Drought Tolerant Maize for Africa (DTMA) Project

Country Report – Household Survey

Characterization of Maize Producing Households in Cacuaco and Lobito Municipalities of Angola

Manuvanga Kiakanua, António Chichicuhua, Desideria V. Pedro, Vuvu Kua Nzambi and Helder S. C. Jezo

CIMMYT MR
International Maize and Wheat Improvement Center

The International Maize and Wheat Improvement Center, known by its Spanish acronym, CIMMYT® (www.cimmyt.org), is an international, not-for-profit research and training organization. With partners in over 100 countries, the center works to sustainably increase the productivity of maize and wheat systems to ensure global food security and reduce poverty. The center's outputs and services include improved maize and wheat varieties and cropping systems, the conservation of maize and wheat genetic resources, and capacity building. CIMMYT belongs to and is funded by the Consultative Group on International Agricultural Research (CGIAR) (www.cgiar.org) and also receives support from national governments, foundations, development banks, and other public and private agencies. CIMMYT is particularly grateful for the generous, unrestricted funding that has kept the center strong and effective over many years.

The Drought Tolerant Maize for Africa (DTMA) Project is jointly being implemented by CIMMYT and the International Institute of Tropical Agriculture (IITA). It is funded by the Bill & Melinda Gates Foundation and the Howard G. Buffett Foundation. The project is part of a broad partnership also involving national agricultural research and extension systems, seed companies, non-governmental organizations (NGOs), community-based organizations (CBOs), and advanced research institutes, together known as the DTMA Initiative. Its activities build on longer-term support by other donors, including the Swiss Agency for Development and Cooperation (SDC), the German Federal Ministry for Economic Cooperation and Development (BMZ), the International Fund for Agricultural Development (IFAD), and the Eiselen Foundation. The project aims to develop and disseminate drought tolerant, high-yielding, locally-adapted maize varieties and to reach 30–40 million people in sub-Saharan Africa with these varieties in 10 years.

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This report is presented without a thorough peer review with the main purpose of making data and information rapidly available to research teams and partners in the Drought Tolerant Maize for Africa (DTMA) project and for use in developing future, peer-reviewed publications. Readers are invited to send comments directly to the corresponding author(s). The views expressed in this report are those of the authors (all from the Agronomy Research Institute, Luanda, Angola) and do not necessarily reflect opinions of CIMMYT, the Agronomy Research Institute, other partners, or donors.

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Acronyms and abbreviations

ADRA	Association for Environment and Rural Development
AKZs	Angolan Kwanzas (Angola monetary unit)
CBO	Community Based Organization
CEU	Consumer Equivalent Units
CIMMYT	International Maize and Wheat Improvement Center
DR	Dependency Ratio
DTMA	Drought Tolerant Maize for Africa
EDA	Agrarian Development Station
Hhs	Households
IDA	Agrarian Development Institute
Kg	Kilogram
MEU	Man Equivalent Units
MFI	Micro Finance Institutions
MINADERP	Ministry of Agriculture, Rural Development and Fishery
NGO	Non Governmental Organization
WFP	World Food Program
PCA	Principal Components Analysis
PEDR	Extension and Rural Development Program
PNIC	National Cereal Research Program
SPSS	Statistical Package for the Social Sciences
T/ha	Tons per hectare
TLU	Tropical Livestock Units
USD	US Dollar (USA monetary unit)

Acknowledgements

Maize is Africa's most important cereal crop. It is particularly vital for more than 300 million people in sub-Saharan Africa (SSA) whose livelihoods are threatened by recurrent droughts responsible for crop failures. Considering the devastating impact of droughts on food security and economic development in SSA, effective solutions are of uttermost importance, especially as the situation is set to worsen as climate change progresses.

The Drought Tolerant Maize for Africa (DTMA) initiative aims to address this challenge. It joins the efforts of people, organizations and projects supporting the development and dissemination of drought tolerant maize in 13 countries in SSA. The initiative is supported by the Bill & Melinda Gates Foundation and Howard G. Buffett Foundation. For further information about the initiative, visit the project website (http://dtma.cimmyt.org).

Developing, distributing and cultivating drought tolerant maize varieties is a highly relevant intervention in SSA to reduce vulnerability, food insecurity and the damage to local markets caused by food aid. However, for this to succeed, it needs to be embedded in the local reality. For this purpose, each of the participating countries was supported to conduct a community assessment and a household survey in the target areas. This report presents the findings from initial analysis of household survey data which will serve as a baseline and characterizes the maize producing households in Cacuaco and Lobito Municipalities of Angola.

This country study received financial and technical support from the DTMA project. The views expressed in this report are those of individual scientists and do not necessarily reflect the views of the donor, the DTMA project, or the author's institutions. We gratefully acknowledge the support of Augustine S. Langyintuo (a former CIMMYT economist, Zimbabwe), Girma Tesfahun Kassie (CIMMYT economist, Zimbabwe), and Fernando P. Sito (head of PNIC/IIA, Angola), who rendered assistance on various aspects of the study. We thank all the extension agents (Cacuaco and Lobito Agrarian Development Stations) who helped during the survey, and the farmers who patiently listened and responded to the questions. The authors are responsible for any remaining errors and inferences.

1. Introduction

Maize is a major staple food crop in Angola. In Southern Angola, maize is consumed in different forms including as an ingredient in a traditional brew. In Northern Angola, where cassava is a dominant crop, maize is mainly consumed green. The production is concentrated in Huambo, Benguela and Bié provinces where maize constitutes up to 40% of the total crop production. Maize is grown intercropped with other crops such as beans, peanuts, sweet potatoes and cassava. About 93% of the total crop production in Angola is by smallholder farmers (IIA/MINADERP, 2008). Maize production in 2005/2006 (drought year) was about 526 084 tons with a deficit of 200 955 tons and in 2006/2007 (normal year), it was about 905 287 tons with a deficit of 35 597 tons (IIA/, MINADER, 2008).

It is thus apparent that increasing maize production and productivity is an important entry point to significantly enhance livelihoods in Angola. The International Maize and Wheat Improvement Center (CIMMYT) in collaboration with its partners has been developing and deploying maize germplasm that has traits associated with the challenges the poor farming communities are facing. For livelihood changes to happen, there has to be adoption and continuous use by the farming community of the technologies generated by CIMMYT and other research organizations. Assessing adoption of technologies is therefore important to understand the dynamics of technology use and its impact.

The main objective of the household survey was to collect baseline data on farm households to construct indicators to be used to measure the changes in the adoption of improved maize varieties and its impact on adopting households. The specific objectives were to:

- Identify farmer perceptions of and preferences for maize variety attributes;
- Identify factors that influence the adoption of improved maize varieties;
- Characterize maize production systems and gender mainstreaming; and
- Assess farmer's perceptions of risks and shocks and their coping strategies.

2. Materials and methods

2.1 Description of the study areas

Cacuaco and Lobito municipalities are located along the western coastal line of Angola with Cacuaco up in the North and Lobito in the Center. Cacuaco receives on average 575 mm of rainfall per annum whereas Lobito receives only 63 mm of rainfall per year. The average daily temperature ranges between 18 and 35 ^{o}C and between 23 and 31 ^{o}C in Cacuaco and Lobito, respectively (Table 1). Lobito municipality has 6,950 hectares of cultivated land. The average land holding is about one hectare. The municipality of Cacuaco has about 5,560 hectares of cultivated land. The number of households that have right to land (own land, bought or inherited) is approximately 11,120. Therefore, each household typically has about half a hectare of land in Cacuaco. The land under annual crops is 2,029 hectares and under permanent crops is about 350 hectares, making a total of 2,379 hectares of cultivated land.

Table 1. Agro-Climatic characteristics of Cacuaco and Lobito municipalities.

Study areas	Rainfall (mm)			Temperature (0C)		Latitude	Longitude	No. of villages
	Min	Max	Average	Min	Max			
Cacuaco	400	750	575	18	35	- 8050'	13030'	60
Lobito	14	112	63	23	31	-12016'	13083'	79

Source: DTMA/Angola Survey 2008.

2.2 Sampling and data collection

Proneness to drought and extent of maize production were the main factors considered in the selection of the study districts in Angola; i.e., Cacuaco municipality in Luanda and Lobito municipality in Benguela province (Figure 1). Five villages/associations or cooperatives were visited in each municipality after selection from a list provided by the municipality level offices of the Ministry of Agriculture and Food Security. The villages/associations visited were Kilunda, Kazulu de Estrada, Kalilongue, Kamikutu and Mukulu in Cacuaco Municipality; Ekuikui II, Kabaia Gama, Ossochi, Palmerinhas and Tuma in Lobito Municipality. Fifteen households were interviewed per village (total sample size of 150 households). The survey was conducted between July 14 and August 4, 2008 and involved extension agents in both districts.

A structured questionnaire was used to survey sampled farmers. A wide spectrum of data were generated on issues including characteristics of households, household level resource endowment, availability and access to social services, agricultural production and productivity with particular focus on maize, risk perception and management, access to agricultural markets and marketing decisions, and income and expenditure profile.

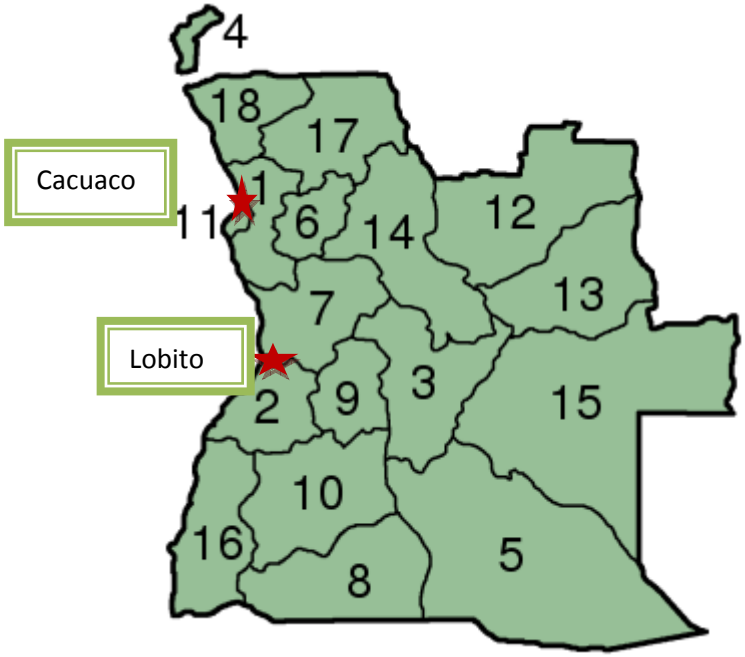

Figure 1: Map of Angola showing the location of study areas.

2.3 Data analysis

The data generated were analyzed in different ways to explain the different aspects of the livelihoods of the farming communities in the study districts. Mainly descriptive statistics have been employed to characterize the socioeconomic and biophysical features of the households. Principal Component Analysis (PCA) is also used to generate the wealth indices for each household based on fixed asset. This asset based method was employed following the literature that highlights the difficulty and irregularities of wealth indicators based on reported income and expenditure data. According to Montgomery et al (2000), the collection of accurate income data is quite demanding as it requires extensive resources for household surveys. And in some cases, an indicator of income is difficult to use. For example, income information does not capture the fact that people may have income in kind, such as crops which are traded (Cortinovis et al, 1993). Therefore, asset based indicators have become quite common in characterizing welfare states of people (Filmer and Prichett, 2001; McKenzie, 2003).

PCA is a statistical procedure used to reduce dimensions of a data set in terms of aggregating variables through orthogonal linear combinations of the variables. Mathematically, from an initial set of n correlated variables, PCA creates orthogonal components, where each component is a linear weighted combination of the initial variables. For n assets and livestock, for instance,

$$\begin{aligned} PC_1 &= a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n \\ &\vdots \\ PC_m &= a_{m1}X_1 + a_{m2}X_2 + \ldots + a_{mn}X_n \end{aligned} \qquad (1)$$

where a_{mn} represents the weight for the m^{th} principal component and the n^{th} variable.

The weights for each principal component are given by the eigenvectors of the correlation matrix as we used the original data. The covariance matrix could be used if the data were standardized. Using the scores generated by the first principal component and the mean and standard deviation of the original data set, the wealth indices were computed using the formula:

$$W_j = \sum_{i}^{n} [\gamma_i * (x_{ij} - \bar{x}_i) / \delta_i] \quad (2)$$

where, W_j is the wealth index for each household; γ_i represents the weights (scores) assigned to the n assets on the first principal component; x_{ij} is the original observation of asset i in household j, $\bar{x}_i$ is the mean holding of asset i in the sample and δ_i the standard deviation of holding of each of the assets in the sample.

The wealth indices were used to categorize the households into two wealth classes. Wealth class one has the poor households and their indices ranged from the negative minimum to zero, and the rich wealth class included households with indices that are above zero.

The data analysis also included logistic regression to determine the factors that influence adoption decision of improved maize varieties. The logit model is based on the plausible assumption that each decision maker selects adoption or non-adoption decision only if it maximizes its perceived utility. Utility is, however, latent and only the decision variable (adopting or not adopting) is observed. The decision of the respondent "y" takes on one of two values, 0 (not-adopting) or 1 (adopting). The probability that the respondent decides to adopt improved maize varieties can be formulated as

$$\Pr ob(Y_i = 1) = F(X_i \beta) \quad (3)$$

where X_i is a vector of explanatory variables and β is a conformable vector of coefficients to be estimated. By choosing F to be a logistic distribution, the probability can be estimated using the logit formulation as

$$\Pr ob(Y_i = 1) = \Lambda(X_i \beta) = \frac{\exp(X_i \beta)}{1 + \exp(X_i \beta)} \quad (4)$$

An easier way of interpreting the estimated coefficients is considering the partial derivatives of the probability that Y_i equals one with respect to a continuous variable or with respect to a change from the reference level to another of a discrete variable (X_k). The partial derivatives give the marginal effects and are formulated as

$$\frac{\partial E(Y_i = 1)}{\partial X_k} = \frac{\exp(X_i \beta)}{(1 + \exp(X_i \beta))^2} . \beta_k \quad (5)$$

The estimation of the logit model is done with the maximum likelihood (ML) approach. The general log likelihood function is specified as

$$\log \boldsymbol{L}(\boldsymbol{\beta}) = \sum_{i=1}^{N} \boldsymbol{Y}_i \log \boldsymbol{F}(\boldsymbol{X}_i'\boldsymbol{\beta}) + \sum_{i=1}^{N} (1-\boldsymbol{Y}_i) \log(1-\boldsymbol{F}(\boldsymbol{X}_i'\boldsymbol{\beta})) \tag{6}$$

The first order condition of the ML function is generated by differentiating the above equation with respect to β, which gives

$$\frac{\partial \log \boldsymbol{L}(\boldsymbol{\beta})}{\partial \boldsymbol{\beta}} = \sum_{i=1}^{N} \left[\frac{\boldsymbol{Y}_i - \boldsymbol{F}(\boldsymbol{X}_i'\boldsymbol{\beta})}{\boldsymbol{F}(\boldsymbol{X}_i'\boldsymbol{\beta})(1-\boldsymbol{F}(\boldsymbol{X}_i'\boldsymbol{\beta}))} \boldsymbol{f}(\boldsymbol{X}_i'\boldsymbol{\beta}) \right] \boldsymbol{X}_i = 0 \tag{7}$$

Where f is equal to F', denoting the density function. For the logistic function the above equation is simplified as

$$\frac{\partial \log \boldsymbol{L}(\boldsymbol{\beta})}{\partial \boldsymbol{\beta}} = \sum_{i=1}^{N} \left[\boldsymbol{Y}_i - \frac{\exp(\boldsymbol{X}_i'\boldsymbol{\beta})}{1+\exp(\boldsymbol{X}_i'\boldsymbol{\beta})} \right] \boldsymbol{X}_i = 0 \tag{8}$$

The solution for this equation is the maximum likelihood estimator $\hat{\boldsymbol{\beta}}$. This estimator can be used to estimate the probability that $Y_i = 1$ for a given X_i as

$$\hat{\boldsymbol{P}}_i = \frac{\exp(\boldsymbol{X}_i'\hat{\boldsymbol{\beta}})}{1+\exp(\boldsymbol{X}_i'\hat{\boldsymbol{\beta}})} \tag{9}$$

3. Household characteristics

3.1. Household access to assets

Farm households are endowed with different assets each of which can potentially contribute to their wealth status (Langyintuo and Mungoma, 2006). Access to or ownership of a range of assets determines the livelihood strategies and outcomes available to a given household. Zezza *et al.* (2008) classified household assets into seven major categories: human capital which comprises of education and household labour force; natural capital that involves land access; physical capital which includes ownership of assets such as livestock and machinery; public capital (access to public services and infrastructure such as schools, health clinics and electricity); social capital that involves participation in organizations, associations and links to other individuals and households both within and outside the community; financial capital (access to credit, insurance); and geographic capital (locational factors such as proximity to markets).

The capital endowments vary considerably between households making them difficult to compare or to characterize the household's wealth status. It is therefore necessary to find a common denominator that could be used to classify households by their assets. That is why the asset based wealth index calculation was employed.

Estimating the household wealth index

The PCA was run on the selected rural wealth status indicators using Statistical Package for Social Sciences (SPSS). Eight components were extracted and the first component was chosen for use in constructing the index because it explained 18% of the total variance in the eight indicators (Table 2).

Table 2. Total variance explained using PCA

	Initial Eigenvalues		
Component	**Total**	**% of Variance**	**Cumulative %**
Motor cycle	2.547	31.832	31.832
Wheel barrow	1.183	14.790	46.622
Television sets	1.057	13.210	59.833
Radio sets	.885	11.068	70.901
Water pumps	.829	10.366	81.267
Generator	.698	8.721	89.988
Mobile phone	.489	6.110	96.098
Credit received or not	.312	3.902	100.000

Source: DTMA/Angola Survey 2008.

The weights (or scores) assigned to the indicators contributing to component 1 are shown in Table 3. The impact of each variable on the overall index is calculated as the score divided by the standard deviation. Following Filmer and Pritchett (2001), the assigned weights were then used to construct an overall 'wealth index', applying the formula in equation 2.

Table 3. Characteristics of the first principal component

Capital asset	Mean	Standard deviation	Score	Impact factor
Physical capital				
Motor cycle	0.12	0.326	0.112	0.344
Wheel barrow	0.10	0.323	0.206	0.638
TV sets	0.32	0.496	0.317	0.639
Radio sets	0.50	0.621	0.271	0.436
Water pumps	0.16	0.419	0.184	0.439
Generator	0.21	0.406	0.245	0.603
Mobile phone	0.27	0.564	0.249	0.441
Financial capital				
Credit received or not	1.90	0.301	-0.88	-2.924

Source: DTMA/Angola Survey 2008.

From Table 3, the assets with the largest impact factors are ownership of a television set, a wheelbarrow, a generator, a mobile phone and a water pump. After estimating the wealth index for each household, the households were sorted based on the wealth scores. These scores ranged from 0.579 to 4.140 (mean =0.524 and standard deviation=0.976).

Figure 2 illustrates the ranked distribution of households according to the wealth indices. The households were then grouped into "well endowed" (WE) and "poorly endowed" (PE) if they fell above or below zero, respectively. The mean score for well endowed households was 1.1 and -0.3 for the poor endowed households. The poor endowed households in the study areas constitute around 41.3% of the sample. This estimate of relative poverty is relatively low compared with a study conducted by the Angola Statistical National Institute in 2008/9 which estimated rural poverty level in Angola around 58%.

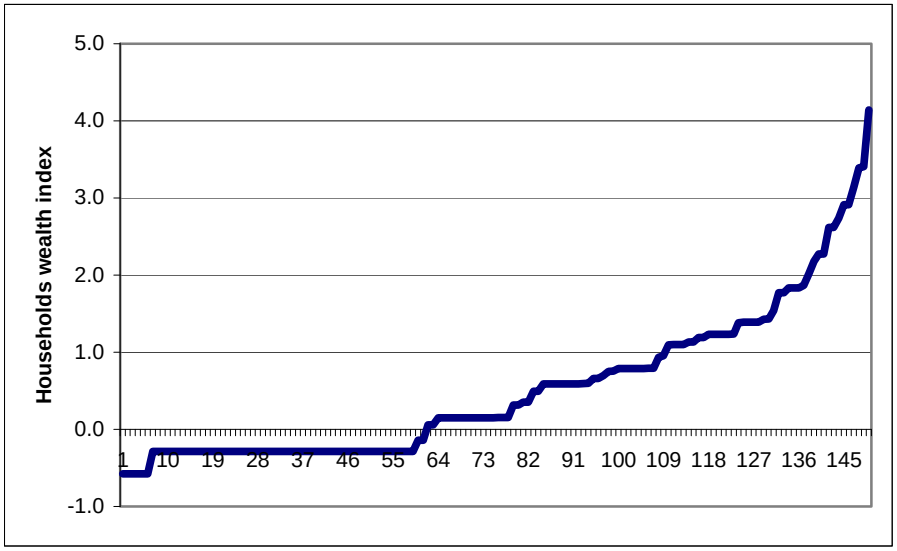

Figure 2: Distribution of households according to wealth groups in Angola.

The mean wealth indices for female and male headed households in the poor endowed category were -0.287 and -0.314, respectively. The corresponding well endowed mean wealth indices for female and

male headed households were 1.562 and 1.007, respectively. These figures show that female headed households are somewhat more endowed than men in the study areas.

3.2. Availability of human capital

The average household size is seven members with a range of 1 to 14. The mean age of sample household heads is 49 years with a range of 20 to 79 years. Forty two percent of the households are headed by females with the largest proportion in Lobito Municipality. About 50% of households are members of an association in the village, being particularly common in Lobito Municipality (91%). Seventeen percent of the respondents are illiterate; 39% have attended primary school, 28% have attended secondary school, 2% have attended post secondary school; and 16% have experienced adult education. Nearly half (45%) of the sample farmers are single whereas 40% are married and 14% are widowed (Table 4).

Family labor is the main labor source for the major field operations, with a few recruited laborers and tractor for land preparation. For other field operations like planting, weeding and fertilization, smallholders in the selected study areas use communal or reciprocal labor. Harvesting and threshing are exclusively reserved to family labor to minimize wastage due to carelessness or theft.

Table 4. Descriptive statistics of survey in Cacuaco and Lobito municipalities.

	Cacuaco	Lobito	Whole sample
Average household size	7 (1-14)	7 (4-11)	7 (1-14)
Age of household head	48 (20-46)	50 (33-79)	49 (20-79)
Female headed household (%)	25	58	42
Association membership (%)	13	91	49
Educational level of household head (%)			
• Illiterate	13	20	17
• Primary	45	30	39
• Secondary school	20	34	28
• Post secondary	2	2	2
• Adult education	20	14	16
Marital status of household head (%)			
• Single	52	37	45
• Married	42	37	40
• Divorced	1	1	1
• Widowed	5	25	14

Source: DTMA/Angola Survey 2008. Note: Numbers in parenthesis are range.

Following Runge-Metzer (1988), each household member was converted to a man-equivalent unit (MEU)[1] with the assumption that individuals in different age groups cannot perform field operations at similar rates of efficiency. The development of man-equivalent unit takes into consideration the differences in labor use efficiencies among different age categories. Aggregated for each household and municipality, the estimated MEUs ranged from 0 to 9.2 with a mean of 4.2 for female headed household in Cacuaco and 4.7 for male headed households in Lobito Municipality. The estimated dependency ratio (DR)[2] which gives the number of household members who need to be looked after, indicate that while in some households the adult workers do not have anybody to look after, in

[1] MEUs were calculated after Runge-Metzger (1988) as follows: household member less than 9 years=0; 9 to 15 years or above 49 years = 0.7; and 16 to 49 years old = 1.

[2] DR = (household members under 16 years + household members above 60 years)/(household members between 16 and 60 years).

some cases up to two people need to be looked after. We used similar principles to construct the consumer equivalent units (CEU)[3] to have a sense of households' consumption need. It is argued here that in general, individuals in different age groups require different amounts of energy for active physical work. CEU ranged from 0.9 to 7.1 with a mean of 5.0.

3.3. Access to natural capital

In the selected study areas in particular and generally in Angola, land is often held by the community lineage or clan and the community may give out a piece of land to another person for use with the knowledge of the village chief (soba). People who do not belong to the villages or non-natives of these villages may use the acquired land for annual or staple crop only and they may not pass the piece of land to another person. As shown in Figures 3, the predominant forms of land ownership are own land (65%) followed by rented land (23%).

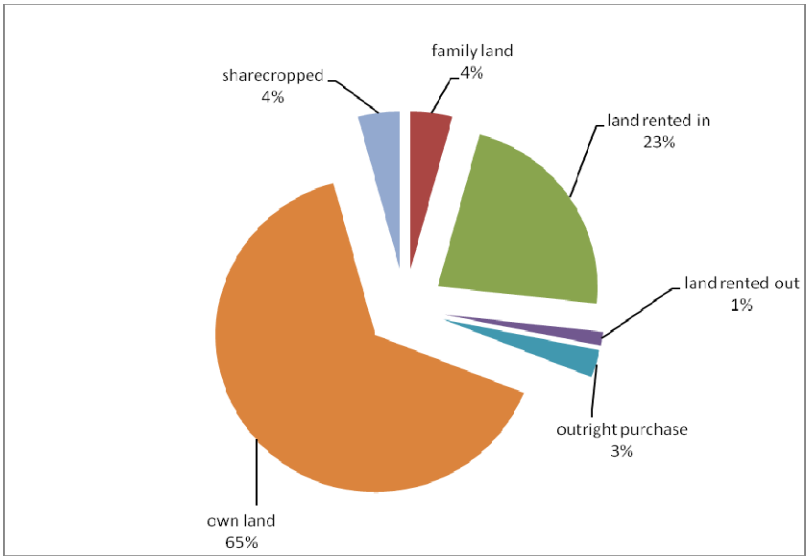

Figure 3: Distribution of land ownership in selected municipalities in Angola

Distribution of farm land among households

The average farm size is about 1.8 but unevenly distributed (Table 5). The average land use intensity is about 0.5 with a higher pressure on land in Cacuaco Municipality (0.7). In terms of distribution among different wealth categories, poor endowed households have 2.98 hectares of total farm land against 1.77 hectares held by the well endowed households. As expected, well endowed households cultivate 92% of the total farm land owned while poor endowed households cultivate only 42% of owned total farm land.

[3] CEU were calculated after Runge-Metzger (1988) as follows: less than 9 years = 0.4; 9 to 15 years = 0.7; males 16 to 49=1; females 16 to 49 = 0.9; and over 49 years old = 0.8.

Table 5. Land use by wealth group in the study areas.

	Study areas		Wealth group	
	Cacuaco	**Lobito**	**Poor endowed**	**Well endowed**
Total farm land (ha)	2.3(0.5-7)	1.2(0.1-6)	2.98	1.77
Total cropped land (ha)	1.6(0.5-6)	1.6(0.2-4)	1.26	1.64
Mean years of fallow	0.5	3.3	1.1	0.4
Mean cropped years	1.3	1.5	2.4	0.8
Land use intensity (R-value)	0.7	0.3	-	-

Source: DTMA/Angola Survey 2008. Note: Land use intensity (R-value) = cropped years/ (cropped years + fallow years)

Dynamics of cultivated farm size

Households in the study areas as development projects are taking off in Angola following the prolonged civil was the country passed through. Another important development in Angola is that more and more are returning to agriculture since the end of the civil war. In fact, the peace in the country has also encouraged people to migrate to the petrol industry leaving behind their farmland despite the risk of losing their usufruct right. This dynamics in the access and entitlement of land significantly influences the food security level of the community that still depends on agriculture. Therefore, information on whether farm sizes have been increasing or decreasing over time is important for the design of land development interventions. For instance, if cultivated land has been shrinking, it would be appropriate to suggest crop intensification, emphasizing the use of improved technologies (including seed). On the other hand, if farmers can expand their farm areas, because of, for instance additional land is available due to emigration of some of the farming households; farmers may be unwilling to accept crop intensification as a measure to increase productivity. When respondents were asked to indicate how their current land sizes are compared with what they cultivated over the years, a total of 58% reported a change in land size, with 36% reporting an increase and 22% reporting a decline. In general, farmers consider availability of seed and land when deciding on how much land to cultivate (Figure 4). As shown in Figure 5, the major reasons why farmers reduced their farm sizes over the years include reduced cash to pay for inputs (33%) and shrinking farm size (24%) as more and more people are coming back to engage in agriculture.

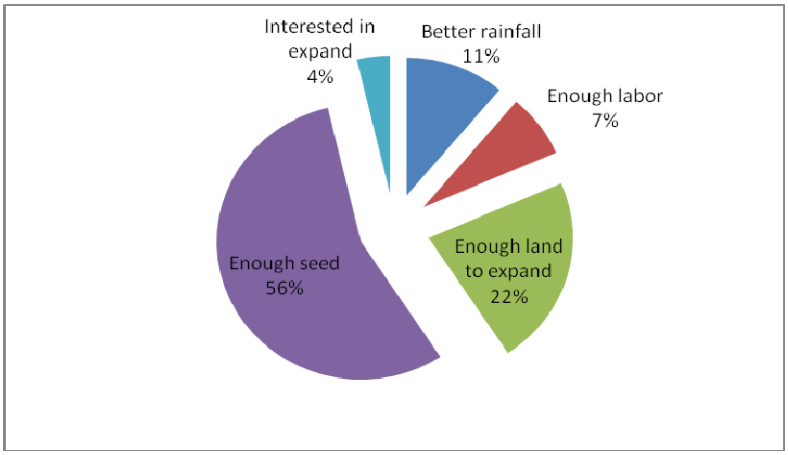

Figure 4: Important reasons for choice of farm size in each season

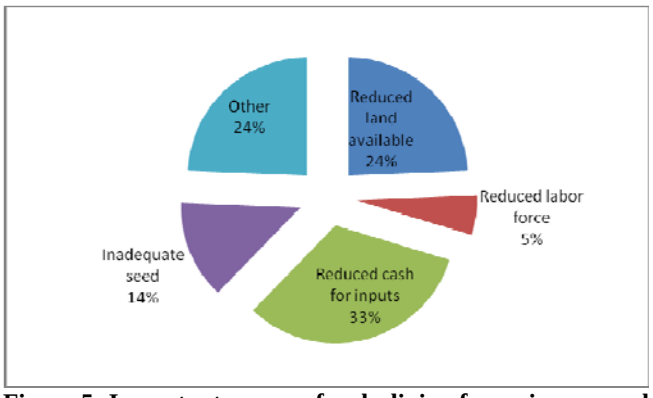

Figure 5: Important reasons for declining farm size ownership

3.4. Access to physical capital

Good housing is a wealth indicator. As indicated in Table 6, wooden houses with iron roof are the most common housing type (66%), followed by brick houses with asbestos/iron roof (18%).

Table 6. Types of dwellings of sample households (%)

	Cacuaco	Lobito	Whole sample
Mud hut with grass thatch roof	1	0	1
Mud hut with asbestos/iron roof	5	0	3
Brick house with grass thatch roof	0	2	1
Brick house with asbestos/iron roof	13	14	18
Block house with asbestos/iron roof	8	5	7
Pole and dagga with grass thatch	4	4	4
Other (wood house)	68	64	66

Source: DTMA/Angola Survey 2008.

The most popular capital assets are radio sets, television sets, mobile phones, generator, water pumps, bicycle, and wheel barrow (Table 7). In general, respondents of Cacuaco Municipality have more assets than those of Lobito Municipality. Motor cycles, cultivators, private wells, diesel pumps and water tanks are also popular among households of the selected study areas. The well endowed households have more assets like mobile phones, radios sets, television sets and generators than the poor endowed households except motor cycle which is a popular transport means among poor endowed households.

Table 7. Fixed assets owned by sample households.

Asset	Study areas		Wealth group	
	Cacuaco	Lobito	Poor endowed	Well endowed
Motor cycle	1	0	15	10
Bicycle	6	12	-	-
Mobile phones	23	17	2	44
Radio sets	43	32	46	53
Television sets	27	21	26	36
Generator	19	12	15	25
Water pumps	21	3	13	18
Wheel barrow	10	5	8	11
Cultivator	1	0	-	-
Private well	1	0	-	-
Diesel pumps	2	0	-	-
Water tank	0	3	-	-

Source: DTMA/Angola Survey 2008.

3.5. Access to financial capital

Households in the study areas lack cash resources to meet immediate needs and they have limited access to micro-finance institutions (MFI). Households sometimes received input from Local Extension Services (EDA) and NGOs mainly for maize cultivation and transport of produce after harvest. Table 8 shows that only 11% received any type of credit, generally on time especially in Lobito municipality (83%). The main reasons for lack of credit are the absence of micro-finance institutions in the area and the tough collateral requirement of the institutions available (Table 8). For those who have accessed credit, financial institutions are the main source for 57% of the households in Lobito and money lenders; neighbors and relatives are the principal sources for 67% of the credit recipients in Cacuaco Municipality.

Table 8. Access to credit in the study areas (% households).

	Cacuaco	Lobito	Whole sample
Hhs who received credit	9	12	11
Credit received on time	60	83	73
Reasons of lack of credit:			
No source of credit in vicinity	66	38	54
No collateral to guarantee credit	16	34	24
Did not look for credit	7	14	10
Sources of credit:			
Financial institution	0	57	31
Money lender, neighbor and relative	67	14	8
Other sources	33	29	31

3.6. Access to social capital or institutional support services

Households sometimes need social interactions to effectively achieve a better standard of living. The social supports examined in this section include membership to a community based organization (CBO) and participation in governmental and NGO support programs. About five support institutions were mentioned by the households in the visited study areas: Local Extension Services, World Food Program (WFP), Association for Environment and Rural Development (ADRA), World Vision, and Africare. Out of the five institutions, only WFP was mentioned by the households as being engaged in distribution of food. Agricultural extension staff are the main source of extension messages in Lobito Municipality (56% of respondents). Radio stands out as a major source of extension messages in Cacuaco Municipality (Figure 6).

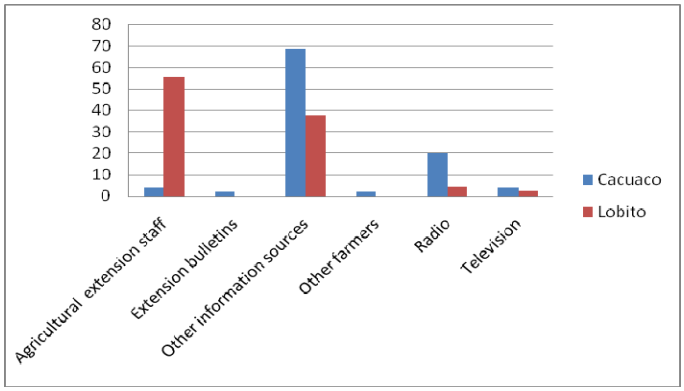

Figure 4: Sources of Extension messages (% hhs)

Demonstration fields organized by the local extension services were visited by the households of the selected study areas: in Lobito Municipality, households visited 33 demonstration fields, and 10 demonstrations visited by Cacuaco municipality respondents. An important responsibility of the Agrarian Development Institute (IDA) to the farming populations is to provide them with extension services through extension workers of the Ministry of Agriculture (MoA). The effectiveness of IDA in providing this vital service is affected by various constraints. In spite of the implementation of the Extension and Rural Development Program (PEDR) since 2006 by the MoA throughout the country, only 9% of interviewed households had five contacts with the extension staff during the 2006/07 crop season with predominance in Cacuaco Municipality at 25% (Table 9).

Table 9. Number of visits by extension staff in 2006/07 cropping seasons (% hhs)

	Cacuaco	Lobito	Whole sample
Once	25	16	17
Twice	0	32	26
Three times	50	39	39
Four times	0	11	9
Five times	25	2	9

Source: DTMA/Angola Survey 2008.

4. Household livelihood strategies

In rural settings, farm households engage in various livelihood strategies like crop production, livestock and sale of labor or trading in consumer goods. This section examines some of these livelihood activities such as crop and livestock production, petty trading and employment in the selected study areas of Angola.

4.1. Crop production activities

Abandoning or fallowing plots or leaving plots for pasture are not common practices in the study areas. Crop production is generally subsistence. Maize is the main crop cultivated (81% of respondents), supplemented by vegetables - like tomatoes, cabbages, onions and pepper - by 25% of households; cassava by 7% of respondents; beans by 1% of respondents; and other crops such as banana, ground nuts, and sweet potatoes. In the two municipalities, maize is planted on more than 50% of the cultivated area.

Maize is a dual purpose crop – produced for home consumption and the market. An interesting feature in both municipalities is that more than half (in the case of Cacuaco-close to 100%) of the maize produce is sold after the harvest. Farmers seem to have limited options to generate cash income to settle day to day expenditure and this apparently forces the households to sell part of the maize produce as soon as it is available. Remaining unsold maize produce is insufficient to meet consumption needs, often compounded by households' social obligations such as giving out grain as gift to relatives as well as reserving some grain as seed for the next agricultural campaign (Table 10).

Table 10. Maize grain disposal pattern by households (per year)

	Cacuaco	Lobito	Whole sample
Quantity of maize grains produced (kg)	592	629	609
Quantity sold (kg)	577	329	439
Quantity given out as gift (kg)	45	71	56
Quantity reserved as seed (kg)	42	29	53
Estimated maize quantity consumed (kg)	350	233	282

Source: DTMA/Angola Survey 2008.

In terms of the estimated energy requirement per household, the results show that households in both selected municipalities do not produce sufficient maize to meet energy requirements even if they consumed all the maize they produce (Table 11).

Table 11. Household level energy balance from maize

	Cacuaco	Lobito
Mean consumer unit equivalent	4.9	5.2
Minimum energy requirement (MJ)1	53.4	56.7
Total maize produced (kg)	592	629
Total energy from maize (MJ)2	21.4	22.8
Energy balance from maize	-33.0	-33.9

Source: DTMA/Angola Survey 2008. Note: [1]Minimum energy requirement per CEU per year is assumed to be 10.9 MJ (Runge-Metzger, 1988). [2] This assumes total production is available for consumption. Maize is assumed to have 36.2 kcal.

4.2. Livestock production and marketing

Livestock, particularly small ruminants and poultry are an important component of the rural livelihoods in the study areas. Livestock provide meat for in-house consumption and in some cases, manure for crop production. Additionally, livestock plays various roles in accomplishing social obligations such as marriage ceremonies, child baptism ceremonies, etc. All the livestock species owned by the sample households are local breeds.

4.3. Income and expenditure profiles of households

Households engage in both formal and informal economic activities (Table 12). The combined income generated from the different activities for the 2006/07 production season was 3.6 million and 1.9 million Angolan Kwanzas (AKZs) for Cacuaco and Lobito respondents respectively. Crop and livestock sales contribute about 88% of the total income in the study areas reflecting the important role of agriculture in the livelihoods of the households.

Table 12. Sources of household income in the study areas

	Cacuaco	Lobito	Whole sample
Total income (AKZs Millions)4	3.6	1.9	
Sources of income (% of total)			
Crops (grains/seeds) sales	43	28	38
Fruits and vegetables sales	48	53	49
Livestock/fish sales	0	0	0
Petty trading	0	2	1
Paid employment	8	0	5
Self employed	1	5	3
Remittances	0	0	0
Other	0	12	4

Source: DTMA/Angola Survey 2008.

To supplement income from farming, households carry out various off-farm activities such as petty trading, employment in the formal and informal sectors as well as selling labor to generate income for their livelihoods. In terms of wealth group, well endowed households depend to a larger extent on off-farm income such as paid employment and self employment while poorly endowed households depend only on income from farm activities (crops, fruits and livestock).

Expenditure profiles

In the study areas, about 48% of the total reported expenditure is spent on consumables, 19% on medication, and 11% for educational payment (Table 13). In terms of wealth category, well endowed households spend more in tobacco and fuel, paraffin and wood, while the poorly endowed households spend more money in medicinal fees.

[4]AKZ is called Angolan Kwanzas. The official rate in August 2008 was: 1USD=75 AKZs.

Table 13. Expenditure patterns of households in the study areas.

	Cacuaco	Lobito	Whole sample
Total expenditure (AKZs Millions)	3.9	1.6	
Consumption expenditure (% of total)			
Staple foods/snacks	39	47	41
Tobacco/Alcohol	10	0	7
Other expenses (% of total)			
Educational fees	9	14	11
Medical expenses	15	26	19
Clothing	17	5	14
Fuel-wood, paraffin, etc	3	2	3
Remittances to relatives	2	1	1
Social contributions	1	2	1
• Miscellaneous (bicycle repairs, gifts, etc)	4	3	3

Source: DTMA/Angola Survey 2008.

4.4. Impact of shocks on household livelihood outcomes

Farm households face a number of threats and livelihood shocks in their day to day lives. Sample households indicated that illness, food insecurity, and drought were the three most important challenges of livelihoods in the study areas. Medication expense was accordingly indicated to be the second most important expense item after food. The problem of food insecurity is essentially due to the deficit in maize production in both districts. Sample households were asked to list the sources of livelihood risk and shocks. About 27 sources were mentioned including too much rain and flooding, drought, plant pests and diseases, bird attack on crops, low maize price, animal diseases, loss of farm land, and increasing input prices (in order of importance).

4.5. Production and price risk

The results of the survey also showed that about 50% of the households experienced crop failure due to drought at least two times over the last 10 years whereas about 75% of the respondents have been facing crop failures due to drought every three years over the last 10 years. In terms of wealth groups, the poorly endowed households experienced two crop failures due to drought in the last 10 years whereas the well-endowed ones only experienced one crop in one season over the same period – showing the vulnerability of the poorly endowed households to drought.

Only 25% of the households indicated to have sold any assets mainly to buy food for the family. While assessing riskiness of crops based on yield variability, maize was indicated by 68% of the households as the most risky. With regard to farmers' ways of increasing or compensating for maize productivity and/or profitability, 38% of the respondents tend to increase their land allocation to maize production, 28% grow other cash crops and 14% diversify their crop production.

The most important strategy (according to 72% of the respondents) to reduce the production risk was to follow advice from the agricultural extension staff. Engaging in off-farm activities (13%) and diversification of agricultural activities (12%) were also indicated to be important strategies. It must be noted that factors like changes in grain price, yield, fertilizer price, and credit availability had no influence on the increase or decrease of cultivated crop area of households in the study areas.

In terms of produce price fluctuations, maize is the most risky crop (63% of interviewed respondents). The most important strategies used in the selected study areas to reduce or eliminate price risk are immediate sale (13% of respondents) and asset accumulation (11% of households)

5. Technology use in crop production

5.1. Input use by farm households

The use of agricultural inputs is not widespread as the communities are engaged in subsistence oriented low input agriculture. In the whole of Cacuaco and Lobito municipalities, only 5.8 and 6.6 tons of fertilizer were applied in the 2006/07 cropping season respectively. The use of herbicides and insecticides is even less with only 12 and 37 liters of herbicides and insecticides respectively, used in Cacuaco Municipalities.

The most important production decisions farmers make are the choice of seed type and the quantity to plant. Figure 7 below illustrates the three most important attributes of desired maize variety by the households: yield potential (74% of respondents with large predominance in Lobito Municipality, 78%); cob size 16% of respondents; and performance under poor rainfall as the third factor for 10% of households.

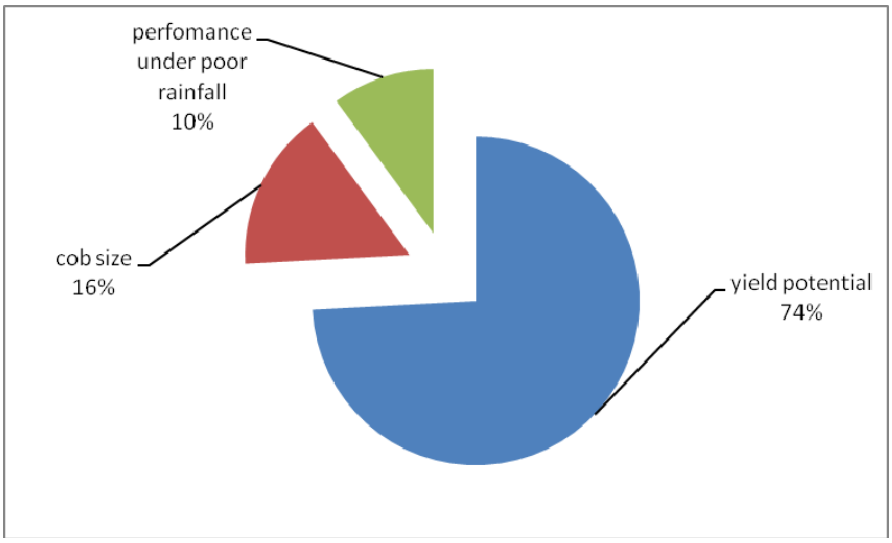

Figure 5: Three most preferred traits of maize seed

An effort was made to estimate the quantity of inputs, especially maize seed that was planted by farmers during the 2006/2007 crop season. Farmers were asked to account for the seed planted during the major and minor seasons. Aggregated over two crop seasons, a typical household planted 14 Kg of seed on less than a hectare resulting in a total maize grain output of some 600 Kg (Table 14).

Table 14. Maize input/output indicators (2006/07 cropping season)

	Cacuaco	Lobito
Mean cultivated maize area (ha)	0.7	0.5
Total quantity of maize seed (kg)	18	11
Total maize grain output (kg)	592	629

Source: DTMA/Angola Survey 2008.

5.2. Determinants of adoption of improved maize seeds

The adoption rate of improved maize varieties in the study areas is around 12%, with a higher rate in Lobito Municipality. In Lobito, 22% of the households have planted improved maize over the last five years, whereas 21% of the households have been planting an improved maize variety continuously since their first time of use (Table 15).

Table 15. Improved maize variety adoption level indicators

	Response	Cacuaco	Lobito	Whole sample
Ever planted any improved maize variety in the last 5 years	Yes	4	22	12
	No	96	78	88
Planting an improved maize variety continuously	Yes	5	21	12
	No	95	79	88
Planted an improved maize variety last cropping season	Yes	5	21	12
	No	95	79	88

Source: DTMA/Angola Survey 2008.

The most popular varieties planted during the 2006/07 production season were Cateta variety (33%), Vermelho (28%) and Branco (20%) – all local maize varieties (Table 16). Regarding sources of seeds, 75% of respondents saved seeds from last season (recycled seeds); 12% of households purchased seeds from the market and 10% acquired from cooperatives. The results also show that there are no agro-dealers in the study areas. When choosing seed sources, farmers indicated that they consider affordability (14%) and availability (9%) of seed.

Table 16. Maize cultivars planted by households in the 2006/7 season (%, n=150)

	Cacuaco	Lobito	Whole sample
Cateta	40	26	33
Cassenha	0	4	2
Branco	8	32	20
Amarelo	4	0	2
Dente de cavalo	2	0	1
Kalahari*	0	16	8
Kanjala	0	8	4
Mabuya*	2	0	1
Matuba*	0	2	1
Vermelho	56	0	28

Source: DTMA/Angola Survey 2008. Note: * Improved maize varieties

Factors influencing the adoption of improved maize cultivars

Given the limited extent of improved maize variety adoption (Table 15), it is imperative to look into the reasons that govern the decisions of adopting or otherwise. One of the specific objectives of this study was to identify the factors that influence the adoption of improved maize varieties.

The estimated model was found to be significant at $P < 0.001$ and has a pseudo R^2 value of 0.342 which is commendable for a binary logit model (Verbeek, 2005). The model was estimated with 13 variables that have both theoretical and empirical relevance in southern Africa maize production in general. Five of the factors considered were found to be statistically significantly affecting adoption of improved maize varieties in these two municipalities of Angola (Table 17).

Male household heads, membership in local associations, and interactions with extension staff were found to positively influence adoption. As indicated by the marginal effects estimated, if there is a

move from female to male headed households, the likelihood of adopting improved maize varieties increases by 0.081, ceteris paribus. This is an expected result as it is apparent that women have limited access to resources and information constraining them such that they are less inclined to try new practices as the expected risks are too costly.

Membership in local associations was also found to have a positive influence on adopting improved maize varieties. If the head of the farming household decides to be a member of a local level association, he/she will increase the likelihood of adopting improved maize by 0.057. This result is also in line with a priori expectation as involvement in social gatherings enhances information sharing that increases farmers' awareness about technologies thereby reducing the uncertainty that emanates from inadequate knowledge. This in line with the other important result that more interactions with extension personnel will positively influence farmers' decision to adopt improved maize technologies. One more interaction with an extension staff increases the probability of adoption of improved maize varieties by 0.042, all other factors being held constant.

On the contrary, being married and frequency of crop failures due to drought were found to be negatively related to adopting improved maize varieties in the study areas. If a household head decides to marry, then the likelihood that he/she will adopt improved maize varieties will decrease by 0.067 all other factors being constant. This can be related to the complicated decision-making process as decision of trying and adopting a new technology is usually a shared decision which can easily be undermined by the accumulation of uncertainties about the technology by family members who have a say in such decisions.

Frequency of households' experience of crop failure due to drought over the last 10 years was also negatively associated with adoption of improved maize varieties. A single crop failure due to drought decreases the likelihood of adopting improved maize varieties by 0.034, holding all else constant.

Table 17. Logit model estimation of factors influencing adoption of improved maize

	Coefficient	dy/dx	Std. Err.	P>z
Constant	-2.264		4.724	0.632
Gender of household head (male =1)	3.113+	0.081	1.240	0.012
Age of household head	-0.084	-0.004	0.187	0.654
Age squared of household head	0.001	0.000	0.002	0.729
Marital status of hh head (1 = married)	-1.419*	-0.067	0.804	0.078
Hh head attended primary school (1 yes, base = illiterate)	0.025	0.001	0.549	0.963
Hh head attended secondary and post secondary school (1 yes, base = illiterate)	-1.056	-0.053	0.747	0.158
Hh head attended adult education (1 yes, base = illiterate)	0.590	0.030	0.817	0.471
Total family size	-0.023	-0.001	0.189	0.902
Experienced shortage of cash (1 = yes)	0.338	0.015	1.429	0.813
Member of local associations	1.132+	0.057	0.450	0.012
Frequency of interaction with extension agent	0.832‡	0.042	0.276	0.003
Total crop farm size (ha)	0.178	0.009	0.337	0.597
Experience of crop failure due to drought over the last 10 years	-0.671*	-0.034	0.385	0.081
N = 135				
LR chi2(13) = 36.24	Prob > chi2 = 0.0005		Pseudo R2= 0.3418	

Source: DTMA/Angola Survey 2008. ‡, +, and * denote significance at 1%, 5%, and 10% statistical error.

6. Conclusions and recommendations

This study characterized maize producing farm households in Cacuaco and Lobito Municipalities of Angola, including assets and maize production indicators, varieties grown and preferred by households, and factors that can enhance adoption of improved maize varieties. The information has some implications for priority setting, construction of indicators to be used to measure the changes in the adoption of improved maize varieties and impact on adopting households.

The mean age of the households in Cacuaco and Lobito municipalities was about 48 and 50 years, respectively. The average size of households in both municipalities is seven members. The proportion of households who attended primary, secondary or post secondary school was about 69%. The sample of 150 households comprised 42% female-headed and 58% male-headed households. The corresponding mean wealth indices for well endowed female and male headed households were 1.562 and 1.007, respectively. These figures roughly show that females are somewhat more endowed than men in the study areas.

Poorly endowed households have 2.98 hectares of total farm land against 1.77 hectares held by the well endowed households, but well endowed households cultivate their total farmland while poor endowed households cultivate only half of their farm land. The average land use intensity was higher in Cacuaco Municipality.

The use of agricultural inputs is not wide spread as the communities are engaged in subsistence oriented low input agriculture. Only 5.8 and 6.6 tons of fertilizer were applied in the last cropping season in the whole of Cacuaco and Lobito municipalities respectively. The use of herbicides and insecticides was even less at only 12 and 37 litres of herbicides and insecticides, respectively, used in Cacuaco Municipality.

Regarding sources of seeds, most of respondents used saved seeds from previous harvest. The results also show that there are no agro-dealers in the study areas. When choosing seed sources, farmers indicated that they consider affordability and availability of seed. In the two municipalities, maize is planted on more than 50% of the cultivated areas. The most popular varieties planted during the 2006/07 production season were all local: Cateta, Vermelho and Branco. The important characteristics desired by the households in the maize varieties were yield potential, cob size and performance under poor rainfall. The Logit model showed that male household heads, membership in local associations, and frequency of interaction with extension staff were found to be positively influencing adoption of improved maize varieties.

Maize yields are correspondingly low. In terms of the estimated energy requirement per household, the results show that households in both selected municipalities do not produce sufficient maize to meet their food requirements, even if they consumed all maize they produced. Farmers have limited options to generate cash income to settle day to day expenditure.

About 91% and 82% of the farmers in Cacuaco and Lobito municipalities, respectively, had not received credit. The constraints to obtain credit were the absence of credit facilities in the areas and the lack of collateral to guarantee credit. The formal credit system needs to address these problems.

The main sources of extension messages were agricultural extension staff and radio. The study recommends that in addition to the traditional means of information provision for disseminating and promoting new technologies used by the extension services, attention may be focused on the use of mass media like radio, television, mobile phone, etc to facilitate the adoption of improved maize varieties. The formation of farmer groups should be encouraged, because working with groups tends to increase information access.

Both municipalities are prone to drought. Drought tolerant maize varieties with good yield potential, large cob size and performance under poor rainfall may thereby provide a valuable option to enhance famers' livelihoods whose income is predominantly derived from agriculture.

7. References

Cortinovis, I., V. Vela, and J. Ndiku. 1993. Construction of a socio-economic index to facilitate analysis of health in data in developing countries. *Social Science and Medicine,* 36: 1087–97.

Filmer D. and L.H. Pritchett. 2001. Estimating wealth effect without expenditure data – or tears: an application to educational enrolments in states of India. *Demography,* 38: 115–32.

IIA/Minader, Janeiro de 2008. Viabilidade técnica, economica e social da criação do ENIA.

McKenzie, D.J. 2003. Measure inequality with asset indicators. BREAD Working Paper No. 042. Cambridge, MA: Bureau for Research and Economic Analysis of Development, Centre for International Development, Harvard University.

Montgomery, M.R., K. Gragnolati, A. Burke, and E. Paredes. 2000. Measuring living standards with proxy variables. *Demography*, 37: 155–74.

Runge-Metzger, A. 1988. Variability in agronomic practices and allocative efficiency among farm households in Northern Ghana: A case study in on-farm research. Nyankpala Agricultural Research Report No. 2. Nyankpala, Tamale, Ghana.

Verbeek, M. 2004. A Guide to Modern Econometrics. Second Edition. John Wiley and Sons Ltd, The Atrium, Southern Gate, Chichester, England.

Zezza, A., B. Davis, C. Azzarri, K. Covarrubias, L. Tasciotti and G. Anriquez. 2008. The Impact of Rising Food Prices on the Poor. Food and Agriculture Organization, Rome.