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Assessment of Rift Valley Pilot Rice Project and Recommendations for Follow-on Activities

TANZANIA
USAID

WATER MANAGEMENT SYNTHESIS PROJECT

WMS REPORT 24

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ASSESSMENT OF RIFT VALLEY PILOT RICE PROJECT AND RECOMMENDATIONS FOR FOLLOW-ON ACTIVITIES TANZANIA/USAID PROJECT NO. 698-0410.03

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WMS Report 24

PREFACE

This study was conducted as part of the Water Management Synthesis-II Project, a program funded and assisted by the United States Agency for International Development through the Consortium for International Development. Utah State University, Colorado State University and Cornell University serve as co-lead universities for the Project.

The key objective is to provide services in irrigated regions of the world for improving water management practices in the design and operation of existing and future irrigation projects and give guidance to USAID for selecting and implementing development options and investment strategies.

For more information about the Project and any of its services, contact the Water Management Synthesis-II Project.

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FOREWORD

The Rift Valley Rice Project was intended as a pilot project. In this light, it performed remarkably well. It turned out to be a pilot not only for rice cultivation, but for large earth moving machinery rehabilitation as well.

The Rift Valley is clearly a hostile environment for rice cultivation. Water availability is very low but surprisingly the circumstance of topography, soils and rainfall distribution recommend lowland paddy. There is no draft animal tradition to farm the heavy clay soils so the burden falls on human labor. The support services to agriculture are in their infancy. Add to this a national fuel shortage during project implementation and floods followed by late season drought in the first year and the project accomplishments seem impressive indeed.

What is difficult to evaluate in extending this pilot to other areas was the role of the project manager, Kurt Lonsway. Clearly his seemingly limitless energy and fierce dedication to the project and people of the region played a key role in moving the project forward. His capacity to work within the system and his ready response to new opportunities as they presented themselves seemed a critical input. Perhaps even more central, his skill as an engineer allowed him to become actively involved in the day-to-day operation of the project.

The type of innovative management displayed on this project may be a necessary condition for the success of such schemes. This suggests close attention to the training of Tanzanian personnel.

The evaluation team was especially appreciative of the help of special consultant, C.K. Chiza, Zonal Irrigation Officer. His considerable experience helped in viewing the project from a broader Tanzanian perspective.

The assistance provided the team during their visit by USAID personnel, especially Mr. Kenneth Lyvers, was very professional and much appreciated. The openness of the Tanzania officials with whom the Team had contact was welcomed and extremely useful in gaining an understanding of the project and its potential.

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EXECUTIVE SUMMARY

Conclusions and Lessons Learned

In the opinion of the Review Team this has been a successful pilot project. The lessons learned can provide the basis for similar projects and for new efforts such as heavy construction equipment rehabilitation. For complete understanding of the Rift Valley Project it will be necessary to monitor use of the newly bunded paddy fields to determine the existence of any labor constraints to full project utilization. This would be of utmost importance in planning for similar projects in other areas.

In addition to the measured outputs from the Project the following important lessons have been learned during Project implementation. These lessons should be incorporated into any plans for continuing or expanding the Project.

1. There is no current capacity to support the introduction of improved paddy rice production packages to the Project area. At this time, the most effective program would be to find and observe the practices of the more successful farmers and transfer these practices.
2. There is local demand for newly bunded fields in the new perimeters in the Project area at the current cost of 1,750 Tanzanian shillings (TShs) per 0.5 ha plot. This charge is the approximate operating cost (fuel, lubricant, maintenance and operators' wages for tractor work plus material and labor for channel structures) of constructing the diversions, channels and bunds plus rough leveling of the paddies. The likely financial return to the cultivators, especially under parallel market but also with government prices, is sufficiently great to make the purchase of cultivation rights to the half hectare bunded fields of the project an attractive investment. The available evidence suggests, however, that the capacity to pay the 1,750 TShs charge may be limited to not more than 25 percent of the farm families in the project area. Any future projects of this type may wish to provide a credit system for less advantaged farm families for the purchase of cultivation rights.

3. There appears to be considerable demand outside the Rift Valley Project areas for building new and rehabilitating existing paddies at the approximate cost of operating the machinery.

4. It is important to go beyond rough bulldozer leveling to obtain grades within 10 cm of the average desired grade. However, fields should be surveyed to within 2 cm and levelled accordingly. Irrigations are made whenever runoff water can be diverted and water is stored up to a maximum of about 60 cm. Thus, precision leveling is not as important as with more conventional paddy irrigation systems. Furthermore, farmers can (and do) level their own fields by hand where they feel it will be profitable enough to justify the effort. It is worthwhile to mention that on both traditional paddies and Project paddies, the bunds are up to 1.0 m high and the paddies are at most 50 m x 100 m. Leveling such small paddies with such high bunds on the high clay content soils would be difficult with machinery and would probably more than double the unit area cost and complexity of development.

   It is recommended that the bunding of additional fields for which design work has been completed in new sub-project areas be completed. This can be readily accomplished with the trained personnel on hand. Additional construction in the area is not warranted until labor constraints and the distribution issues raised previously are understood. There may, however, be opportunities to build some small tanks before the construction equipment is returned to the government system.

5. Diversions on the larger perennial streams and water courses serving new perimeters larger than 10 ha should be provided with a control structure with some means for shutting off the intake canal. Such a structure is recommended in order to shut off inflow and effect repairs in the event that the channel breaches. The control structures should be simple stone masonry with grooves to hold stop logs as it is not necessary to completely shut off the flow.

6. There is a sufficient number of people in the district who have had enough previous mechanical experience and training so they can be trained to do good preventive maintenance and medium repair work on

heavy construction machinery. Thus, it was possible to keep the Project's earth moving machinery in serviceable condition at all times since an Agricultural (machinery specialist) Engineer with adequate access to spare parts was included in the Project. There is also a sufficient number of people in the district with potential talent to be able to rather quickly learn to operate the construction machinery efficiently. The operators were also able to learn to service their equipment and be cognizant of when a mechanic was needed.

7. It was discovered that much (essentially all in the Dodoma and Manyoni Districts) of the non-functioning heavy earthmoving equipment could be rehabilitated by relatively minor repair. In fact, the Project's mechanics have rehabilitated nine pieces of heavy machinery (value in excess of 1 million U.S. dollars) with approximately US $15,000 worth of spare parts. Seven of these were from previous rice projects and two belonged to the Water Department. Now the Project has three to four times its original capacity to do earth work (although there is not sufficient diesel and lubricants available to fully employ even the original Project [2 D7 bulldozers] equipment).

8. Because of the additional rehabilitated machinery now available, the Project machinery is very underutilized. This excess machine capacity should be utilized whenever fuel is available for other purposes (and use does not conflict with Project activities) within the districts such as tank construction, water spreading, contour ditches, flood control ditches, and access to roads to Project villages. The infrastructure of trained mechanics and spare parts inventory which has been created under the Project could form the core of a multi-agency repair and maintenance facility for the two districts. This service might, in part, be supported by PL 480 funds.

9. There is no system to monitor pest and disease problems. The entire area is vulnerable to the introduction of pests from other areas. It would be well to upgrade services in this area in the immediate future.

RAPID MINI APPRAISAL
OF
IRRIGATION DEVELOPMENT OPTIONS
AND INVESTMENT STRATEGIES
FOR TANZANIA/INDIA

TABLE OF CONTENTS

Page

PREFACE.....i

FOREWORD.....ii

INDIVIDUALS CONTACTED.....iii

EXECUTIVE SUMMARY.....iv

MAP OF TANZANIA.....ix

PROJECT DESCRIPTION.....1

Production/Output Goals.....2
Traditional Production and Management Techniques.....2

Rice Varieties.....3
Paddy Yields.....4

Overall Performance.....4

PROJECT OUTPUTS.....5

Bund Development for Paddy.....5
Pilot Project Perimeters Completed.....6

Chibumagwa Perimeter.....6
Ngaiti Rice Project.....9
Bahi Rice Project.....9

Other Perimeters.....10
New Traditional Plots.....10
Rehabilitation of Traditional Plots.....10
Other Works.....11
Training.....13

Agricultural (Irrigation) Engineer.....13
Agricultural Mechanics.....13

TABLE OF CONTENTS

Page

Skilled Machinery Operators/Drivers....14
Unskilled Operator/Driver Assistants....14
Irrigation Techniques....14
Storekeeper....14

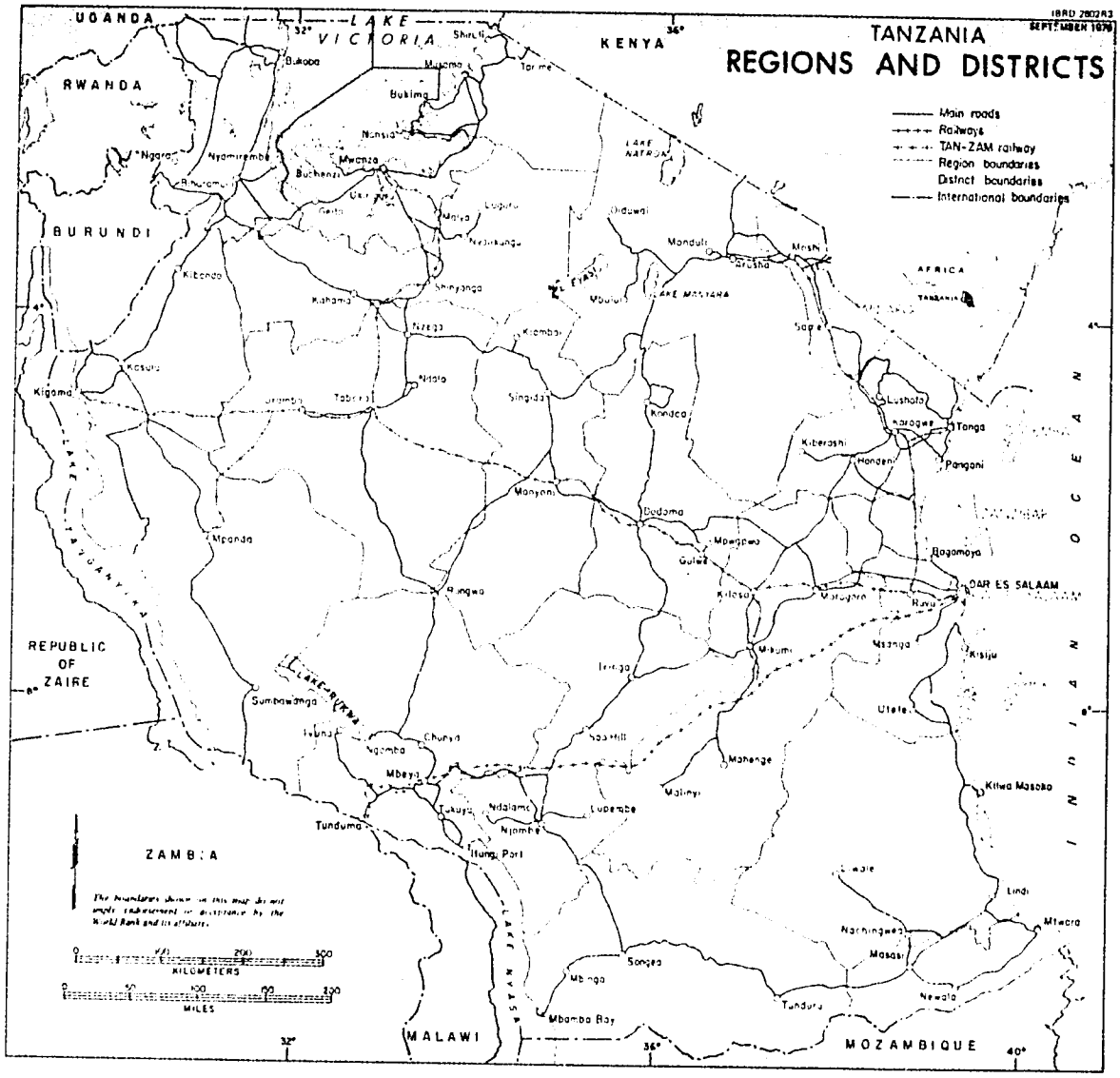
PROJECT IMPACTS AND CONCERNS....15

The Demand for Agricultural Labor....15
Concern for Pest and Disease Control....17
Data Collection....17
The Distribution of Project Benefits....18

ANNEX I: PROJECT EQUIPMENT INPUTS AND EVALUATION....20

ANNEX II: ENVIRONMENTAL ASSESSMENT OF RIFT VALLEY RICE PROJECT....26

ANNEX III: ENVIRONMENTAL EVALUATION OF THE RIFT VALLEY RICE PROJECT....31


TANZANIA
REGIONS AND DISTRICTS
Main roads
Railways
TAN-ZAM railway
Region boundaries
District boundaries
International boundaries
UGANDA
KENYA
RWANDA
BURUNDI
REPUBLIC OF ZAIRE
ZAMBIA
MALAWI
MOZAMBIQUE
LAKE VICTORIA
LAKE TANGANYIKA
LAKE RUKWA
LAKE NYASA
LAKE NATRON
LAKE MANYARA
INDIAN OCEAN
DAR ES SALAAM
KILOMETERS
MILES

PROJECT DESCRIPTION

The Rift Valley Pilot Rice Project (RVPRP) was a two-year accelerated impact program to test the feasibility/suitability of alternative assistance interventions to increase rice production in a four-village area of the Rift Valley in Central Tanzania and facilitate the design of a larger scale rice production project with cost effective and manageable interventions.

The Project area encompasses: a population of 8,601 people, 2,432 families; 22,500 ha, of which 3,000 were estimated suitable for rice production; and four villages--Ngaiti and Kintinku in Manyoni District, and Bahi Sokoni and Bahi Makulu in Dodoma District. The area's inhabitants are primarily Wagogo pastoralists with immigration of Nyamwezi and other groups which are believed to have introduced rice cultivation to the Wagogo about 30 years ago.

The Project intent was to introduce improved rice production technologies as a cash crop and enhance the welfare of the area currently based on semi-arid crops of sorghum and millet, and the less drought tolerant crops of maize and groundnuts.

The soils are vertisols with about a one percent slope varying from sandy clay loam to clay loam. They are subject to baking and cracking and become hard and difficult to work when dry, particularly with the existing hand hoe technology. The organic matter content in these alluvial soils is low and destined to remain so unless cropping patterns are developed which will alleviate this condition. The paddies are grazed clean and any remaining crop residue is burned prior to planting.

The Bahi Depression is a semi-arid ecosystem in the extensive inland drainage basin. The rainy season extends from December to April with 400-600 mm annual precipitation. The evapotranspiration rate is high and the potential for water impoundment carryover for dry season irrigation is very minimal. Agriculture is basically dependent on the direct utilization of the annual rainfall and within season drainage into the lower regions of the basin.

The Project rehabilitated and/or constructed new paddies along with water diversion bunds from seasonal rivers. On one perimeter the main waterway is provided with a control gate to reduce the danger of damaging the inlet canal and paddies during periods of excessive runoff.

In the first year of the Project early season flooding and destruction of some of the earth works and then late season drought prevented agronomic tests from being completed. However, the lesson learned with the machinery and equipment maintenance and rehabilitation and the development of the earthworks (see lessons learned section) can be extended to larger production programs.

Production/Output Goals

The constraints to increased production and incomes are as much a function of factors external to the irrigation schemes as direct agronomic factors within the schemes. There is an extreme shortage of and access to production inputs (tools, fertilizers, insecticides, improved seeds, productive services, support research, and extension and training). This limits the capacity of farmers to increase or improve production. In addition, current pricing and marketing policies and production regulations appear to act as disincentives. With current policies, considerable production bypasses official channels and moves into the so-called parallel market.

The Project goal of increased agricultural production and incomes of small subsistence farmers during their two-year pilot project was overly optimistic. The excessive early rains, flooding, and late season drought mentioned earlier prevented this goal from being realized. In addition, there was no package of practices to introduce from other areas or strong institutional system to facilitate change in the agricultural production system.

Traditional Production and Management Techniques

Due to the potential early season flooding of the Mbuga River and consequent loss of seedlings, nurseries are planted on raised plots along the sides of the main road or on top of the bunds where water can be splashed on the seedlings. This results in uneven moisture penetration

and seedling growth, and less than ideal nursery management. Manure is burned and the ashes spread on the nursery prior to planting. The farmers report that burning kills weed seeds and that plants grow better. No commercial fertilizer is used, whether due to unavailability or farmer reluctance is unknown.

The seedlings are transplanted in the paddies when they are about 25 cm high. The nurseries are often some distance from the paddies, so the rate of transplanting is limited by the volume and speed with which seedlings can be head loaded to the paddies. No attempt is made to plant in rows, but seedlings are placed at 75 to 90 mm intervals in all directions. In a few cases seedlings are planted at a heavier rate and the slower growing plants subsequently rogued.

The paddies are generally poorly leveled with high and low spots. After the first rains, as the soil becomes workable, they are hoed with the jembe, but are not and cannot be puddled by hand.

Under existing conditions little water control can be practiced. As soon as a few centimeters of water enter the paddies the low spots are planted first, with subsequent planting of the high spots as the water level increases. Experience has taught that frequently the rains start and then cease. The maximum level of water, therefore, is accumulated in the paddies throughout the growing season. One weeding is usually done after the seedlings are transplanted and before the water level rises. Farmers claim that the depth of water coverage largely eliminates weed problems.

Harvesting is totally by hand, using a small knife to cut one panicle at a time. The panicles are laid on top of the bunds to dry. They are then head loaded or packed to the house on a donkey, thrashed, hulled and polished by hand using a wooden pole, pestle and hollowed out mortar.

Rice Varieties. Supa, Kihoga Red, Kilombero, Mabwawa and Aphaa are grown in the RVPRP. IR8 and IR579 are to be tested this year (1983/84). The local varieties all require 150 days to maturity. The IR varieties are 120-day varieties. Supa, the main local variety, appears to yield higher and shatter least under the existing production and harvesting practices. Kihogo is preferred for eating but shatters easily.

Paddy Yields. Average yields of 1.5 to 2 tons per ha are reported for the project area. At one site in Udimaa, in 1982/83 under local production practices, average yields of 4.8 tons per ha were reported. This seems very high, especially since fertilizer was not used, but can be neither verified or refuted.

Overall Performance

Economic and social development from production increases in the RVPRP will be determined by a combination of project circumstances and external factors. Unless a package of agricultural practices and related support services are provided, along with price incentives, the potential of the RVPRP irrigation (or any irrigation) system is unlikely to be realized. Although the RVPRP, as well as other irrigation schemes, form a small part of the agriculture sector and the national economy, they are adversely affected by the same factors that affect agriculture overall.

PROJECT OUTPUTS

Bund Development for Paddy

Traditional construction of small rice paddies in the Bahi Depression is highly labor intensive. Mbuga soils (vertisols) are extremely heavy and difficult to work when dry. Farmers usually begin plot construction immediately following the first rains (around November) and continue until transplanting begins. A traditional bunded paddy field is not very level and conforms to no defined shape or size. Size reflects the suitability of the area as well as the individual's strength or ambition as a farmer. Bund maintenance is a yearly requirement due to erosion or settling of the bunds caused by rainfall, flooding, human and animal traffic.

One of the major project goals was to test the feasibility of using heavy machinery for paddy construction. Major advantages of machine developed plots are (1) longer duration construction season (June-December); (2) shorter time period required for construction; (3) greater bund, plot and surface uniformity; and (4) stronger bunds and diversion structures.

Three approaches in machinery intervention were tested over the two construction seasons during the Project: establishment of pilot schemes; construction of new traditional plots; and rehabilitation of existing traditional plots. Major problems encountered during the course of the project were:

1. Recurrent shortages of fuel, lubricants and other vital commodities;
2. Lack of an effective support system to maintain, service and repair heavy equipment on a district, regional and national level;
3. Delays caused by lack of local funds needed to purchase fuel, lubricants, and other required local commodities;
4. Difficulties in transporting heavy equipment to project sites; and
5. Lack of necessary spare parts.

Pilot Project Perimeters Completed

During two consecutive land development seasons (June-December) three unique pilot perimeters were completed (101 hectares total) and a ten hectare project is currently under construction. Larger, more fully developed village level project areas differ from the smaller scattered traditional developments in the following ways:

1. The perimeters are strategically located to take maximum advantage of available water (e.g., surface runoff, small streams, floods, etc.);
2. Channels are constructed to improve water accessibility;
3. Bunds are constructed larger and stronger to protect against erosion and excessive flooding and to enable retention of a larger volume of water; and
4. Structures or methods for improved water control and flood protection are introduced.

Chibumagwa Perimeter. The following is an historical review of the development of the Chibumagwa rice scheme which was the first of the new perimeters to be constructed. The description was taken from Project reports and supplemented by the USAID project officers.

Chibumagwa has a population of approximately 6,000 and is located approximately 29 kilometers southeast of Manyoni. The local populace is primarily involved in rice cultivation, pastoral herding and fishing. Since rice irrigation/cultivation is usually rainfed, and rains can be irregular and inadequate, rice production often falls far short of local needs.

The Chibumagwa Mission had been seeking a means for increasing food production. In 1980 they approached Manyoni and Singida Regions on the possibility of hiring a D-7 caterpillar which was working on a Freedom From Hunger Campaign project in nearby Chikuyu. The District and Region agreed, and money was collected from local parishioners and external donors for the Mission. However, as of July 1982, no action had been taken.

It was agreed that the RVPRP would try to assist the Mission. A suitable working contract was arranged whereby the Mission agreed to assume responsibility for the supply of diesel and lubricants, transport

of the caterpillar from Dodoma to Chibumagwa, and nights out allowances for drivers and surveyors. On July 2 the Project surveying team moved into the field. After discussions with the Mission and local farmers, the most suitable area was located (approximately 10.7 hectares), staked off and surveyed.

Since the selected area was relatively flat, it was decided that a 100-meter grid spacing would be adequate for surveying needs. Surveying was completed within two days. An initial contour map was drawn, and a few days later the D-7 caterpillar was on location to begin clearing brush from the site. A major difficulty of design was a lack of suitable hydrological data, both meteorological and runoff. Sources of runoff include both the spillway from a nearby dam and the surrounding catchment area. It was assumed that 30 cm of water could be applied in one day (24 hours).

When it came to the actual construction of the main channel and field lateral, it was found that the design size was much too small. Taking into consideration the erodibility of the clay soil, and assuming maximum settling and soil losses of 50 percent of channel bunds, it was decided on channel sizes larger than the initial design. Also, considering high degrees of settling, erosion, and other losses, it was decided on block bund heights of 1.5 to 1.7 meters with side slopes of 1:1 to 1:1.5. Where flooding erosion is not such a threat to inner field bunds, bund heights of 0.8 to 1 meter with side slopes of 1:1 to 1:1.5 were constructed.

A small earthen dam was constructed to trap runoff from the dam spillway and divert the flow directly into the main channel. The crest of the dam also serves as an access road to the project site.

Due to local cultural practices, project planners limited most plot sizes to square one-half hectares. However, the Mission expressed a desire to use a small tractor within the plots for cultivation purposes. One-half hectares is small but still feasible for small-scale mechanical cultivation. The Mission plans to use this scheme as a pilot project with the intention of enlarging the present cultivated area if it is successful.

Land development activities took place between July 15, 1982 and August 27, 1982. Problems of running short of diesel and discharged batteries were repeatedly encountered. A D5B caterpillar from Freedom From Hunger Campaign was obtained after making minor repairs and equipping it with spare batteries. The D7E left for another site on August 12 and the D5B left on August 27. The Mission provided all fuel, lubricants and expenses.

D7E	Total hours worked	138 hours
	Total diesel consumption	2150 liters
	Total engine/transmission oil	64 liters
	Total hydraulic oil	130 liters

Calculated hourly fuel consumption rate:

$$\frac{2150 \text{ liters}}{138 \text{ hours}} = 15.6 \text{ liters/hour}$$

This figure may be below actual consumption rate due to inaccurate measuring facilities.

D5B	Total hours worked	65 hours
	Total diesel consumption	860 liters
	Total engine oil	2 liters

Calculated fuel consumption rate:

$$\frac{860 \text{ liters}}{65 \text{ hours}} = 13.2 \text{ liters/hour}$$

No major problems were encountered with either the D7E or D5B. Both performed satisfactorily; however, the D5B was much slower in making bunds and proved more difficult to use for rough leveling.

Ngaiti Perimeter. Ngaiti is located approximately 80 km east of Manyoni with a population of 5,000 inhabitants. The Project developed an area of 70 hectares, falling 30 hectares short of the target of 100 hectares called for in the project paper. At Ngaiti the water source is from a seasonal stream overflowing from the Bubu River located approximately 15 km east of the project area. A total of three caterpillar D-7s, one D-5, a Rome plow, a 110 horsepower wheel tractor with 8-foot blades were used in construction.

Project execution occurred from mid-August until the end of November 1982. There were no significant different construction methods employed (since Chibumagwa) other than utilizing the Rome plow to facilitate ground preparation and the use of a wheel tractor for minor leveling within finished plots.

Costs were slightly lower than at Chibumagwa, mostly attributed to greater acquired operator and supervisor skills, less clearing required, and reduction in equipment transport costs. Total estimtaed cost per hectare was 2250 TShs.[1] Again, major problems encountered were recurrent shortages of fuel, lubricants and mechanical breakdown.

Bahi Rice Perimeter. The Bahi pilot perimeter consists of 29 hectares developed during the 1983 land development season. Bahi is located 60 km west of Dodoma. This perimeter was designed to utilize the seasonal flows of the Bubu River. Building on experience gained during the 1982 season, an intake protection structure and other erosion prevention measures were introduced. Perimeter and plot orientation takes advantage of natural contours and drains. The main canal allows for future expansion of the project. A projected cost estimate of 3500 TShs per hectare reflects the increases in fuel, lubricant, material and labor costs. Major constraints were severe fuel shortages and lack of suitable construction materials (e.g., cement, stone, gravel, etc.)

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[1] Excluding cost of equipment purchase and depreciation.

Other Perimeters

1. Lusilile, a ten hectare pilot perimeter in the Kintinku area (70 km east of Manyoni), is currently under construction. The project diverts a seasonal stream and bunds are constructed along natural contours.
2. Mwanachungu in the Bahi area was chosen by the villagers as a potential development site. Thus far (late 1983) 179 hectares have been surveyed, mapped and preliminary field and design work started. The project will attempt to redirect a seasonal stream into the project area to increase potential water availability.

New Traditional Plots

A new traditional plot is a machine-constructed plot following farmer design. The water supply is from rainfall and surface runoff. The farmer acts as surveyor, engineer and construction supervisor. Cost of construction is cheaper at around 1250 TShs per half hectare and also precludes the necessity of extensive channel construction. Bunds are easily twice the size of the traditional handbuilt bunds, plots are deeper and leveling is usually rougher.

Rehabilitation of Traditional Plots

Rehabilitation of existing traditional plots requires the shortest time and is the least expensive of all machinery interventions tested. Plots are often reshaped and bunds are usually twice the traditional size upon completion. Cost of construction averages 1000 TShs per half hectare reflecting lower fuel, labor and other costs. This approach, as well as building new traditional plots has met with the greatest villager enthusiasm.

Project Developed and Costs

Duration	Type of Development	Development Period	Total Area Developed	Estimated[a] Time to Develop per ha	Estimated[b] Cost per ha
Chibumagwa	Pilot scheme	July-Aug.'82	11 ha	16 hrs.	2300 TSh
Ngaiti	Pilot scheme	Aug.-Nov.'82	70 ha	14 hrs.	2250 TSh
Bahi	Pilot scheme	Aug.-Oct.'83	20 ha	16 hrs.	3500 TSh
Bahi	Traditional scheme	Oct.-Nov.'83	10 ha	8 hrs.	2500 TSh
Bahi	Traditional scheme	Oct.-Nov.'83	20 ha	4-6 hrs.	2000 TSh
Lusilile	Pilot scheme (under construction)	Sept. '83	10 ha	--	--

[a]Includes clearing, channel construction plus all other construction averaged over total area developed. Also a function of development equipment used.

[b]Covers cost of fuel, lubricants, labor and other inputs.

Other Works

The initial delays encountered in starting up the RVPRP due to lack of local funds, equipment, transport, etc., suggested the possibility of utilizing the Project machinery to assist other relevant development projects. After discussion with relevant authorities it was agreed that the RVRP could enter into contracts with other government branches or legitimate agencies if the following conditions could be met:

1. All fuel, lubricants and other inputs were supplied by the contractor;
2. Transport of equipment to and from the site was paid by the contractor;
3. All additional labor costs, other than operator salaries, paid by the contractor;
4. The contractor, depending on the nature of the contract, agreed to pay standard government hiring wages; and
5. The contractor agreed to assume responibility for all mechanical and/or other failures directly related to job execution.

The RVPRP was not to undertake other work during the project land development season unless lack of funds, fuel or projects precluded utilization for Project purposes.

From May 1982 until December 1983 the Project undertook and completed five major "other works." The following is a brief description of each project undertaken:

1. Mchito Dam spillway construction--An FAO funded project lacking suitable heavy equipment to complete a large spillway, construct roads and clear irrigable land was assisted for two months, May-June 1982, with a D7 caterpillar.
2. Chibumagwa Pilot Rice Project--(see pilot projects completed).
3. Nyakali Quarry Project--Project assisted the System Building Services (SBS) on a Dodoma Capital Development Authority (CDA) project for a total of three months (Aug.-Sept. 1982 and April-June 1983).
4. College of Business Education-Dodoma--D7 project caterpillar assisted SBS to complete most earthworks and roads on a large construction project.
5. Chibumagwa Dam Reconstruction Project--The Chibumagwa Dam was destroyed in 1983 by excessive rainfall and flooding. The Chibumagwa Rice Project was heavily damaged and the project assisted Maji (Water Department), Manyoni, to obtain funds from the PL 480 proceeds committee in Dar es Salaam for dam reconstruction. Construction began in June 1983 and was

completed in November 1983. The rice project was also reconstructed. Two heavy machines under Maji were also rehabilitated (see rehabilitation). Rice Project equipment and other equipment was located to complete the project.

Major benefits realized during other works include:

1. Demonstration of project willingness to cooperate with other government and private organizations during idle periods;
2. Observation of mechanical performance and to gain practical experience with project equipment;
3. Provide operators and mechanics with valuable working experience; and
4. Generate additional local funding for the Rice Project.

Training

A significant accomplishment of the Project was personnel training. Few of the Project personnel entered the Project with applicable skills. Most had virtually no job related experience. Emphasis was given to "hands on, on-the-job" training of Tanzanians in the maintenance and repair of heavy machinery and the design and supervision of Project work. People were actively recruited and trained over the life of the project and the quality of the staff is believed sufficient for continuation of the Project.

Agricultural (Irrigation) Engineer. The Tanzanian Irrigation Engineer-Project Director did not arrive on-site until early October 1983. He was U.S. trained for three years in Agricultural Engineering and worked for a short period on the Dakawa Rice Scheme in Morogoro before transferring to the Project. He is responible for all design, construction and administrative duties. The Project will be operated as a substation under the Zonal Irrigation Office located in Tabora.

Agricultural Mechanics. Of the three agro-mechanics recruited for the Project, two remain in the program. Both received training at the Ministry Agriculture Training Institute (MATI) at Mlingano, Tanga and are exceptional workers. Project mechanics were expected to work with limited resources and tools to perform minor repairs and routine maintenance at the field level. Since facilities for major repairs and overhauls were not available the mechanics were encouraged to work

closely with the operators to monitor machinery performance and carry-out preventive maintenance. The Project is currently establishing a workshop to facilitate the Project repair and maintenance capabilities which in turn will increase the mechanic's ability to maintain Project machinery.

Skilled Machinery Operators/Drivers. The Project acquired the services of five skilled heavy equipment operators and one tractor driver in the initial stages of the Project. Some had previous experience with (perimeter) plot construction. Operator/drivers were trained to perform all routine and preventive maintenance on their respective machines and when to recognize the need for a mechanic. Skills in techniques used in constructing perimeters were refined and drivers were instructed in ways to work more closely under the supervision of irrigation technicians.

Unskilled Operator/Driver Assistants. Approximately fifteen unskilled operator/driver assistants joined the Project. All arrived with virtually no operational, driving or mechanical skills. They were probably the greatest beneficiaries of the mechanical component of the Project. The assistants were trained in the mechanics and operation of Project machinery under the close supervision of experienced operators and mechanics. Most are very young and have learned their first valuable, marketable skill.

Irrigation Technicians. Four irrigation technicians in two districts were the backbone of the design and supervisory team. All hold a two-year diploma in irrigation and land-use planning from the Nyegezi Training Institute in Mwanza. The technicians were qualified to do all surveying, simple Project design, Project organization and administrative tasks. The only major training required was in coordinating and supervising Project machinery and construction. However, the Project technicians are not qualified to undertake large complicated schemes where extensive engineering and research are a prerequisite.

Storekeeper. All Project spares are temporarily stored in Bahi (Dodoma) and are managed by a single storekeeper. She was trained by the district storekeeper in Dodoma and is responsible for inventory management of all Project spares and commodities. A permanent store is under construction at Kintinku. The storekeeper will then be responsible for coordinating spares between the two Districts and the Project.

PROJECT IMPACTS AND CONCERNS

It is too early to determine the total impact of the Rift Valley Irrigation Project. The first crop in the newly bunded fields was planted during the 1982 cropping season. This crop failed almost completely because of the early cessation of rainfall. The 1983 crop is just now being started in the transplanting beds. We can, however, identify some areas of special concern where it would be well to monitor impact quite closely. These are: (1) the impact on the demand for agricultural labor; and (2) the impact on the distribution of agricultural lands in the Project area.

The Demand for Agricultural Labor

Except for the presence of very heavy latisole (Black cotton) soils, paddy could not be grown in the Bahi area. Few would predict that paddy would become the principal food grain in a 600 mil rainfall area, where evapotranspiration is likely greater than 1100 mil during the mid-December through May growing season. Production becomes possible because of (1) the very low infiltration rates of low lying black cotton soils; (2) surface run-off to these low lying areas; and (3) in some places the flooding of annual streams provides soil enrichment from silt deposits. Clearly, the potential for rice production is limited to these low lying areas.

In the time frames usually associated with the rice producing regions of the world, this is virgin agriculture. No centuries of tradition here. The crop was likely introduced into the region less than forty years ago. Many fields in the project areas are now lands never before under cultivation. Likely the great majority of pre-project fields are new, rather than old, and there is no indigenous source of power for field development other than hand labor. Cultivating these heavy soils by this same means is a difficult undertaking.

The system of rice cultivation which has developed has had to adjust to these physical realities of low water, no animal or mechanical power and difficult to work heavy clay soils. The transplanting culture used

is necessary to lengthen the growing season (the nursery is started with the very first rain) and transplanting takes place in fields which have had only the lightest hand cultivation. The puddling operation normally associated with transplated rice culture is not done. The local cattle and oxen, even if they were trained to plow, would not be strong enough to puddle these heavy soils. It is even doubtful that they would be able to plow them.

Hand labor then has been the essence of the Rift Valley system of rice cultivation. The labor input necessary to initially build the bonds required to prepare virgin land for paddy is very high and the time when the soils have a moisture content which allows working by hand may be no more than 40 to 60 days per year. This has undoubtedly been the limiting factor in the growth of paddy cultivation in the regions.

The RVPRP has directly confronted that constraint. When cultivators were asked how long it would take to bund a half hectare field in the project area the reply was that it would be impossible. It is cetain that at the current government wage rate of 17.65 TShs per day, the one-time charge of 1220 TShs to 1750 TShs per half hectare field for cultivation rights is well below the equivalent cost to a cultivator of bunding and leveling the project fields. We do not know what the pre-project rate of new field development has been in the Project area. It is certain that the Project has accelerated that rate in a very major way.

What is not known at the present time is what quantity of labor is available to carry-out paddy cultivation in the Project fields and what is the maximum acreage of paddy which can be cultivated with the available labor supply. The 1972 FAO study gives paddy labor requirements as from 150 to 167 person days for yields of 1 and 1.5 tons/hectare.[1] A Mission report on RIDEP by Doyle James, dated September 1979 from Dodoma, sets paddy labor requirements on the basis of farm survey data at 374 person days per acre. The Japanese project planners

[1]FAO, The Economics and Planning of Irrigation Report to the Government of Tanzania, UNDP No. T.A. 3096, FAO, Rome, 1972.

working in the Arusha area have used in the neighborhood of 280 person days. Based on a conservative estimate of 220 man days per acre in the Project Area, the 140 hectare of new bunded land means an additional 30,800 person days above the pre-project years' total area labor input. Much of this labor requirements will be lumpy, occurring at planting and harvesting time. There are no available labor force statistics for judging the capacity of the project area to meet this labor demand. It would be well to monitor these effects to determine the capacity of a region to absorb this type of field bunding project.

Concern for Pest and Disease Control

There is a remarkable absence of pest, disease and varment problems in the Bahi region. According to extension workers such problems are virtually unknown. It seems very probably, especially with increased hectarage and greater movement of new seed stocks, more road vehicles and so on that the usual pest and disease problems associated with paddy production will sooner or later be found in the area. For example, the farm manager at the Ruvu Rice Project reported that red rice was a very serious problem and was limiting yield potential on the farm. The Evaluation Team saw evidence of a red rice problem in Dakawa. Red rice is reportedly unknown in Bahi region. In the opinion of the Evaluation Team there is absolutely no capacity within the region to identify such a pest problem when it starts and to eliminate it before serious damage occurs. This could be a major problem on a national level.

Data Collection

Baseline data are needed on the economic, technical, socio-political and physical environments of the areas. These data collection activities should avoid elaborate, sophisticated instruments requiring computer analysis unless a computer and computer programmer are available for involvement at the start, the competence exists for analysis and interpretation of the data and continuing participation is assured.

Designing research and extension activities in such areas as marketing, storage, production, cropping systems, farm power and labor and water management requires a knowledge of the existing circumstances.

Any programs and interventions must be location specific rather than general broad brush. This cannot be done without the knowledge best obtained from a baseline data. These should be followed up with ongoing monitoring type data collection to identify continuing or new constraints, entry points for interventions, progress or regression. The data collection, analysis and interpretation program should be designed by an experienced social scientist with inputs from the various technical specialists.

In the opinion of the Evaluation Team the critical information that should be obtained at this time in order to provide guidance for similar rice bunding projects in Tanzania are: (1) the labor requirements for paddy cultivation compared to the available labor supply. This would require a farm level survey and collection of or access to village census data; and (2) a listing by income class and occupation of those individuals who purchase cultivation rights to the Project fields. This would require access to official purchase documents and a survey of purchasers. Records should be kept on the percentage of the Project plots which are actually cultivated. Survey techniques should be used to determine reasons for any nonutilization.

The Distribution of Project Benefits

The first offering of newly bunded Project half hectare fields was oversubscribed. Cultivation rights were offered for sale by the Tanzanian government at from 1125 to 1750 TShs per half hectare plot. Even at an assumed low yield of 0.75 tons of paddy per one-half hectare and using an official paddy price of 6.00 TShs per Kilo, an investor who has to pay for all labor could more than repay his investment by the end of the second cropping season. On the high side with yield of 1.7 tons per half hectare, sale in the parallel market and even hiring all labor at the government wage of 17.65 TShs per day, an investor could hope for a net return of over 25,000 TShs in the first year including repayment of the costs of cultivation rights. Given this, it is not surprising that the first offering of half acre plots in 1982 were over-subscribed and many of the subscribers were absentee owners including officials from as far away as Dodoma.

We have no information on which cultivators in the Project area purchased the cultivation rights. We note, however, that based on the pre-project asset levels established by the North Carolina A&T farm survey in 1981, not more than 30 percent of the indigenous cultivators could have afforded the intital cost per half hectare bunded lot. Clearly then, if these survey data are accurate, and given that no credit purchases were allowed, the Project benefited the wealthiest group of farmers in the project communities. Those farmers with insufficient purchasing power may benefit by selling their labor to the successful buyers.

It would be well to monitor the patterns of field ownership by income class over the next several years. The official concern for equity may suggest provisions for credit purchases be provided in future Projects service and other support institutions are successful and the medium and higher yield levels are realized.

It is not worthy that the 1983 offering of a recent completed project area of 40 hectare plots was undersubscribed. A number of reasons have been suggested in explanation: (1) that a local representative announced he would arrange for the plots to be secured at a lower charge; (2) that the fields are too far from the village; and (3) that it will be too difficult to cross the river during the flood stage to get to the fields. It would be well to monitor this situation closely for guidance on Project placement.

ANNEX I

PROJECT EQUIPMENT INPUTS AND EVALUATION

PROJECT EQUIPMENT

Summary of Project Equipment Inputs and Evaluation

Quantity	Equipment Description	Spares Included	Machinery Performance	Remarks
1	Reconditioned CAT D7E	20%	Good	Both machines reconditioned although prone to excessive seal and bearing failure. Spares consisted of too many filters, hoses and mismatched blade cutting edges.
1	Rome Plow	0%	Excellent	Designed for use with D7 caterpillar suitable for heavy soil cultivation.
1	Rome Land Plane	0%	Not needed	72 ft long x 12 ft wide rubber tired landplane unsuitable for the heavy soil, thorny bush covered project area. Plot sizes small for landplane use.
1	1086 International wheel type tractor	20%	Good	108HP large for Project needs and lacking proper implements. Spares package excellent.
1	Disc-type ridge former	20%	Not needed	Machine too light for heavy dry soils. Unsuitable for project construction.
1	International 8 ft Terrace Blade	0%	Poor	Rear mounted blade inefficient for minor leveling. Light for ditch digging.

PROJECT EQUIPMENT

Quantity	Equipment Description	Spares Included	Machinery Performance	Remarks
1	Fuel tank (700 gal) on trailer	0%	Good	Well built but not durable for rough roads.
1	Arc Welder and Generator	5%	Good/Poor	Arc welder suitable but 110V auxillary generator unacceptable in 220V country. Machine also heavy and non-mobile.
1	Landrover Pick-up (Australian Model)	20%	Excellent	Suitable for rough roads and mechanically simple to repair.
1	Landrover Panel Wagon (English)	0%	Good	Problems with factory defects, mechanically sound.
2	Landrover Station Wagon (Australian)	20%	Unknown	Assigned to regions for Project support purposes. Where not used on Project or related Project business.
1	Honda 110cc Motorcycle	20%	Good	Two stroke oil and motorcycle spares difficult to obtain. Two stroke engines not recommended for Project.
1	Jeep 1 1/4 Exprop maintenance vehicle	10%	Poor	Poorly reconditioned. Vehicle granted to project grant-in-aid by USAID/Dar es Salaam. High fuel consumption and mechanically difficult to service and repair.

PROJECT EQUIPMENT

Quantity	Equipment Description	Spares Included	Machinery Performance	Remarks
1 set	Project Tools	--	Good	One set Caterpillar Serviceman's tool group suitable for light repair and routine maintenance only.
1	Air Compressor (2HP)	--	Good	220V non-convertible, sufficient for Project use.
1	Battery Charger (80 amp)	--	Good	220V non-convertible heavy duty battery charger, more than adequate for Project requirement.

Desirable Equipment

One of the major Project intentions was to test and recommend various types, quantities and combinations of machinery and equipment suitable for establishment of rice paddies and flood control. After repeated testing it was apparent that some of the Project machinery and equipment was either unsuitable and/or uneconomical for Project use. However, it became apparent that some different types of equipment and machinery would have greatly assisted effective Project implementation. Additional suggested machinery and equipment for projects of similar objectives and scale are:

- One lorry (truck) seven-to ten-ton load capacity for transporting commodities, materials, etc. Tipper (dump) is recommended.

- Two large fuel storage tanks (10-13 thousand liter capacity) for the project installed in Dodoma and Manyone districts.

- One mobile workshop, mounted either on trailer or separate flatbed lorry (7 ton). Should include electric welder, oxy-acetelyne welder, generator, air compressor, battery charger, selection of hand-held electirc tool, adequate selection of other tools and required lubrication equipment.

Rehabilitated Machinery

During execution of the Project other heavy construction equipment was located that had been previously procured by the Tanzanian Government and other donor agencies to work on paddy construction in the area. Very few were in working order, all lacked spare parts and an effective machinery support system does not exist. Using less than $15,000 worth of Project and other spares, the Project carried out medium to light repairs and extensive maintenance on nine machines. A support system was established whereby operators were involved in rehabilitation efforts and later trained to do preventive and routine maintenance. The Project assumed joint responsibility for the continued operation of all rehabilitated machinery until it was felt that the support system established was adequate to ensure continued operation of the machine.

REHABILITATED MACHINERY

Machine Description	Location & Department	Spares Required	Repairs
1. Caterpillar D7G	Manyoni Ag.	Cutting edges, filters, batteries, hydraulic hoses.	Complete rebuilding of exhaust system.
2. Caterpillar D5B	Manyoni Ag.	Cutting edges, batteries, filters, hydraulic hoses, main leaf spring.	Remedied short in heating system, repaired hydraulics.
3. Caterpillar D5B	Dodoma Ag.	Cutting edges, batteries, filters.	Repaired starter, alternator, electrical system, radiator.
4. Caterpillar D5B	Dodoma Ag.	Cutting edges, batteries, filters, hydraulic hoses, switches.	Repaired starter, alternator, hydraulic system.
5. Caterpillar D4E	Dodoma Ag.	Cutting edges, starter, alternator, switches, batteries.	Repaired electrical system, adjusted clutch and brakes, repaired alternator.
6. Caterpillar D4E	Dodoma Ag.	Cutting edges, starter, alternator, switches, batteries.	Repaired electrical system, starter, alternator,exhaust system, adjusted clutch brakes.
7. CASE 1450 Crawler	Manyoni Water	Torque converter seals, starter, hydraulic seals, batteries, filters, drive shaft U-joints, cutting edges.	Repaired torque converter drive shaft, ripper hydraulic system, electrical system.
8. CASE W20 Wheel loader	Manyoni Water	Batteries, bucket teeth starter parts, exhaust, switch filters.	Repaired electrical system, exhaust system, brake (air) system.
9. Caterpillar D7G (under repair)	Manyoni Ag.	Seat, batteries, complete electrical system, filters transmission pump, seals, fuel pump, etc.	All spares purchased and currently under repair.

ANNEX II

ENVIRONMENTAL ASSESSMENT OF RIFT VALLEY RICE PROJECT

REPORT ON ENVIRONMENT ASSESSMENT OF RIFT VALLEY PILOT RICE PRODUCTION PROJECT 1983

EXECUTIVE SUMMARY

Reporter: Dr. C.M. Kihamia

Introduction

Following an agreement between the government of The United Republic of Tanzania and USAID (as a donor agency) the Rift Valley Pilot Rice Production Project was planned and initiated and is now in its initial phases of implementation.

The Project envisages increasing rice production in this Rift Valley area through irrigational cultivation mainly by use of flood water of the Bubu River. Irrigational cultivation, however, may be associated with increased incidence of endemic diseases--notably malaria, schistosomiasis, and, to some extent, intestinal helminths.

In order to avoid this health hazard in this project area (Bahi/Kintinku) in Dodoma/Singida regions of Tanzania, a health component has been incorporated into the Project involving carrying out an environmental assessment to get a baseline health situation of the people living in the Project area and to carry out health monitoring during the operational phase of rice cultivation.

An environmental assessment to get baseline health data was carried out in selected villages in the Project area and the results obtained are summarized below:

Summary of Results of Environmental Assessment Carried out in February 1983

1. Prevalence of Malaria

Village	Prevalence Rate
Bahi-Sokoni	66.4%
Kintinku	23.5%
Lusilile	37.2%
Maweni	29.7%

2. Prevalence of Urinary Schistosomiasis (Bilharziasis)

Village	Prevalence Rate
Bahi-Sokoni	19.0%
Kintinku	33.0%
Lusilile	39.2%
Maweni	21.4%

3. Prevalence of Intestinal Helminths

Village	Prevalence Rate	
Bahi-Sokoni	a. *S. mansoni*	6.4%
	b. Hookworm	0%
	c. Ascaris	2.9%
Kintinku	a. *S. mansoni*	1.6%
	b. Hookworm	6.3%
	c. Ascaris	14.1%
Lusilile	a. *S. mansoni*	11.8%
	b. Hookworm	10.0%
	c. Ascaris	0%
Maweni	a. *S. mansoni*	0%
	b. Hookworm	3.8%
	c. Ascaris	0%

4. Other Findings

a. Vectors

i. Mosquitoes - in all the four villages both *Anopheles* and *Culex* mosquitoes were found.
ii. Snails - Bulinus vectors of urinary schistosomiasis are present in various water bodies in the villages.

b. Latrines

A large proportion of people do not have any latrine facilties and many of the latrines are not satisfactory. Promiscuous defecation is common.

c. Human - water contact - This occurs in three ways.

i. Cultivation - both male and females.
ii. Fetching water - mainly females.
iii. Recreation - mainly children of school age.

General Remarks

The results of this environmental assessment generally agree with those of a similar survey of 1981 and the recommendations made in 1981 are still valid and their implementation to protect the health of the people living in the rice Project area is necessary since the potential exists for increasing the incidence of these endemic diseases, especially malaria and urinary schistosomiasis.

Recommendations

The recommendations are as follows:

1. It is strongly recommended that a health-education campaign be part and parcel of the Pilot Rice Production Project. For this, it is recommended that a full-time Health Auxiliary should be employed to carryout the health education program. He could be stationed in Kintinku/Bahi where rented accommodation might easily be available, and from there he could carryout the campaign in the project villages. He must be provided with reliable transport. The Health Auxiliary will concentrate on educating people in (a) sanitary disposal of human excreta; (b) the safeguarding of water supplies; and (c) personal protection and prevention of communicable diseases such as malaria; schistosomiasis and fecal-born diseases.

2. Inhabitants should be encouraged and assisted somehow in latrine construction. Encouragement could be through health education and also through the local political and village-governemnt leaders. USAID should consider providing materials and tools or machinery which villagers could purchase or hire at a subsidized price. Expert advice on the construction of permanent latrines may be obtained from Muhimbili Medical Center/Afya.

3. Since wells form a major part of the village water supply for most of the year, these wells should be protected by constructing raised concrete walls and aprons around them. Villagers should be mobilized to participate in well protection, but materials should be made available at subsidized prices. It is also recommended that many bacterial diseases could be controlled by simple chlorination of wells by the health auxiliary.

4. Malaria control should be carried out by ensuring that chloroquine is readily available for the protection of pregnant mothers, young children and school children by weekly prophylactic doses. Chloroquine should also be available for treatment of acute cases. Mosquito nets and pyrethrum mosquito coils should be made readily available.

5. It is also recommended that mosquito control on an experimental scale should be attempted in one of the project villages, for example, introducing drought-resistant mosquito-eating fishes or other biological methods. This can be done by the department of Parasitology/Entomology, Muhimbili Medical Center.

6. Urinary schistosomiasis control by chemotherapy (using Metrifonate) should be carried out among school children, who are the most heavily parasitized.

7. Snail vector control by molluscicides should be attempted on an experimental basis in one of the villages.

8. The engineering department should look into the possibility of water management exercises that might lead to snail control without interfering with rice cultivation.

9. Periodic monitoring of the health situation should be done by Muhimbili. It is recommended that health evaluations should be carried out every six months.

ANNEX III

ENVIRONMENTAL EVALUATION OF THE RIFT VALLEY RICE PROJECT

DATE: November 4, 1983

TO: Arthur Handley
Director, USAID/Dar es Salaam

FROM: John J. Gaudet
Regional Environmental Advisor, REDSO/ESA

THROUGH: Kenneth Lyvers
Agricultural Development Officer, USAID/Dar es Salaam

SUBJECT: Tanzania - Trip Report on the Rift Valley Pilot Rice Project/698-0410.

Purpose of Trip. (1) Review the environmental impacts of the project; (2) determine whether or not the impacts were mitigated; (3) provide a report which can be used by the Evaluation Team due to arrive later this month; and (4) Provide a summary of the situation which can be incorporated into their final recommendations, as well as providing guidance for remaining activities in the present project (USAID input ended in December 1983).

Travel and Interviews

October 24-27 -- Travel to Dar es Salaam and interviews with Dr. C.M. Kihamia at the Muhimbili Medical Center, Mr. Njau at the Ministry of Lands/Sanitation Section (ARDHI) and USAID staff.

October 27-30 -- Travel in Project area accompanied by Messrs. J Kurt Lonsway and Kelly Theisen (PCVs at Bahi); site visits to Bahi-Sokoni rice fields, Kintinku Health Center (Manyoni District), Chimbumagwa Mission (PL 480 dam construction), Kilimatinde Hospital, Regional Agricultural and Medical Officers in Dodoma.

October 30-31 -- Final interview with Dr. Kihamia in Dar es Salaam and USAID Staff.

November 1-2 -- Travel to Arusha. Discussions with Tropical Pesticides Research Institute, and return to Nairobi (for TPRI discussions see Lyvers/TPRI letter dated November 1, 1982, handcarried by J.J. Gaudet).

Introduction. The original Environmental Assessment was carried out in February 1981 by a team of Third Year Medical Students from the Faculty of Medicine, University of Dar es Salaam under the direction of Drs. Kihamia and E. van Praag. This gathered baseline information is from a randomly sampled population. It was then assumed that the Project would be started up and rice planting would begin so that another (follow-up) assessment would be carried out in February of 1983--two years later.

The baseline information obtained in 1981 was obtained from four villages within the Project area where rice production was proposed. Two control villages were also selected outside the rice population sites, but within the same regions. The six villages in total were divided equally between Dodoma and Singida Regions. The information collected was based on urine, blood and stool examination, questionnaries, observations on latrines and water sources, and snail and mosquito catches. The general results are shown in Table 1. (Note: A few results from 1983 were taken from a draft report shown to me by Dr. Kihamia. The final version of this 1983 report is due for delivery to USAID shortly. In the interim, it was felt that the few figures used here would be of immediate use. However, the full Final Report should be made available to the Evaluation Team when they arrive.)

Table 1. General results of the surveys carried out in 1981 and 1983.

	1981		1983	
Observation	Project	Control	Project	Control
Malaria Incidence	21.0%	16.0%	27%	29%
Malaria Density	5.1%	4.7%	--	--
Urinary Schisto. Incidence	38.0%	13.0%	31%	28%
Schisto. Egg Density	42.4%	15.8%	--	--
Ascaris Infections	2.0%	2.7%	--	--
Latrine Occurrence	58.4%	41.5%	--	--

Conclusions. The incidence of malaria was found to be at moderate levels throughout both in Project and control areas. Urinary schistosomaiasis (S. haematobium) was more prevalent in the Project villages than in the controls. Intestinal schisto (S. mansoni) was only present at low levels (1.1-1.3 percent) throughout. Ascaris infections were generally of low prevalence Latrines were evident but all areas were not adequately supplied.

There were little or no differences in the 1981 and 1983 surveys, probably because rains in the Project area did not meet expectations in 1982/83. Consequently, little or no rice production could go on, even though the Project area had been prepared for planting and seed had been set out.

Recommendations. Earlier in the 1981 assessment a series of recommendations were put forward, and they still apply today. They are summarized as follows:

1. A Health Education Campaign to be mounted by a full-time Health Auxiliary.

2. Encouragement and/or assistance in latrine construction.

3. Well construction on a self-help basis, and possibly simple chlorination of water.

4. Malaria prophyllactic drug distribution.

5. Mosquito control (bio-control using larvea-eating fish).

6. Urinary schistosomaiasis control by chemotherapy using metrifonate (Bilarcil).

7. Snail control using molluscicides.

8. Water management to reduce snail populations.

9. Periodic assessment of health status in the Project area.

With regard to these recommendations, Dr. Kihamia has suggested that there will be only slight changes between the 1981 and 1983 assessments. He felt that certain interventions (such as molluscicide application) would now be difficult because of the presently unfavorable economic situation in the country. He also indicated that the Final Draft of the 1983 assessment would be submitted shortly.

Current Status. Virtually none of the 1981 recommendations have been taken up in the Project area. This is largely due to the fact that a Health Auxiliary has not been assigned to the Project. Dr. Kihamia informed me that there is still some interest in the original plan to second a sanitarian from Singida as a Health Auxiliary. In addition to this problem, we still do not know what impact the Project will have. The 1983 assessment was carried out with the assumption that the Project would already be involved in rice production. However, due to the shortness of the rains during the December-January period in 1982/83, rice production either failed or was much reduced. It is not surprising then that the 1983 assessment showed a disease incidence not much different from that of 1981.

All of the Health Centers visited were treating patients (approximately 200 on clinic days), some of whom had malaria or urinary schistosomaiasis. But the centers generally were lacking in diagnostic capacity.

Environmental Concerns. In addition to the obvious environmental impacts which will occur on general health, several other concerns have not been properly addressed in the Project area. Chief among these are water supply and soil salinity. In regard to water supply and treatment,

several new wells are being drilled in the area, but most are in regions where saline groundwater is prevalent and chances of tapping good drinking water are not high. One high potential shallow well has been tested and is of good quality. Recently, a sand filter has been installed at Chibumagwa Mission for treatment of local catchment water. Its efficiency will be tested during and after the coming rainy season (December-January). Although this filter lies outside of the Project villages, it will be of interest to see if it will work under local conditions.

There are several other water supply interventions being tested at this Mission. In fact, the Chibumagwa Mission could well serve as a model site for demonstration of what should be done in the Project area. For example, they have installed a rainwater roof collection and storage system for drinking water. They also have installed a working windmill to pump water from a catchment reservoir. This water can be used before filtration for watering fruit trees and other small agroforestry efforts such as windbreaks, etc., and this same water, after the sand filtration mentioned above, will supplement the drinking water supply. The original catchment dam here was overtopped by floods last year, and presently the dam has been rebuilt by PCVs under the PL480 program. It now seems to be in good condition, with a new spillway diversion and better design. It should serve as a model for future catchment dams in these regions. However, if such catchment dams were to be used in rice irrigation some problems would have to be resolved. For example, access of animals, use by humans, siltation and erosion. Thus, any catchment dams designed for use in rice growing should provide for: (1) fending or otherwise restricting animal access to specific places so that trampling is kept to a minimum; (2) an access point for local people to take water for domestic use; (3) sand filtration for limited supplies of drinking water; and (4) replanting sides and banks of the dam to prevent siltation and erosion. The Evaluation Team may want to consider recommending the above measures to the GOT as part of any comprehensive rice irrigation plan.

Salinity is a large problem in the Bahi Depression as evident in the saline groundwater, occasional saline ponds and lakes, and the frequent occurrence of saline pans. Until now the problem of salinity has been dealt with by simply not planting rice in any local field or pan already known to be saline. However, because of the prevalence of saline conditions, the poor drainage typical here, and the tendency of standing water to evaporate, there will certainly be salinity problems in the future. The Evaluation Team should consult local soil scientists in Dar es Salaam about the potential for salinity buildup on black cotton soil when used for rice cultivation. They might also inquire about the use in Tanzania of brackish water rice varieties to determine if this is a viable possibility.

Next Steps. The original 1981 recommendations should still be implemented. The Health Education Campaign should be mounted, if possible, prior to the next rice growing season. The Health Auxiliary should be seconded as soon as possible so as to be on hand for the above.

Both assessments (1982 and 1983) called for surveys on a periodic basis. These surveys should go forward after rice planting has started, but they must be reduced in size and scope. Such surveys are intended only to measure the impact of the Project and could be carried out by a small team (1-2 medical students) rather than the large teams used in the assessments. Also these "Impact Surveys" would sample fewer villages because the team now has a more accurate idea of sampling programming based on the two earlier assessments.

Based on the results of the first Impact Survey, the Health Auxiliary could then educate local people in: (1) sanitary disposal of excreta; (2) safeguarding water supplies; and (3) public health measures to prevent the spread of communicable diseases. These efforts should be directed at the target population (those people actually working in the rice fields). Health center staff informed us that most patients suffering from water-born diseases did not know how or why they caught that disease, especially when disease symptoms (e.g., for schisto) develop during the dry season well after the infections occurred in the rainy season.

The Health Auxiliary probably will already have received training at Muhimbili Medical Center, but may need some refresher training (e.g., a visit to the demonstration site for latrine construction at the University). This person should at least be supplied with the Proceedings of the USAID/ETMA Workshop in Sanitation and Environment, as well as the new posters to be produced by the Public Health Engineering Department. Any interest shown by the people in building latrines in the Project area should be followed up. ARDHI could supply a technical person on a short-term basis to help direct any such effort (contact: Mr. Njau, ARDHI). It will be particularly important to have this technical input because latrine construction must be carefully planned in this region. For example, in the village areas latrines are easily dug and they work well, but in the rice farms and fields, the whole region is flooded with water levels exceeding bund depth. Any field latrine would therefore suffer from flooding and would exacerbate the water-borne disease problem. Also, as one of the chief worries here is urinary schisto the rice farmers should be instructed and cautioned on the dangers of urinating in flooded fields.

The most difficult of the 1981 recommendations to carry out are those calling for interventions such as: distribution of malaria prophyllaxis; treatment of the target population for urinary schisto and malaria; and snail and mosquito control. All of these interventions call for inputs of chemicals, application equipment, drugs, petrol, transport, etc. Perhaps some of these expenses could be born by local government sources, multi- or bilateral aid programs, etc. But to be successful such interventions must be outlined in detail in order to show exactly how each would work. The scope of work for the Impact Survey should include an action plan for prophyllaxis, chemotherapy and vector control. This action plan should contain: list of specific compounds and quantities to be used on a village-by-village basis; a timetable

coordinated with the rice planting schedule; and an estimate of cost for labor, equipment and commodities needed. Some of these items could be ordered now under the present project and stockpiled for later use.

Summary. From its inception this Project included the very real concern that the incidence of water-borne diseases would increase in the Project area. This concern was reinforced by the 1981 Environmental Assessment which pointed out a higher incidence of urinary schistosomiasis in the villages within rice production regions. This first assessment was done early in the life of the Project and was a thorough job. However, it dealt only with baseline data. The second assessment was meant as a follow-up, but because of the failure of the rains it only served to confirm the first results and indeed showed a slight decrease in urinary schisto in the Project area. What is needed now is an Impact Survey which would have the value of showing whether or not diseases do increase in the Project area, and whether or not they are seasonal in their outbreak. This information cannot be obtained from local (regional) medical records as there is almost no capacity at the health center level for diagnosis. Until such information is actually available it will be difficult to use this Pilot Project as an example of how these impacts can be mitigated. As a Pilot Project it should have some flexibility, consequently, I would suggest the following four actions for Dr. Kihamia acting in cooperation with the Regional Medical Officers. This would result in some meaningful ideas and examples which in turn would be valuable in designing other rice irrigation projects in Tanzania (and East Africa).

1. The Regional Medical Officer at Dodoma should be approached about urgently seconding a Health Auxiliary for the Project. Failing this, other avenues of approach could be pursued (PCVs, etc.)

2. The Health Education Campaign should be monitored and directed specifically against water-borne diseases in the target population in the Project area.

3. An Impact Survey should be carried out after rice planting has begun, using a compact team (1-2 medical students) in a few carefully selected villages.

4. The Impact Survey Team should be charged with producing a brief, concise Action Plan to include prophyllaxis, chemotherapy and practical vector methods. Supplies needed for this should be purchased now under the present project, however, expenses for the Impact Survey could be met under a limited PL480 activity.

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