

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF AGRICULTURE AND FOOD SECURITY



IRRIGATION INTAKE IMPROVEMENT PROGRAMME

A PAPER PRESENTED TO A SEMINAR
DURING THE RUAHA "+10 (1993-2003)"
Ten Years of the Drying up of the Great Ruaha River
December 11-12, 2003

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1. BACKGROUND

The recently formulated National Irrigation Master Plan (NIMP)¹ puts irrigation potential in Tanzania at 29.4 million ha. Out of these 2.3 million ha. are rated as high potential, 4.8 million ha. of medium potential and the rest 22.3 million ha in the low potential category. Presently the area under irrigation is 200,000 ha of which 80% is under smallholder farming. Rice, maize and vegetables being major crops. While rice is prominent in the lowland maize and vegetables major in the highlands irrigation but also are alternative crops in the lowlands irrigation as well.

Irrigation history in Tanzania is some 100 years old when the farmers on the slopes of Mt. Kilimanjaro, Mt. Meru, the Usambara and Matengo slopes diverted water from numerous streams to irrigate their farms especially during severe dry seasons. Gradual expansion of irrigation in the lower river basins was due to population pressure when farmers acquired land usually occupied by wildlife to establish irrigation farming. Rice cultivation became prominent in the lower lands especially in the Usangu, Kilombero and Kyela plains when rice became one of major cash crops in the country. Farmers expanded their farming area and thus demanding more water to be diverted from the rivers. These water diversions were mostly made of traditional technology using locally available materials such as tree stamps, shrubs or loose stone boulders piled or placed across the rivers to divert water into un-gated irrigation canal.

1.1 Irrigation development in the Great Ruaha Catchment

Most of the irrigation schemes in the Great Ruaha sub-catchment are established as economic areas providing food to the communities as well as sell a major part of the produce (rice) for cash income. The prevailing problems facing the irrigators are low yields of paddy and frequent shortage of water which had started causing water use conflicts with other downstream users.

Water shortage and related conflicts were revealed by the Rapid Water Resources Assessment (RWRA)² - (1995) by the Ministry of Water, and also noted in the National Irrigation Development Plan (NIDP)³ - (1994). Following observations in these two documents the government decided to implement a project which would address the problems of water resources management and improvement of irrigation efficiencies in the Pangani and Rufiji Basins which indicated to have high water use conflicts.

1.1.1 Traditional Irrigation Scheme Survey

Irrigation scheme survey carried out in 1995 in the Pangani and Rufiji basin (upstream Mtera Dam) showed that there were 715 (Pangani 593 and Ruaha sub basin 122) traditional irrigation schemes. The purpose of the survey was to identify potential schemes for improvement under River Basin management and Smallholder Irrigation Improvement Project (RBMSIIP).

2. INTAKES IMPROVEMENT

The programme to improve intakes started in 1980s in the Great Ruaha Catchment in order to improve water use efficiency and increase crop production. The government took improvement measures involving intakes and other irrigation systems of the schemes of Motombaya, Kimani, Chimala, Kiwira, Kapunga, the Usangu Multipurpose Irrigation Programme covering Majengo and Mswiswi schemes. Also intake improvement were made to schemes of Mbuyuni, Msosa and Malolo which are downstream of Mtera Dam.

Under RBMSIIP which started in 1996 to December 2003, the intakes of 7 schemes were improved. These include Ipatagwa (542 ha), Ruanda Majenje (450ha), Igomelo (300ha), Luganga (300ha), Mangalali (104ha), Nyamahana (109ha) and Mapogoro (250ha). *Brief descriptions of improvements is shown in Annex 1.*

Improvements of these schemes took into consideration of drainage systems. This ensures removal of excessive water from the scheme and allows smooth flow of water released from irrigation plots back to the sources/river.

3. RBMSIIP INTAKES IMPROVEMENT PROCESS:

3.1 Selection of Schemes for Improvement

Scheme selection was based on criteria developed in the NIDP (1994). A computer programme was developed based on:

- (i) Social Aspects 50%
- (ii) Technical Aspects 15%
- (iii) Economic Aspects 15%
- (iv) Ease of Implementation 10%
- (v) General 10%

3.2 Review the existing farmers organization and/or assist to establish a viable farmers organization to enable an effective beneficiaries participation

3.3 Conduct Scheme Improvement Assessment (SIA) and produce a Scheme Improvement Assessment Report (SIAR). The SIAR focused on:

- Technical requirement
- Socio-economic requirement
- Agronomic requirement and
- Environmental requirement

3.4 Water Right

All participating schemes have Water Rights. The Water Rights were granted to the schemes by the respective Basin Water Offices. For Rufiji basin schemes, the authority is Rufiji Basin Water Office and for Pangani basin schemes, the authority is Pangani Basin Water Office.

3.5 Participatory Design

A cost effective design of the Intakes and associated irrigation systems was conducted in the participatory manner between the engineers and the farmers. The engineers developed

preliminary designs which were extensively discussed by the farmers before final designs were produced.

3.6 Construction of Intakes

Construction of Intakes and other related irrigation systems was also carried out in participation of the beneficiaries. The major works were contracted to private contractors while on farm canal/drainage development was done by the farmers. Through this process the farmers were at the same time being trained in the O&M of the scheme.

3.7 Farmers Training

During the course of intake improvement it was necessary to conduct a capacity building training of beneficiaries. The training focused on;

- (i) Irrigation Water Management
- (ii) Agricultural Production Techniques
- (iii) Scheme Operations and Maintenance
- (iv) Book keeping and Marketing
- (v) Participatory Agronomic demonstrations aimed at increasing crop yield

4. INCREASE IN IRRIGATION EFFICIENCY⁴

Specific objectives of the Smallholder Irrigation Improvement Component of the RBMSIIP were mainly to improve irrigation efficiency from 15% taken as overall baseline to overall average of 30%. Increase crops yield, and improving farmer incomes.

The irrigation Monitoring Programme which started in year 2000 has revealed that the target of raising efficiency to an average of 30% has been achieved as shown in the table 2 below. Table 1 shows baseline values of efficiency for selected schemes.

Table 1: Baseline Values of Efficiency at Irrigation Schemes

Scheme	Wet Season				Dry Season			
	Conveyance Efficiency (E c)	Field canal Efficiency (E a)	Application Efficiency (E b)	Overall Efficiency (E)	Conveyance Efficiency (E c)	Field canal Efficiency (E b)	Application Efficiency (E a)	Overall Efficiency (E)
Igomelo	0.35	0.55	0.40	0.08	0.53	0.55	0.40	0.12
Luganga	0.29	0.55	0.32	0.05				
Nyamahana	0.53	0.55	0.32	0.09				
Mapogoro	0.41	0.55	0.32	0.07				
R. Majenje					0.65	0.63	0.40	0.16
Kivulini					0.73	0.48	0.32	0.11
K. Tanga					0.64	0.58	0.40	0.15
Longoi					0.45	0.66	0.40	0.12
Average	0.40	0.55	0.34	0.08	0.60	0.60	0.38	0.14

Source: Assessment of irrigation efficiency in Traditional Smallholder schemes in Pangani and Rufiji basins in Tanzania by MAFS December 2002

Table 2: Estimated Irrigation Efficiencies Values Under Improved Situations

	WET SEASON				DRY SEASON			
	E c	E b	E a	E	E c	E b	E a	E
Mombo	0.89	0.72	0.40	0.26				
Mombo	0.87	0.80	0.40	0.28				
Mombo (Avg)	0.88	0.76	0.40	0.27	0.92	0.87	0.40	0.32
Lakikatu	0.86	0.55	0.40	0.19				
Ipatagwa	0.85	0.59	0.40	0.20	0.88	0.72	0.50	0.32
Igomelo	0.88	0.57	0.45	0.23	0.88	0.73	0.50	0.32
R. Majenje	0.70	0.63	0.45	0.20	0.84	0.69	0.50	0.29
Mahenge	0.78	0.63	0.40	0.20	0.72	0.72	0.50	0.26
Lemkuna	0.84	0.60	0.40	0.20				
Soko					0.85	0.70	0.40	0.24
Average	0.84	0.65	0.41	0.23	0.85	0.74	0.47	0.30

Source: Assessment of irrigation efficiency in Traditional Smallholder schemes in Pangani and Rufiji basins in Tanzania by MAFS December 2002

5.3 Community participation is important at all stages of intake improvements in order to come up with realistic design requirements which leads to sustainable scheme management

REFERENCES

1. National Irrigation Master Plan-MAFS, 2003
2. Rapid Water Resources Assessment – MWLD, 1995
3. National Irrigation Development Plan – MAFS, 1994
4. Assessment of irrigation efficiency in Traditional Smallholder schemes in Pangani and Rufiji basins in Tanzania by MAFS December 2002

5. ADVANTAGES OF INTAKE IMPROVEMENT

- 5.1 Establish orderly control of irrigation water
- 5.2 Provide means of water discharge measurement
- 5.3 Shortens time of water flow to application points
- 5.4 The system provides drainage thus removing excess water on the fields.
- 5.5 With improved system water distribution scheduled is maintained
- 5.6 Agricultural Production Plan can be developed
- 5.7 Increase crop yield as water distribution and control is guaranteed

6. DISADVANTAGES OF UNIMPROVED INTAKES

- 6.1 Temporary intakes are vulnerable to damage and washed away by seasonal floods
- 6.2 Without hydraulic control structures in the irrigation system the scheme canals are subject to frequent damages due to excessive water flows during floods
- 6.3 Planning of water distribution schedules and the overall agricultural production plan become difficult due to lack of reliable intake and other hydraulic control structures hence reduced crops production.

7. RECCOMENDATIONS FOR FUTURE IMPROVEMENT

- 5.1 It is recommended to improve all traditional intakes in a catchment in order to obtain an optimum water management
- 5.2 Permanent Structures involving weir is costly. It is recommended to develop cheaper alternatives. However, a research is needed to obtain the so called cheaper alternative.

Annex 1

Brief Description of Improved Schemes in Ruaha Sub basin under RBMSIIP

1. IPATAGWA IRRIGATION SCHEME (542ha):

Ipatagwa Irrigation Scheme is located in Mbeya Region, Mbarali District about 35km from Mbeya. Water for irrigation is abstracted from Ipatagwa and Halanzi/Mkoji Rivers. Water Right number and amount for Ipatagwa river is RBWO10 for 1,000l/sec in the wet season and 100l/sec in the dry season. Water right number for Mkoji river is RBWO79 for 300l/sec in the wet season.

Irrigated crops include paddy, maize, beans and vegetables. The scheme has a registered farmers organization called Umoja wa Kilimo cha Umwagiliaji Ipatagwa with registration No. SO.No.9596 of October 1998.

1.1 Improvement

Improvement involved construction of 2 Diversion Weirs (Ipatagwa and Halanzi/Mkoji), 2 main canals and all associated irrigation hydraulic structures.

The construction started in Nov. 2000 by J.W. Ladwa and in March 2001 by Ms China Anneng Corporation and completed in February 2002.

Farmers excavated tertiary drains.

2. RUANDA MAJENJE IRRIGATION SCHEME (450ha)

Ruanda Majenje Irrigation Scheme is located in Mbeya Region, Mbarali District about 50km from Mbeya. The scheme has a water right No. RBWO80 to abstract 360l/sec from Lwanyo River. Irrigated crops include paddy, maize, beans and vegetables. The scheme has a registered farmers organization called Ushirika wa Kilimo cha Umwagiliaji Majenje with registration MBRP 70.

2.1 Improvement

Improvement involved construction of a Diversion Weir, Main canal and all associated irrigation hydraulic structures.

The construction started in Feb 2001 by China Electric Power Tech. Import & Export Corp. and completed in December 2001. Farmers excavated tertiary drains.

3. IGOMELO IRRIGATION SCHEME (300ha)

Igomelo irrigation scheme Mbeya region, Mbarali district about 5 km from Igawa, South of Iringa - Mbeya main road. Irrigation activities started several years ago when Mr. Acardo, a foreigner from German constructed a main canal for irrigation purposes. Water source for the scheme is Mbarali river and have a water right number 4630 for 450l/sec. Irrigated crops include paddy, maize, Onions and vegetables

Igomelo scheme has now a new farmers organisation called Ushirika wa Umwagiliaji Igomelo with Registration No. MBRP 71.

3.1 Improvement

3.1 Improvement

The main works were (i) improvement of the headworks including provision of flow control gates and flood protection walls and Trap/Side escape spillway structure (ii) improvement of the Main canal, secondary and tertiary canals and its associated structures. Farmers were involved in excavation of tertiary drains.

4. NYAMAHANA IRRIGATION SCHEME (109ha)

Nyamahana Irrigation Scheme is located in Iringa Region, Iringa Rural District about 55km from Iringa town along the Iringa - Ruaha National Park road. Water for irrigation is abstracted from Mloa River. Irrigated crops include paddy, maize, vegetables and sweet potatoes. The scheme has a registered farmers organization called Umoja wa Umwagiliaji Nyamahana with registration No. SO.No.9610 of October 1998. The water rights for this scheme is number RBWO17 for 160 l/sec and 300l/sec in wet the season and 15l/sec in the dry season.

Improvement

Improvement involved construction of 2 Diversion Weirs (Mtakuja and Mbuyuni), 2 main canals and all associated irrigation hydraulic structures.

The construction started in May 2002 and completed in April 2003.

Farmers excavated tertiary canals and the Catch drain.

Current status

The scheme is under crop production after improvement. Crops currently grown are maize, various types of vegetables and sweet potatoes. Paddy will be cultivated during wet season (Nov-May). Agronomic demonstration conducted during scheme improvement period has shown an increase in paddy production to an average yield of 4.5 t/ha. Likewise yield for maize before intervention was 1.0 t/ha. With project agronomic demonstration yield increased to 2.3 t/ha and it is likely to increase up to 3.5t/ha this season after harvest.

As for other improved schemes, increase in crops yield has been a result of both scheme improvement and training of farmers in crop production, water management, business farming and organization leadership. 115 farmers have been trained in this scheme.

Noted Achievements

After infrastructure improvement and training of farmers on best methods of water management, the control of water use has increased to the extent of providing irrigation water to every plot in time and hence increased yield to every crop cultivated.

5. LUGANGA IRRIGATION SCHEME (300ha)

Luganga Irrigation Scheme is located in Iringa Region, Iringa Rural District about 50km from Iringa town. Water for irrigation and domestic water supply is from Little Ruaha River. The scheme has a registered farmers organisation called Umoja wa Kilimo cha Umwagiliaji Luganga Pawaga (UKULUPA) with registration SO. NO. 9600 of October 1998. The scheme has a water right number RBWO66 for 600l/sec throughout the year.

Scheme Improvement

The main works were (i) improvement of the headworks including provision of flow control gates and flood protection walls and Trap/Side escape spillway structure (ii) improvement of the six km long Main canal and construction of a 5.4 km extension of the main canal (iii) Tertiary Canals and some tertiary drains (iv) Construction of several farm structures (v) Spot improvement to existing 8 km long access road and (vi) Rehabilitation of the existing domestic water supply intake structure.

Farmers excavated fifteen tertiary drains with a total length of 7.944 km.

Current Status

The scheme is under production. Crops currently grown include paddy, maize, vegetables and a recently introduced high value crop of paprika³.

Yield of paddy before project was 1.8 t/ha. With project average yield is 5.0 t/ha. Yield of maize before intervention was 1.0 t/ha. After scheme improvement the yield has also risen to 5.2 t/ha as per February 2003 records.

Increase in yield is a result of scheme improvement and farmers training in various aspects including crop production techniques, water management etc. 130 farmers have been trained in this scheme.

with Corrugated Iron Sheets (CIS) roofs after increased income through crops production.

6. MANGALALI IRRIGATION SCHEME

Mangalali Irrigation Scheme is located in Iringa Region, Iringa Rural District about 35km from Iringa town along the Iringa – Ruaha National Park road. Water for irrigation is abstracted from Little Ruaha River. Irrigated crops include paddy, maize, vegetables and sweet potatoes. The scheme has a registered farmers organization called Umoja wa Umwagiliaji Mangalali with registration No. SO.No.9609 of October 1998.

The scheme has a Water Right NO. RBWO22 to abstract 160l/sec.

Improvement

Improvement involved construction of a Diversion Weir, main canal and all associated irrigation hydraulic structures. The construction started in May 2002 and completed in April 2003. Farmers excavated tertiary drains and the portion of the Catch drain.

Current status

The scheme is under first production after improvement. Crops currently grown are maize, various types of vegetables and sweet potatoes. Paddy will be cultivated during wet season (Nov-May). Agronomic demonstration conducted during scheme improvement period has shown an increase in paddy production to an average yield of 4.5 t/ha. Likewise yield for maize before intervention was 1.0 t/ha. With project agronomic demonstration yield increased to 2.3 t/ha and it is likely to increase up to 3.5t/ha this season after harvest.

As for other improved schemes, increase in crops yield has been a result of both scheme improvement and training of farmers in crop production, water management, business farming and organization leadership. 115 farmers have been trained in this scheme.

Noted Achievements

³ Red pepper used in cooking

After infrastructure improvement and training of farmers on best methods of water management, the control of water use has increased to the extent of providing irrigation water to every plot in time and hence increased yield to every crop cultivated.

7. MAPOGORO IRRIGATION SCHEME

Mapogoro Irrigation Scheme is located in Iringa Region, Iringa Rural District about 100 km from Iringa town along the Iringa – Ruaha National Park road.

The scheme is still under construction and the area that will be put under irrigation is 250 hectares. Water for irrigation is abstracted from the Makombe River.

The scheme has formed farmers organisation known as "Umoja wa Umwagiliaji Mapogoro with registration SO. NO. 11895.

The scheme has a Water Right No. RBWO76 for 160 l/sec.

7.1 Scheme Improvement

Scheme construction is in progress. Main works are executed by the local contractor M/s J.W. Ladwa". The works include (i) Improvement of head works with two gated intake structures, (ii) Improvement of the two main canals namely Kibaoni and Kinyali with a total length of 4312 m, (iii) Construction of five Secondary canals with a total length of 11054 m, (iv) Construction of forty six Tertiary canals with a total length of 14,655 m, (v) Provision of farm roads with a total length of 4,500 and (vi) Construction of various control and conveyance structures for irrigation and drain water such as check structures, road culverts, division boxes, side escape spillways, turnouts, check drop structures and canal/drain crossings. To date the contractor has achieved 70% of the permanent works.

Contract amount for this scheme is Tsh 391,720,680.

Farmers' contribution is mainly the excavation of drains and the cost estimate of these works is Tsh. 60.6 million. Achievement by farmers is about 65%.

3.3 Farmers Training

Training has been an ongoing exercise aiming at providing skills to farmers in relation to irrigated agriculture. Subjects covered include crop production techniques, water management, agro business, organizational leadership and financial management.

In this scheme 110 farmers have been trained.

3.4 Current Status

The prominent crop in the area is paddy. The yield before project is 1.1 t/ha. With project interventions the yield is likely to increase four folds. Recent average yield data from demonstration plots shows an increase to 4.5 t/ha.

General Assessment of SIIC Scheme Improvements:

- Productivity increased by 150-180%
- Irrigation efficiency increased by 100%
- Increased crop diversification
- Improved sustainability through farmer ownership, cost-sharing for development, and full cost recovery of O&M costs

Scheme rehabilitation costs of US\$1,700 per ha

Secure water rights issued to irrigation schemes

It is possible to both improve irrigation efficiency **and** increase productivity