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ISBN 9987 - 417 - 32 - 9

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The Case of Chamazi in Lushoto District, Tanzania

Abiud L. Kaswamila
&
Baker M. Masuruli

Research Report No. 04.3

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RESEARCH ON POVERTY ALLEVIATION

MKUKI NA NYOTA PUBLISHERS LTD,
P. O. BOX 4246,
DAR ES SALAAM, TANZANIA

Published for: **Research on Poverty Alleviation (REPOA)**
P.O. Box 33223, Dar es Salaam, Tanzania
157 Mgombani Street, Regent Estate
Tel: +255(0)(22) 270 00 83 / 277 2556
Fax: +255(0)(22) 277 57 38
Email: repoa@repoa.or.tz
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by: Mkuki na Nyota Publishers Ltd
6 Muhonda St. Mission Quarter, Kariakoo
P. O. Box 4246,
Dar es Salaam, Tanzania.
Website: www.mkukinanyota.com

ISBN: 9987 417 32 9

Table of Contents

TABLES

FIGURES

ABBREVIATIONS

FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GoT	Government of Tanzania
IFAD	International Fund for Agricultural Development
MoA	Ministry of Agriculture
MoAF	Ministry of Agriculture and Food Security
NGO	Non-Governmental Organisation
NIDP	National Irrigation Development Plan
NPES	National Poverty Eradication Strategy
pH	Measure of acidity or alkalinity/salinity
REPOA	Research on Poverty Alleviation
TIS	Traditional Irrigation Systems
Tshs	Tanzanian shilling (currency)
UNESCO	United Nations Educational, Scientific and Cultural Organisation
URT	United Republic of Tanzania

ACKNOWLEDGEMENT

The authors would like to thank REPOA for funding this study. We are also thankful to the REPOA secretariat particularly Prof. Semboja, the Executive Director, and Dr. Jambiya, the Research Coordinator, for their moral and logistical support. The same should also be extended to Messrs. Ngalewa, Mtembei and Ms Nyika.

We are also thankful to the principal of the College of African Wildlife Management (Mweka), Mr. Gamassa, for permitting us to undertake this research and use the college's facilities. Special thanks also go to the 2002/2003 REPOA workshop participants for their critical comments during the preliminary presentation of our work.

It will be unfair not to acknowledge the contribution of Mr. Semfukwe, the Ward Agricultural Extension Officer, the village leaders and farmers of Kivingo, Lunguza, Kwemkwazu, Mkundi, Langoni, Mbaramo and Mng'aro for their support, which enabled us to collect the required information. We say, *ahsante sana*. The list of those who assisted us in one way or another is long, and since we cannot mention all of them here, they should be assured that we appreciate very much their support and assistance. We therefore say: "Thank you all".

ABSTRACT

This study investigates the role of the *Chamazi* farming system in alleviating poverty in the semi-arid low lands of Lushoto district. It was conducted in seven villages between 6th March and 29th March 2002. The villages, which administratively are in the Umba division, included Kwemkwazu, Mbaramo, Lunguza, Mng'aro, Mkundi, Kivingo and Langoni. Data was collected from interviews, meetings and discussions with some selected key informants from each village. A total of 272 respondents, of which 18% were females, were interviewed.

Chamazi is a vernacular word of the Sambaa people meaning "use of residual moisture in valley bottoms for mixed crop production". It is practised by 90% of the population in the study area. Although practised at subsistence level, its contribution to food security was found to be superior to both the short and long rain seasons, and was able to produce four months' food surplus in villages where the practice is dominant. In terms of cash income, the practice has the ability to generate an average of Tshs. 133,000 per cropping season/household. This amount was 30% more than households in villages where the practice was not dominant.

Despite this farming system's potential, the practice is faced with a number of constraints. These include: drought, low crop yields, poor agricultural extension services, salinisation and the high prices of agricultural inputs. In order to improve the practice, this study recommends the construction of water reservoirs, provision of soft loans to farmers to enable them buy basic irrigation farming equipment and materials, and appointing agricultural extension officers with a strong background in irrigation to these villages.

1. INTRODUCTION: *CHAMAZI* IN THE SEMI-ARID AREAS OF LUSHOTO DISTRICT

Tanzania has made some progress in reducing poverty, the incidence of which fell from 65% of the population in 1983 to 51% in 1993, before rising to 60% (URT, 1999). Poverty in Tanzania is mostly a rural phenomenon, with over 90% of those affected being rural. Poverty is particularly rampant among rural households in the arid and semi-arid regions, which depend primarily on the production of food crops. There is an important gender dimension to poverty. Female-headed households (25% of the total) earn 45% less than their male-headed counterparts; 69% of female-headed of households live below the poverty line (URT 2001; URT, 1999).

Tanzania is partially self-sufficient in food, with maize and rice surpluses in some years. Crop failures are common, as 11 out of 20 regions of the mainland are prone to drought. This is particularly true in some parts of the country, such as those areas of the central plateau, with drought occurring about every three years. Drought affects both rainfed agriculture and areas dependent on seasonal watercourses for irrigation.

The National Poverty Eradication Strategy (NPES) and the Poverty Reduction Strategy Paper (PRSP) intend to create an environment that promotes new alliances between the government and civil organisations, mobilising all available resources, facilitating different actors, building the capacity of the poor and empowering civil society to participate effectively in poverty eradication. This can be achieved through the mobilisation of physical, financial and human resources with a projected target of reducing the poverty line by 50% by the year 2010 (URT 2001). Through this background it is evident that the *Chamazi* farming system is in line with the national irrigation policy and instrumental in eradicating poverty and ensuring food sufficiency in the country.

1.1 Statement of the Problem

The annual precipitation in the semi-arid areas of Lushoto district does not exceed 500 mm and in some years drought is experienced throughout the year (Kaswamila & Tenge, 1998). The problem is aggravated by high population density, low land productivity, poor soil fertility and low crop production (Shelukindo & Kilasi, 1993).

Rainfall records over the past 26 years in the study area show that the maximum monthly rainfall is usually recorded in November and December with 110 mm and 131 mm respectively (Fig. 1). Other months with relatively higher rainfall are April (101 mm), January (71 mm) and March (67 mm). Usually the annual precipitation does not exceed 500 mm.

The irregular and unreliable rainfall has caused the people in the rain-shadow areas of the West Usambara Mountains to intensify the *Chamazi* farming system as a strategy to cope with food shortage and as a means to generate cash income. Faced with this dilemma, the people of the plains, in past generations had been using their indigenous environmental knowledge through the use of indigenous water harvesting techniques from the Umba

and Mbaramo rivers, in order to irrigate crops such as maize and other horticultural crops during dry periods and during rainfall shortages.

A preliminary survey by the senior researchers revealed that more than 80% of the people in the plains depended on *Chamazi* for their livelihood, that is, for food security and income generation. Despite the immense contribution of the system to alleviating poverty, no study had been carried out to assess its economic and social significance. It was against this background that this study became a necessary step to undertake.

1.2 Research Objectives

The main objectives of the study were to assess the contribution of this farming system to food security and poverty alleviation, to obtain some insights into the farmers' indigenous knowledge concerning the *Chamazi* irrigation technique, to identify the system's strengths and weaknesses for possible improvement, and to assess the on-site and off-site impacts of the *Chamazi* system and suggest improvements.

1.3 Research Questions

The following questions guided this research work:

- Is the practice contributing significantly towards poverty alleviation and food security in the study area?
- If yes, to what extent?
- Is the practice detrimental to the environment in the way it is practised?
- If yes, what suggestions should be put forward to improve the farming practice?

1.4 Hypotheses to be Tested

- *Chamazi* farming system cannot ensure year-round food security in drought/rainfall failure periods.
- *Chamazi* system has no important role to play in the maximisation of production and income in the semi-arid areas of Lushoto district.
- Farmers practising *Chamazi* do not earn more food and cash income than those who do not practise it.
- *Chamazi* system has no off-site environmental degradation that requires attention.

2. BACKGROUND TO THE STUDY AREA

2.1 Location and Climate

The study villages are located in the lowland areas of Lushoto district in Umba division. The relief ranges between 300-500 m above sea level except Mbaramo, which is 1,323 metres above sea level. The climate of the area can be described as semi-arid with bi-modal rainfall patterns. The long rains occur between March and May while the short rains run from November to December. These two rain seasons are usually unreliable (Fig. 1).

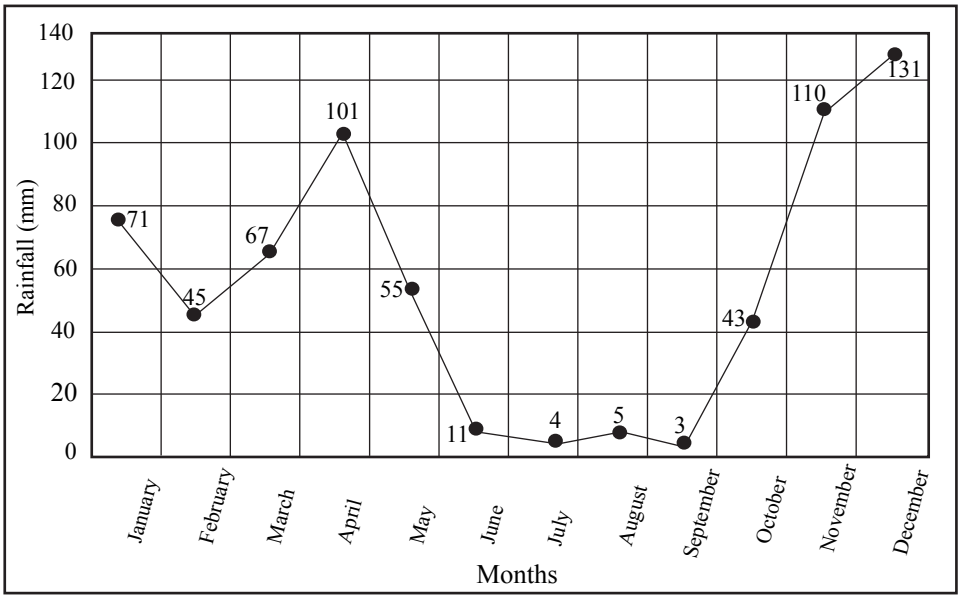

Fig 1: Mean monthly rainfall over 26 years at Mnazi station

2.2 Major Economic Activities

The major economic activities in the area revolve around agriculture and livestock production, mostly at subsistence level. The major crops cultivated vary from one village to another, based on the geographical setting. Major crops include maize, beans, coffee, ginger (*tangawizi*), sweet potatoes, rice, cotton, cassava, onions, cabbage and watermelon. Coffee, cardamom (*iliki*) and ginger are mostly grown in Mbaramo village due to its relief position, which favours their growth.

2.3 Main Demographic Features

Human population volumes vary from village to village. According to field data Mbaramo has the largest population with approximately 4,532 people, and Mkundi has the least with 1,680 people. The rest of the villages' population volumes are: Lunguza 4,000, Kivingo 3,800, Kwemkwazu 4,500, Mng'aro 3,225 and Langoni 3,200.

3. LITERATURE REVIEW

3.1 Agricultural Sector Performance

Agriculture is the most important sector in Tanzania, generating about 50% of GDP, and constituting 50% of the export earnings (www.tanzania-online.gov.tz/Agriculture.htm). Most of the 3.5 million farming families engage in subsistence cultivation and smallholder cash cropping (IFAD, 1999). Production is highly labour intensive and yields are low due to low input use and limited access to new technologies. Agricultural production is highly vulnerable to climatic conditions, with decreases in production in the order of 20% for maize and other crops from the 1993/94 drought and the 1997/98 El-Nino effect.

3.2 Irrigation and Irrigation Policy

Tanzanian farmers cultivate only 6.3 million hectares of the total 43 million hectares of arable land. Only 150,000 hectares, of the 1 million hectares with apparent potential are under irrigation (URT, 2001). A large proportion of irrigated area (85,000-100,000 ha) is farmed by smallholders using diversion furrows. The main crops in such areas are rice paddy and horticultural crops (Mrema, 1984).

The 1997 irrigation policy shows that the Government of Tanzania (GoT) sees irrigation as a means of stabilizing agricultural production and livestock keeping, both being adversely affected by periodic droughts. The government developed this policy as an important aspect of its strategies to improve food security, increase farm productivity and incomes generated therefrom and enhance production of higher value crops (URT, 2001).

The Ministry of Agriculture and Food Security (MoAF) formulated and adopted the National Irrigation Development Plan (NIDP) which concentrates on low cost schemes and stresses: (i) highest priority on rehabilitating or upgrading existing schemes (ii) upgrading traditional water harvesting technology where more intense irrigation schemes are not possible; and (iii) investing in new smallholder schemes in those regions where the conditions are appropriate and where there are no traditional schemes. The 1997 policy statement declared that GoT would focus its support on the development of smallholder irrigation schemes in areas of high potential and where there is demand from beneficiaries.

3.3 Traditional Irrigation Systems (TIS) in Developing Countries

The traditional irrigation system adopted in this report is that defined by Stern (1989). That is " have evolved over the cause of time, without any known outside institutional intervention". These practices are the results of continuing learning processes and emerge from a knowledge base accumulated by indigenous people by observing, experimentation, and processes of handing down through peoples' experience and wisdom (Stern, 1989). Traditional irrigation systems are also shaped, emerge from, and are modified in response to changing socio-economic, political and ecological conditions (Hans et. al, 1996).

Traditional irrigation systems have sustained small scale farmers not only in Tanzania, but also elsewhere in Africa. For instance, Howard (1996) reports that "the traditional irrigation techniques locally known as *Fadama* has enabled farmers on the Jos Plateau in Northern Nigeria to generate income in the slack period for rainfed cultivation". The technique is suitable for the production of wide range of vegetables as well as other crops such as sugarcane, wheat, maize and barley. As such it has been incorporated into highly productive and profitable year-round farming system. In Tanzania the examples are the *Chamazi* and *Vinyungu* farming systems (Kaswamila & Tenge, 1998; Lema, 1996; Mkavidanda & Kaswamila, 2001).

3.4 Irrigation Potential and Development Opportunities in Tanzania

Tanzania has an approximate of 933,000 hectares (ha) of potential irrigatable land. This includes land for irrigation from surface water and underground water sources. By 1980, only a total of 144,000 ha of this land were under irrigated agriculture, both partial and full scale irrigation. Out of this, the traditional small scale accounted for 120,378 ha, while 23,622 ha were under large scale estate farms (MoA, 1992). Hence, it can be said that there is still ample scope to expand irrigated areas in the country.

According to Mrema (1984), irrigation farming in Tanzania can be grouped into three main categories. The first is that of the traditional smallholder irrigation. Individual and or groups of farmers who attempt to harness the available water from rivers, springs and flood plains own these. The category covers relatively small and scattered areas, often not more than 5 ha large. They employ traditional methods and their intake structures are often temporary, having to be replaced from time to time. Much of the diverted water is lost due to seepage before reaching the field. In the field the irrigation efficiency is normally very low. This category covers more than 79% of the total irrigated land in Tanzania. Major areas covered by the category are Kilimanjaro, Meru, West Usambaras in Lushoto district as well as the flood plains of the major rivers.

The second category is the modern small scale holder/village irrigation schemes. In most cases these are planned and constructed by central/local government, which bears the costs of head works, the main canal, and where necessary the storage reservoir and some laterals. In most cases the distribution of water, land preparation and decisions on what should be grown, as well as scheduling, are the responsibilities of the farmers. Although a lot of money was spent to construct and sustain these schemes, nearly all of them became unsuccessful and degraded after a few years. Examples of these can be found in Mlali in Morogoro, Mombo in Korogwe, Mto wa Mbu in Arusha and Kitivo in Lushoto (Mrema, 1984; Kaswamila & Tenge, 1998).

The last category is large scale irrigated private/public plantations and estates. These are large scale farms growing high value crops for export and/or local consumption. They are centrally managed by either private or parastatal companies and generally have quite efficient irrigation systems. They require large capital, skilled investment and manpower. Due to a lack of capital, low technological know-how and high maintenance costs of

large irrigation schemes, rural farmers cannot afford this type of irrigation.

The most common problems with TIS include lack of drainage, which results in the progressive accumulation of salts. Poor organisation and planning cause some fields to receive much water while others receive too little. Other problems include trampling of animals in farms resulting in destruction of soil structure and irrigation canals. Also, the unfavourable environment for crop growth, and the deforestation of catchment areas resulting in soil erosion and frequent floods. Almost all the above problems prevail in Kirya, Mvuleni, Kileo and Kigonigoni traditional irrigation schemes in Kilimanjaro (Banzi et. al, 1992). Studies by Kaswamila & Tenge (1998) in the Lushoto district revealed that cultivation around water sources was also a threat to sustainability of TIS and the environment in general.

Mrema (1984) identifies the following essential factors that might make small scale irrigation scheme successful: the scheme must be centrally managed, that is, the interests of the individual farmers must be subordinate to the interests of the scheme, the availability of well trained and multi-disciplinary extension manpower and essential inputs.

According to FAO/UNESCO (1973), irrigation improvements usually occur in one of the following categories: addition of water storage facilities, new or improved canal, lateral or farm ditch structures, water quality improvement, new methods of irrigation and better water measuring devices. Corrective measures of drainage, ground water or return flow utilization, better water management, system maintenance and land developments are other categories for improving irrigation projects. Other areas include reclamation of salt affected soils and training of farmers.

Training on new methods of irrigation and better water and soil management practices is perhaps the most valuable assistance that can be provided to farmers. Many problems of existing projects either resulted from a lack of knowledge by farmers, or neglect of farmers' knowledge and experience by planners resulting in poor management with low crop yields. Proper fertilization, selection of best crop varieties, best crop rotation, best methods of irrigation and proper irrigation techniques are equally important.

4. METHODOLOGY

4.1 Selection of the Study Areas

Seven study villages in the semi-arid areas were selected based on the following criteria: their high agricultural potential (Shelukindo & Kilasi, 1993), *Chamazi* dominant and non-dominant villages, representation of the semi-arid areas (north, west and east) and accessibility. Five practising villages (Mng'aro, Lunguza, Kivingo, Mkundi and Langoni) and two non-practising (Mbaramo and Kwemkwazu) were picked as representative samples of the study area. *Chamazi* non-practising villages were picked as control villages to enable comparison of research results.

4.2 Data Collection Procedures

Data collection involved several steps which included obtaining research clearance from the Lushoto District Executive Director (DED), questionnaire pre-testing, revision of the questionnaires and village visits for household selection, interviews, discussions and farm visits.

4.2.1 Questionnaire Pre-testing

After obtaining the research clearance from the DED's office, questionnaire pre-testing was conducted. The aim was to refine the questions by removing ambiguous questions, or including important questions which had been omitted. The researchers and two research assistants did the pre-testing. Eight questions out of the previous forty-two questions were omitted and ambiguous ones were reformulated.

4.2.2 Selection of Respondents

In collaboration with village administrations, 50 respondents from each village were selected based on stratified probability sampling (Moser & Kalton, 1986). A complete list of all units in the population was made available in collaboration with the village leaders. The population was then stratified based on gender balance, duration of stay (≥10 years) and the need for the sample to include youth (20-34 years), adult (35-50 years) and old people (>50 years) age categories. From the identified strata, 50 respondents were picked as interviewees. The aim of creating unique sub-sets of the population was to ensure each stratum was represented.

4.2.3 Focus Group Discussions

The survey team planned discussions with some selected key informants in each village. For this study the researchers selected about 15 informants from each village with discussions taking into account the status, age and sex. Different sessions were organised for each category, namely, village leaders, influential farmers and youths. The aim was to obtain further insights on farming systems.

4.2.4 Farm Visits

Farm visits were made for each village. The aim was to assess the *Chamazi* farm sizes, irrigation channel structures/systems used, types of crops grown, farm operation constraints and management aspects. Farm discussions were held during farm visits and were instrumental in providing the survey team with more insights on farming systems.

4.2.5 Informal Discussions

This was done on the last day of the village visit when the survey team walked around the village for informal interviews and discussions. The objective was to cross-check (triangulate) the already collected information.

4.3 Data Analysis

Data was analysed using both qualitative and quantitative analysis such as the use of means, standard deviations and cross-tabulations. Tables and figures were used to summarise the results.

4.4 Limitations of the Study

The major limitation encountered during the study was poor attendance at interviews in some villages, particularly, Mkundi and Langoni, where only 54% and 60% respectively were interviewed (Table 1).

5. RESULTS AND DISCUSSIONS

5.1 Major Features of the Sample Survey

The summary of respondents' features is given in Table 1. According to the Table, the 272 respondents were categorised into three major age categories: youth (20-34 years), adult (35-50 years) and old (> 50 years). On average, more male respondents (82%) were interviewed than female respondents (18%). The males' percentages ranged between 60% and 94% while females ranged between 6% and 40%.

Regarding ethnic composition, the main tribes found in the area were *Sambaa* and *Pare,* who recorded an average of 88% and 7% respectively (Table 1). Other minority tribes included *Mbugwe*, *Taita*, *Kiga*, *Maasai*, *Zigua*, *Nyamwezi* and *Kamba*. The field data further indicates that 70% of the *Sambaa* in the study area are natives, with only 30 having moved from other parts of the country. Mng'aro and Mkundi have an exceptionally high percentage of immigrants compared to other villages probably due to their agricultural potential for rice production. The two villages have extensive plains highly suitable for irrigated agriculture, thus acting as pull factors.

5.2 Involvement of the Communities in the Chamazi Practice

The study results revealed that on average 90% of the surveyed population in the area practised *Chamazi*, the village with the highest proportion of involvement being Mng'aro and Lunguza where all of the respondents practised it (Table 2). Kivingo, Langoni and Mkundi follow with ≥89%. Villages with the least involvement were Kwemkwazu (77%) and Mbaramo (69%). The relatively low involvement in Kwemkwazu (Mnazi) village can probably be attributed to the township nature of the village, this village is the divisional headquarters. As a business centre, the chances of people being engaged in other activities become high. For Mbaramo, the hilly/mountainous topography coupled with arable land shortage, especially lowlands with irrigation potential, may have contributed to the situation.

The practice involves both sexes, as evidenced by an average of 72% of the respondents. It is only in Mng'aro where most respondents had the view that the practice was mostly engaged in by females (43%). The involvement of both sexes in the practice shows its importance both as an economic activity and for food security. The major reasons described by farmers for their involvement in this practice were: food security, drought alleviation, and a source of seeds for the following season (Table 3). Others included use of leisure time, and that *Chamaz*i had become part and parcel of their daily activity, taking into account the fact that local people have been practising it for generations.

Table 1: Major Features of the Sample Survey

	Sample Size (n)	Sex of Interviewees (%)		Major Tribes	Tribe Composition	Native to the Village? (%)		Average Household Size	Age Category of Interviewees (%)		
Village		**M**	**F**			**Yes**	**No**		**20-34**	**35-50**	**>50**
Kivingo	52	94	6	Sambaa Pare Mbungwe	94 4 2	98	2	7	33	44	23
Lunguza	53	87	13	Sambaa Pare	94 6	60	40	7	19	46	35
Kwemkwazu	39	69	31	Sambaa Pare Taita	77 23 10	69	31	8	5	85	10
Mkundi	27	74	26	Sambaa Pare Kiga Maasai	81 11 4 4	56	44	8	11	48	41
Langoni	30	93	7	Sambaa Pare Zigua	94 4 4	70	30	7	37	30	33
Mbaramo	36	94	6	Sambaa Pare Nyamwezi	94 3 3	86	14	6	36	53	11
Mng'aro	35	60	40	Sambaa Zigua Kamba	84 8 8	50	50	6	13	48	39
	Total. 272	**Av.82**	**Av.18**			**Av. 70**	**Av.30**	**Av.7**	**Av.22**	**Av.51**	**Av.27**

Av = average

Source: Field Survey, 2002

Table 2: Farmers' Involvement with Chamazi

Village	Involvement with *Chamazi* (%)		Dominant sex involved with *Chamazi* (%)			Total
	Involved (%)	Not involved (%)	Male	Female	Both	
Kivingo	91	9	24	19	57	100
Lunguza	100	0	13	0	87	100
Kwemkwazu	77	23	20	27	53	100
Mkundi	89	11	0	0	100	100
Langoni	97	3	7	3	90	100
Mbaramo	69	31	14	10	76	100
Mng'aro	100	0	17	43	40	100
Average	**89**	**11**	**13**	**14**	**72**	

Source: Field Survey, 2002

Table 3: Reasons for Involvement with *Chamazi* (%)

Kivingo	**%**	**Lunguza**	**%**	**Langoni**	**%**	**Mkundi**	**%**	**Kwemkwazu**	**%**	**Mbaramo**	**%**	**Mng'aro**	**%**
Food security	48	Food security	47	Utilise leisure time	49	Food security	50	Food security	44	Food security	55	Drought	43
High chance of harvesting	25	High chance of harvesting	25	Main season harvests not sufficient	36	Subsist cash	41	Subsist cash	38	Subsist cash	31	Food security	27
Drought	23	Not rely on rains	18	Food security	12	Use of leisure time	5	Drought	12	Source of seeds for next season	10	Subsist cash	20
Indigenous practice	4	Subsist cash	10	Drought	3	Indigenous practice	4	Main season harvests not sufficient	6	Main season harvests not sufficient	4	Main season harvests not sufficient	10

Subsist. = Subsistence
Source: Own survey, 2002

5.3 Crop Production and Yield Levels

The major crops grown using the *Chamazi* practice include maize, beans, sweet potatoes, watermelons and Irish potatoes (Table 4). The common planting practice in the system is mixed cropping. Beans, maize and Irish potatoes are normally mixed. It is normal to mix maize with beans to take into account the latter's ability in fixing nitrogen in the soil, which is an essential nutrient for crop growth. It was not easy to establish why Irish potatoes were mixed; however land scarcity (valley bottom plots) could be the reason.

Crop yields for the two main crops in the area, namely maize and beans, with respective average yields of 6 bags/acre and 4 bags/acre can be classified as being low. The average yield levels in Lushoto for maize and beans in lowland areas are estimated at 12 and 10 bags/acre respectively under favourable climatic conditions (Shelukindo, pers. Com). The low crop yield level contentions accord with the farmers perceived production levels. According to the field data about 56% of the farmers perceived maize production as being low. 52% perceived bean production levels also as low. The only crops with reasonable yields were watermelons (25 bags/acre) and Irish potatoes (8 bags/acre).

The farmers attributed the low levels of production to drought, lack of permanent irrigation channels, lack of agricultural advisory services, rodents and vermin, and timely availability of agricultural inputs (Table 4). These reasons are explicitly revealed by the low percentages recorded on the use of fertilisers and agricultural services offered (Table 5). Table 4 reveals that about 76% of farmers do not use fertilisers. The situation is most critical in Lunguza, Langoni and Mkundi villages where (greater than or equal to) ≥80% do not use fertilisers be it industrial or organic.

The reasons mentioned for the not using industrial fertilisers were: unavailability in local markets, unaffordable prices and lack of general agricultural education (agricultural extension services). About 72% of the population lack advisory services (Table 5). This is more pronounced in Lunguza and Mbaramo as (greater than or equal to) ≥90% of the population said they did not receive services. When combined these two factors, i.e., not using fertilisers and advisory services are likely to affect crop production immensely.

The lack of use of fertilisers is most critical in Mbaramo with a record of 97% (Table 5). Although the village has an agricultural extension officer, he was rarely seen. The village chairman had this to say: "*tunaye hapa bwana shamba lakini haonekani mara kwa mara na muda mwingi yuko Mnazi ambako pia ni makazi yake*" implying "we have an agricultural extension officer but he is rarely seen and he lives at the distant village of Mnazi". During our discussions with one of the agricultural extension officers at Kwemkwazu concerning the complaints by the farmers, he said: "*Hawa watu ni Waswahili mno hawataki ushauri na wanapenda majungu hivyo msiwasikilize sana*" meaning "these people don't take our advice and are not trustworthy. We are now used to them, so, just ignore them". But on the other hand he admitted that due to lack of transport, it was difficult to perform his day-to-day duties as a ward agricultural extension officer. "I don't have even a bicycle, I have never been promoted for 15 years now, what could you expect."

Table 4: Crops and Yields Using Chamazi

Village	Major Crops in ranked order	Average Yield (bags*/ acre)	Perceived Production Levels (%)			Total (%)	Reasons for Low - Medium Levels
			L	M	H		
Kivingo	Maize Beans Tomatoes	53 3 n/a	34	66	0	**100**	Lack of water reservoirs Drought
Lunguza	Maize Beans Water-melon	8 3 28	77	21	2	**100**	Lack of permanent irrigation channels and maintenance Lack of agricultural advisory services Drought Lack of improved seeds
Kwem-kwazu	Beans Maize Irish-potatoes	4 6 7	70	30	0	**100**	Lack of water reservoirs Drought Poorly designed channels Lack of agricultural advisory services
Mkundi	Beans Sweet potatoes Maize	6 9 4	63	33	4	**100**	Insufficient irrigation water Drought Lack of agricultural advisory services

Langoni	Beans Maize Irish-potatoes	3 9 7	28	72	0	**100**	Drought Lack of reservoir Rodents and vermin Lack of improved seeds
Mbaramo	Beans Irish-potatoes maize	3 10 5	46	46	8	**100**	Lack of agricultural advisory servicesInputs Water dam
Mng'aro	Maize Beans Water-melon	7 3 22	57	37	6	**100**	Drought Lack of reservoir Lack of permanent irrigation channels and maintenance Plots too small Lack inputs
			Avg 54	**Avg 44**	**Avg 2**		

* Bag = 100 Kgs L = low M = medium H = high Avg = average n/a = not available

Source: Field survey, 2002

Table 5: Assessment of Fertiliser Use and Agricultural Extension Services (%)

Aspects	Kivingo		Lunguza		Langoni		Mkundi		Villages Kwemkwazu		Mbaramo		Mng'aro	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Fertiliser use (industrial)	18	82	9	91	20	80	16	84	33	67	44	56	26	74
Agri-cultural extension services	65	35	9	91	27	73	38	62	29	71	3	97	20	80

Source: Field survey, 2002.

5.4 Chamazi Contribution to Food Security and Cash Income

5.4.1 Food Security in Chamazi and Non-Chamazi Villages

Maize is the main staple food of the division, and it is also used as a cash crop during bumper harvests. In assessing food security the following assumptions were made: maize is the staple food in this area, one adult person needs 90 kgs of maize for the whole year to meet his or her food requirements (URT, 1999). A bag of maize is equal to 100 kg and the average household size in the area ranges between 6 - 8 people (Table 1) and the average household farm is 1 acre (Table 9). The food security situation could be assessed at household level based on the maize yields. By using the above-mentioned assumptions the food security at household level could be computed using the formulae:

Annual maize household requirements =
Adult person maize requirement/annum (URT, 1999) X Household family size
i.e. Column ***1*** × Column ***2***
e.g. for Kivingo =630 kgs/annum (Table 6)
Food surplus or deficit =
Column ***4*** - Column ***3*** (Table 6); with plus sign (+) showing surplus and negative (-) showing deficit
e.g. for Kivingo = -130 kgs/annum (deficit)

Household maize deficit or surplus in months =
Household maize food requirements/maize surplus or deficit:
Column ***3*** ÷ Column ***5***
e.g. for Lunguza = 630 ÷ 170 = 3.2 months

Results from villages with high frequencies of practicing *Chamazi* (Table 6) indicate that the practice plays a big role in food security. Out of the five villages, only two, Mkundi and Kivingo, showed a food deficit, with Mkundi being the worst hit. Overall, the villages were able to have surplus (210 kgs/hs/annum), which could cover household requirements for 4 months (Table 6). Mkundi and Kivingo recorded food deficit due to frequent droughts (Semfukwe, pers. com.).

On the other hand, Table 7 indicates that the Kwemkwazu and Mbaramo villages, where *Chamazi* is not dominant, are faced with serious food shortages of about 160 kgs/household in total, equivalent to 3 months' shortage. This scenario clearly indicates the importance of *Chamazi* in the issue of food security in these lowland semi-arid areas of Lushoto. The survey results show that if the government was to collaborate with villages, the *Chamazi* practice could be used to improve production compared to the current situation. Collaboration could, for instance, be based on the construction of permanent water dams, strengthening the present/existing irrigation channels, extending soft credit loans to farmers and improving the availability of agricultural inputs and markets.

Table 6: Annual Household Food Assessment for Villages where Chamazi is Practised

Villages	Maize food requirement /adult person (Kgs)/ annum *1*	Average Household Size** *2*	Household food requirement /annum (kgs/annum) *3*	Estimated Yield of Maize (kgs/ acre/hs/ annum) *4*	Surplus (+) or deficit (_) Kgs/hs/ annum *5*	Number of maize surplus or deficit months *6*
Kivingo	90	7	630	500	- 130	- 2.5 months (household maize deficit)
Lunguza	90	7	630	800	+ 170	+ 3.2 months (household maize surplus)
Langoni	90	7	630	900	+ 270	+ 5.1 months (household maize surplus)
Mkundi	90	8	720	400	- 320	- 5.3 months (household maize deficit)
Mng'aro	90	6	540	700	+ 160	+ 3.6 months (household maize surplus)
Total					**+ 210**	**+ 4.1 months (household maize surplus in all villages)**

* Referenced from Table 4 ** Referenced from Table 1 hs = Household + Food surplus/annum - Food deficit/annum

Source: Field survey, 2002.

Table 7: Annual Household Food Assessment of Non-dominant Chamazi Villages

Villages	Maize Food Requirement /adult person (Kgs)/ annum	Average House hold size**	Household Food requirement /annum (Kgs/ annum)	Estimated Yield of Maize (kgs/acre /hs/ annum)*	Surplus (+) or Deficit (-) in Kgs/hs/ annum	Number of Maize Surplus or Deficit Months
Kwemkwazu	90	8	720	600	-120	- 2 months (household maize deficit)
Mbaramo	90	6	540	500	- 40	- 0.9 months (27 days) (household maize deficit)
	Total				**- 160**	**- 3 months (household maize deficit)**

* Referenced from Table 4 ** Referenced from Table 1

Source: Field survey, 2002.

5.4.2 The Contribution of Chamazi and Rainfed Agriculture to Food Security

Three cropping seasons in the area were compared in terms of their contributions to improving food security (Table 8). Results showed that the *Chamazi* cropping season contributed more to food security than the short and long rains groupings, as evidenced by 46% of the respondents. However at the village level the *Chamazi* cropping season contributions do vary, with Mng'aro (97%) and Lunguza (79%) taking the lead, and Mbaramo (13%) and Langoni (24%) being the least.

Other important cropping seasons in order of importance are the long rains (39%) and short rains (10%). The contributions from the long rains were significant in Mbaramo and Langoni villages with 79% and 69% respectively (Table 8). We could not establish the reasons for the high contribution of short rains in Kivingo. Unlike other villages, the figure was astonishingly high (51%). The low levels of contributions by these short and long rain seasons could be explained by the irregularity and unreliability nature of the rains during these seasons.

5.4.3 Income Level Generations in Chamazi Dominant and Non-dominant Villages

When computing the expected cash income from the farming systems, the following assumptions were applied: The average *Chamazi* plot size for the mixed crops in all villages was 1 acre, surplus maize was normally sold (refer Tables 6 and 7). The rest of the major crops in *Chamazi* i.e. beans, Irish potatoes, watermelon, sweet potatoes and cassava were also sold; production costs were the same in almost all villages. Results in Table 9 indicate that for villages where *Chamazi* is dominant, the average income is equivalent to Tshs. 133,078 per season, whereas in *Chamazi* non-dominant villages the income was found to be Tshs. 92,500 - lower by 30% (Table 10). Taking the average wage in Tanzania to be Tshs. 48,000 per month, this income could be used by a household for 2.7 months (Tshs. 133,078/Tshs. 48,000). For a farmer from Mkundi earning Tshs. 191,700 (Table 9) with a food deficit of –320 kgs/hs/annum (Table 6), this income could be used to purchase food for 4 months (Tshs. 191,700/Tshs. 48,000), thus, remaining without food for only one month (5.3 months – 4 months).

If we are to take the poverty line income established for Tanzania of Tshs. 1,000/day (URT, 1999; URT 2001; www.poverty.worldbank.org/file/Tanzania.PRSP.pdf), then using the Mkundi example, the income would enable the purchase of food for 192 days, which is equivalent to 6 months (Tshs.191, 700/ Tshs.1,000) / 30 days. This would result in a surplus of one month (Table 6). We can, therefore conclude that *Chamazi* has a significant household income contribution where it is most dominant, and it could serve the double purpose of providing cash income and reducing food shortages when the produce is sold.

5.4.4 Who Benefits from Chamazi?

Results from Table 2 indicate that the practice has a dual gender dimension, on average 73% of both genders are involved, unlike the earlier assumptions that it was mainly a female occupation. With this scenario it can be concluded that the practice is extremely beneficial to the practising communities.

Table 8: Farmers' Assessment of Cropping Season's Contribution to Food Security (%)

Cropping systems	Villages							
	Kivingo	Lunguza	Langoni	Mkundi	Kwemkwazu	Mbaramo	Mng'aro	Average
Chamazi	47	79	24	27	33	13	97	**46**
Short rains	51	6	7	0	0	0	0	**10**
Long rains	2	13	69	55	50	79	3	**39**
Both	0	2	0	18	7	8	0	**5**
TOTAL	100	100	100	100	100	100	100	100

Source: Field survey, 2002.

5.5 Farmers' Views on How to Improve the Chamazi Practice

Despite the significant contribution of *Chamazi* to food security and income generation, farmers were of the opinion that the practice, if improved, could record higher returns than the current ones. Different views were suggested to this effect in areas where it was dominant (Table 11), as well as where it was less dominant (Fig. 1 & 2) below.

5.5.1 Chamazi Dominant Villages

Farmers from these villages had several views on how to make the practice more effective. They suggested constructing water reservoirs, constructing durable irrigation water canals that could be easily maintained, improving agricultural extension services, providing access to soft loans and the timely availability of agricultural inputs (Table 11).

5.5.1.1 Construction of Water Reservoirs

In ranking the suggestions of the farmers, three out of the five villages ranked the need to have water dams as the most important aspect in improving the practice (Table 11). These villages were Kivingo, Langoni and Mkundi. Mng'aro ranked the need for soft loans as most important, while Lunguza suggested the construction of durable irrigation canals.

At the time of this study no dams could be observed, although there was information that at Mkundi, during the colonial period some years back there used to be a dam. Taking the irregular nature of the rains in these semi-arid areas and the fact that they were frequently hit by famine, the idea of having dams was a sound one. Reserve water from these structures could be used during rainfall shortages. The use of these dams could ensure year-round crop production, which in turn would lead to poverty alleviation.

The farmers from these villages said they were willing to collaborate with the government to get the dams constructed. They were willing to contribute labour and materials. Therefore, it is recommended that the government looks at this issue critically and includes it in its development plans.

5.5.1.2 Construction of Irrigation Channels and Maintenance

The need to have permanent irrigation channels and proper periodic maintenance of channels were raised in four villages, except for Mng'aro (Table 11). Earth channels were observed as being common in these villages. Earth channels were said to have the disadvantage of being regularly blocked by debris and mud, particularly during heavy rains and floods. The other limitation was the high water loss due to seepage as compared to lined channels. Where lined channels were in place, they lacked proper maintenance. This was observed at Kivingo village, where channel maintenance was within the local community's capacity to address. Therefore, what is needed is the provision of education to farmers by agricultural extension officers.

Table 9: Household Income of Dominant Chamazi Villages

Village	Major Crops	Average Production Less Food (kgs)	Average Price/Kg	Average Farm size size (acres)	Total Revenue (Tshs)	Average Production Costs/acre (Tshs)	Gross Margin (Revenue average production costs)
Kivingo	Maize	0	90	1	0	30,000	39,000
	Beans	300	230		69,000		
	Tomatoes	n/a	n/a		n/a		
Lunguza	Maize	230	93	1	21,390	30,000	180,990
	Beans	300	240		72,000		
	Watermelon	2,800	42		117,600		
Langoni	Beans	300	200	1	60,000	30,000	96,300
	Maize	270	90		24,300		
	Irish potatoes	700	60		42,000		
Mkundi	Beans	600	230	1	138,000	30,000	191,700
	Sweet potatoes	900	93		83,700		
	Maize	0	67		0		
Mng'aro	Maize	160	90	1	14,400	30,000	157,400
	Beans	300	210		63,000		
	Watermelon	2,200	50		110,000		
Average							**133,078**

N/a = not available *1 bag = 100 Kgs. 1 bag of cassava = 90 Kgs

Source: Field survey, 2002

Table 10: Household Income of Non-dominant Chamazi Villages

Village	Major Crops	Average Production Less used for food kgs	Average Price/kg	Average Farm size	Total Revenue T.shs	Average Costs/ Acre T.shs	Gross (Revenue-Average Production Costs)
Kwemkwazu	Beans	400	220	1	88,000	30,000	96,500
	Maize	0	80		14,400		
	Irish potatoes	700	55		38,500		
Mbaramo	Beans	3001	240	1	72,000	30,000	102,000
	Irish potatoes	1,000	60		60,000	30,000	102,000
	Maize	0	90		0		
Average							**92,500**

N/a = not available *1 bag = 100 Kgs. 1 bag of cassava = 90 Kgs.

Source: Own survey, 2002.

5.5.1.3 Improvement of Agricultural Extension Services

The services of agricultural extension officers were not appreciated, as indicated by opinions that rested at the average of 68% (Table 5). Lunguza recorded 91%, Mng'aro 80% and Lunguza 73% in terms of dissatisfaction with the services. Farmers suggested that the services had to be improved for the betterment of the practice (Table 11). The study could not establish why in these three villages the respondents were not satisfied, taking into account that they had extension officers stationed there. It could be that the working morale of the officers was low, as explained by one extension officer based at Kwemkwazu village.

However, it was deduced from the research that good agricultural extension policies, guidelines and legislation alone could not make extension officers deliver accordingly. The challenge to central government is to address the root cause of the problem, and not treat the symptoms only. There is need for these officers to be motivated in different ways, such as offering them attractive salaries, equipment (bicycles and motorbikes), paying overtime, making timely payment of salaries and offering them soft loans for developmental projects such as housing, school fees etc. With mobilisation the situation in the study villages could change.

5.5.1.4 Loans

Access to soft loans was viewed by 35% of Mng'aro farmers as the best approach to improve *Chamazi.* The rest of the villages did not mention this at all (Table 11). Observations showed that irrigation farming required some basic equipment and materials to make it yield the expected outputs. Such requirements include simple engines/petrol

water pumps, pesticides and fertilisers. Unfortunately, the purchasing power of most of the farmers was found to be too low to afford equipment and materials. Therefore, it would be a good idea if financial institutions (banks, Non-Governmental Organisations, Community Based Organisations, government institutions) were to consider providing soft loans to these people. Currently, as discussions with common people in the study areas indicated, loans aimed at poor local people may end up landing into the hands of the rich rural or urban entrepreneurs, due to nepotism and corruption. To minimise this anomaly the lending system need to be re-examined to ensure that credit lands in the hands of the targeted group(s).

5.5.1.5 Availability of Inputs

Timely availability of inputs was also mentioned as another way to improve *Chamazi* for all the villages, the percentages ranging from 5 - 21, (Table 11). The researchers could not see depots/shops selling agricultural inputs in these villages. In order to get these inputs one had to travel to either Mlalo, the divisional headquarters, or to the town of Lushoto. The distance from Kivingo, Lunguza, Langoni and Mkundi to Mlalo is on average 30 km, and this is further complicated by transport problems during both the dry and wet seasons. Public transport is available at Kwemkwazu daily, but one has to spend a day at Kwemkwazu (Lunguza and Mbaramo commuters) to catch a bus to Lushoto the next day.

Apart from transport inconveniences, the two-way fare is also another limiting factor to these farmers. One has to set aside at least Tshs. 8,000 for both transport and accommodation at the district headquarters. The farmers themselves could solve this problem, instead of central or local government, through the formation of farmer cooperatives. These cooperatives could open several stores at convenient distances to sell agricultural inputs. The government could also encourage local business persons by reducing the taxes attached to these goods.

5.5.2 Chamazi Non-dominant Villages

Views of the farmers in these villages were the same as in the *Chamazi* dominant villages (Figures 2 and 3). In Mbaramo 50% of the respondents viewed improvement of extension services as a way forward, while at Kwemkwazu only 18% held the same opinion.

5.6 On-site and Off-site Environmental Effects of Chamazi

5.6.1 On-site Effects

During the research field visits there were signs of salinisation and the farmers also mentioned this as a problem in some areas, particularly Mng'aro village. Saline soils normally have significant effects on crop yields for most crops, as most crops grow well in soils with a pH not above 7. Saline soils occur where the supply of salts, for example from rock weathering, capillary rise, rainfall or flooding, exceeds their removal, for example by leaching or flooding that cause water logging (Landon, 1991). Thus they tend

to coincide with areas where evapotranspiration exceeds precipitation and where there is no lengthy rainy season. These characteristics provide some evidence of the problem in the area. To rectify this problem salts should be leached regularly and the water table should be kept low through the use of adequate drainage systems.

5.6.2. Off-site Effects

The off-site effect, which was evident during field visits was soil erosion to the relatively lower areas. This problem becomes more pronounced during floods as a result of heavy rains. To combat the problem the observations suggested the need to construct lined water diversion channels for safe diversion of water to rivers or reservoirs. Also, suggested was the construction of contour bunds (terraces) for safe guidance of water from fields. The vertical intervals for the contours would depend on the gradient angle of the area.

Table 11: Ranked Farmers' Views (%) on How to Improve the Practice

Kivingo	%	Lunguza	%	Langoni	%	Mkundi	%	Mng'aro	%
Construct water dam	46	Provision of permanent irrigation channels and maintenance	46	Construct water dam	44	Construct water dam	45	Government provide soft loans	35
Improve agriculture advisory services	20	Improve agriculture advisory services	37	Provision of permanent irrigation channels and maintenance	41	Provision of permanent irrigation channels and maintenance	30	Improve agriculture advisory services	26

Continues on next page

Table 11: (*from previous page*) Ranked Farmers' Views (%) on How to Improve the Practice

Agricultural inputs availability	18	Agricultural inputs availability	13	Improve agriculture advisory services	5	Improve agriculture advisory services	16	Agricultural inputs availability	21
Provision of permanent irrigation channels and main-tenance	16	Construct water dam	4	Agricultural inputs availability	10	Agricultural inputs availability	9	Construct water dam	18
TOTAL	100		100		100		100		100

Source: Field survey, 2002.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Despite current operational and technical problems facing *Chamazi*, the farming system has significantly contributed to both food security and cash income. In villages where the practice was dominant, the villages were able to produce a four months' food surplus and a cash income of approximately Tshs. 133,078 per cropping season per household. This scenario shows that, the practice, if well advocated, has the potential to alleviate poverty and ensure year round food security in the semi-arid areas of the Lushoto district.

6.2 Recommendations

- Local government work hand in hand with farmers to ensure construction of permanent water reservoirs and irrigation channels.

- Financial institutions including banks, the government and NGO's should consider giving rural farmers soft loans to enable them purchase basic irrigation equipment and other requirements.

- Local government should ensure irrigation dominant villages have agricultural extension officers with a strong background in irrigation.

- Improve water use efficiency through the use of lined channels instead of the currently used earth channels.

- Frequent salinity reclamation and construction of soil erosion control structures down the slope should be emphasised to minimise both the on-site and off-site environmental effects.

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