Report of Evaluation of the Tanzanian FSR Project and Related Activities - Land Development and Station Development at Ilonga

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Executive Summary

This evaluation addressed the Tanzanian Farming Systems Project, [implemented by the Consortium for International (CID) with Oregon State University (OSU) as the lead university], Land Development at Ilonga and Station Development at Ilonga.

The FSR project focuses on two major constraints to increased food production. The first is the availability and use of appropriate scientific information, and the second is the dissemination of this information to farmers. The project is pilot scale in nature with concentration in zones served by the Ilonga and Lyamungu Agricultural Research Institutes.

The purpose of the project was to (1) introduce and apply the farming systems approach to technology generation and dissemination activities, (2) provide management assistance to Tanzanian Agricultural Research Organization (TARO) and (3) provide encouragement and assistance to TARO and other research and extenssion agencies to work cooperatively toward common goals and objectives.

In brief, the project performed in a commendable fashion given major redirection and concomitant fund reductions. Major accomplishments with enduring qualities after life of the project are: (1) application of farming system techniques to identify a major system constraint, identify and field test a possible solution to the constraint, and in turn disseminate the solution to farmers consistent with farmers' system requirements; (2) ground work laid for integrating farmers, extension personnel and commodity research personnel into effective interaction that promotes relevant technology generation and dissemination activities, and (3) an impressive documentation of project processes and products through various publications, with many authored by Tanzanians.

Two other activities closely associated with the FSR Project and taken into consideration during this evaluation are Land Development and Station Development at Ilonga. These two activities are between one half and one third completed. Additional time and funds are the limiting constraints at this writing. The remaining part of the summary focuses on recommendations regarding FSR activities that should be addressed during the life of the project that will impact not only on the project but Tanzanian FSR in the future. In addition, recommendations are made regarding the Ilonga irrigation project and research facility development.

A. Farming Systems

1. Training

Training activities should continue to receive high priority for the remaining life of the project. On-job, in-service (short term) and long term training issues should receive attention

- Integrate extension more effectively into FSR by field team training activities. The current Ilonga FSR team could serve as trainers.

- Address FSR in a total system context. Approach the farm and farm family as a total entity and seek to understand the important enterprise interaction as a system. FSR team orientation may be the only feasible accomplishable training activity in this area for the remaining life of the project.

- Efforts should be made to procure or extend training funds for the long-term training participants.

2. Research

- Continue FSR activities (design, testing and evaluation) that focus on all intercropping alternatives and relay cropping patterns.

- Where appropriate, address the interaction among food crops, cash crops, and livestock because of intervention(s) design implications.

- Address the labor allocation issues as proposed in the "intra-household" study from a total family labor supply and demand perspective. The role of women should be a sub-set in the study effort to understand the labor availability and allocation issues of the farming system.

- Factors influencing total system performance through a complete production cycle should be investigated. What does the total system produce? Variance in systems performance was observed and was reflected by differences of wealth, use and ownership of tractors, etc. Understanding this variance could be valuable in the design of system interventions.

- Additional soil conservation design interventions should be formulated for all of the target areas where erosion is a problem. Particular attention should be devoted to residue management techniques to enhance productivity.

- The proposed "marketing study" identified in the workplan should be initiated as soon as possible. Particular attention should be devoted to the impact of "official" pricing policy and actual market performance in regard farm inputs and outputs. In turn, how market activities impact on farmer decisions and subsequent system performance should be addressed.

- Determine the role of risk in enterprise selection, cultural practices and finally system performance. Further insight into how farmers react and their strategies of dealing with risk will give insight into system perform

and in turn influence the design of interventions.

3. Policy and Organizational Issues

- The Ministry of Agriculture should be encouraged to implement the FSR recommendation that a National Farming System Advisory Committee be organized to oversee and coordinate all FSR activities within Tanzania.

- TARO should be encouraged to implement management/co techniques developed by the FSR Project to improve the policy decision making and operational capabilities.

B. Land Development at Ilonga

The irrigation facility for 50 hectares of land is the main component of this activity. Approximately half of the work has been completed and all of the necessary commodities have been procured and are at site.

- An additional T.Shs 10.5 million are required to com this activity, most of which is earth moving.

- Funds should be included in the TARO budget for the recurrent costs associated with providing irrigation water and maintaining level fields.

C. Station Development at Ilonga

This activity is for the construction of 19 buildings for th research staff at the station. The Evaluation Team has estimated the construction is about one third completed. It appears that there are adequate funds in the PL 480 Title I counterpart to complete these buildings. The plumbing and electrical supplies have been purchasd and are at the project site.

- A Tanzanian expediter should be identified and assigned the responsibility of seeing that this construction is completed in a reasonable length of time.

- No foreign exchange is currently available to purcha laboratory equipment and supplies, air conditioners, se dryers, and office equipment and supplies. A foreign donor should be sought who is willing and able to provide these necessary funds.

- The current budget for electricity costs is no more than one third of the charges. These costs will be markedly increased when the facilities are made operational. It is very important to take into consideration these added c as well as the current deficit at the time of preparin recurrent budget.

I. Project Purpose

The Tanzania Farming Systems Project has at its major purpose the introduction of several modifications that will link research workers more closely to the farm and the extension staff. The project is to build upon what has been achieved in the past but with an important shift in emphasis to reflect present needs. It has three major components:

- Introduction of a farming systems approach to make food crop research more relevant to Tanzanian farmers.

- Continuation of the on-going food crop research program with emphasis shifting to lowland food crops.

- Supporting efforts to increase managment effectiveness for the national food crop research institutions within the Tanzanian Agriculture Research Organization (TARO).

The project is pilot-scale in nature with concentration in the geographical zones served by the Ilonga and Lyamungu Agricultural Research Institutes. The three primary centers of focus are Kilosa, Moshi, and Dodoma.

One part of the second component of the project is to improve and expand the research facilities of the Ilonga Research Station. Under this project, construction of commodity work areas, laboratory facilities, storage, equipment maintenance and office space, and improvements in water and electrical supply will occur.

At the request of the Government of Tanzania, a team developed a comprehensive land development and physical plant facilities plan for the Ilonga Research Station. The physical implementation of land development was started in 1980 by IITA. A net amount of 50 Ha was agreed upon as the area to be developed for irrigation for speeding up breeding programs and for simulating differing rainfall quantity and distribution regimes. An area of 150 Ha was to be developed for research on rainfall pattern and bulking up of seed of newly released varieties.

II. End of Project Status

A. Farming Systems Research and Extension Approach

The central output of this project is the introduction of a farming systems research and extension approach in Tanzania. By the end of the project, at least two zonal teams, one or more each in Ilonga and Lyamungu zones, will have been established, trained and work completed within one or more districts within each zone. District teams likewise will have been named and work completed in selected villages and on selected farm sites. The number of such teams and sites will be dependent on the availability of Tanzanian counterparts at National, Zonal, and

District levels. Pilot scale work will have been completed in two or three districts.

B. Stronger Linkages Established between TARO and Other Agencies, and Improved Management Capability

A second major output of the project is to strengthen the relationship between TARO and other government agencies involved in agricultural production, research and extension.

Planning, budgeting and management training, advice and counsel will have been offered to cooperating units aimed at the preparation of annual budgets that would take into account and propose the implementation of findings from the FSR/E activities. On commitment of the Government to such proposals, management assistance will have been made available to aid in their orderly execution, including the development and monitoring of research projects and extension plans of work, the handling of funds and accounts, and other components of good research and extension management concepts and procedures.

C. Training

In-country, short-term training will be arranged in cooperation with TARO as well as with the Sokoine University of Agriculture and with the CIMMYT Regional Training Office. This will apply especially to the FSR/E teams and for staffs working with them. Out-of-country, long-term training in the U.S. will be provided for four participants (TARO employees) to be funded under the FSR Project and for six additional ones to be funded under the TRD I project.

D. Improved Physical Facilities at Ilonga Agricultural Research Institute .

A host country construction contract has been awarded to Tanganyika Builders to construct 19 administrative and laboratory buildings at Ilonga. Equipment and supplies to make these buildings functional will be provided under the project to the extent possible and within the limits of funds availabl Also, land development work will be completed to include a dam and lake, land leveling of 100 hectares and a fully functional and operational irrigation system.

The end of project status highlights that program success will be indicated by the FSR approach being introduced (field tested) and established in two geographical zones. This part of the evaluation assesses the extent to which this has been accomplished. Particular attention will be devoted to implementation problems and suggestions for program improvement will be addressed.

The resources originally planned for the CID/OSU FSR Contract were reduced substantially from those projected and specified in the early documentation. Therefore, the OSU project will be

evaluated on the basis of program delivery activities specified in the workplan(s).

III. Project Implementation Plan

Originally the principal implementing agency for the FSR project was to be Colorado State University, but the institution withdrew. Oregon State Univesity then agreed to carry out the role and signed a collaborative assistance type contract on March 1, 1983 for $2.225 million. Eight months later three team members arrived. Diagnostic surveys were initiated shortly after the arrival of the team. Ten long-term participants were selected for training which was one year behind schedule.

The architectural and engineering designs were finished in the second quarter of FY 1983. The procurement contract for imported construction materials was signed in the third quarter. A local construction contractor was selected and a host country contract was signed in the fourth quarter of CY1983. Construction commenced in mid-January 1984. Implementation was monitored by the Ministry of Works and USAID.

The Land Development component is being implemented by TARO. The earth moving equipment and irrigation equipment and supplies were purchased with funds from the former Agricultural Research Project.

Local costs for the construction of the Station Buildings and for the Land Development have been provided from the PL 480 Title I counterpart funds.

This project is to continue assisting in building the Tanzanian research organization and management capability. The management of the project has been incorporated into TARO. The Director General of TARO is designated as Project Director and thus assumes responsibility for seeing that the project purpose and outputs are met. The Project Director will be assisted in these responsibilities by TARO's headquarter staff and by the expatriate staff, especially the planning/management advisor.

The Directorate of Extension and Technical Services (DETS) will help insure that the FSR Project is properly integrated with the extension workers in the field. DETS will insure that the RADOs and DADOs are adequately briefed and become actively involved with project implementation. The DETS will also provide one person at the District level to be a permanent member of the District FSR Team. Also, in selected villages within each district, the village agriculture extension worker will help conduct surveys, carry out field trials and demonstrations do other work to implement the project.

IV. Evaluation

A. FSR

1. Approach

The workplans succinctly highlight the purpose, approach, methodology associated with FSR in the generation and tran[sfer] of technology to farmers. Worthy of note, and the basis for some evaluation focus, are the following comments from the workplans:

> "The underlying philosophy of the workplan was to surpass the existing state of the art for FSR field operation. [Five] five FSR field methodology stages (diagnostics, techn[ology] design, technology testing, evaluation and extension [...]) were incorporated so as to embrace explicit economic performance criteria to (1) measure the economic performance of technologies currently used by farmers [to] establish bench-marks against which introduced technologies will be evaluated, (2) establish research priorities which meet farmer/researcher choice criteria including techn[ical] feasibility, cost effectiveness and time sensitivity, provide continuous screening of introduced tehnology [with] technical/economic criteria to eliminate technologies [with] little promise and modify promising technology to enh[ance] potential for adaption and (4) measure actual level of economic gain when adoption occur. Based on the exist[ing] body of FSR literature, it appears that the Tanzania Project is the first FSR project to embrace the devel[opme]nt and use of explicit economic performance criteria. [The] project also will seek to identify and evaluate non-economic factors that influence farmers decisions.
>
> The FSR approach involves assisting on-going agricult[ural] research and extension activities to redirect agricul[tural] technology development, testing, and dissemination processes toward the needs of farmers. It views the [farm] and farm family as a total entity; seeks to understand the more important interactions of the operation of the fa[rm] as a system; and includes the farmer directly in the agricultural technology development process. The thrust is farm level (micro) in nature so it must ultimately be supplemented with macro efforts to address national issues of political economic social technical and institutional nature."

2. Diagnosis of Farmer Constraints

Every farmer has a system that works. This is reflected by

farmer survival. To adequately address and evaluate intervention or changes in the system requires a thorough understanding of the system - all inputs and outputs of the system and the various interrelationships among inputs, outputs and production system activities.

Knowledge of the system can come from a variety of sources. Among which are prior research - surveys, detailed studies given systems, secondary data, etc. One of the most fruitful approaches employed by farming systems research/extension (FSR/E) practitioners has been the use of formal and informal survey techniques of selected farmers to learn of and describe farmer systems and to identify constraints of the system; hence, information for the FSR/E agenda in terms of diagnosis and design of interventions is provided.

In general, the diagnosis stage of the FSR/E approach was adequately designed in an effective manner for all of the sites, particularly in the Ilonga area. However, there are some limitations.

At this time, all of the resource allocation decisions that farmers must make have not been fully investigated, i.e., the functioning of the total system has not been addressed in an explicit systematic fashion. This shortcoming, however, has been acknowledged and a plan of action to address is put forth in the 1985 workplan. The proposed studies of "Analysis of Markets in Kilosa" and "Intra-household Study" should be formulated and implemented in a manner to provide all of the missing links regarding the total system.

In brief, the marketing study will not only provide the traditional time, place, and form information for systems input and output, but will enable the estimation of enterprise budgets (profitability or gross margins being the bottom line) for enterprise alternatives - includes value of foodstuffs consumed by the farm family - at various time sequences during the annual production cycle.

The purpose of the intra-household study highlights that little is known concerning intra-familial input to farming systems including land, labor, capital and management as well as the division of benefits entailed in overcoming production constraints within the household.

Information from these studies will significantly influence the future design activities for the future FSR/E program. Particular attention should be devoted to understanding consumption, savings, and investment activities of farm families. Information on these activities will enable the design of appropriate intervention strategies as the FSR/E evolves. In addition, this approach and information will enable the addressing of the two most important problems expressed by farmers; (1) lack of tractors and (2) lack of capital to hire tractors and/or labor (Lev, Verification Survey, p. 6).

Surveys, particularly the rapid reconnaissance type, do not always provide the detail on constraints often required for the design of possible interventions to relax the constraints (on farm trials/research station). For example, the reliability of labor availability and labor use by crops is often suspect. In addition, the actual availability of credit and willingness to use credit (internal capital rationing) is difficult to detect by traditional survey techniques.

To overcome these shortcomings, due consideration should be given to intensive interviewing of a limited number of farmers and/or the monitoring of actual system activities and performance over a full production cycle. This approach could also serve as an excellent validation of the findings associated with the more general and widespread reconnaissance surveys.

Of concern in such an approach is the extent of "farm representativeness" in the recommendation domain (somewhat homogeneous ecological zone). But this same issue is germane with extensive surveys when measures of central tendency are used to specify given parameters associated with farmers' production systems.

The real benefit of putting together all of the input/output relationships for the total system is that modeling activities can be effectively used to determine the sensivity of the system to various market and biological changes. There are not perfectly uniform systems in the "recommendation domain". Farm families differ in many ways. They differ in total resources (land, labor and capital) as well as in preference toward risk, consumption and savings. The impacts of such differences can be analysed and observed when the total system performance is monitored. In short, to understand the economic performance of the system is to enable the appropriate design of interventions and subsequently move the system to higher performance levels.

3. Design and Field Implementation

a. FSR Field Team

The OSU/FSR program has provided the leadership to formul[illegible] effective FSR field teams in both geographical zones. Attachment No. 1 highlights the number of personnel and team members' responsibilities in both the Ilonga and Lyamungu regions. Although the evaluation team had limited exposure to Mr. Sungusia (National FSR Coordinator) on a personal basis, he has provided good leadership in implementing FSR program activities. In addition, he works effectively with Dr. L[illegible] provides oversight over all of the field activities. How there appears to have been personnel recruitment problems staffing the field positions. See attachment no. 2. No[illegible]t there are still significant gaps in field manpower.

Attachment 1 shows that most of the necessary actors are on [illegible]e scene to jointly participate in and contribute to an effecti[illegible] FSR/E program - commodity researchers, extension personnel, [illegible] the FSR Team.

Noteworthy is the fact that almost all commodity reseacher[illegible] also part-time farmers. Therefore, one would expect them t[illegible] readily cognizant of the constraints that farmers in the ar[illegible] have, and in turn, that hands-on-experience would influence their commodity research activities.

Apparently this is not the case in that the commodity researchers rarely, if at all, visited FSR/E off-farm trials. In addition the constraints that commodity researchers had [illegible]h their own farm operations were significantly different thar other farmers. Because of these limitations, it was felt t[illegible] the commodity researchers lacked the total system perspecti[illegible] and were not fully aware that other farmer constraints wer[illegible] different. Efforts, however, are underway to alleviate this situation, and some commodity researchers stated that in th[illegible] long run they could see FSR/E program activities as being valuable to their work. The fact that there are significant professional interaction between FSR/E and commodity researchers at the research station is positive for longer run benefits.

The extension participants had been given responsibilities [illegible] setting up on-farm trials with selected clients. Apparent[illegible] they had mixed successes because of design limitations and limited follow-up with their farmer clients.

The evaluation team sees the FSR/E approach and implementat[illegible]n activities as being a source of knowledge and technique that could revitalize the extension activities. FSR/E activities could be the cornerstone for extension programming. Current[illegible], this is not the case because extension personnel did not articulate such benefits associated with the FSR/E approac[illegible]

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Table I: TARO FSR Personnel

POST	NAME	TITLE
Dar es Salaam	Mr. D. Sungusia	National FSR Coordinator
Ilonga	Mr. A. Mwanjali	Zonal Agronomist & Coordinator
Ilonga	Mr. W. Sumari	Zonal Economist
Ilonga	Mrs. L. Mushi	Field Trials Officer
Ilonga	Mr. F. Nkamu	Field Trials Officer
Ilonga	Mr. J. Mamkwe	Field Trials Officer
Ilonga	Mr. S. Mndolwa	Field Trials Officer (joint with National Sorghum Program)
Dodoma	Mr. A. Chilagane	Agricultural Engineer/District Coordinator
Hombolo	Mr. O. Kitundu	Field Trials Officer
Lyamungu	Mr. T. Samki	Zonal Economist
Lyamungu	Mr. V. Akulumuka	Zonal Agronomist
Lyamungu	Mr. D. Mallya	Field Trials Officer
Lyamungu	Mr. S. Swai	Field Trials Officer

In addition to building a team of FSR staff, the project has succeeded in attracting cooperation from commodity oriented researchers. The following TARO personnel are working on joint experiments with the project:

Table II: TARO Personnel Involved in Joint Experiments

POST	NAME	TITLE	PROGRAM ASSOCIATIO
Ilonga	Mr. I. Mhando	Soil Chemist	National Soils Service
Ilonga	Mr. R. Chambuya	Entomologist	National Grain Legumes Program
Ilonga	Dr. J. Kabissa	Entomologist	National Cotton Progra
Lyamungu	Mr. P. Matowo	Agronomist	National Maize Program
Lyamungu	Mr. O. Mbuya	Agronomist	National Bean Program
Lyamungu	Mr. E. Koinange	Breeder	National Bean Program
Lyamungu	Mr. I. Kullaya	Soil Chemist	National Coffee Progr

Attachment 2

TARO/FSR Manpower Requirements

Zone/District	Scientific Officers			Field Trials Officers		
	Requirement	Current	Gap	Requirement	Current	Gap
DSM Headquarters	2	1	1	-		-
Ilonga	3	3	0	4		0
Hombolo/Dodoma	1	0	1	2	1	1
Other Districts	-	-	-	2	0	2

The FSR/E personnel acknowledge that extension can play a vital role in the FSR/E process - the traditional extension or dissemination role as well as an implementing role for the on-farm trials. Their role could become more crucial should FSR/E funds and personnel be reduced. In fact, FSR/E surv could be determined by the extent to which extension participates and is integrated into the FSR/E activities. The OSU/ FSR Project is complimented for their efforts to integrate extension into project activities.

Given the critical necessity for extension involvement, the implementing of separate on-farm trials by extension and FSR should be reconsidered. Recent on-farm trial completion suggests that extension's human resource FSR/E capability may not be adequate. Integrating FSR/E team and extension personnel will contribute to the hands-on or learn-by-doing, on-job training activities. Greater efficiencies (scale economies) can be realized from other on-job, and formal short term training activities by qualified FSR/E team members or from other organizations such as FAO and CIMMYT.

Only two FSR/E professionals (agricultural economist and agronomist) are stationed in the Lyamungu region. They are relatively inexperienced in that they are recent college graduates. In addition, the area is limited by the lack of good field officers (trial implementors). This could explain, in part, some of the trial implementation problems observed with some of the off-farm trials; e.g. the problem of getting appropriate bean density levels among treatments and an adequate control (farmer traditional plant density levels).

The team lacks a more senior person to exercise FSR/E leadership - one who can more effectively interact with commodity researchers and extension personnel. In short, the FSR/E team would be better positioned to interact at the co-professional level.

b. Ilonga Trials

The diagnostic surveys provided information about system constraints. Noteworthy was the Kilosa survey which identified system shortcomings (lack of timely output in the form of foodstuffs for the month of February - the hungary month) in terms of both production and adequate storage activities. Attachments No. 3 and No. 4 show the diversity of trials identified as appropriate interventions to the system. In addition, the "Trip Report" of Ann Stroud suggests focus and priorities for still other interventions. In general, the team concurs with her recommendations.

c. Lyamungu Trials

The FSR/E activities at the Lyamungu area (Moshi district) differed from the Ilonga area (Kilosa district) in terms of constraint identification and on-farm trial design and implementation. Farmer systems in the Moshi district can

Attachment

KILOSA DISTRICT 1985/1986 EXPERIMENTAL PROGRAM

On-Farm Experiments	Crop Sequencing/ Timing	Crop Intensi- fication	Labor/ Crop Manage- ment	Soil Fertility
1. Sequential Cropping Patterns	X	X	X	X
2. Maize Variety x Density	X		X	
3. Maize/Crotalaria Intercropping		X	X	X
4. Maize Varietal Comparison	X			
On-Station Experi- ments				
5. Maize Variety x Density super- imposed on Crotalaria	X	X	X	X
6. Crotalaria Method of Planting			X	X
7. Maize/Crotalaria Intercropping		X	X	
8. Leucaena Alley Cropping			X	X
9. Maize/Cowpea Spatial Arrange- ment	X	X	X	
10. Maize/Cotton Intercropping	X	X	X	
11. Cowpea/Cotton Intercropping	X	X	X	

Attachment 4

DODOMA DISTRICT 1985/198- EXPERIMENTAL PROGRAM

On-Farm Experiments	Moisture	Soil Fertility	Labor
1. Influence of FYM and Crotalaria on Cereal Production		X	X
2. Conservation Tillage Trial	X		X
3. Cereal/Crotalaria Intercropping	X	X	X
4. Minjingu Rock Phosphate		X	
On-Station Experiments			
5. Conservation Tillage Trial	X		X
6. Minjingu Phosphate		X	
7. FYM Application Methods		X	X
8. Cereal/Crotalaria Intercropping		X	X
9. Alley Cropping of Leucaena		X	X
10. Maize Varieties x Time of Planting	X		

characterized as being more complex than in the other program delivery areas.

Farmers' primary food crops are maize, beans, and cowpeas. addition, bananas and coffee are intercropped primarily as crops (bananas also serve as a food crop), and livestock enterprises (cattle, goats, chickens, and swine) are a significant part of the small landholder system. An earlier study (Mlambiti, Edelsten, and Colyer, 1982) shows that about 70 percent of the acreage area is devoted to coffee/bananas intercropping. Maize an maize/beans take about 25 percent the acreage.

Climatic conditions are much more favorable; hence, farmers produce in a much less risky environment. Cunard notes that crop husbandry on the slopes of the mountain is in an excellent state and because it is also intensive, does not require major improvements. Some "fine tuning" is needed to make it possible to grow crop varieties that are adapted to the micro-climatic environment that prevails during the wet season.(Cunard, 19[illegible]).

Land was considered the most contraining factor of production (1985 Moshi District on Farm Trails, p.1). Because land is assumed to be the limiting factor of production, on-farm trials focused on efforts to increase the return to land. Trials then focused on bean and maize density and fertilization levels. Attachment No. 5 summarizes the current field trials under evaluation.

Although the focus of the FSR/E is on food production, lack of knowledge of the total system (refer to previous discussion of this report) can detrimentally influence design of intervention(s). Only after the interaction of all enterprises of the total system are considered can the design of appropriate interventions proceed with assurance that the constraints have been appropriately identified.

4. Impact and Evaluation

a. Impact on Farmers

As highlighted in several of the project publications, a possible intervention to provide food during the hungary month(s) was a short season maize known as the Kito variety days for maturity). Appropriate trials were designed to test adoption feasibility for the traditional systems.

Early on-farm trial results were whopping successes. Almost all farmers were pleased. Seed is in great demand and is reflected in scarce seed supplies.

At this juncture, the role of FSR/E in identifying an important system problem confronting farmers, designing and testing by on-farm trials, and later adoption by farmers as a solution to a

Attachment 5

MOSHI DISTRICT 1985/86 EXPERIMENTAL PROGRAM

On-Farm Experiments	Returns to Land	Labor	Soil Fertility	Moisture
1. Paired Row Intercropping	X	X		
2. Maize/Bean Density X Fertilizer	X		X	
On-Station Experiments				
3. Paired Row Intercropping	X	X		
4. Crotalaria Method of Planting		X	X	
5. Maize/Crotalaria Rotation Cropping	X	X	X	
6. Conservation Tillage Trial		X		X
7. Maize/Crotalaria Intercropping		X	X	

system problem reflects the contribution that the FSR/E app[illegible] can play in increased agricultural productivity. The "Kito" story brings home the necessity of looking at the total system rather than a component, and highlights the necessity of an adequate technology generating or research support system - Kito was on the shelf and FSR/E discovered and assessed its adaptability to farmer systems.

Earlier research efforts produced Kito. The narrower commodity focus of addressing variety development on the basis of maximum yield, irrespective of knowledge about total system inputs and outputs (economic performance of the system), which includes the problem of rodent and insect damage to stored grain until consumption, envisaged little or no value of Kito. This limited partial analysis by commodity researchers was incorrect, and highlights the consequences when researchers and extensionists are not acquainted with the total system perspective.

A large number of other on-farm trials have been designed and implemented for the Ilonga area. Farmers were actively involved in their design. Trials address a large range of interventions - from plant density, variety, fertilization, to intercropping combinations that consider date and planting alternatives.

Worthy of mention is the maize/cotton intrcropping trials. Since there is a national policy against maize/cotton intercropping the trials (with government approval) using an early maturing maize (Kito) could be the basis for a national policy change that would favorably impact on farmer productivity.

Some farmers have intercropped full season maize with cotton and this has reduced cotton and maize yield when compared with cropping practices. A short maturing variety planted early could complete growing activities and the ear in the process of drying at the time of cotton planting. This combination of intercropping and relay cropping could enable timely planting of both crops, with the consequence of both crops providing the maximum yield potential.

Another noteworthy input relates to the effort to promote interaction among all parties (farmers, extension workers, commodity researchers and FSR specialists) necessary for successful FSR programs. Initial underpinnings related to interaction among these groups have been accomplished and hopefully established to the extent that continuity can be maintained after the project terminates. The team acknowledges that institution building is a long term investment, and the U.S. system is still struggling with comparable issues of communication and interaction within the dynamic FSR/E process.

b. Training

The OSU/FSR project has performed well in a number of training activities. In addition to the important on-job training in performance of day today activities, long-term and short-te human capital investments were made.

(1) Short-term Training

Short-term training activities were primarily in the form of National FSR/E training seminars. Three were held and focu on timely FSR/E methodology and implementation issues. Ano is planned prior to project completion.

Other short-term training activities (3) pertain to the 10 U.S. based participant trainees as a supplement to their discipline oriented long-term academic program. The intensive six-day course focused on FSR/E orientation and methodology. The cou se involved classroom lectures, small group work, interviews wit local farmers, data analysis, synthesis and presentation.

Another short-term training activity for the U.S. participan was a two day workshop. The object of the workshop was to improve communication between the technical assistance team and th participants studying in the U.S.

The third training activity allowed participant trainees to attend the Farming Systems Research and Extension Symposium at Kansas State Univesity. The trainees had the opportunity to hear papers and engage in discussion with FSR practitioners from around the world.

Long-term Training

There are 10 persons engaged in long-term training. The participants, academic major, institution they are attendi and time required for training completion are provided belo

Name	Degree	Institution	Est time to comp. Months
1. Nick Lyimo	PhD Plant Breeding	Un. Missouri	18
2. Emil Mbaga	PhD Agronomy	Michigan St.	18
3. Anatolia Mpunami	MSc. Plant Pathl.	Oregon St.	6
4. Clemens Mushi	MSc. Ag. Econ.	Kansas St.	12
5. Kija Bunyecha	MSc. Ag. Econ.	Un. Missouri	3
6. Evelyne Chota	MSc. Ag. Econ.	Michigan St.	3
7. Nurdia Katuli	MSc. Ag. Eng.	Oregon St.	9
8. Juma Katundu	MSc. Entom.	Oregon St.	6
9. Zainab Mbaga	MSc. Ag. Econ.	Un. Missouri	3
10. Otto Ringia	MSc. Ag Econ.	Colorado St	3

All trainees have made good academic progress and worthy of full support. At a minimum, participants should be supported through the completion of their academic course work. This enables the completion of a significant part of the human capital investment, and participants will be in a more favored position to obtain other support to finish their degree program - M.S. theses and Ph.D. dissertations.

c. Publications

The commitment of the FSR Project to documentation of their activities and outcomes of the project is impressive. To date, over 100 documents have been produced. Still others are forthcoming. Noteworthy is the fact that many documents are authored/co-authored by Tanzania. Presentations of project activities at the International Farming System Symposium is to be commended.

The publication activities enhance the efficiency of on-job training, provides support material for short-course training activities, and facilitates interchange within country and among other country FSR/E programs. The project has been effective in disseminating much needed books and periodicals. Granted, the gap is still large, such materials contribute to successful field implementation.

In short the publications contribute to the institutionalizing process that is necessary for FSR to continue in Tanzania. This activity should continue to receive high priority during the phase-out activities.

5. Program Linkages and Improved Management Capacity of TARO

a. Management Capability of TARO

Agricultural research in Tanzania is conducted primarily in four paristatal organizations, (1) Tanzanian Agricultural Research

Organization (TARO); (2) Uyole Agricultural Center (UAC); (3) Tanzanian Livestock Research Organization (TALIRO); and (4) Tanzanian Pesticides Research Institute (TPRI). The Director-General of each of these units reports to the Principal Secretary of the Ministry of Agriculture and Livestock Development (MALD) who, when he has questions may refer them to the Ministry's Chief Research Officers (Agriculture and Livestock). MALD, itself, has essentially no research activity. There is little, if any, privately supported research in the country at present.

There is little to no communication/cooperation among the research parastatals, let alone with the universities, extension and training. This project, however, achieved a considerable amount of this informally.

A consolidation of TARO and TALIRO was announced several months ago by the then Minister of MALD. There is little evidence that serious work is being done toward the implementation of that decision.

In short, the research organizational structure in Tanzania during the life of the OSU/FSR project has been in a state of flux.

A World Bank Assessment of the organizational structure for research and training in agriculture and livestock development reported the highest priority for improving the focus and output of agricultural research in Tanzania is the development of planning, financial control and management of research both at headquarters and at the zonal research stations. Another noted limitation of the system is the lack of up-to-date journals on a regular basis and reliable supply of text books. Scientists cannot do good research or publish internationally without access to scientific literature. Their isolation is heightened by insufficient foreign exchange to support research activities, communication and travel. There is no communication medium (professional or semi-professional research journal for scientists to report research works that are so vital for increased scientific productivity.

The Chief of Party, Dr. Mark Buchanan, identified various activities to address these limitations. He has a distinguished career in research management. Dr. Buchanan developed/adapted a number of micro computer management tools to enhance research management capability of TARO management. In addition a number of short and longer term planning documents were developed.

Unfortunately, TARO Management did not avail themselves to the expertise and management tools that Dr. Buchanan developed. Reasons as to why TARO did not take advantage of this information and expertise were not determined. The old addage of "you can lead a horse to water but you can't make him drink" seems an appropriate description of the situation.

The FSR/E staff had considerable policy dialogue with TARO The

result of much dialogue was the development of how a FSR/E system can be organized, regardless of the Ministry of Agriculture Organization. The Tanzania Farming Systems Pr[illegible] has recommended that the GOT create a National Farming Sy[illegible] Advisory Committee to oversee all FSR/E activities within Tanzania. The NFSAC would empower a National FSR/E Coordi[illegible]or (located within TARO or elsewhere) to coordinate on a day to day basis these activities. At the national level, the Coordi[illegible]or should be supported by a well qualified Production Econom[illegible] and Agronomist (in the short run these roles may be filled by expatriates). This national team would be responsible fo[illegible]e planning and monitoring of all field and training activitie[illegible]nd thus would maintain direct working links with all zonal F[illegible] teams. Figure 1 highlights the functional activities amo[illegible]l of the relevant FSR/E cooperators.

In addition, cooperation should be fostered between the TA[illegible]FSR teams at all levels and FSR/E researchers in other institutions such as Uyole Agriculture Centre, the Tanzania Livestock Research Institute, the Sokoine University of Agriculture, and the University of Dar es Salaam.

b. Project Networking Linkages

A number of networking activities were established during [illegible] life of the project. The most significant are highlighte[illegible] below.

TARO (Commodity Groups):

FSR/E members serve on the executive committees of all of the major crop-coordination committees. Commodity researchers have assisted in the planning of all FSR/E experiments and joint[illegible] administer some of the on-station trials. Many of the com[illegible]ity researchers have participated in the training workshop and conferences.

Ministry of Agriculture and Livestock Development (MALD):

At the national level close links have been maintained with the Directorate of Research and the Directorate of Extension and Training. One staff member from the Directorate of Researc[illegible] and Training has been hired by the project to do a special stud[illegible] on the role of women in agricultural production. At the fie[illegible] level extension personnel have been integrated to the deg[illegible] possible into all on-farm research activities. Field leve[illegible] extension personnel have participated in training and hav[illegible]een active on the District FSR team.

Sokoine University of Agriculture (SUA):

Representatives of SUA Farming Systems Project have attended and presented papers at all workshops and conferences. Faculty members of SUA have with our funding completed a bibliography of FSR related publications on Tanzania and will complete a micro-level marketing study. The SPE has acted as resourc[illegible]

person for the Department of Rural economy and the COP served on a review mission for the University.

Tanzanian Livestock Research Organization (TALIRO), Uyol Agricultural Centre (UAC), and Tanzania Pesticides Research Institute (TPRI):

Staff members from all three research parastatals participated in the National FSR Conference and have exchanged documents with the Project.

FAO Fertilizer Project (Moshi):

Visits have been exchanged during training sessions, data been shared, and research has been jointly outlined to ensure complementarity.

University of Dar es Salaam:

Staff members from the Institute for Resource Assessment (IRA) and the Economic Research Bureau attended project meetings. Planned collaborative research has not materialized to this point.

CIMMYT:

Has been active in providing training to TARO and extension personnel in collaboration with the project technical assistance team. Team members have attended regional CIMMYT workshops.

IITA:

The project has worked with members of the IITA team to ensure synergistic interaction and to avoid duplication of work as the IITA team (located at SUA) initiates field work and training activities.

World Bank:

The technical assistance team provided input to a World Bank mission during its visit to Tanzania as well as comments to the Ministry of Agriculture and Livestock Development on the Mission's findings.

TANSEED:

The FSR Team has provided feedback on the popularity crop varieties to officials at various levels of TANSEED. Suggestions have also been made with respect to future seed production plans.

B. Land Development at the Ilonga ARI

In the late 1970's, it was decided to develop a Master Plan for Station Development at which time technical advice was sought from CIMMYT, IITA, ICRISAT and later, Colorado State University. The Ministry of Agriculture assisted in determining the direction and initiation of the improvement program at Ilonga. TARO became the implementing agency at the begining of the plan in 1980/81.

The final master plan contained three major components:

- Land Development including land leveling of all research plots and irrigation facilities for one fourth of the research farm, namely 50 hectares.

- Agriculture machinery and vehicles.

- Station Development consisting primarily of 19 buildings for offices, seed storage, laboratories and ancillary shops.

The agricultural machinery and vehicles were purchased with funds from the Agricultural Research Project. The discussion/evaluation of Station Development is presented in the following section.

The rationale for land development was two fold. Ridge type terraces were made to control soil erosion, but unfortunately they retarded drainage which created water logged soils. This made for poor crop growth as well as prevented field operations by machines. Also, the opposite occurred during extended dry spells within the cropping season. At times these prolonged dry spells would cause severe stress, severe enough to loose valuable germplasm and the loss of experimental plots.

By developing 50 hectares of irrigated land, the valuable germplasm would not be lost during moisture stress, two or three generations of breeding material could be produced each year and future research programs could include irrigation studies.

The land development consists mainly of the construction of an earth dam 1200 meters along to form a lake of 34 hectares. It will hold 564 acre-feet of water. The water from this lake, which is collected from the catchment area and supplemented with that from the Ilonga River, will be pumped to the reservoir which has sufficient capacity to irrigate 18 hectares through an underground distribution system.

Construction started in 1980/81 when the machinery and vehicles arrived. These items were purchased mainly from the U.S. Excess Property program with an estimated value of $1,050,000.00. Pipes, fittings, valves and other equipment with an estimated value of $775,000.00 was also provided. Thus approximately

$1,840,000.00 was provided for this equipment and supplies from the former Agricultural Research Project.

In 1981/82 when the land development project started the estimated cost was T.Shs. 10 million and was increased to T.Shs. 12.3 million at the end of 1983. These funds were to be provided from the TARO budget, but were not forthcoming. The PL 480 Committee was requested and approved T.Shs. 7.266,5 million to be spent from the last half of 1982 to September 1986. To date, T.Shs. 6.555 million have been spent leaving a balance of T.Shs. 258,500. In January 1986, a new cost summary was prepared and an additional T.Shs. 6.335 million was requested. It is believed that this is an underestimate of about T.Shs. 4.5 million.

The major components yet to be constructed are:

146 Ha. of land to be levelled
15,000 M of roads and drains
102,300 cubic meters of soil for dam construction
12,500 square meters of dam riprapping
350 M of intake channel
4,160 square meters of plastic lining for reservoir
1,800 M electric wire for pump house
Pump house construction

At the time of this evaluation, it is questionable where the necessary funds, estimated to be T.Shs. 10.5 million to complete this project will come from.

Even if these funds were available from some source, whether foreign donor or the Ministry of Agriculture and Livestock Development, the recurrent costs for electricity to pump water, maintenance and leveling of the fields may be of such magnitude that funds will not be available. Thus, until the Ilonga ARI budget is significantly increased, it is probably wise to stop further construction and put the project in abeyance until funds for completing the construction and recurrent costs are available. Due consideration should be given to the costs/benefits of the irrigation regarding the scale designed for the project. Irrigation of plants under stress could adversely impact on selection pressures when drought tolerance is the primary selection characteristic.

The GAO performed an audit of the spare parts purchased for U.S. Excess Property equipment and found that TARO did not have a proper inventory control system. A contract was agreed upon with Price Waterhouse to design an appropriate system for controlling the inventory of expendable and non-expendable items at the Ilonga ARI. Training sessions were held and a manual on inventory control was prepared by the constultant firm. This system has been put into operation and is working satisfactorily.

C. Station Development at Ilonga

The original Project Paper for the FSR Project contains an annex, Engineering Analysis (construction). In this annex, nineteen buildings are proposed which are:

Four office blocks
Four work buildings
One administration building
One farm chemical store
One machinery shed
One power house
One workshop for machinery and vehicle repair and maintenance
One laboratory
One silo work area for seed threshing and cleaning
One seed storage warehouse
One farm office
One industrial gas store

The estimated costs for this construction was $1.2 million in foreign exchange and 2.6 million in local currency.

One of the construction standards presented in the original PP stated that all buildings will be of single level, steel framed modular type of only two widths and two lengths. Alternately they may be of completely prefabricated type supplied as a turn-key operation. Until the finances of the two alternatives are investigate, it is assumed that the buildings will be of steel frame type with local interior construction. The exterior and interior walls will be made of six inch thick hollow sand/cement blocks.

In the PP Supplement No. 1 the total construction cost (excluding imported materials) is estimated at T.Shs. 17.6 million or $1.409 million financed with PL 480 Title I counterpart funds. AID is financing the cost of off-shore materials estimated at $488,000. The original PP included cost of $4.145 million of which $1.235 million was for the foreign exchange cost of imported materials.

At the time of this evaluation, $661,000 have been spent to purchase the off-shore materials. The local currency component from PL 480 Title I funds have been increased to T.Shs. 23,516,000. As of February 21, 1986, T.Shs. 8,638,000 had been claimed by the quantity surveyors. If the amount expended used as a measure of the completion of the buildings, slightly more than one third of the construction is completed. The original contract period was for 65 weeks beginning from January 14, 1984. The extended date of completion was December 29 1985. Presently this date is being extended by about six weeks, which is about the time of this writing. With shortage of labor, local building materials and automotive fuel, it is somewhat doubtful that construction will be completed by the end

of calendar year 1986.

The construction of the buildings is not as stated in the P the buildings are not steel framed modular type with six in hollow sand/cement blocks. The buildings under construction have reinforced concrete columns and ring beams. The walls are made with solid concrete blocks at least ten inches thick. It was estimated by the research staff at Ilonga that because of the present design that the construction costs are at least one third more than necessary.

There are two major concerns which TARO must give due consideration and support. The first is the added recurrent cost for operation and maintenance of the buildings once they are completed. A second, and much more difficult problem is to obtain a source of foreign exchange to provide laboratory equipment and supplies as well as office furniture and equipment. Unless funds become available in the form of foreign currency, it may be sometime in the future before these new buildings are suitably and sufficiently equipped.

v. Phase-out and Recommendations

A. FSR/E

The FSR Team has made very good progress in the relatively short time, particularly in generating interest in this new approach to increased agricultural production. The Team has been very fortunate in the introduction and ready acceptance of the Kito maize variety. Kito is by no means an outstanding variety from an agronomic standpoint. It is earlier maturing than the local varieties and this is its most important characteristic. A new white flint variety with early maturity, disease and insect resistance, and stiff stalk (lodging resistance) should be developed by the maize research staff to replace Kito. This staff should work cooperatively with the FSR/E Team in developing improved maize varieties.

The Evaluation Team observed an interest in the FSR/E program by the extension workers. This interest should be kindled and there should be more involvement by the extension staff, from the highest level down to the village extension worker. It is the latter who works most closely with the farmers.

The diagnostic surveys should look at the total farming system, particularly in an area like Moshi. There the farmers grow both food and cash crops and raise livestock. All of these aspects of the farmers' actual practices must be considered as a total package. Once these are known, interventions should be introduced as they are more likely to be on a sounder basis and more readily accepted.

Nearly all of the research conducted on crops has been done exclusively at the research stations. Not much consideration has been given to the contraints to increased agricultural production with which the farmers must contend. At the same time this agronomic research is being conducted, the research associated with the economics and sociological aspects must be considered. One of the important points for consideration is the economic benefits the farmers will acquire from such things as cost of seed of improved varieties, agricultural chemicals and other inputs.

Much emphasis has been placed on intercropping and plant densities. This should be continued and more research on this should be done at the research stations under controlled conditions.

On-the-job training should continue until the project is terminated. It is strongly recommended that after the termination of this project that the Tanzanian FSR/E Team continue giving short courses, similar to those carried out in the past.

There are ten Tanzanians in the U.S. for advanced training. It will take from three to eighteen months for these participants to complete their M.Sc or Ph.D degrees. It is recommended at

some provision be made to help insure the completion of training of these ten participants. An extension of the FSR project for more than six months will be required for the four participants funded under this project. Hopefully, some other donor will be able to fund this training. It is a sound investment to enable these students to complete their training.

B. Land Development at Ilonga

TARO is the implementing agency for the land leveling, laying of underground irrigation pipes, construction of the lake, dam and the holding reservoir. The major task remaining to be done is earth moving. There are a bulldozer and front end loader for this work, but both currently under repair. Given their present state of repair and age, and availability of spare parts, it is very doubtful that these two pieces of equipment can complete the required earth moving work.

An alternative is to contract with a private firm to do this work. The estimate for a private contractor to complete the dam alone is over three times greater than the estimate for TARO to do this same job. Thus in one instance, the maintenance of the equipment, availability of spare parts and fuel may be the limiting factors while available local currency for a private contractor may also be limiting.

In any event, the recurrent costs for electricity to pump water and the added maintenance cost for irrigated fields must be given due consideration. Detailed plans to provide the necessary request and support for the recurrent budget must prepared early on, based on the assumption that the irrigat facility will be completed.

C. Station Development at Ilonga ARI

It is going to take continual supervision and "bird-dogging" to insure that the buildings are completed within a reasonable time and in a satisfactory manner. As stated earlier in this evaluation, it appears that not much more than one third of the work or contract is completed at this writing.

One factor to take into consideration and to plan for is the recurrent costs associated with these 19 buildings for such items as electricity and maintenance/operation. No doubt these costs will be appreciably greater than those for the present setup.

The buildings now occupied are only four with old equipment and furniture. To replace these items with new supplies and to purchase additional laboratory equipment, office furniture and supplies will require considerable sums of foreign exchange. Given the current economic status of the country, it is very unlikely that any foreign exchange will be available in the foreseeable future for these items. One alternative would be to seek these necessary funds from a foreign donor.

List of Papers and Publications Provided to the Evaluation Team

76 Life of Project Work Plan, as modified by OSU and CID, December 27, 1984.

92 The inclusion of Time Factors in the design of On-Station and On-Farm trials.

97 1984 Annual Report

101 Acker, David G, and Kearns, Jean R., Annual Project Review Report, July, 1985.

104 The "Kito Story" - (An Example of On-Farm Experimentation in Kilosa District).

106 Matzke, Gordon, Preliminary Report of Land Use/Land Tenure Specialist's Reconnaissance of Selected Villages in Kilosa District, Tanzania, August 1985.

107 Lev, Larry S., A Summary of the Current Status of FSR Field Activities, October 4, 1985.

111 Quarterly Report - For the Period July 1, through September 30, 1985.

112 Acker, David G., and Sungusia, Don, - A Study of the Role of Extension in Farming Systems Research in Tanzania. Draft distributed for review and comment, October, 1985.

114 Buchanan, Mark T. Functional Structure for the Professional Component of Farmers/Professionals Farming Systems Research and Development, Paper presented at National Farming Systems Conference, Arusha, November 13, 1985.

115 Ilonga Zone FSR Team, Kilosa District 1985/86, On-Farm and On Station, Experimental Programs, Prepared for: The 1985 National FSR Coordinating Conference, November 12-13, 1985.

116 Ilonga Zone FSR Team, Dodoma District 1985/86, On-Farm and On-Station, Experimental Programs, Prepared for: The 1985 National FSR Coordinating Conference, November 12-13, 1985.

117 Lyamungu Zone FSR Team, Moshi District 1985/86, On-Farm and On-Station, Experimental Programs, Prepared for: 1985 National FSR Coordinating Conference, November 30, 1985.

119 Lev, Larry S., Summary of Fieldwork and Related Activities f. the Fourth Quarter, 1985, January 6, 1986.

121 Staff, Quarterly Report for the Period October 1, through December 31, 1985, (with Program of Work and Expenditures Report for PL 480 TShs. Dollar expenditures are to become available at a later time.), January 15, 1986.

123 Lyamungu Zone FSR Team., Summary of the 1985 Moshi District On-Farm trials, Prepared for: 1985 National FSR Coordinating Conference November 12-13, 1985.

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Buchanan, M.T. and D. Sungusia, "Tanzania Farming Systems Research and Extension Program 1986/87 - 1990/91