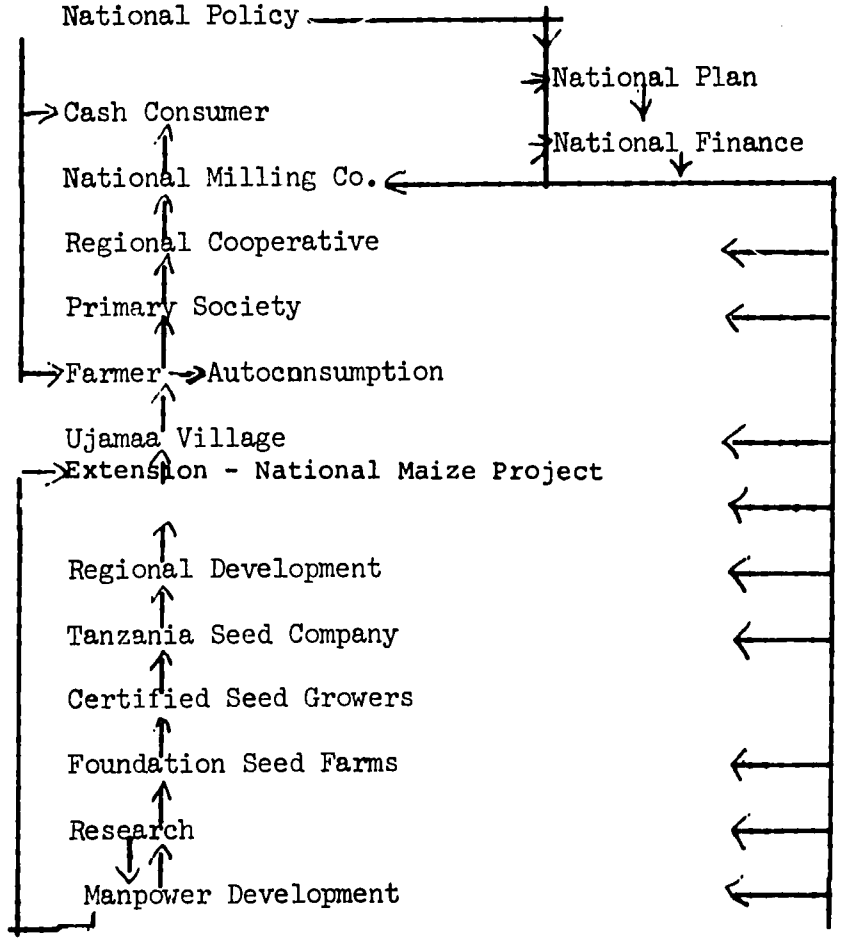
f. A linkage exists between the research entity and EAAFRO at both the administrative and technical levels. That is, the TanGov Chief Agricultural Research Officer participates in the planning of EAAFRO programs and EAAFRO scientists serve as consultants to the project. EAAFRO materials are available as inputs to the project. However, there appears to be a need for TanGov scientists to be kept better apprised of the EAAFRO program in order to make the fullest use of its outputs.

g. Linkages have been established with IITA and CIMMYT, and as a result of current involvements they are likely to continue beyond the life of the project. A linkage with INSOY exists and a linkage with ICRASAT is likely to be established.

C. Purpose: Goal Linkages

The agricultural research entity is positioned second from the bottom in a hierarchy of 16 functional entities which address the sector goal in a single channel system. That is, as a rule each line entity has only one supplier and one client. This is shown in the following diagram

Entities Which Address the Sector Goal of Food Production



D. Assumptions

1. Assumptions Conditioning Goal Achievement

The achievement of the goal is based on the assumption that purpose will be achieved as planned and that the programs of the 14 superior entities will advance as planned. The critical elements of certain assumptions were reviewed:

a. That the foundation seed farms will remain effectively operational after the termination of the AID project activity. This should not be an assumption but an element of design.

b. That the Extension Service will have the trained manpower to effectively implement the National Maize Project and similar production campaigns that would probably be required to achieve the national production goal. The question is whether the output technology of the Research Project will get to enough farmers in an efficient manner under existing transfer conditions. The Maize Project is aware of this and is providing a series of training exercises for trainers of extension agents. This program tends to be ad hoc, inasmuch as training inputs are itinerant.

c. That the communication of technology from the research entity to the Extension Service will be effective. There appeared to be a weakness in this linkage in some cases.

d. That given the seed and technology the National Maize Project can bring about an increase in national production by 270,000 metric tons annually by the end of the project. The Maize Project plan calls for reaching 285,000 hectares in 950 villages by 1980. The Project would deliver Package I inputs (seed and insecticides) to 295 villages for an increment of 34,515 tons; Package II inputs (Package I plus 50 kg Triple Super Phosphate (TSP) and 100 kg Ammonium Sulfate per hectare) to 522 villages for an increment of 171,694 tons; and Package III inputs (Package II plus 50 kg Ammonium Sulfate per hectare) for an increment of 63,441 tons. The Project reports 540 cooperating villages now.

e. That the primary market, specifically the Primary Society, will be responsive to the farmers' harvest. This has been cited as a possibly weak linkage.

f. That the National Milling Corporation will be willing and prepared to provide a soybean market and, further, to fortify its maize flour with soyflour.

2. Assumptions Conditioning Purpose Achievement

a. That project ouputs will become integrated, institutional services during the life of the project.

b. That in the process of regional decentralization the national research programs will be accepted and used as the scientific guidance for regional development programs.

This implies that in every case the ARI Director must see the project's activities on his station as his activities fo the benefit of his program that he represents to the Regiona Development Committee. Of three ARIs visited, there was an assurance that this condition existed in one case but not specifically so in the other two.