AFRICA IN TRANSITION
MICRO STUDY
TANZANIA

Research Report

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1. METHODOLOGY

1.1 Introduction

Administratively, mainland Tanzania is divided into twenty-two regions. Each region is subdivided into districts, which are followed by divisions, wards, villages and households. Thus the household is the smallest administrative unit in Tanzania. Most aggregate statistics are available based on this administrative set up. Maize is the main staple in most parts of the country. The importance of rice as a food crop is also growing in most urban areas and it is the main staple in many rice-growing parts of the country. Multistage purposive sampling was used from the region down to the household. In selecting the regions, districts, divisions and wards, three criteria were considered as follows:

- The area having a high agricultural potential
- The area being accessible by road throughout the year
- The area producing more maize or rice than other areas

Consequently, at the national level, two regions were selected for the Afrint study. Morogoro region, specifically Kilombero district was selected as a rice growing area while Iringa region was chosen for predominance in maize production.

Fieldwork for developing the sampling frame for the Afrint study in Tanzania was done by two teams from 16th – 20th July 2002 focusing on the two study areas. Five villages were selected from each region.

1.2 Selection of Districts

In the case of Kilombero district this step was not necessary since all villages were to come from one district. Iringa region has five districts; Iringa, Ludewa, Makete, Mufindi and the new district of Kilolo that is not yet administratively operational. The first step was to rank the districts in terms of productivity and accessibility. Based on these criteria, Ludewa and Njombe districts were excluded due to distance from Iringa while Makete district was excluded due to low productivity of maize as well as distance. Thus three villages were selected from Iringa district and two from Mufindi.

1.3 Selection of Villages

Selection of divisions, wards and villages for the study was done in collaboration with two staff from the office of the DALDO through brainstorming. Kilombero district has five divisions; Kidatu, Mang'ula, Ifakara, Mngeta and Mlimba. The divisions are about 78, 55, 5, 80 and 150 Kilometres from the district headquarters respectively. The district has 19 wards and 81 registered villages. Based on the criteria specified above, three divisions were selected as follows, Mang'ula, Ifakara and Mngeta. Mlimba division was excluded due to distance from the Ifakara town, the district headquarters. Kidatu division was not selected because sugarcane production rather than paddy predominates.

From Ifakara division one village was selected to represent the urban influence in food production. However, a village that was somehow far (21 km) from the district headquarters was selected. From each of the other two divisions two villages was selected as listed in Table 1.

Table 1: Villages Selected from Kilombero District

No.	Division	Ward	Village	Distance from Ifakara (km)
1.	Ifakara	Idete	Idete	21
2.	Mang'ula	Kiberege	Kiberege	40
		Mkula	Katurukila	60
3.	Mngeta	Mbingu	Mbingu	47
		Mchombe	Njagi	58

In Iringa district, the selection of divisions and villages was likewise done at the district with guidance from agricultural extension staff. Iringa region has ten divisions and 186 villages. The divisions include; Isimani, Idodi, Kilolo, Kiponzelo, Mlolo, Mahenge, Kalenga, Mahenge, Mazombe, and Pawaga. However, Kilolo, Mazombe and Mahengedivisions will form the newly formed Kilolo district.

Further elaboration of the village sampling/selection procedure was necessary. For this exercise all divisions were sampled as part of Iringa district. First all divisions were ranked based on their past performance on maize production and productivity. For example in Iringa and Mufindi districts divisions that produced 1–5 bags per acre on average were ranked as having low productivity. Divisions with yields between 5–15 bags per acre on average were ranked as having medium to high productivity. Yield above 15 bags per acre was ranked as being very high. Based on these criteria, villages were selected from different divisions each representing a different agro-ecological zone as indicated under Table 2. It should be noted that yield per acre was used instead of the official measure of yield per hectare because among farmers the acre is still more commonly used as a unit of measure for area[1].

Table 2: Villages Selected from Iringa District

No.	Division	Ward	Village	Relative Altitude	Distance from Iringa (km)
1.	Kilolo	Ukwega	Isele	High (1,800m)	50
2.	Mlolo	Ifunda	Ihemi	Medium	20
3.	Mazombe	Uhambingeto	Kipaduka	Low	56

Mufindi district has 5 divisions, 28 wards and 132 villages. The wards include Ifwagi, Kibengu, Kasanga, Malangali and Sadani. The same procedure as for Iringa district was used to select divisions from which villages would be chosen. Only two villages were to come from Mufindi, so two divisions and two villages were selected as indicated under Table 3. When the productivity ranking was done at village level, there was variation in the range of productivity as can be noted from Table 4.

Table 3: Villages Selected from Mufindi district

SN	Division	Ward	Village	Relative Altitude	Distance from Mafinga (km)
1	Ifwagi	Rungemba	Kitelewasi	High	12
2.	Kasanga	Kasanga	Kasanga	High (1,500m)	53

[1] 1 ha ≅ 2.471 acres

Table 4: Household-Ranking Criteria for Maize Producing Villages

District	Village	Productivity Category (Bag/Acre)		
		Very Low	Medium/High	Very High
Iringa	Isele	1 – 4	5 – 12	> 20
	Ihemi	< 5	5 – 7	> 7
	Kipaduka	1 – 3	4 – 8	9 – 15
Mufindi	Kasanga	1 – 5	5 - 15	> 15
	Kitelewasi	1 – 5	5 - 10	> 10

1.4. Selection of household for the village diagnostics questionnaire

In order to facilitate selection of household heads that would be respondents for the Household survey, as well as the focus team members for the Village diagnostic Survey, PRA teams were constituted in each village. The target was to get between 15 and 20 village members representing different categories of people as shown in Table 5.

1.5 Selection of household for the household survey questionnaire

The population from which the sampling frame was obtained comprised of all households of the ten villages selected for this study. In some cases the villages were very large, consisting of over one thousand households. Since the sample size required from each village was 40 household, a sampling fraction was determined based on which the size of the sampling frame was established, and sub-villages were sampled accordingly (Annex I).

Table 5: Attributes for Selecting household for the village diagnostics questionnaire

Attribute	Category	Number		
		Female	Male	Total
Age	Young villagers	1	1	2
	Old villagers	1	1	2
Level of Production	Producing much	1	1	2
	Producing little	1	1	2
Gender	Female headed HH	2	-	2
	Male headed HH	-	2	2
Salaried employees	-	2	2	4
Village leaders	-	2	2	4
Total	**-**	**10**	**10**	**20**

Within each village, the researchers in collaboration with the Focus team members as described above, through brainstorming and discussion, listed all the households within the sampling frame and classified each household as falling under the category of very low, medium to high or very high productivity for rice in Kilombero district, and for maize in Iringa and Mufindi districts. The range of the three productivity categories used for the selection of villages was also used to categorise farmers.

In the case of female-headed households they were indicated as being polygamous where the husband is counted as household head only under one of the wife's compound while

the other wives are considered as *de facto* household heads. Other women household heads were widowed, divorced or single (never married). In a few cases there were women who were classified as having been abandoned by their husbands. Representation of all these categories was considered during sampling. A similar breakdown for male-headed households was not considered necessary since virtually all of them are married. The only distinction is that some are polygamous while others are monogamous.

From these sampling frames a proportionate random sampling was used to select 40 households in each village (Annex 2). In order to replace respondents who may not be present at the time of the survey, an additional ten (10) reserve households were sampled, thus making the total from each village fifty (50).

2. THE VILLAGE DIAGNOSTICS SURVEY RESULTS

2.1 Agricultural dynamism

2.1.1 Population size, land use and agro-ecology

The population of the village household from which the sampling frame was made is given in Annex 2. The average proportion of land area cultivated was 45.0 square kilometres. The percentage of village land under different uses is given in Table 6.

Table 6: Land uses in the villages of research

Area of land	Minimum (%)	Maximum (%)	Average (%)
Under cultivation	25.0	65.0	40
Under fallow/pasture	3.0	20.0	10
Forest/virgin land	5.0	35.0	20
Marginal land	0.0	15.0	1
Water bodies	0.0	5.0	1
Other uses	5.0	29.0	24

The area of land irrigated was very small. It ranged from 0 to only 25% of all land cultivated. Six out of the ten villages of research were practising some sort of irrigation. The villages were Njagi and Katurukila in Morogoro Region, and Ihemi, Isele, Kitelewasi, and Kasanga in Iringa Region. Four out of the ten villages had no irrigation means. They were Kiberege, Mbingu and Idete in Morogoro Region, and Kipaduka in Iringa Region. In Iringa Region, a traditional irrigation system locally known as *vinyungu* was being practised in almost every village. The system is practised in valley bottoms, which are cultivated during dry seasons. The system makes use of moisture existing underground, due to the area being close to river streams, which assists crops to thrive. An enquiry about the system of irrigation from District Agricultural Officers revealed that *vinyungu* agricultural system is very important for food security, and contributes about 20% of all food produced in Iringa Region. A similar phenomenon was observed in Morogoro Region, Kilombero District, in Mbingu and Njagi Villages, where underground moisture persists almost throughout the year, and farmers plant some food crops a year round[2].

In 5 of the 6 villages (Katurukila, Njagi, Ihemi, Kitelewasi, and Kasanga) where irrigation was being practised, villagers were using small-scale, farmer constructed, water control devices. Individual households who maintained the water channels that regulated moisture for the households' plots managed the devices. In the other village (Isele) where irrigation was being practised, the system of irrigation was small-scale farmer constructed water control devices managed by associations of households at the village level. For example, households could divert a river in turns into crop fields owned by different households, and different water users agree upon the routine of water use.

In most of the surveyed villages, rainfall amount was reported to be above the average for three consecutive seasons (1999 to 2002) (Table 7).

[2] In some cases limited irrigation is done by carrying water from the stream in buckets.

Table 7: Rainfall conditions

Rainfall condition	Reference season		
	During the most recent season	**During the season before the most recent one**	**Two seasons before the most recent one**
Above average	Idete, Katurukila, Kiberege, Mbingu, Njagi, Kipaduka, Kasanga	Katurukila, Kiberege	Idete, Katurukila, Kiberege, Mbingu, Ihemi, Kitelewasi
Average	Ihemi, Kitelewasi	Idete, Mbingu, Njagi, Kipaduka, Ihemi, Kitelewasi, Kasanga	Njagi, Kasanga
Below average	Isele	Isele	Kipaduka, Isele

In Kiberege Village it was reported that after the 1997/98 *El Nino* rains it has been very difficult to predict the timing, duration and intensity of precipitation. Unpredictable rain pattern is a constraint to agricultural intensification since it creates a risky environment for agriculture.

In terms of soil quality endowment, none of the villages had poor soils. Four villages (Idete, Kiberege, Mbingu, and Njagi) were well endowed with soils suitable for cultivation while the rest of the villages (Katurukila, Ihemi, Kipaduka, Isele, Kitelewasi and Kasanga) had average soil fertility. With regard to topography, eight of the villages (Idete, Katurukila, Kiberege, Mbingu, Ihemi, Kipaduka, Kitelewasi, and Kasanga) are located on flat terrain or gentle slopes. Njagi village is located on mixed slopes and flat terrain while most land cultivated in Isele Village is located on steep slopes.

Combining information on rainfall pattern, the presence of irrigation, soil qualities, and topography, eight of the villages (Idete, Kiberege, Mbingu, Njagi, Ihemi, Isele, Kitelewasi, and Kasanga) have good agricultural potential while two villages Katurukila and Kipaduka have average potential. Thus none of them has low agricultural potential.

2.1.2 Infrastructure and market access

Five villages (Idete, Kiberege, Mbingu, Ihemi, and Kasanga) had regular public transport while the other five villages (Katurukila, Njagi, Kipaduka, Isele, and Kitelewasi) did not have regular public transport. The distances from the village centres to the nearest all-weather roads; permanent crop outlets; town-based and permanent markets; places with permanent electricity; and places serviced by permanent or mobile telephone connections are summarised in Table 8.

Table 8: Distances from village centres to various service centres

Village	Distances from village centres to nearest places with (km)				
	All-weather road	Permanent crop outlet	Town-based /permanent markets	Permanent electricity	Permanent or mobile telephone
Idete	0	0	20	20	20
Katurukila	6	7	7	6	7
Kiberege	0	0	0	0	5
Mbingu	0	55	55	55	55
Njagi	12	65	65	65	65
Ihemi	0	0	5	0	40
Kipaduka	12	0	12	12	57
Isele	14	55	55	55	55
Kitelewasi	0	0	10	7	0
Kasanga	0	0	6	6	50
MEAN	4.4	18.2	23.5	22.6	35.4

Only one village (Katurikila) had some villagers involved in outgrower contract farming scheme, growing sugarcane for sale to the Kilombero Sugar Company factory. In Kasanga, the villagers grow tea that is sold to Mufindi Tea Company through the village government. However, there is no contractual agreement between the company and the growers so far.

On the basis of a summary of information on infrastructure and market conditions, the positions of five villages (Mbingu, Njagi, Kipaduka, Kitelewasi, and Kasanga) had average market access while Idete, Kiberege and Ihemi have good access to markets. Only Katurukila and Isele had marginal access to markets.

2.2 State initiatives

Nine out of the ten villages had received public food relief in the past. The food had been given to only some very poor households. The only village where no food relief had been provided was Njagi. Apart from Isele and hemi villages (in Iringa region) that received relief food in 1972 and 1974 respectively all other villages received relief food in during 1998/99 following the *El Nino* rains. In both times, food relief was necessary because of weather calamities i.e. draught in the case of the early 1970s and the *El Nino* rains in the late 1990s. Moreover, the respondents reported that they did not receive any form of public price support or input subsidies directed at food crops[3]. However, two villages (Kiberege and Kipaduka) were receiving some form of NGO/donor support for food production, particularly in terms of improved maize seeds through the Agricultural Sector Programme Support (ASPS).

The main channel through which farmers were selling food crop products was through private traders. The public sector is no longer involved in buying any farm produce in the survey villages. Following the economic reforms since 1986 and comparing the Pre-SAP

[3] But the subsidy under the national Maize Project (1974-79) and the FAO fertilizer project (1979-84) applied in all areas in the Southern Highlands. Therefore, the villagers may not have been aware that they bought fertilizer at subsidized rates.

to the Post-SAP periods, there seems to have been great improvement in road infrastructure in the post SAP period in all villages. This has enabled private buyers (traders) to go to the villages and purchase produce and in some cases supply inputs. The improved roads make it possible for a few villagers to take their produce to more central markets where they expect to fetch better prices. Most villagers however, cannot afford the transportation costs to more central markets. There were also restrictions on private traders involving themselves in trade of food until 1984 and in 1987 restrictions on the free movement of food crops was lifted.

Input costs have gone up in the post-SAP period as a result of removal of input subsidies by the state since 1984 and the devaluation of the shilling which eliminated overvalued exchange rates. The latter is partly another reason for the increase in prices of inputs because the liberalisation of the exchange rate regime, which has resulted in substantial depreciation of the Tanzanian shilling making imported inputs relatively more expensive. The situation is made much worse by the collapse of most cooperatives that used to bring subsidised inputs to the villages. In the current input marketing system farmers have to buy the inputs from trading centres and therefore pay transport and travel costs. This has reduced the use and intensity of use of agricultural inputs such as fertiliser in all villages.

In the pre-SAP period up to 1989 when regional pricing was abolished the government fixed prices and this removed the risk of price variation. In the post-SAP period farmers have experienced great variation in prices as the traders now tend to collude to fix prices. In a number of villages there was a feeling that some of the traders were pushing down prices far below the farmers' expectations using non-pricing strategies. In Kiberege for example, a sack that used to be filled with six tins (about 100Kgs) of paddy up to year 2000 and was sold at Shillings 10,000 is now required to be filled with seven tins with no change in the price. Traders do not observe standard weights and measures.

In Njagi (which is 65km from Ifakara) the focus group discussion revealed that high transport costs contribute to farmers getting lower prices compared to the pre-SAP period when the government used to buy their products at fixed prices and when transport costs were covered by the government.

At present the only provider of extension services in all the villages was the government. However, the quality of extension services have declined in the post-SAP period in almost all villages. In pre-SAP period each village used to have its own Village Agriculture Extension Officer (VEO) but in the post-SAP era there are fewer VEO's due to retrenchments. Villages therefore have to share extension officers. The extension officers no longer stock inputs or run demonstration farms. The main duty of extension officers in the post-SAP period is advisory. In Idete the focus group discussants informed that since they have reduced the use of farm inputs they do not have a great need for the extension officer. In Ihemi similar sentiments were expressed. In general the village extension officers do not have reliable means of transport but in Kipaduka it was revealed that the VEO visited regularly since he had a motorcycle.

The modern varieties of rice and maize are generated by the national agricultural research system. In the case of rice the research stations were Kilombero Agricultural Training and Research Institute (KATRIN) and Rice Research Institute at Dakawa, Morogoro,

where as Ukiriguru and Ilonga are important centres for generation of maize technologies. The funding for these centres is mainly donor supported.

2.3 Markets

In seven of the ten villages (Idete, Katurukila, Kiberege, Mbingu, Isele, and Kasanga) artificial fertilisers, improved seeds, and agro-chemicals were timely available. The problem was high prices of the inputs. In the other three villages (Njagi, Ihemi, and Kipaduka) the above inputs were not timely available, regardless of the prices. In most cases private traders were selling the inputs. Pre-SAP prices of inputs were more stable than the post-SAP. The post-SAP period coincided with the appearance of private buyers (traders) who pay promptly for the produce they purchase.

Generally central and local governments taxation of agricultural produce increases the cost for buyers who as a result would prefer to buy crops from areas with low or no tax. For example in Idete before the year 2000 businessmen from Pemba and Zanzibar were buying all the rice the farmers could sell, but during the year 2000 the local tax went up to TShs 1500/- from under TShs 1000/- per bag. The tax was split between the village government, which received TShs, 500 per bag and the district council that received TShs 1000/- per bag. This tax increment resulted in the buyers finding alternative sources in Kilosa and Shinyanga and the villages in Kilombero has therefore lost this attractive group of buyers. As a result maize is becoming more important since year 2000 especially with the opening of the Makambako market which handles maize destined for Malawi, Zambia and Zimbabwe.

In Kasanga, villagers grow more tea for selling to Mufindi Tea Factory (MTF) despite having no contract with MTF. Given this more reliable market, farmers grow less maize than previously. Consequently, private crop buyers visiting the village to buy food crops have decreased in number and frequency.

For Isele Village the relative price of green maize on the cobs to that of a dry cob of maize is about twice as much and most farmers therefore engage more and more in green maize trade. Traders from within or outside the village buy directly from the field for sale in urban markets especially Iringa and Dar es Salaam. All the above examples show how producers are sensitive to relative prices between competing products.

2.4 Farmer organisations

Agriculture related organisations of small farmers were found in only four villages namely Kiberege, Njagi, Isele, and Kasanga. The main activity for all of them was agricultural production. In Kiberege there is a farmer's organisation running milling machines.

Kilombero Cooperative Union (KCU) and Iringa-Mufindi Cooperative Union-(IMCU) Cooperative Unions, which used to operate in Kilombero and Iringa and Mufindi districts respectively ceased operations in the mid eighties. These were used to bring in the much-needed subsidized inputs. Agricultural inputs are now only available from private individuals and are no longer subsidized. Ihemi, Isele, Kitelewasi and Kasanga have no farmer organisation.

Kitelewasi and Kasanga had village shops but these operated at a loss and eventually closed down. In Kiberege there is a group dealing with milling machines but it is operating at a loss and its future is not certain. In Njagi there are a number of farmer organizations that were formed expecting to get credit; unfortunately they have failed to fulfil credit conditions such as providing required collateral. Contrary to prior expectations both the women and youth development groups have not been able to secure credit from the district council.

The contribution of farmers' organisation to agricultural intensification therefore appears to have been little and the main drawback seems to be poor management and the perceived inefficiency of co-operatives. If run properly and efficiently these could play a very important part by consolidating input requirements and organising the marketing of output.

2.5 Land tenure and gender issues

Major means by which newly formed households and those already established acquire land are summarised in Table 9. In three villages Idete, Ihemi and Kipaduka, some small-scale farmers held formal title deeds for their land. The land frontier was still open in nine of the ten villages but could be foreseen to close within the next 5 to 10 years. The exception was Kitelewasi Village where discussants said that the land frontier was open with no acute pressure on land.

Table: 9: Major means of acquiring land

How new households mainly obtain land		How established households mainly increase farm size	
Being allocated land not previously cultivated	Mbingu, Ihemi, Kitelewasi	Clearing virgin land	Kiberege, Mbingu
Being allocated family land	Kiberege, Njagi, Isele	Cultivating communal pasture grazing land	Kitelewasi
Inheriting land already under cultivation	Kasanga	Borrowing/renting land	Katurukila, Ihemi, Kipaduka, Isele
Purchasing land	Idete, Katurukila,	Purchasing land	Idete, Njagi, Kasanga
Borrowing/renting land	Kipaduka	-	-

In Kiberege and Mbingu migrants can acquire land from village governments. The same holds for Kitelewasi where new immigrants can only be allocated land if they produce evidence from their former village attesting to their being trustworthy. In Idete new immigrants do buy land from some villagers who hoard land galore and sell land by pieces. In Kipaduka and Isele land is not sold and migrants therefore have little access to land. Land could also be allocated by the village government. This is particularly true in villages where buying land is not yet usual as an option. This implies that people can still borrow or get land allocation from the village government so long as the land frontier is still open.

In Njagi most villagers are Nyakyusa by tribe from Mbeya Region who practice patriarchy. Divorcees and widows do not get any land from the husband's side. The situation is different in Kasanga, where land is bequeathed to sons only but widows can inherit land left behind by their deceased husbands.

The government gender campaigns have had some positive effect in Katurukila, Kiberege, Idete and Mbingu where women have better access to land. Katurukila village being multi-ethnic, more women now have more access to land than previously. In Kiberege widows can inherit land from their deceased husbands, and daughters, even married ones, can get land from their parents. Land inheritance used to be restricted to sons mainly in Idete and Mbingu, but in these days girls also inherit land. About 95% and 85% of parents in Idete and Mbingu respectively have changed their attitudes positively towards land bequeathal to girls as a result of the influence of government gender campaigns. In Kipaduka and Kitelewasi widows continue owning their husbands land so long as they do not marry men from other clans, otherwise they have to forfeit the land.

Generally women in Iringa region may continue to use the land they had been allocated by their parents before getting married i.e. they continue to have use right after they get married. Women enjoy equal land use rights as men. This increases farm productivity because minimum risks in land ownership encourages investment in it.

2.6 Credit

Credit is not a regular feature in the development process of these villages. In the Pre-SAP period some villages had access to credit especially through cooperative unions mainly in the form of inputs for cotton (Katurikila, Kiberege, Idete) and fertiliser for the Southern Highlands, but this ceased in the mid 1980's. Since then credit has been sporadic. For example in Kitelewsi Sasakawa Global 2000 provided credit in the form of starter packs (fertilisers, improved seeds and pesticides) for maize production for a limited period only. Kilombero District has a Women Development Fund (WDF)[4] and a Youth Development Fund (YDF). Of the five villages in the district surveyed only one Mbingu women group and one youth group have ever obtained credit. Credit is only given to registered groups, which should also provide the needed collateral. Most of the villages have to do without formal credit in the SAP and Post SAP period.

Credit schemes that are on and off are unlikely to sustain agricultural development in the long run as their availability is not assured and they may be used to push producer/farm-gate price down. As an example, in Kiberege village it was reported that "some traders provide some inputs to farmers at the time of weeding but in return the farmers have to sell to these traders at prices which are quite low. For example last season's produce (2001), the average price paid to a beneficiary of a loan was TShs. 5,000 per bag of rice, whereas one large-scale farmer and a women's group who did not acquire any loans managed to sell their rice at a price of 17,000/- per bag.

[4] This fund is available in all districts.

2.7 History of intensification

a. Maize

The percentages of villagers using non-traditional maize seed materials varied between zero and 30%. Over 90% of villagers in all the villages were using local maize seeds. In the traditional maize growing region of Iringa, hybrid seeds were introduced in the villages much earlier in the 1970s after the Arusha declaration. These were followed by the Open pollinated varieties (OPV's) in Isele (1972), Kipaduka (1990), and Kasanga (1999). Quality Planting Materials (QPMs) were only introduced in Kipaduka in 1994. In the rice belt the maize OPVs[5] were introduced in 1998 in Katurukila, in 2000 in Idete, and in 2001 in Mbingu. The OPV's are yet to be introduced in Kiberege, Njagi, Ihemi, and Kitelewasi. Despite the fact that in most villages OPVs were introduced in the 1990s a very small fraction of farmers are currently using these modern varieties. The economic impact of maize research in Tanzania is well summarised by Moshi, et al. (1997).

b. Rice

In the rice growing villages lowland rice was introduced as early as 1938 in Mbingu (before the Maji Maji war), 1969 in Idete, 1974 in Katurukila and 1976 in Njagi. Improved rice varieties were introduced in the following patterns: Idete (1983), Katurukila (1985), Kiberege (1999), and Njagi (2000). Irrigated rice is grown in Katurukila and Njagi villages.

The History of Idete shows that at its formation as an *Ujamaa* village in 1969 two varieties of rice (India and *Rangi mbili*) were introduced to be followed by two more in 1970 i.e. Super Mwanza and Kisegese. In 1986 Dakawa variety was introduced and in 2000 Line 85 and Line 88 were introduced. In Kiberege it was indicated that the physical structure, taste and odour of rice partly determine the success of a variety. Line 85 for example has good tastes like India but is odourless. Traders therefore prefer to buy the India variety first although it is lower yielding than the recently introduced HYVs (Line 85 and Line 88).

c. Cassava and Sorghum

Cassava is grown in three villages, Idete, Katurukila and Njagi but only Idete has introduced improved cassava varieties. Traditional varieties of sorghum are being grown in Katurukila and Isele Villages.

d. Chemical Fertiliser, Animal Manure and Pesticides

Fertiliser is substantially being used in Ihemi and Kitelewasi where 90% and 95% of the households are estimated to use fertiliser. In Isele, use of chemical fertiliser has declined significantly because of high costs, instead 30-40% of households apply animal manure. Mbingu and Njagi villages are not using any fertiliser and this is probably due to the fertile soils complemented by excellent availability of water because of a very high water table throughout the year.

Animal manure is used in all five villages in Iringa where traditional livestock herds are kept. The use of animal manure is non-existent in Kilombero district but this may change with the arrival of migrating Masai and Sukuma herds into the district.

[5] This may be incorrect due to farmers ignorance about technical aspects of the seed they buy.

In Kiberege and Idete the use of herbicides in rice is quite common. The practice was introduced at Kiberege in 1988 and it is estimated that about 80% of the household apply herbicides. At Idete it was reported that before 1990 few farmers used herbicides but most households started using it after 1990. The pattern of use and introduction of traditional and modern inputs in survey villages is summarised in Table10.

e. Irrigation

Focus group members reported that the proportion of farmers with some kind of irrigation were zero in Idete, Kiberege, Mbingu, and Kipaduka while they were 2% in Katurukila, 10% in Njagi, 99% in Ihemi, 95% in Kasanga and 100% in Isele and Kitelewasi. In Iringa Region almost every household practises *vinyungu* traditional irrigation technique, which has been used since time immemorial. In the other villages, irrigation structures had been constructed in 2000 (Katurukila) and 1988 (Njagi) but they were abandoned and have never been functional.

Table 10: Percentage input usage and year of introduction

Village	Chemical Fertiliser		Animal manure		Pesticides	
	Farmers using (%)	Year Introduced	Farmers using (%)	Became common in	Farmers using (%)	Year Introduced
Mbingu	0	NA	0	NA	5	1985
Njagi	0	NA	0	NA	0	NA
Idete	10	1970	0	NA	1	1998
Ihemi	95	1970	36	1994	98	1970
Kitelewasi	90	1970	5	1975	90	1975
Isele	0	1972	35	Immemorial	75	1972
Kassanga	20	1973	15	1971	100	1973
Kipaduka	10	1974	20	1989	0.5	1974
Kiberege	6	1988	0	NA	0	NA[a]
Katurukila	25	1997	0	NA	25	1982

[a] In Kiberege pesticides were used to control armyworms in horticultural crops in 1999.

f. Improved cattle production

Six of the ten villages, Katurukila, Kiberege, Mbingu, Njagi, Kipaduka, and Isele did not keep stall-fed cows. In Idete, Kasanga, Mbingu, Kitelewasi, and Ihemi the proportions of household practising stall-feeding were: 0.1%, 0.4%, 4%, 0.5%, and 15.0% respectively. This practice started in 1993 in Kasanga, 1994 in Ihemi, 1997 in Kitelewasi and 1998 in Idete.

Up-graded dairy cows (crossbred or pure) were not kept in Katurukila, Kiberege, Mbingu, Njagi, Kipaduka, and Isele. The proportion of households keeping dairy cows were estimated to be 0.4%, 1.0%, 10.0%, 21.0%, and in Kasanga, Idete, Kitelewasi, and Ihemi, respectively. Up-graded cows were introduced in Kasanga in1993, Ihemi (1994), Kitelewasi (1997) and Idete (1998).

g. Fallowing

The proportions of farmers in the villages that were regularly putting part of their land in fallow were 20.0% in Idete, 20.0 % in Mbingu, 0.5% in Njagi, 2.0% in Ihemi, 10.0% in Kipaduka and 12.0% in Isele. Fallowing ceased to be a regular practice in Ihemi (1980), Kiberege (1986), Njagi (1989), and Katurukila (1990). No farmers practiced fallowing in Katurukila and Kiberege and less than 4% practiced fallowing in Njagi, Ihemi, Kitelewasi and Kasanga.

2.8 Labour use, mechanization and non-farm activities

In the lean season when agricultural activities are minimum, most youths in Kilombero district tend to migrate to urban centres in search of jobs. At Katurukila and Isele it was reported that out migration of labour is more serious in poorer households. In hard times people sell their labour to others within the same village. It was reported that some migrants from Kiberege, Ihemi and Kitelewasi remit money, of which some is invested into agriculture. Those from Idete and Mbingu remit very little or nothing to assist agricultural production. The meagre wages they get are hardly sufficient even for themselves. During the farming season there are in-migrating labourers who come to Kilombero district looking for farm work mainly from Mbeya and Iringa Regions. This workforce together with the use of tractors makes timely farm preparation possible.

However it should be noted that weeding which tends to be more labour intensive and has to be done in a timely manner creates problems for some households in that they fail to hire labourers and thus incur production losses due to untimely weeding operations. For example about 80% of the households in Kiberege fail to employ labourers where the cost for weeding one acre of rice is about 12 USD. In Katurukila the use of tractors and herbicides help to reduce the need for manual labourers. However, some farmers cannot afford hiring tractors for tillage or to buying herbicides. The two (timely tillage and weeding) are more important determinants of food productivity in the village.

The use of tractors is very minimal in Njagi probably because it is far from the District headquarters and the road may not be passable during the rainy period. In this village about 75% of the immigrant labourers have now settled in the village. In Ihemi, Kitelewasi and Kipaduka, which are in Iringa Region, oxen are used to prepare farms and therefore there are no acute labour shortages despite some village youth migrating out. Tractors are hardly used in these villages.

Non-farm income activities were very varied in this study. Most young men in Kasanga do casual work for Mafinga Tea Company and others work for timber industries, they use part of their income to invest in agricultural production and modern houses. Other opportunities include making roofing tiles, brick-making, and dairy cattle husbandry. These opportunities together with declining profitability of maize have resulted in the shrinking of the maize market. Lumbering is also an important activity in Isele, and Katurukila. In Isele the non-farm activities extend to selling of timber and other forest products, masonry, and carpentry. Local brew preparation is almost a universal activity being practised in all the villages. In villages within Iringa Region one important source of income is growing bamboo and tapping bamboo wine, which is sold as *Ulanzi*–a local alcoholic beverage. This may be considered as a type of farming. Almost all villages

from Iringa region that were covered in this study are engaged in the production and selling of *Ulanzi*. Likewise in Kiberege one of the most important non-farm income-earning activity is selling of palm wine to various places of the district. Small shops are also found in all villages. Fishing is an important economic activity in Idete. In Njagi and Ihemi milling machines is another important business investment although milling machines are found in all the villages. Other non-farm activities include fishing, bicycle repairs, (Idete); tailoring, petty trade, and small shops (Njagi.); brick making (Ihemi); and aquaculture (Kitelewasi).

2.9 Economic constraints and facilitating factors

A number of problems that hamper agricultural activities were mentioned in the survey villages. For example it was reported that the prices of outputs relative to inputs have gone down in all villages. For example in Ihemi in the pre-SAP period a farmer used to sell one bag of maize in order to purchase three bags of fertiliser, but the maize-fertiliser ratio increased from 1:3 during the pre-SAP period to 2:1 in 2002.

With the demise of cooperative unions the godowns in Kasanga, Idete, Kiberege, Kitelewasi are no longer used for storage of produce and inputs. In Kasanga the godown has been unroofed to provide corrugated iron sheets for a school building.

Generally, profitability from farming is low in all 10 villages due to high costs of inputs and low prices for produce. In Idete, Katurukila prices for rice fell after the early 1990s when traders from Pemba and Zanzibar withdrew from these markets due to the imposition of a local produce tax. Transport costs are perceived to be high and therefore most farmers wait for traders or buyers to come to purchase their produce within their villages. Surprisingly, HIV/AIDS is not yet being perceived to be a major factor in the context of agricultural labour availability in all survey villages.

2.10 Chapter summary

Patterns that emerged in the pre-SAP and post-SAP periods

Generally there has been an improvement in infrastructure and market access in the SAP and post SAP period compared to the pre-SAP period. In the post-SAP period markets have been liberalised and the state has withdrawn from marketing of major staple grains. Producers depend on the private sector to sell their produce. Those who can afford, take their produce to more central trading center.

Input costs have gone up in the post-SAP period as a result of (a) removal of input subsidies by the state since 1984 and (b) liberalisation of foreign exchange regime. Following the failure of most co-operatives, input supply has been left to the private sector and this increase in transaction costs has further reduced the use and intensity of use of agricultural inputs such as fertiliser in all villages.

The main provider of extension services in the post SAP is the government and some civil organisation. The quality of the services has however changed with government extension officers carrying out an advisory role mainly because they lack the inputs

required to run demonstrations. Furthermore extension officers lack proper means of transportation given the large distances they have to cover.

Major constraints to intensification

In both regions and the country at large there has been a shift in the weather pattern. Since the *el-nino* rains, the rainfall pattern has become very unreliable in terms of timing and intensity. The change in weather pattern would imply the need for emphasis on irrigation and water harvesting policies and improving weather prediction accuracy.

There is evidence of private traders pushing down prices by not observing standard weights and measures.

Credit is not a regular feature in the development process of these villages. In the Pre-SAP period some villages had access to credit especially through cooperative unions mainly in the form of inputs for cotton (Morogoro Region) but this ceased in the mid 1980's. Most of the villages have to do without formal credit in the SAP and Post SAP period.

Transport costs are perceived to be high and therefore most farmers wait for traders or buyers to come to purchase their produce within their villages.

Major distinctions in trends between regions

More chemical fertiliser is substantially being used in Iringa than Morogoro. Due to the increase input prices in the pre-SAP and Post-SAP periods, animal manure is used in many villages in Iringa but its use is non-existent in Morogoro.

There is a relatively small population of improved animals introduced in the 1990's. Iringa has a higher number of households keeping these animals than Morogoro.

In Morogoro the relatively large number of immigrants from the traditional maize growing regions of Iringa and Mbeya influence the pattern of growing maize in the region.

3. HOUSEHOLD SURVEY RESULTS

3.1 Household characteristics

Overall 403 heads of households were interviewed from the two regions over three-quarters of whom were males (Table 11). The count of farm managers reveals a very high level of correlation between household headship and farm management responsibilities because 80 % of the heads of the households were also farm managers. In the remaining few cases the respondents were either wives, grown up children or other relatives of farm managers. These patterns were almost the same in both regions.

Table 11: Sex of head of household (%)

	Region		Whole sample
	Morogoro (n = 199)	Iringa (n = 204)	(n = 403)
Male	81.9	77.9	79.9
Female	18.1	22.1	20.1
Total	100.0	100.0	100.0

Half of all households were nuclear families. The rest were either extended families (21%), polygamous (14%), *de jure* female headed (12%), and *de facto* female headed or not yet married males (3%). The respondents average age was 42 years and most had attended school for at lest 5 years.

The median year when most households were formed worked out to be 1974 when many rural families were settled in new villages during the implementation of the Ujamaa Villages Act of 1973. In general 3.4% of all households were formed between 1940 and 1960, 6.9% during 1961-1970, 17.3% during 1971-1980, 25.8% during 1981-1990 and 46.8% during 1991-2001.

3.2 Farm and crop management of major staple food crops

3.2.1 Crop choice and preferences

The respective predominance of maize and paddy in Iringa and Morogoro regions is apparent because almost all sample households in Iringa grew maize in the previous season compared to 77% in Morogoro. Ninety seven percent of all households in Morogoro grew paddy compared to less than one percent in Iringa. However, in both regions 89% of all households grew maize last season compared to less than a half that cultivated paddy. This underscores the importance of maize as a staple crop in the country.

Close to 90% of sample households from both regions grew other food crops and vegetables, although slightly more respondents from Iringa region reported doing so. In addition, although close to one-third of all sample households reported growing non-food cash crops Iringa region dominates these statistics with a half of the respondents in the region being able to do so compared to only 16% of their counterparts in Morogoro region.

Comparison of proportion of sample households growing particular crops at present relative to the time when the household was formed reveals two aspects. First, the patterns are more or less the same because the majority of households cultivated more of the preferred staple food crops-maize and paddy and cultivated less of the food reserve crops-cassava and sorghum. Cassava was grown by 21% of all households in the two regions the majority of whom from Morogoro. Sorghum was not an important crop in either region. Second, there seems to have been significant shifts towards production of other food crops and vegetables and non-food cash crops. (Table 12). However, the relative magnitudes of these shifts in the two regions were different with more farmers in Morogoro shifting to the cultivation of other food crops and vegetables whereas more farmers in Iringa region shifted towards production of non-food cash crops.

Table 12: Patterns of crop cultivation in reference and most recent season (%)

	Other food crops and vegetables			Non-food cash crops		
	Reference year	Most recent season	Change	Reference year	Most recent season	Change
Morogoro	46.2	81.4	35.2	6.5	15.6	9.10
Iringa	84.1	97.1	13.0	31.4	50.0	18.6
Whole sample	65.8	89.3	23.5	19.1	30.0	10.9

3.2.2 Maize production, marketing and technology

Maize area under cultivation

Forty five percent of all sample households grew maize as pure stand although regionally 57% and 36 % of households did so in Morogoro and Iringa regions respectively. The rest grew maize as a mixed crop together with other crops. The latter strategy seems to have been partly aimed at maximising both utilization of resources and maximization of output from a fixed portion of land.

On quality of maize land compared to the average quality of the land in the village, close to two-thirds of all respondents felt that the quality of their land has not changed. However, roughly a quarter of the respondents in Morogoro and Iringa felt that their land was better than the rest of the land in the village. A similar proportion of farmers in Iringa felt the opposite.

Forty one percent of respondents from both regions irrigated part of their maize farms. However, two-thirds of respondents in Iringa did so compared to only 7% in Morogoro. Close to a half of those who irrigated part of their farms grew more than one maize crop per season. It is therefore not surprising that 46% of all respondents mentioned that besides growing maize, they put their land to no other specific use. Thirty six percent use it for other crops and a mere 3% (mainly from Iringa) used it for grazing.

A statistical comparison of the mean areas under maize in the two regions showed that the area under maize in Morogoro was significantly lower ($p \leq 0.05$) and almost a half in size compared to that in Iringa for the most recent three seasons. However, although the

difference in maize land size between the two regions in the reference year is also significant, the disparity seemed to have widened over time (Table 13). Moreover, in both regions and for the whole sample paired sample t-tests revealed a significant difference in land area under maize between the most recent season and in the reference year when the household was formed where land under maize declined substantially by more than a half in Morogoro and by a third in Iringa.

Table 13: Mean area under maize (pure stand equivalent) (ha)

	(a) Most recent harvest	(b) Season before most recent harvest	(c) Two seasons before most recent harvest	(d) Mean of recent three seasons (a)+(b)+(c)	(e) When household was formed	(f) Percent change [(d-e)/(e)]*100
Morogoro	0.623	0.660	0.619	0.634	1.500	-158
Iringa	1.351	1.328	1.293	1.324	1.960	-32
Whole sample	1.033	1.038	1.002	1.024	1.760	-42

Maize marketing patterns

It is apparent that a sizable number of farmers earn cash by selling some of their maize because 49% and 42% of sample households in Morogoro and Iringa regions respectively reported that they sold some maize after the harvest before the most recent one. However, the amount of maize sold was significantly lower in Morogoro compared to Iringa (Table 14).

Table 14: Total amount of maize sold, harvest before most recent, (kg)

	n	Mean	Standard deviation
Morogoro	71	394.49	642.27
Iringa	82	857.39	1,002.91
Whole sample	153	642.58	882.96

In the most recent season slightly more than a half of all respondents mentioned that they sold or they intend to sell some maize although this determination was more pronounced in Morogoro where 56% declared this intention compared to 48% in Iringa. As is the case for the season before the most recent one, total amount of maize sold in the most recent harvest was significantly different between the two regions with Iringa region reporting higher sales. Without any significance the approximate distance to nearest market outlet or crop depot was longer in Morogoro than in Iringa (Table 15).

Examination of maize prices paid to farmers using two-tailed paired sample t-tests showed two interesting features. First, within regions and for the whole sample there were significant differences ($p \leq 0.05$) between lowest prices and highest prices received by farmers. Second, whereas there was no significant difference between lowest prices across the two regions, the converse was true for highest prices. This phenomenon is expected because most farmers sell the bulk of their produce soon after harvest when prices are low. Since the harvest seasons in different parts of the country are more or less

the same, we expect a similar pattern of seasonal price changes across the country. However, farmers who received the highest prices are a minority and might have sold produce at different times during the lean season.

Table 15: Maize sales, prices and distance to markets for the most recent harvest

	n	Amount sold (kg)	Lowest price (USD/100kg)	Highest price (USD/100kg)	Distance to nearest market (km)
Morogoro	84	411.39	7.48	12.24	1.76
Iringa	97	962.93	7.65	10.77	0.92
Whole sample	181	707.18	7.62	11.45	1.31

The main market outlet or crop depot for maize was overwhelmingly private traders to whom 91% of farmers sold their maize. The rest either sold maize on piecemeal bases (8%) or to farmer cooperatives and organizations (1%). It is therefore not surprising that for the majority (97%) of farmers the crop is never grown on the bases of pre-arranged contracts with private traders. More than a third of all households sold some maize in the past three seasons (Table 16).

Table 16: Total amount of maize sold two seasons ago (kg)

	n	Mean	Standard deviation
Morogoro	56	362.38	498.11
Iringa	66	917.59	955.95
Whole sample	122	662.74	825.15

An analysis of maize marketing when household was formed shows that households have been depending on maize crop for cash income since the households were formed because 46% and 41% of respondents in Morogoro and Iringa respectively reported that they sold maize at that time. Without any particular trend, the proportion of farmers reporting selling some maize in all seasons is more or less the same. However, this observation not withstanding, it seems households' reliance on maize as a source of income has declined over time because two-thirds of respondents felt that less maize is sold now compared to 27% and 7% who felt that more maize is sold now or do not feel any significant change respectively compared to when households were formed.

When asked to compare the prices of maize when the household was formed and today over a half of all respondents felt that the prices they received were worse then against over one-third and less than one-tenth who felt that prices were better then and who did not notice any significant difference respectively. A similar pattern is observed in the respondents' feeling about how access to market outlets have changed over time where 10%, 71% and 19% felt that access is the same, is better now and is worse now respectively.

Overall, 58% of all respondents felt that the general profitability for maize changed for the better since their households were formed, over one-third felt that the profitability has declined and 7% feel that there has been no change in this respect.

Analysis of most important economic factors constraining maize production for the market showed that the problems which affect most farmers in Morogoro in decreasing order of importance are lack of credit, low prices, high input prices and unreliable market outlet whereas in Iringa region the most critical problems are high input prices and lack of credit (Figure 1). It is therefore not surprising that the majority (87%) of respondents are of the opinion that the price for modern inputs (fertilisers and seeds) as measured in maize equivalents has gone up whereas a mere 2% and 11% feel that prices have respectively gone down or have not changed significantly. As far as household factors constraining maize production for the market are concerned, it was noted that lack of capital for both the purchase of inputs and for land preparation were the most important factors in Morogoro whereas lack of capital for inputs and chronic illness were the most constraining factors in Iringa (Figure 2). As far as sickness is concerned it seems that some households face a calamity when some members of the family fall ill. Their livelihood becomes threatened until they recover and go back to work. Overall 60% of all respondents felt that household factors are the most constraining compared to market factors. The rest felt the opposite.

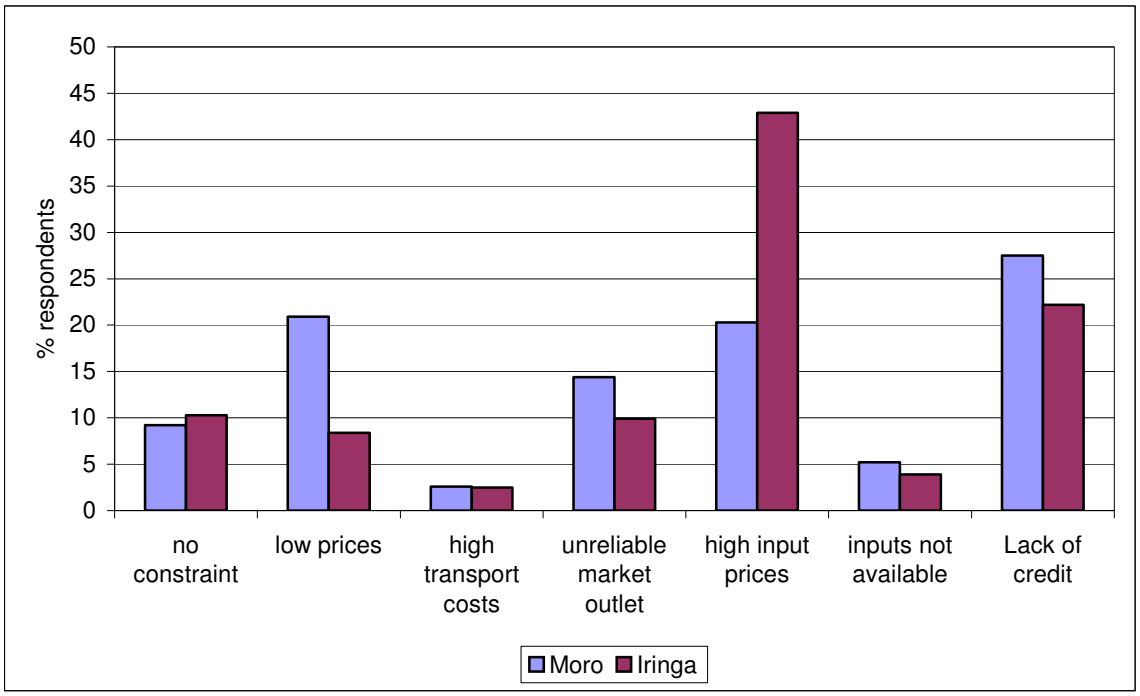


Figure 1: Most important economic factor constraining maize production for the market

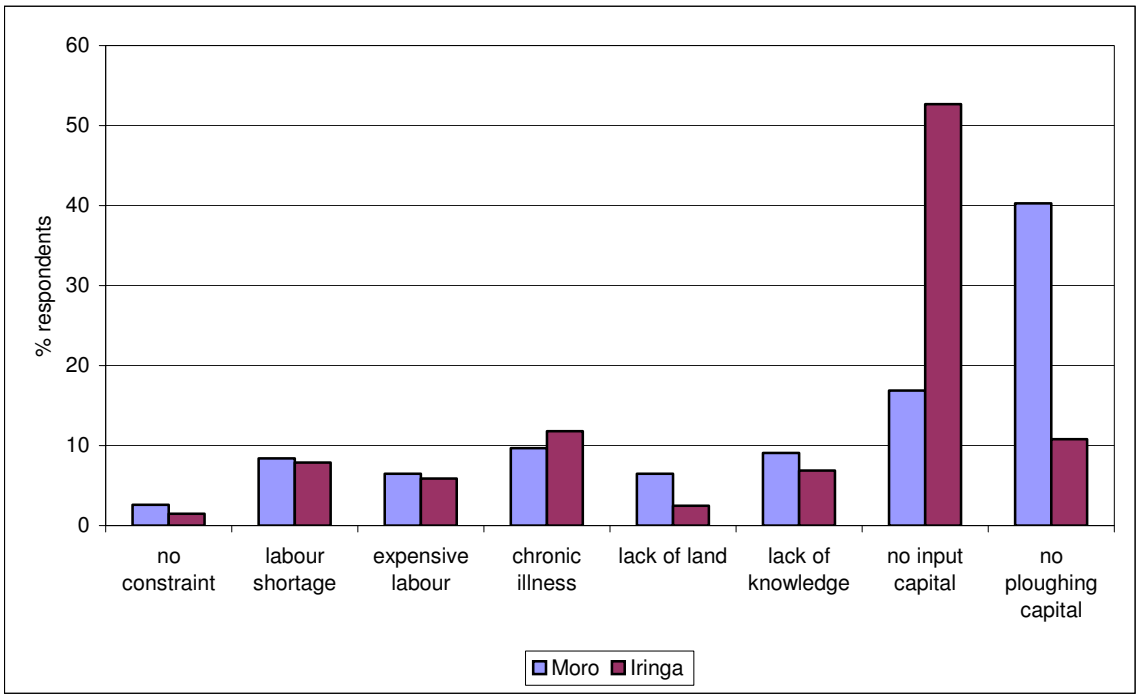


Figure 2: Most important household factor constraining maize production for the market

Maize production and utilisation

Maize production and utilization patterns in the two regions as shown in Table 17 reveals three aspects. First, both total production in different years and the quantities used for different purposes out of total production were significantly different between the two regions with Iringa region dominating these statistics. Second, total maize production between seasons was significantly different in Iringa region whereas, no significant differences were observed in Morogoro region. Finally, the proportion of total production that is used for different purposes is more or less the same in both regions with slightly more than half being consumed by the household. Morogoro farmers sold 40% of total production compared to Iringa's 33%. The rest was either used to pay for hired labour or for other uses such as seed, for brewing and as animal feeds.

Table 17: Maize production and utilization

	n	Total production in past three seasons (kg)				Utilisation of the most recent harvest (%)			
		Most recent harvest	Before most recent harvest	Two seasons ago	Three-year average	Household consumption	Payment for hired labour	Sales	Other uses
Morogoro	154	560	611	520	564	50	4	40	6
Iringa	203	1,341	1,231	1,122	1,231	51	5	33	11

Whole sample	357	1,004	960	858	941	51	5	35	9

Compared to the time the household was formed 59% of all respondents felt that maize productivity has declined over time because they used to get more maize from a given size of land (e.g. one hectare) compared to now. Relatively more (60%) households in Iringa felt this decline compared to 55% in Morogoro. Seventeen percent felt that there is no difference in productivity while 23% felt that productivity has increased respectively.

Maize technology and input use

Irrigation is rarely practiced for maize production in Morogoro region where only 7% of respondents reported using some sort of irrigation on the crop. In Iringa however, 48%, 14%, 3% and 2% of respondents reported irrigating a quarter, a half, three-quarters, and all or nearly all of their maize farms respectively.

Poor production technologies seem to characterize maize production in the two regions. Eighty two percent of all sample households used traditional seed varieties. Twenty seven percent of the farmers in Iringa used improved seed of whom 15% used hybrid seed while 12% used open pollinated varieties. This pattern is revealed more when we examine the use of oxen and tractors for land preparation and the use of fertilizers. Ninety three percent of sample farmers in Morogoro used the hand hoe as the main method of land preparation. The rest used tractors and none used oxen. Although close to two-thirds of households in Iringa also used the hand hoe to till their land, one third used oxen and only 3% used tractors. In addition, on average farmers in Iringa region used some 52kg of fertiliser per farm compared to less than one kilogramme in Morogoro. Furthermore, 72% of households in Iringa applied pesticides compared to only 3% in Morogoro.

Analysis of the use of improved farming practices shows mixed results. Whereas up to a third of all respondents in both regions practiced crop rotation, green manuring and soil and water conservation methods (level bunds, grass strips and terracing), no farmer applied manure in Morogoro and none practiced conservation tillage in both regions respectively. Lack of livestock seems to be the major reason for this situation in Morogoro. In Iringa region where livestock keeping is predominant, more than a third of households reported using manure. Fallowing is practised in both regions and 21% and 28% of sample farmers in Morogoro and Iringa respectively rested part of their farm land for some time. The respective figures for intercropping practices were 46% and 76% for Morogoro and Iringa.

Maize technology and inputs when household was formed

With minor differences the technology patterns described above are more or less the same as when households were formed. Comparing the reference year to the most recent season revealed that the number of households cultivating maize decreased by 7% in Morogoro, but increased by 4% in Iringa. Irrigation in maize production was practiced by only 4% of respondents in Morogoro compared to 41%, 10%, 3% and 2% of respondents

in Iringa who reported irrigating a quarter, a half, three-quarters, and all or nearly all of their maize farms respectively at the time when households were formed. There was also a big proportion of farmers using local maize varieties with only 3% and 12% of respondents using improved seeds or hybrids in Iringa and Morogoro respectively.

It is therefore not surprising that equal proportions (13%) of farmers felt that there are either no differences or they used more fertilizers when the household was formed than now. Eight percent of households felt that the use of fertilizers has increased over time. The patterns of using pesticides, method of land preparation and practicing of improved farming practices were more or less the same in the most recent season and the reference year. One remarkable farming practice is the predominance of intercropping in Iringa region in both periods.

Sample farmers acknowledged that maize yields have either increased (27%) or decreased (73%) over time since the households were formed. The main reasons for yield increases identified by farmers in Morogoro were mechanized land preparation (3 farmers), conservation farming/improved tillage (7 farmers) and other reasons (15 farmers). More than a half of farmers in Iringa identified access to new seed varieties and chemical fertilizers as the main factors attributing to yield increases. Other reasons were conservation farming/improved tillage and other reasons. In both regions the major factors attributing to decline in yields were identified as bad weather conditions and declining soil fertility. In Morogoro farmers mentioned increasing pests, weeds, etc. as other major reasons that reduces maize yields.

3.2.3 Paddy production, marketing and technology

Paddy area under cultivation

As noted earlier paddy rice was mainly important in Morogoro than in Iringa because only two farmers reported growing rice in Iringa region[6]. Two-thirds of all paddy farmers felt that the quality of the land on which they grow rice is average compared to the general quality of the land in their villages, a quarter felt that their land is better and 10% claimed to have worse land. To a large extent land destined for paddy was exclusively used for that purpose because less than 10 percent of all paddy farmers reported using the same land for other crops and vegetables in addition to rice.

On average the land area under paddy for the past three seasons fluctuated around one hectare (Table 18). This area was not statistically significant between different seasons except between the most recent season and two seasons before the most recent. Table 20 also shows that the number of paddy farmers seems to have increased slightly over the years.

Although the areas under paddy between years are not significantly different, 42% of farmers mentioned that areas under paddy were smaller at the time the household was

[6] Therefore this analysis is predominantly confined to Morogoro farmers. It is also worth noting that only two farmers in Iringa region reported growing sorghum in the past season so analysis of sorghum is not included in this study.

formed compared to the last season although 29% and 21% felt that farm sizes then were the same and larger respectively.

Table 18: Mean area under paddy (ha)

n	Most recent harvest	Season before the most recent	Two seasons before most recent	Average
N	194	188	182	-
Mean	1.02	0.97	0.91	0.97
Standard deviation.	0.73	0.72	0.81	-

Rice marketing

Of recent paddy has become an important source of cash income because over three quarters of households reported that they have sold or intend to sell some paddy following the most recent harvest. Those who had sold any paddy by the time of this research sold slightly over one metric ton each (Table 19). The crop was sold within 3 km from the villages. As was the case with maize and cassava the highest and lowest prices were significantly different from each other. Almost three quarters of households reported selling paddy after the harvest before the most recent one with an average sales volume of 967 kg per household.

Table 19: Paddy sales, prices and distance to market for the most recent season

	Amount sold kg	Highest price USD/100kg	Lowest price USD/100kg	Distance to market km
n	49	148	47	148
Mean	1,007	9.14	12.74	2.93
Standard deviation	1,809	2.54	3.79	12.44

That the commercial nature of paddy has changed over time is further witnessed by the increase in the proportion of households selling paddy from 54% at the time when the household was formed to over three-quarters today. Indeed 43% of households felt that more rice is sold now compared to when the household was formed. However, another 40% felt that less rice is sold now whereas 16% reported no significant change.

Price incentives could have motivated households to sell more paddy because over a half of the households acknowledged that the price for paddy is better now than it was when the household was formed. Still 29% felt that prices are worse now and 15% thought that the price level is the same. This is also supported by the fact that 45% of respondents felt that access to market outlets for paddy are better now compared to 38% who felt that market access at present is worse than previously and those who are indifferent (17%).

However, any benefits accruing from price incentives might have been cancelled by increases in the price for modern inputs (fertilisers and seeds) needed for paddy production. Although 20% and 10% of respondents thought that input prices have not changed significantly and have gone down respectively, measured in paddy equivalents,

over two-thirds of all respondents acknowledged that input prices have gone up in recent years compared to the reference years when households were formed. The fact that over two-thirds of households think that profitability for paddy is worse now against a quarter who think that the situation is better now lends support to this observation.

Further insight of disincentives for commercial production is gained when we examine the market related and household factors constraining production of paddy. The major market related factors, in order of decreasing importance were identified as low or fluctuating producer prices, lack of credit facilities, unreliable market outlets, and high price of modern inputs. The most important household factors are lack of capital to buy inputs and for land preparation, chronic illness in the family, expensive hired labour and lack of knowledge about yield improving farming techniques. Overall 56% and 44% of respondents thought that household factors and market related factors respectively are the main constraining of the two groups.

Rice production

Without any statistical significance , total average annual paddy production per household in the last three seasons ranged between 1.4 and 1.6 tons. (Table 20). The bulk (49%) of this was sold. The rest was used for home consumption (36%), other uses (9%) and for payment of hired labour (5%).

Table 20: Paddy production and utilisation

	Total production in past three seasons (kg)				Utilisation of the most recent harvest (%)			
	Most recent harvest	Before most recent harvest	Two seasons ago	Three-year average	Household consumption	Payment for hired labour	Sales	Other uses
N	193	187	177	-	195	192	192	192
Mean	1,577	1,621	1,443	1,547	36	5	49	10
Std Dev	2,550	2,315	1,856	2,240	-	-	-	-

Fifty one percent and 31% of households thought that they got more and less paddy respectively from a given size of land at the time when the household was formed compared to now. Ten percent felt that there is no difference in paddy output between the two periods.

Paddy technology and input use

The bulk (95%) of paddy in the last season was grown as lowland rain fed rice and only one percent was grown as lowland irrigated rice. The remaining 3% was upland rain fed rice. Overall 88% of households planted traditional varieties against 12% who planted improved varieties. Although close to 90% of respondents used artificial fertilizer in paddy most used sub-optimal quantities because on average less than 5 kg (Std dev. 21 kg) was used per household. Slightly less than one third of sample households used pesticides and most (79%) households used the hand hoe for land preparation. The rest used tractors (20%) and oxen (1%) to till their land.

The use of other technologies was also low because less than 10% of households used animal manure or practiced crop rotation, intercropping or conservation tillage in paddy farms, 23% practised fallowing, 13% applied soil and water conservation measures and 20% used manure in paddy farms.

Rice has been grown in the area for a long time because 89% of households reported that they also grew it when their households were formed. However, as was the case during the most recent season, most (97%) of the crop was rain fed lowland rice. The majority of households also used traditional varieties (93%), did not apply fertilizers (88%) or pesticides (85%), and used the hand hoe for land preparation (86%). The pattern of use of improved methods of cultivation (such as fallowing and use of manure) was also similar to those observed for the most recent season.

As far as changes in paddy yields are concerned almost a third and two-thirds of rice growing households acknowledged that paddy productivity increased and decreased respectively. The most important factors influencing yield increases in order of decreasing importance were conservation farming and improved tillage, mechanised land preparation, access to new seed varieties, and use of fertilisers. Reasons responsible for yield decreases were increasing weeds and pests, declining soil fertility, untimely planting, inadequate or untimely land preparation, inadequate water access or availability, and poor seeds.

3.2.4 Cassava production, marketing and technology

Cassava area under cultivation

Cassava was grown by 21% of (or 83) of all respondents with only 6 from the Morogoro sample. However, there seems to have been an increase in the number of farmers cultivating cassava now compared to the reference year because 22% of farmers who grow cassava at present did dot grow the crop during the reference season. This increase may have been a strategy to reduce food insecurity and as a result of government campaigns to promote cassava as a reserve crop. This is a good precaution against crop failures of most preferred staples such as maize and paddy. Slightly over half of households growing cassava intercropped it with other crops. Seventy one percent of cassava farmers felt that the quality of the land on which they grew cassava was average compared to the average quality of the land in this village. Eighteen percent and 11% felt that their land was better and worse now respectively. Overall 30%, 14% and 33% felt that the size of the land under cassava when the household was formed is the same, larger and smaller respectively compared to the last season.

Cassava marketing conditions

Forty six percent of respondents sold some cassava in the course of the past year. The crop was mainly sold as tubers almost exclusively to private traders. However, about 2 farmers in Iringa reported growing cassava on the basis of pre-arranged contracts with private traders. Most crop was sold within the villages of residence. As was the case for maize there was a significant difference between the lowest price and the highest price received by farmers (Table 21).

Table 21: Cassava sales during last year

n[a]	Total amount of cassava sold (kg)	Lowest price received (USD/100kg)	Highest price received (USD/100kg)	Distance to market/depot (km)
36	711.06	2.89	3.69	0.26

[a]Regional analysis is ignored because only one farmer from Morogoro reported selling cassava.

Thirty two percent of the households growing cassava sold some cassava during 1999/2000. Slightly more cassava (801 kg) was sold then compared to the most recent season. Thirty eight percent of households reported selling cassava during the period from September 2000 to September 2001 each selling approximately 881 kg. Twenty two percent of the households that grew cassava in the most recent season sold some cassava at the time when the household was formed. A third of all cassava growers felt that there is no difference in the amount of cassava that was sold in the most recent season compared to when the farm or household was formed. Forty four percent and 22% of respondents felt that more cassava is sold now and less cassava is sold now respectively.

Well over a half of respondents feel that prices were worse in the earlier years than they are now. A quarter feels the opposite and 18% were indifferent. The same pattern of responses was recorded in terms of how access to market outlets for cassava have changed since households were formed. In addition, a half of all farmers who sold cassava feel that profitability for cassava has increased against a third who feel that profitability has worsened and 17% who mentioned that there is no significant change over time.

As far as inputs, technology and constraints are concerned some farmers also recorded some changes. For example, asked about how the prices for modern inputs (fertilisers and seeds) as measured in cassava equivalents have changed since the household was formed four out of five respondents felt that prices have gone up[7].

The most important economic factors constraining production of cassava for the market were identified as unreliable market outlets and low or fluctuating prices, mentioned by 40% and 19% of respondents respectively. Twenty three percent experienced no economic constraints. The most important household constraints were lack of capital to buy inputs and for land preparation, household labour shortage and lack of land. Seventeen percent of respondents experienced no household problems constraining cassava production. Asked about which of the two groups of factors, market or household conditions, is the most constraining for the marketing of cassava, overall 58% of respondents thought that household factors are the most constraining. The rest considered market related factors as being more crucial.

[7] However, this observation should be interpreted with caution because only five respondents answered this question, four from Morogoro and one from Iringa

Cassava production

Table 22 shows that the production of cassava did not change very much over the three years referred in this analysis. Over a half of total cassava produced was used for home consumption, 37% was sold and 8% was used for other purposes such as feeding livestock. Only a very small amount was used for labour payment.

Table 22: Production and utilization of cassava (kg)

	n	Total production in past three seasons (kg)				Utilisation of the most recent harvest (%)			
		Most recent harvest	Before most recent harvest	Two seasons ago	Three-year average	Household consumption	Payment for hired labour	Sales	Other uses
Morogoro	55	1,007	918	1,085	1,003	53	2	38	7
Iringa	3	675	550	475	567	67	1	15	18
Whole sample	58	985	901	1,057	981	54	0	37	8

Asked whether at the time when the household was formed, farmers got more or less cassava from a given size of land compared to now, 29% and 35% said they received a larger crop then and a larger crop now respectively. No difference was observed by 15% of respondents and 20% did not grow cassava at the time.

Cassava technology and input use

Use of improved technology seemed to be very limited because no households reported using artificial fertilizers, pesticides, animal manure or conservation tillage and only two households out of 81 respondents reported that they used improved variety of cassava and used a tractor or oxen for ploughing during the most recent season. However, intercropping was practiced by 36% of all households growing cassava, a quarter practiced crop rotation, fallowing, and soil and water conservation practices. Another 19% used green manure or compost.

Sixty percent of households that grew cassava in the most recent season also grew the crop when the household was formed. As is the case for the most recent season, use of improved inputs and technology was very minimum during the reference year.

Overall, 42% and 50% of cassava growers felt that cassava yields have increased or decreased respectively over time since when the household was formed. A half of the former category of respondents mentioned that increase in yields was attributed to conservation farming and improved tillage. On the other hand close to a half of the latter group singled out declining soil fertility as the main reason leading to a decline in cassava yields. This was followed by bad weather conditions and inadequate or untimely land preparation.

3.3 Farm and crop management of other crops

3.3.1 Other food crops and vegetables

As a means to diversify sources of income and food security, households cultivated a number of other food crops last season. Overall, some 0.4-0.6 ha was cultivated for other food crops. In Iringa region over 40% of this land was under irrigation compared to 7% in Morogoro (Table 23). Both the total size and the corresponding proportion of this area that was irrigated were significantly different between the two regions. That relatively more land for alternative food crops is irrigated in Iringa than Morogoro perhaps reflects the increased desire by farmers in the former region to grow horticultural crops that require irrigation. Largely because of differences in climatic conditions the importance accorded to each of the products in the two regions was different. For example whereas bananas, sweet potatoes and vegetables were grown by at least a half of all households in both regions, peas and groundnuts were most important in Morogoro region only. In Iringa the other most important alternative food crops were beans, Irish potatoes, peas and millets[8]. Both regions also reported growing other unspecified alternative food crops. However, the crops that were sold most are not equally profitable in the two regions. For example, in Morogoro the alternative food crops that are sold and are most profitable are bananas, groundnuts, vegetables and sweet potatoes while in Iringa they include beans, Irish potatoes vegetables and other unspecified crops. Overall it seems that Iringa households have more diverse sources of income compared to their Morogoro counterparts.

Table 23: Total size of land devoted to other food crops in the most recent season (ha)

	n	Total size		Irrigated land	
		Mean	Std Dev.	Mean	Std Dev.
Morogoro	141	0.42	0.44	0.03	0.08
Iringa	184	0.56	0.70	0.24	0.37
Whole sample	325	0.50	0.60	0.15	0.30

As far as use of modern inputs are concerned at least a third of the Iringa households reported using chemical fertilisers, animal manure, and pesticides on the alternative crop compared to less than 5% of the households in Morogoro. However, at least one out of every five households used green manure in both regions.

Compared to when the farm or household was formed over a half of all respondents feel that more of the most profitable alternative food crop they mentioned is sold now compared to slightly over one-third who acknowledged that less is sold now, and eleven percent felt no significant change in the pattern of sales. For the whole sample the overall market access for the most profitable crop is perceived to better now according to 62% of respondents. Twenty one percent felt that access is worse now while 17% see no significant change in market access. Only two farmers from Morogoro mentioned that they grew any other food crops on the basis of a pre-arranged contract with a private trader.

[8] Pies include different types such as pigeon peas and cowpeas and millets include bulrush millet, finger millet etc.

The approximate distance to the nearest market outlet for the most profitable alternative food crops ranged between 0.6 km in Morogoro and 3.8 km in Iringa. The distances to nearest markets were significantly different between the two regions.

3.3.2 Non-food cash crops

The possibility of growing other non-food crops shows that Morogoro households had a chance of growing sugarcane and cocoa as indicated by 35% and 6% of households respectively. In Iringa the biggest alternative non-food crops were coffee and pyrethrum indicated by 17% and 5% of respondents respectively. In addition to these specific crops it seems that Iringa farmers have a wider possibility of growing other unspecified crops than their Morogoro counterparts as mentioned by 84% and 50% of the sample households respectively.

Table 24 shows the total size of land devoted to non-food crops and the proportion of irrigated area in the most recent season. It is clear from the table that the proportion of irrigated land in both regions is very small. Whereas the total sizes of land were significantly different between the two regions, irrigated land areas were not.

Only 5% and 12% of respondents, all from Iringa reported using chemical fertilizer, pesticides and animal manure on non-food crops. However, 19% and 8% of all respondents in Morogoro and Iringa regions respectively reported using green manure in non-food cash crops.

Table 24: Total size of land devoted to non-food crops and proportion of irrigated land (ha)

	n	Total size		Irrigated land	
		Mean	Std Dev.	Mean	Std Dev.
Morogoro	24	0.22	0.21	0.01	0.03
Iringa	93	1.02	1.56	0.0 [a]	0.02
Whole sample	117	0.86	1.43	0.0 [a]	0.02

[a] Actual figures are less than 0.01 ha.

Prominent non-food crops that are sold and are most profitable were mentioned to be sugarcane, cocoa and pyrethrum for Morogoro and a group of other crops that could not be specified for Iringa. Seventy four percent of all respondents confirmed that the profitability for the most profitable non-food cash crop mentioned by respondents has changed since the households were formed. Two groups of 13% each mentioned that there was no significant change and that the situation is worse now. Only 3 farmers (all from Iringa) out of 92 respondents grew any of the mentioned cash crops on the basis of a pre-arranged contract with a private traders.

At present, the approximate distance to the nearest market outlet for the major non-food cash crop ranged between less that a kilometre in Morogoro to over 4km in Iringa. However, the standard variations within both regions were very high. The mean distance were not significantly different between the two regions.

Respondents were also asked to explain whether or not there a significant change in the overall amount of land devoted to non-food cash crops since their households were formed. In Morogoro region 50% felt that there is no change, 35% thought the

proportion has increased and 15% thought it has decreased. The respective percentages for Iringa were 36%, 53% and 11%.

3.4 Land resources

Table 25 shows that the total cultivated area of all the farm plots per household during the most recent season or year ranged between 1.9 and 2.1 ha. Whereas the total cultivated areas were not significantly different between the two regions, the sizes of both extra land that could be cultivated and area currently under irrigation were statistically different. Although the mean irrigated area is small there seems to be sufficient extra land that could be cultivated. The latter case points to the possibility of expanding land under cultivation by different means including hiring, borrowing, and allocation by village government.

Over half of those who reported using irrigation, more than a half said that they use communally owned irrigation systems, and 29% used either privately owned well or privately owned river diversions.

Table 25: Land resources ownership during the most recent season or year (ha)

	n	Total cultivated area		Extra land that could be cultivated		Irrigated land	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Morogoro	195	1.854	1.292	1.369	1.630	0.163	0.823
Iringa	204	2.069	1.859	0.954	1.223	0.291	0.324
Whole sample	399	1.964	1.609	1.158	1.451	0.228	0.625

Forty five percent and a quarter of all respondents felt that the total size of the land cultivated has increased and decreased now since the households were formed respectively. A third of all respondents felt that there has been no significant change in the level of land tilled over time. According to 58% of all respondents there has been no change in the total size of the land under irrigation since the households were formed. One third and 8% of all households felt that more land and less land is cultivated now respectively.

3.5 Livestock

Livestock resources do not seem to play a very big role in the economies of most households in both regions. Examination of the number of livestock owned by households show that although the absolute number of animals owned is small for the whole sample farmers in Iringa, seem to own more of each type of livestock except poultry than households in Morogoro (Table 26). The average number of animals owned was significantly different between the two regions except for camels/donkeys and poultry.

Table 26: Number of livestock owned

	n	cows	Oxen	Goat/sheep	Camels/donkeys	Pigs	Poultry
Morogoro	199	0.00	0.00	0.13	0.00	0.03	7.74
Iringa	204	0.62	0.31	0.73	0.03	0.73	6.46
Whole sample	403	0.31	0.16	0.43	0.02	0.38	7.09

Stall feeding cows has never been a common tradition in the economies of the two regions and except for a few isolated cases where stall feeding (zero grazing) and private (own) grazing is practiced, most cows raised using communal (open) grazing land. A quarter of those few farmers owning cattle in Iringa have some graded or crossbreeds cows. However, improved breeds are a recent phenomenon and sample households reported that they never kept graded or crossbreed cattle when households were formed.

3.6 Labour resources

The average household size in the survey regions was six people with the number of adults significantly different between the two regions. In both regions the dependency ratio was over 120% (Table 27)[9]. Over ninety percent of all heads of households' and farm managers' occupation was farming. The rest attended mainly to non-farm activities.

Table 27: Labour resources in a household

	N	Total household members	Adult members (16-60 yrs)	Adults workers (16-60 yrs)	Children (≤15 yrs)	Old members (≥61 yrs)	Dependency ratio
Morogoro	199	6.10	3.12	2.46	2.59	0.39	121
Iringa	204	5.71	2.70	2.33	2.74	0.27	129
Whole sample	403	5.91	2.91	2.39	2.67	0.33	125

Most households that engaged themselves in non-farm activities were mainly employed outside the farm or were conducting micro-businesses (Table 28). Slightly over a half of all households in the two regions reported that they regularly hire farm labour. This supports the earlier observations that labour hiring in and outside the household is a common phenomenon in the two regions. All figures in the table were not significantly different between the two regions.

Table 28: Non-farm income sources and dependency on non-household labour

	n	**Adults employed outside the farm**	**Adults involved in some micro business**	**Adults involved in large scale business**	**Total adults involved in off-farm activities**	**Outsiders working in the farm**
Morogoro	199	0.67	0.60	0.10	1.37	1.11
Iringa	204	0.58	0.75	0.10	1.43	1.37
Whole sample	403	0.63	0.67	0.10	1.40	1.24

3.7 Institutional conditions

The most important institutional factors affecting livelihood and agriculture in the survey areas are extension services, credit, farmer organizations and land ownership. Seventy-

[9] The dependency ratio was calculated by dividing the sum of number of household members 15 years and below and number of household members 61 years and above by number of the adults (16-60 years old) who are able workers.

three and 63% of respondents in Morogoro and Iringa regions respectively never received any advice from extension staff at any time during the last year. A quarter of the households in Iringa received extension advice on rare occasions compared to 16% in Morogoro. For the entire sample only 12% of households reported that they received extension services on regular basis. With statistical significance the average distances to extension agency or service were reported to be 2.6 km and 4.0 km in Morogoro and Iringa respectively.

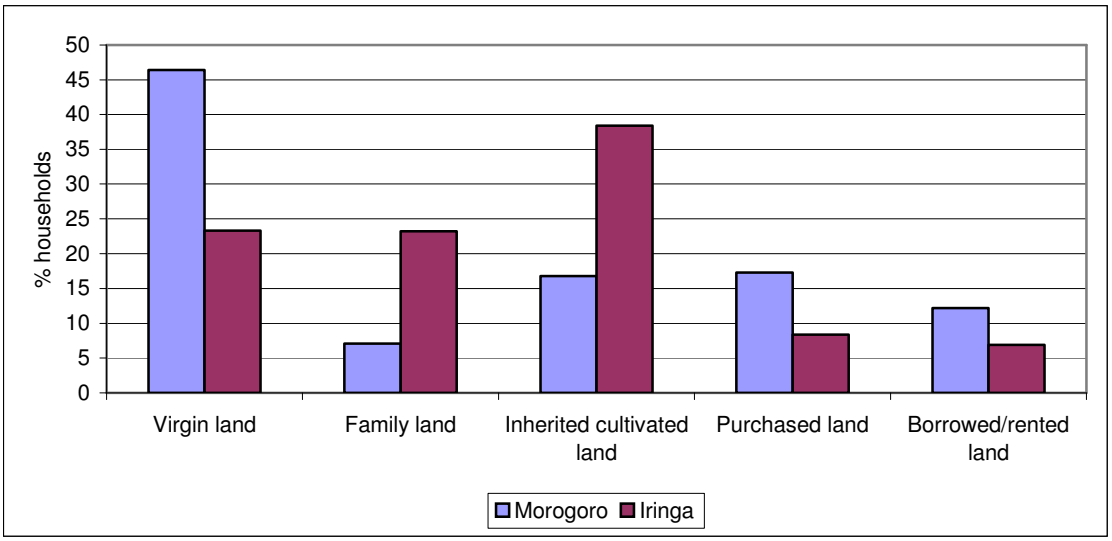
Less than 10% of all the farm managers in both regions were members of any local farmer organisation dealing with agriculture. Region wise however, 14% of respondents in Morogoro reported to be members in such organizations compared to only 5% in Iringa. As far as credit is concerned only 6 (1.5%) of respondents, three from Morogoro and Iringa regions reported receiving any form of agricultural input credit.

More than two-thirds of sample households from both regions mentioned that the status of most of the land they cultivate at present is Individually owned by farm households, a quarter have use rights allocated by the community, clan or government and 9% have borrowed or rented from other individuals or families. These patterns are more or less the same in both regions.

Eighty eight percent and 94% of all respondents in Morogoro and Iringa reported having full control of all the land they cultivate now and they do not need to consult any other person in order to obtain permission for cultivation, change crops or land use.

In both regions the common most important means by which households acquired land when households were formed were use of virgin land and inheritance of family land already under cultivation (Figure 3). However, purchase of land and use of family land seem to be uniquely important in Morogoro and Iringa respectively. The latter pattern is expected given the fact that most households in the Morogoro sample were migrants. In this case commercialisation of land resources is more likely than in Iringa where immigrants within the survey villages were minimum. Consequently family ties that compels inheritance of property are still more pronounced.

Figure 3: Means of land acquisition when household was formed



The most appropriate ways to expand land in both regions is through buying land and use of either fallow or virgin land although renting is also common (Figure 4). In relative

terms buying land and use of virgin land seem to be more applicable means of expanding land in Morogoro than in Iringa where use of fallow land stands out as the best option. However, these options for land expansion are limited given the fast dwindling land resources in most parts of the survey villages.

The most important means by which land resources are bequeathed or transmitted to children in the survey regions is by purchasing land, allocation of unused fallow land and inheritance (Figure 5). Whereas purchase of land was the predominant means in Morogoro relative to Iringa, Iringa seems to surpass Morogoro in the latter three means of allocating land to children. As discussed above the impact of immigrants and strong family ties seem to be largely responsible for this pattern in the two regions.

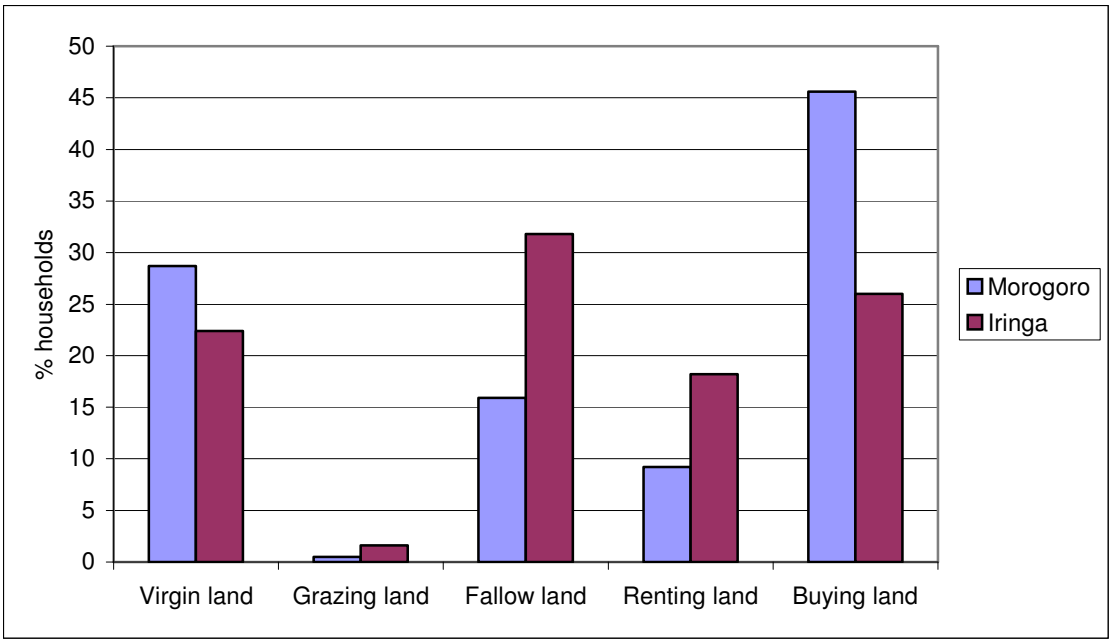


Figure 4: Means of land expansion

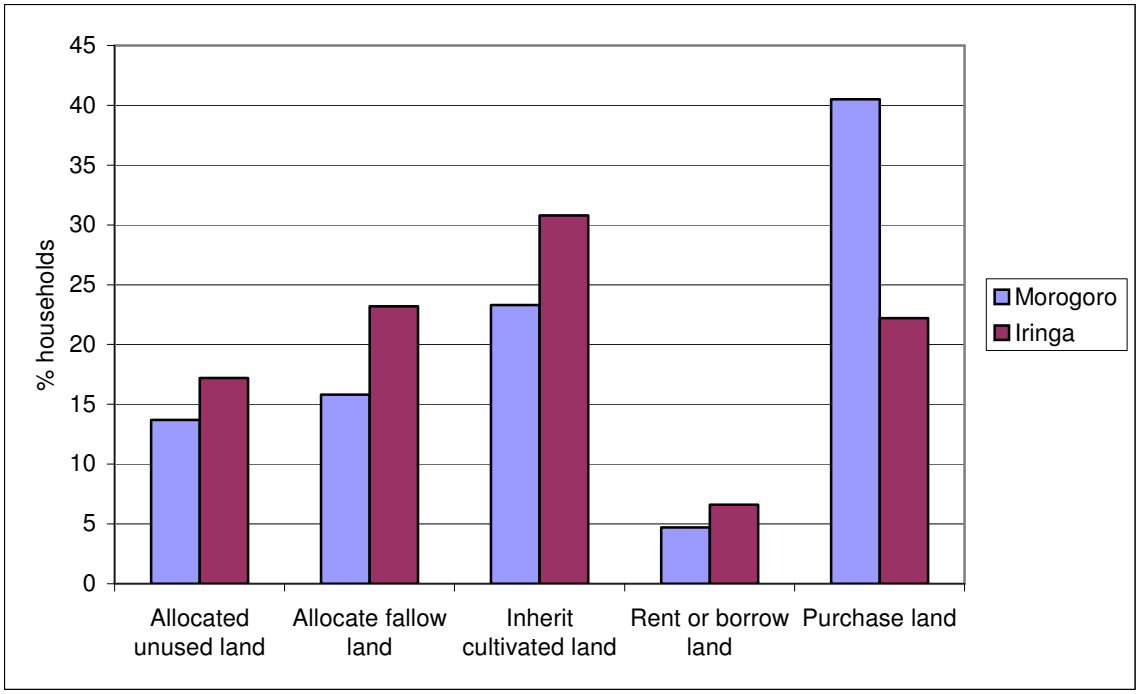


Figure 5: Means of allocating land to children

3.8 Expenditures

3.8.1 Costs of farm operations

An examination of the opinion of sample farmers on the relative costs of different farm operations revealed three aspects. On the one hand, for all sample households, seeds, land and land improvement measures were considered to have no cost outlays by the majority of farmers. This is partly due to the fact that most farmers do not use these technologies. On the other hand, chemical fertilizers, pesticides, hired labour, machinery and equipment and transport were items with some, moderate or significant cost implications. Second, the pattern of responses did not show any significant disparities in opinions between farmers from the two regions for two cost items-improved seeds and transport. Finally, in relative terms, and in cases where items were considered to have significant cost implications, chemical fertilizers and pesticides were more important cost elements in Iringa than in Morogoro. Conversely, hired labour, land rent, machinery and equipment and land improvement measures were more significant cost elements in Morogoro than in Iringa.

3.8.2 Food purchases

Over half of all households reported buying maize in the previous year although relatively more (65%) households purchased maize in Morogoro compared to Iringa (40%). However, this pattern is reversed when we examine rice purchases because only 35% of households in Morogoro reported buying rice compared to 84% of their counterparts in Iringa.

Looking at the responses on food purchases crops can roughly be grouped into three categories: those that are most preferred and are purchased by more than 40% by households-maize, beans, Irish potatoes and groundnuts in both regions and rice in Iringa region. The second category is the intermediate group of crops bought by 20-30% of households, including bananas, peas, sweet potatoes and millets. The last group of less important crops being purchased by less than 10% of respondents were sorghum in both regions and cassava in Iringa region.

Most households hired labour for different tasks. The most demanding tasks were land preparation and weeding where over 80% of households hired labour. Some 31-66 households hired labour for planting, harvesting, and transporting products from farms to homesteads. The other tasks for which labour was hired least are fertilizing, tending livestock and other activities. In Morogoro region no household hired labour for tending livestock and only 5% of respondents in Iringa region hired labour for this purpose.

3.9 Sources of income and ownership of assets

3.9.1 Sources of income

Three-quarters of all respondents received income from sale of food staples (Figure 6). However, Morogoro households seemed to depend more on this because 95% of respondents reported doing so compared to 55% in Iringa region. Statistics show further that rather than depending on sales of food crops farmers in Iringa region depend relatively more heavily on sale of other food crops and non-food cash crops. Whereas 62% and 36% of respondents in the region depended on theses sources the respective figures for Morogoro region were 48% and 7%.

Relatively more households reported sale of animals or animal products as a source of income in Iringa compared to 8% in Morogoro. Reliance of households on non-farm salaried employment was more or less the same in both regions with 23% and 27% of households in Morogoro and Iringa respectively depending on it. Opportunities for micro business as a source of income were more prominent in Iringa than in Morogoro where 54% and 36% of sample households respectively depend on this source of income. Rent and interest was mentioned by only 4% and less than 2% of all respondents mentioned to have depended on large-scale business and pension schemes respectively as the major source of income during last year.

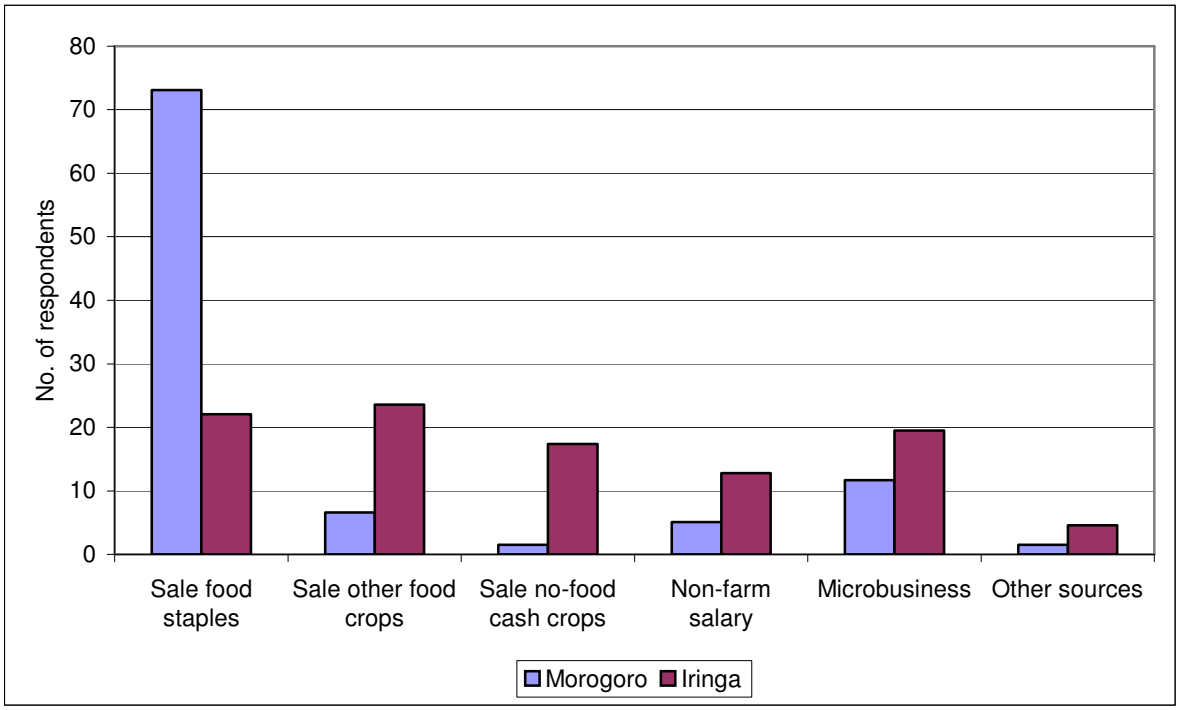


Figure 6: Income sources that generated most cash during last year

For the whole sample 20% of respondents mentioned to have received remittances from absent household members especially children, although regionally, twice as much respondents in Iringa region benefited from this compared to their Morogoro counterparts.

Of all the farm-based income sources mentioned by respondents sale of food staples generated most cash during last year for 91% of respondents in Morogoro region. Sale of other food crops was the most important source of income for only 8% of the households. In Iringa region, however sale of other food crops was the most important source of income mentioned by 37% of respondents. There also seems to be at least two other more or less equally important sources of income in the region namely sale of staple food crops and sale of non-food cash crops identified by 34% and 26% of respondents respectively.

3.9.2 Asset ownership

Overall none of the respondents in the sample had a mobile or stationary telephone, only one or less than one percent owned wired electricity or power, a diesel-powered generator or similar equipment, a water pipe connected to the house, and a TV set. Only 5% possessed a sewing machine. However, 45%, 53% and 54% of all respondents possessed a battery torch, a radio and a bicycle.

The most common means of own transport was carrying luggage as head-loads on foot (51%), and by bicycle (40%). The remaining minority (9%) reported using either a car or a motorcycle to transport their produce.

More than a half of all households have mud houses with thatched roof, 20% have mud houses with corrugated iron roof and only slightly more than a quarter have brick-advanced houses. However, the proportion of households with brick houses in Morogoro (i.e. 36%) is slightly less than double that of Iringa region (19%).

Looking at the households by way of their capital assets and appearance, on average around 60% of all households were ranked as very poor or below average wealth although the proportion of the very poor category in Morogoro-a quarter of all households in the region-was twice the percentage of the same category in Iringa. A quarter of all households were ranked as having average wealth, 12% as having above average wealth and only 2% as very wealthy. These latter patterns are more or less the same in both regions (Figure 6 and Figure 7).

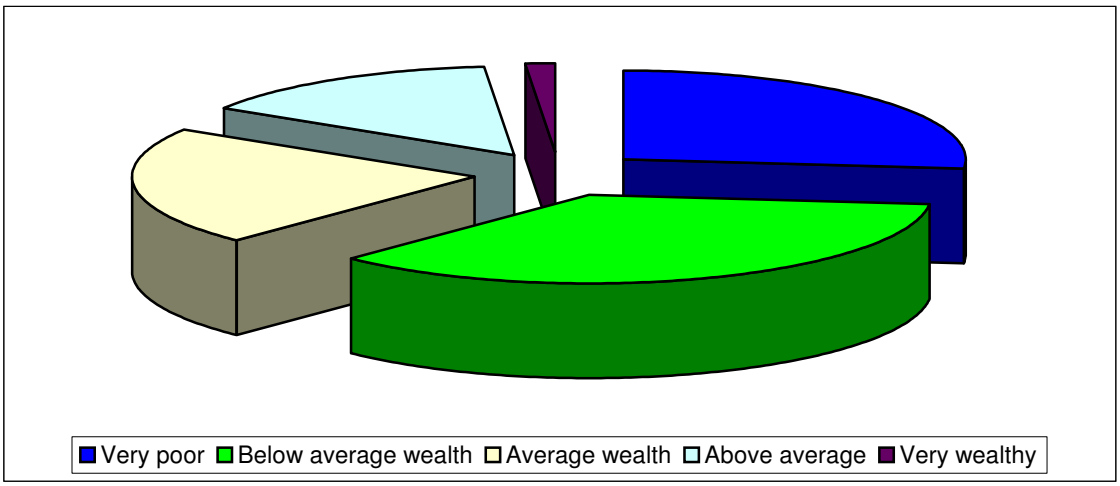


Figure 6: Morogoro wealth profile

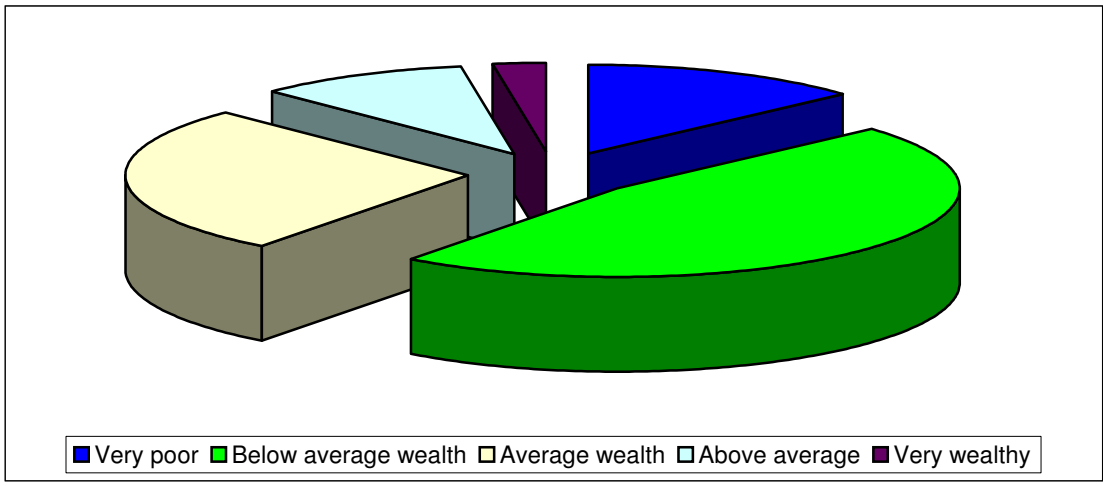


Figure 7: Iringa region Wealth Profile

3.9.3 Influence of structural and demographic variables

An attempt was done to assess the impact of individual characteristics on production and marketing of grains. In order to capture the differences between the two regions this analysis was attempted exclusively for maize. Using data from the sample farmers, we can observe relationships significant at the 0.05 levels as in Table 25. Maize yield is related positively to education level. Extension services, fertiliser adoption and household size.

Table 25: Zero order correlations statistically significant at 0.5 per cent level

	Maize area	Education level	Extension services	Age	Region	Fertiliser adoption	Household size
Maize yield		0.148	0.132			0.202	0.105
Maize area			0.172	0.187	-0.359	0.103	0.273
Education level				-0.380		0.141	
Extension services				0.143		0.141	0.175
Age							0.236
Region						-0.455	
Fertiliser adoption							
Household size							

Technology adoption has often been considered as one of the key determinants of grain production. In order to judge the true strength of the influence of selected variables on adoption of modern technology in maize cultivation, a binomial logistic regression model was used. The dependent variable took a binary nature as fertiliser adoption (1 if adopted and zero otherwise). Variables considered in the analysis are maize area (measured as cultivated area in hectares), education level (measured in years of attendance) and distance to nearest market (measured in kilometres).

To complete the model, five additional binary explanatory factors are added. These are gender of the household head (1 for males and 0 otherwise), extension services (measured as 1 when available and zero otherwise), cash crop production (1 if household cultivated any cash crop and 0 otherwise), region (1 if Iringa and 0 otherwise), wealth (1 if household was ranked as above average in wealth and 0 otherwise), and 3 dummies representing whether the household was formed soon after independence (1961-67), after the Arusha declaration and before structural adjustment programmes (pre-SAP, 1968-1986) and after SAP (post-SAP 1986-2002).

The results of the regression are summarised in Table 26. Results from the model indicate that the maize area is negatively and significantly correlated with fertiliser use. This implies that farmers will only apply fertilisers in smaller farm units than larger ones. These results are expected given the increasing prices of fertilisers and conform to an earlier observation that farmers fertilised only part of their farms. Fertiliser use is also negatively correlated to gender and cash crop production. The coefficients for the wealth, pre-SAP and post-SAP dummies were not statistically significant. The insignificance of the pre-SAP and post-SAP coefficients implies that these time farmers have no effect in terms of farmers decisions to use fertilisers are concerned. Cash crop production is negatively related to use of fertiliser perhaps because cash crops are competing with maize in the use of fertilisers.

This discussion stresses the observation put forward by Mattee (1994) that the notion that many small farmers in Tanzania adhere to traditional farming practices deemed unsuitable and unproductive is actually a reflection of a poor understanding of the process of adoption of agricultural innovations. There is therefore the need for policy research to examine the influence of government policy decisions on farmers adoption of specific innovations.

Table 26: Regression results for fertiliser adoption function

Variable	Coefficient	Standard error	T ratio
Constant	0.49***	0.186	2.670
Maize area	-0.0188**	0.027	-0.706
Gender	-0.194**	0.095	-2.051
Education	0.0284*	0.012	2.377
Extension	0.106***	0.061	1.742
Cash crop	-0.214***	0.069	-3.090
Market distance	0.004292	0.010	0.417
Region	0.373***	0.082	4.524
Wealth	0.0889	0.074	1.205
Post-independent	-0.051	0.153	-0.333
Pre-SAP	-0.0974	0.161	-0.606
Post-SAP	-0.134	0.166	-0.806
R^2	0.532	-	-
Adjusted R^2	0.487	-	-
Number of observations	133	-	-

***, **, and * means coefficients are statistically significant at the 1%, 5% and 10% respectively.

A linear regression analysis was also undertaken to determine the factors that influence the marketed surplus of maize in the survey villages. The results conform to expected results very closely. Key variables, which appear to explain the amount of grain that is marketed, are total amount of maize produced, region and education. Although not significantly, maize prices were negatively related to maize sales. This is expected because the majority of farmers sell maize at the time of harvest when prices are very low. Very few farmers can store maize for long up to when prices plummet to the lowest levels. The implication is that any efforts to promote commercial grain production must go hand in hand with policies that will ensure fairer returns to farmers.

Table 27: Regression results for marketed surplus function

Variable	Coefficient	Standard error	T ratio
Constant	-139.981	132.814	-1.054
Region	271.228***	40.480	6.700
Household size	1.293	9.689	0.133
Age	-0.126	1.659	-0.076
Education	-17.502***	6.655	-2.630
Gender	20.518	52.035	0.394
Post-SAP	166.413***	49.104	3.389
Maize production	0.592***	0.016	36.988
Maize price	-5.066	6.713	-0.755
Rice price	2.374	5.663	-0.263
R^2	0.821	-	-
Adjusted R^2	0.817	-	-
Number of observations	329	-	-

***, **, and * means coefficients are statistically significant at the 1%, 5% and 10% respectively.

3.10 Chapter summary

Village/population size, land use and agro ecology

In general soils are fairly suitable for agricultural production and rainfall was average in the past three years[10]. Most villages are on flat lands that can allow mechanization. However, agricultural intensification is limited by lack of irrigation and in most villages fallowing is becoming something of the past because the land frontier is closing fast. Village governments and customary laws still influence land allocation.

[10] Eight villages had good agricultural potential and two had average potential.

State intervention and markets

Analysis of market access gave mixed results because some villages have good all weather roads while the other five have not. Generally, however, road infrastructure has improved and this has increased the number of traders buying products and hence competition. Farmers may wish to sell to town but they cannot afford the transport costs. In some villages inputs are available on time but they are highly priced. In others they (inputs) are not available on time regardless of prices.

As far as supply of improved seeds is concerned the main sources have been the government research institutions that are poorly funded. The Agricultural Sector Programme Support (ASPS) is funding production and marketing of QPM for maize and other crops in Morogoro, Dodoma and Iringa regions.

Pre-SAP period up to 1989 when regional pricing was abolished. By then prices were guaranteed. The government provides extension but quality has deteriorated due to lack of incentives and lack of demand for extension services in the absence of use of inputs and improved technology. Some regions critically lack extension officers and have staff equivalent to a 1: 1,672 staff-household ratio compared to the national average of 1: 600 (Personal communication).

History of intensification

This micro study confirmed that the history of intensification of food crop production involved the government and donor funding. The National Maize Project that started in 1974 is a case in point. This Project introduced most of the maize seeds and technologies in the southern highlands. As a result, until 1984-88, the growth rate of yield of maize was higher that for all cereals (CIMMYT, 1990).

Economic constraints and facilitating factors

Most households are food self-sufficient and food relief assistants are rare except during disasters. In the lean season, some members of households migrate to urban areas in search of jobs and other economic activities. There are also a number of other non-farm activities that are performed during this time. Part of the proceeds from these activities is invested in agriculture.

There are very few farmer organizations that deal with agricultural production and marketing in the villages. In the past many such organizations were formed with expectations of getting loans, something that rarely materialize. Therefore, the scope of using farmer organizations to agricultural intensification is little unless if farmers are empowered by providing them with technical and managerial skills.

Formal sources of credit are rare and can only be availed to individuals or groups of farmers with collaterals. Loans from informal sources are often very exploitative. Generally lack of credit limits investment. Alternative means of increasing agricultural finance would be the development of efficient micro-finance institutions (MFIs).

One of the biggest constraints is the declining profitability of agricultural production, which is mainly a result of the mismatch between increasing prices of inputs and decreasing prices of outputs. Therefore any policy initiatives must aim at improving profitability through reduced prices of inputs, increasing output prices or both. This could

be achieved by mobilizing farmers to procure inputs in bulky and by exploiting external markets for their products.

The numerous local taxes charged by Local Authorities and levies related to crop purchases also discourage crop production and marketing and need to be harmonized.

This study has generally shown that there is little evidence that market liberalization has benefited rural people in remote areas of the country. This is largely because the necessary backward and forward market linkages are not fully in place, i.e. rural farmers lack both reliable and cost-effective inputs such as extension advice, mechanization services, seeds, fertilizer and credit on the one hand, and guaranteed and profitable markets for their output on the other hand. This implies that the biggest challenge is to improve the functioning of markets through the institution of sound policies and improvement of infrastructure.

4. Major trends

4.1 Productivity, technology use and intensification

In general, one undoubted factor has been has been poor technology – heavy reliance on the hand hoe and lack of access to improved seed and fertiliser, and cultivation in rain fed agricultural systems. Therefore, low production intensities, lack of access to improved seed, fertiliser, and insecticides-are the most important constraints to increased crop production and they seem to be major factors, explaining the low yields among farmers (Table 28). Typical crop yields among survey households were generally low, ranging between less than a tons per hectare for maize to about 1.6 t/ha for paddy. With good cultural practices, including use of fertilisers and with pest and disease control, improved cultivars have reached very high yield levels (Table 28).

Table 28: Average yield of major crops at farm level compared to potential yield(kg/ha)

Crop	Yield		
	Optimum Yield[a]	Farm level	Gap
Maize	6,250	939	5,311
Paddy	4,750	1,594	3,156

[a] TOSCA's variety performance records from varieties released by the Variety Release Committee.

Some qualifications for yield and production levels outlined above are pertinent. First, with the use of agricultural inputs such as seeds farmers can substantially increase the rate of crop yield per unit area. Second, given the small farm size, output per farm is usually very low and that puts emphasis for the provision of improved seeds. If improved inputs are not available the only other means by which production may be increased is by extensive means of farming involving farm area expansion. Since most farms are limited to one hectare or two, and given the limited labour and lack of mechanisation, it seems difficult to expand area under crop production beyond practical limits. However, the extent of use of modern inputs in the two study regions is not the same. For example

between 1973 and 1992, on average, Iringa consumed around 25% of the national fertiliser share compared to less than 5% in Morogoro.

In general the low agricultural output and productivity growth rates have not been able to bring a significant number of the rural poor above the poverty line, perpetuating the existing pervasive rural poverty. Given the importance of agriculture as the mainstay of rural livelihoods, agriculture must grow faster if rural poverty reduction is to become a reality in Tanzania. However, a recent study (Meertens, Fresco and Stoop, 1995) stresses that in order to make any headway in improving agricultural productivity, differences in the principle agro-ecological factors of soils in relation to the topography should be considered more closely.

4.2 Commercialisation

Commercialisation can best be described in terms of marketed surplus and market access. It is apparent that most households depend on the sale of some of their staple grains as a source of income. This was true for both maize and paddy farmers. However, the pattern of change has not been the same. Although in absolute terms the number of farmers growing maize and paddy increased in both regions, relatively more farmers in Morogoro shifted to maize production. This could be explained by two reasons. First, the influence of many immigrants from Mbeya and Iringa regions, the most prominent in the production of maize. Second, the failure of the paddy marketing system might have forced farmers to shift to maize.

4.3 Market access and the role of the private sector

Market access has generally improved as the role of private traders in the marketing system of most crops increased over the years. Following the liberalization policies farmers everywhere in the country are free to sell their produce to anyone. In this respect trade is currently dominated by the private sector and private traders have been the only outlet to dispose off the marketable surplus produce. In this respect it has been proven that even factors such as price might not be a significant factor in farmers' decision to sell a given amount of produce (Ashimogo, 1997). This means that farmers depend largely on these traders for market information and income, which, as a result, is influenced by the nature of functioning of this marketing channel. Although they have an alternative to sell their produce to any outlet of their choice, farmers seem to sell their grains and other produce to village and inter-village traders although occasionally wholesalers from urban areas may also enter the rural markets and buy directly from farmers. Sales of produce took place mainly at the village level and at the household or at the farm. Transport constraints appear to be the most limiting factor for distant trading.

4.4 State, markets and farmers

According to the Agricultural sector development Strategy (URT, 2000), several factors that are heavily influenced by the state have contributed to the modest performance of the agricultural sector in the country: First, the incentive structure in the sector over the past decade has not encouraged growth or investment in the sector. Agriculture's barter terms of trade, that measure the relative change in agricultural producer prices compared to the price of industrial goods have not changed significantly over the past decade. Second, past market interventions in Tanzania distorted agricultural price incentives resulting in

an inefficient allocation of resources and lack of comparative advantage. Removing these distortions has brought some improvements in terms of farmers' incomes. However, although farmer's shares of income in both food crops and cash crops have increased over time, the magnitude for the latter has remained modest. Generally, large differences in the producer's share of the border price for export crops can be largely explained by agricultural policies, macroeconomic policies, rural infrastructure, volumes of crops traded and crop type.

This is probably the fundamental problem to the whole underdevelopment of the agricultural sector because the implementation of the solutions to many of the problems affecting the sector depends on the effectiveness of the government in planning, implementing, supervising and monitoring the en-acted agricultural policies. Right from independence, the government has shown lack of consistence in policies to the development of the agricultural sector though it has all along been proclaiming the importance of the sector to the country's economic development. The lack of seriousness of the government has been shown, among others, by meagre location of national budget to the sector for years, in-adequate funding of research and extension services, frequent and un-coordinated reshuffling of the Ministries concerned with agriculture, and failure to enact marketing policies that provide guidelines to a fair marketing practice for all players.

In addition regulatory/legal framework needs to be worked out to create favourable environment for market participants. We note that some government controls that may be considered regulatory are wrongly placed – they do not enhance investment or facilitate efficiency in marketing inputs or outputs.

Apart from the government initiatives narrated above, still a number of problems persist. State controlled agricultural marketing systems continue to distort price signals in some parts of the country. In addition, although liberalisation has improved food market integration in the country but many markets in Tanzania remain isolated and large transaction costs erode incentives. Grain market reforms have induced private sector investments but mobility barriers continue to inhibit widespread private sector entry into all marketing niches. Transport costs remain particularly high in the country and continue to inhibit incentives and furthermore currency devaluations have not been consistently passed on to farmers as the corresponding higher prices.

Continued improvements in marketing efficiency can be a significant source of growth for Tanzania. This can be achieved by addressing agricultural policies that distort incentives, distort allocative efficiency and hence agricultural productivity. Removing policies that distort agricultural incentives should improve efficiency and investment to facilitate growth.

Greater collaboration and understanding needs to be developed between the public and private sector with clearly defined roles for each. The government can improve private sector activity by providing a range of public goods. These include investments in infrastructure (roads, communication and electricity), ensuring rule of law and promoting free entry and competition. Also in collaboration with the private sector, the government should make sure market information is as widely disseminated as possible.

4.5 Influence of household resources and characteristics

Naturally, a number of key variables were seen to influence the production capacity of the households that were surveyed. Total hectarage appeared to be the single most important variable in accounting for the variability in total production. Other important variables in accounting for the variability in total production include available labour, year's education and the availability of extension services. These same variables have been found to be the variables affecting total value of farm production in other parts of Tanzania (Due and Anandajayasekeram, 1984; Due and Magayane, 1989). In general however, smallholder farmers that are female-headed should be assisted to solve their special constraints of shortages of labour, credit and appropriate labour saving technologies.

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Appendix 1: Number of Households Sampled by Productivity Category

Village	Sub-village	Number of HH per Productivity Rank						Total	
		Very Low		Medium/High		Very High		All HH	Sample HH
		Total HH	Sample HH	Total HH	Sample HH	Total HH	Sample HH		
Iringa district									
Ihemi	Igunga	22	7	43	13	2	1	67	21
	Ihemi A&B	14	4	47	14	2	1	63	19
	Kilimahewa	11	3	22	7	0	0	43	1
Sub-total		**47**	**14**	**112**	**34**	**4**	**1**	**163**	**50***
	Isele A	13	3	37	9	3	1	53	13
Isele	Isele B	5	1	63	15	1	0	69	16
	Malambo A	2	0	39	9	1	0	42	10
	Malambo B	9	2	38	9	1	0	48	11
Sub-total		**29**	**7**	**177**	**42**	**6**	**1**	**212**	**50***
Kipaduka	Malangali	6	1	41	10	2	0	49	12
	Kipaduka A	96	23	56	13	10	2	162	38
Sub-total		**102**	**24**	**97**	**23**	**12**	**3**	**211**	**50***
Mufindi district									
Kasanga	Ilongelo	17	4	19	4	0	0	36	8
	Lupunga	13	3	24	6	1	0	38	9
	Ngelele	13	3	24	6	1	0	38	9
	Tangini	29	7	35	8	1	0	65	15
Sub-total		**89**	**21**	**126**	**29**	**2**	**0**	**217**	**50***
Kitelewasi	Mtakuja	37	8	50	10	3	1	90	19
	Mwongozo	20	4	41	9	5	1	66	14
	Neema	41	9	41	9	1	0	83	17
Sub-total		**98**	**21**	**132**	**28**	**9**	**2**	**239**	**50***
Kilombero district									
Idete	Godown A	150	30	17	3	1	0	168	34
	Godown B	58	12	22	4	1	0	81	16
Sub-total		**208**	**33**	**39**	**8**	**2**	**0**	**249**	**50***
Katurukila	**Msumbiji**	**101**	**26**	**73**	**19**	**17**	**4**	**191**	**50***
Kiberege	**Msufini**	**107**	**25**	**88**	**21**	**16**	**4**	**211**	**50***
Mbingu	**Londo**	**35**	**14**	**89**	**34**	**5**	**2**	**129**	**50***
Njagi	Miale	15	4	15	4	15	4	45	12
	Ngavaria	39	10	46	12	10	3	95	25
	Njagi	20	5	24	6	6	2	50	13
Sub-total		**74**	**19**	**85**	**22**	**31**	**8**	**190**	**50***
Grand Total		890	204	1,018	260	104	27	2012	500

* Note that only the first 40 names will be included in the sample. The remaining 10 will serve as reserves.

Appendix 2: Sampling Fraction and Sampling Frame

No.	District	Village	Number of households	# Sub-villages in frame	# HH in Frame	Sampling Fraction	Sample size
1	Kilombero	Idete	1,164	2	253	0.158	40
		Katurukila	666	1	190	0.211	40
		Kiberege	1,187	1	215	0.186	40
		Mbingu	900	1	132	0.303	40
		Njagi	940	2	201	0.199	40
	Sub-total	***-***	***4857***	***8***	***991***	***0.204***	***200***
2.	Iringa	Ihemi	470	3	163	0.566	40
		Isele	288	4	212	0.736	40
		Kipaduka	643	2	211	0.328	40
	Sub-total	***-***	***1401***	***9***	***586***	***0.418***	***120***
3.	Mufindi	Kasanga	352	4	217	0.616	40
		Kitelewasi	280	3	239	0.853	40
	Sub-total		***632***	***7***	***456***	***0.679***	***80***
Grand Total			**6,890**	**24**	**2,033**	**0.295**	**400**