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THE MARKET LINKAGES INITIATIVE

FY2010 Annual Report
October 1, 2009 – September 30, 2010

October 2010

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ACDI/VOCA	Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
ACE	Agricultural Commodity Exchange
ACTESA	Alliance for Commodity Trade in Eastern and Southern Africa, an agency of COMESA
AGRA	Alliance for Green Revolution in Africa
CEO	Chief Executive Officer
COMESA	Common Markets for Eastern and Southern Africa
COMPETE	Competitiveness and Trade Expansion Program
CRS	Catholic Relief Services
DRC	Democratic Republic of Congo
EAGC	East Africa Grain Council
EGAT	Economic Growth and Trade
EOI	Expression of interest
Esoko	Web based commercial market information service
ETG	Export trading group
ETU	Export Trading Uganda
Dr.	Doctor
FACET	Fostering Agriculture Competitiveness Employing Information and Communications Technology Program
FAMIS	Food and Agricultural Marketing Information System
FFP	Food for Peace
GBC	Grain Bulking Center
GBS	Grain Bulking System
GIS	Geographical information system
GPS	Global positioning system
LEAD	Livelihoods and Enterprises for Agricultural Development project
M&E	Monitoring and Evaluation
MACE	Malawi Agricultural Commodity Exchange
MALEZA	Malawi Enterprise Zone Association, a Local NGO
MIS	Market Information System
MLI	Market Linkages Initiative
MT	metric tons
P4P	Purchase for Progress
REGI	Regional Economic Growth & Integration
USAID	United States Agency for International Development
USG	United State Government
USD	United Sates Dollar
VAC	Village Aggregation Center
WFP	World Food Program

EXECUTIVE SUMMARY

The Market Linkages Initiative (MLI) is a 2-year project funded by the Famine Prevention Fund with activities supporting the project goal: *to promote growth in food staples and food security by integrating smallholder staple food producers into national and regional markets*. This report outlines the progress of project activities implemented in first year of the project.

During the year under review, MLI awarded a total grant of US$ 1,122,530 to 15 grantees in Northern Corridor and Malawi. Nine of these grants worth US$ 1,066,030 relate to Grain Bulking System (GBS) activities that link village aggregation centers to grain bulking centers and onward connections to wider national and regional markets, to farmer training activities, and support to ACTESA. MLI awarded a grant to Danya International, a specialized ICT and M&E consulting firm to develop a communication strategy for Alliance for Commodity Trading in Eastern and Southern Africa (ACTESA). Aside meeting ACTESA's wider communication needs, this strategy will define communication protocols of project-supported service forums. Grants worth US$72,500 were awarded to business development partners to support potential grantees in developing their business plans and proposals. By the close of the year, 31 business plans and proposals had been developed. It is expected that 43,498 smallholder farmers will benefit from the approved grants.

In the Malawi project activity, the Esoko MIS platform is up and running in readiness for a merger with current spot price information services for its roll out to smallholder farmers and other market actors. The success of this process follows a wide stakeholder discussion among MIS partners in Malawi. The process was supported by a consultancy funded by USAID/AFR/SD/EGEA's FACET (Fostering Agriculture Competitiveness Employing Information and Communications Technology) program. The consultations resulted in the development of an MIS design report which proposed Esoko as the best model for adoption in Malawi.

In its efforts to expand and strengthen grain bulking system operations, the MLI supported a total of 6 grain bulking systems with grants to expand and equip their warehouses. This has resulted in to a total of 2910 metric tons of commodities valued at US$ 523,800 passing through the storage facilities of Chitsosa Trading Company and Nuru Kenya. The other 4 supported Grain Bulking Center (GBC) will reflect its volumes in FY2011 reporting period. Despite the sterling performance of the first MLI grantees, the project witnessed delays in awarding grants to implement farmer training program. However, the project has already developed and translated crop conditioning manuals for all targeted crops as well as basic MIS training materials to introduce farmers to the benefits of and prepare them to use project supported MIS. Additionally, a training grant has already been awarded to MALEZA, a local NGO in Malawi and the integration of training component in Nuru and ETU proposals will result to training of 10,500 farmers in Kenya, Uganda and Malawi.

In summary, the project managed to achieve 55% level of performance in its key indicator of „*volumes and value of commodities flowing into USAID supported storage'*. Despite this, MLI exceeded its annual targets in the number of small holder farmers participating in Grain bulking System operations and the number of market development actors using platforms to share information and experiences by 201% and 200% due to existing network of village aggregation centers (VAC) among the supported GBCs and the fact that MLI technical staff provided support to an existing Agro enterprise platforms being spearheaded by Catholic Relief Services (CRS) with existing users. The table below gives a snapshot of project's achievement indicated higher level project outcomes.

Table 1

Indicator	FY10 Targets		FY2010 Achieved		% Achievement	Variance Explanation
Volumes and value of commodities flowing into USAID supported storage(level 2 storage)	Volume in metric tons	Value in US dollars	Volume in metric tons	Value in US dollars	55%	Due to delays in the development and approval of GBC grants, full targets have not been reached at the one year mark. However, volumes and values are running at 55% of targets with only 67% of GBC's target reached. This suggests that MLI will significantly meet commodity volume and value targets when all grants have been awarded as in grant pipeline.
	6000	1,080,000	3290	592,200		
Number of small holder farmers participating in Grain bulking System operations	1175 males		1950		166%	The project has surpassed this target due to the fact that the first project supported GBCs have extensive VAC networks and excellent relationship with its supplying communities. Additionally, project support has encouraged the GBCs to expand their reach and volumes.
	350 females		826		236%	
Number of market development actors using platforms to share information and experiences	4		8		200%	CRS, ACDI/VOCA, World Fish, World Vision, Land O'Lakes, ACTESA, WFP (P4P) and USAID are currently using a platform initiated by CRS. MLI supports this platform through its commodity marketing specialist who serves as board member.

In summary, FY2010 has set a solid foundation of ensuring that over 65,000 smallholder farmers in MLI's 7 target countries participate through a network of 406 village aggregation centers to deliver over 96,000 metric tons of high quality staple food commodities valued at over US$ 12 million to national and regional markets during the project lifespan.

1 PROJECT BACKGROUND

Implemented by CARANA Corporation in conjunction with ACDI-VOCA, the Market Linkages Initiative (MLI) is a two-year activity funded by the Famine Prevention Fund. This activity is managed by USAID East Africa's Regional Food for Peace mission, and Regional Economic Growth and Integration office. The project seeks to promote growth in food staples and food security by integrating smallholder staple food producers into national and regional markets. The MLI specific goal is to integrate smallholder farmers' production into strengthened markets. The project is expected to achieve this goal through four key result areas:

1. Expansion and strengthening of grain bulking system (GBS) operations in target locations

2. Enhancing the capacity of producer groups and farmers to integrate into GBS

3. Supporting GBS operations by relevant market institutions

4. Developing institutional platforms that disseminate lessons learned and best practices

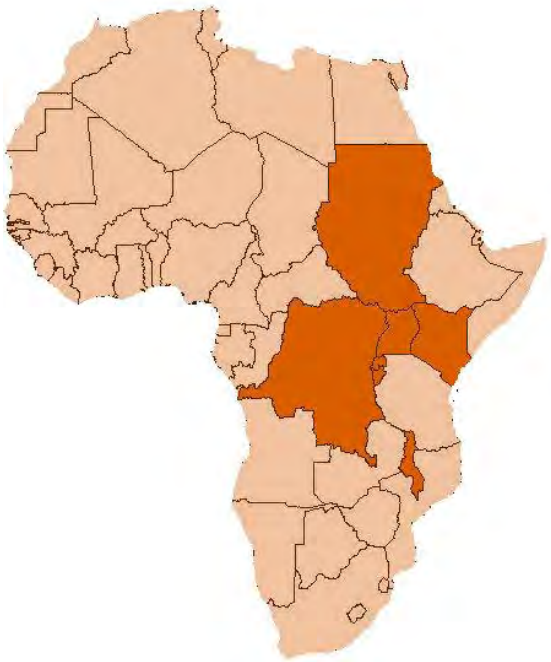
These key result areas are expected to interact resulting to integration of smallholder farmers' into more efficient and structured markets.

Figure 1 Improving quality of grains through winnowing and drying

2 PROJECT COVERAGE

MLI project covers target locations in 7 countries: Malawi, Uganda, Kenya, Rwanda, Burundi, South Sudan and Northern DRC (Kivu region). Project interventions focuses primarily on staple food commodities, as identified by MLI team and its strategic implementing partners in each country. These commodities range from grains, pulses and the root tubers. The choice of which food commodities constitute a staple food for MLI support were informed by the consumption levels, ACTESA's priority list of food staples and practicability of utilizing storage to enhance the trade for each of identified commodities.

Figure 2 – Shaded area represents MLI's target countries



2.1 PROJECT OPERATING ENVIRONMENT IN THE YEAR UNDER REVIEW

In Kenya, it is expected that the current harvest period (October 2010 through January 2011) will result in a bumper harvest. As a result, the price of maize in Kenya has dropped from about Kshs 2,300 per 90 kg bag in August 2009 to Kshs 1,100 in August 2010.

In Rwanda, the government is actively involved in agricultural marketing. During the first harvesting season (January-March 2010), the government recommended a retail purchasing price of Rfc 120/kg. In the second harvesting season (August-September 2010), the Rwandan government provided soft loans to some grain trading companies to buy maize at Rfc 180/kg. However, the maize market price has since dropped back to Rfc 120/kg, and is expected to drop further due to entry of cheaper Ugandan maize from November 2010.

Uganda's main food crops include plantains, cassava, maize, sweet potatoes, millet, sorghum, beans, and groundnuts while coffee, cotton, tea, and tobacco constitute the major cash crops. Maize ranks third most important staple food in Uganda, in terms of caloric intake. According to the 2005 Ugandan National Household Survey (UNHS), maize is the most widely grown crop in the country. Nationally, about 57% of farm households grow maize. The highest percentage growing maize is found in the eastern region (78%) and offers farmers some measure of liquidity and flexibility, since it can be dried and stored, fed to livestock, consumed, or sold for cash. Maize production averaged 1.2 million tons annually between 2005 and 2007, up from about 0.6 million tons in the early 1990s (FAO, 2009). Maize surplus is estimated at over 1.0 million tons annually as of 2010.

According to Malawi Enterprise Zone Association's (MALEZA) proposal submitted to MLI, grains constitute the largest percentage of agricultural commodities grown in Malawi. It utilizes the most acreage and provides income to smallholder farmers who produce in excess of 80% of all Malawi's agricultural production. As a result, maize, has huge economic and political implications, and accounts for 60-70% of per capita calories intake. Recent developments in the grain sector in Malawi highlight an increasing trend towards liberalized markets.

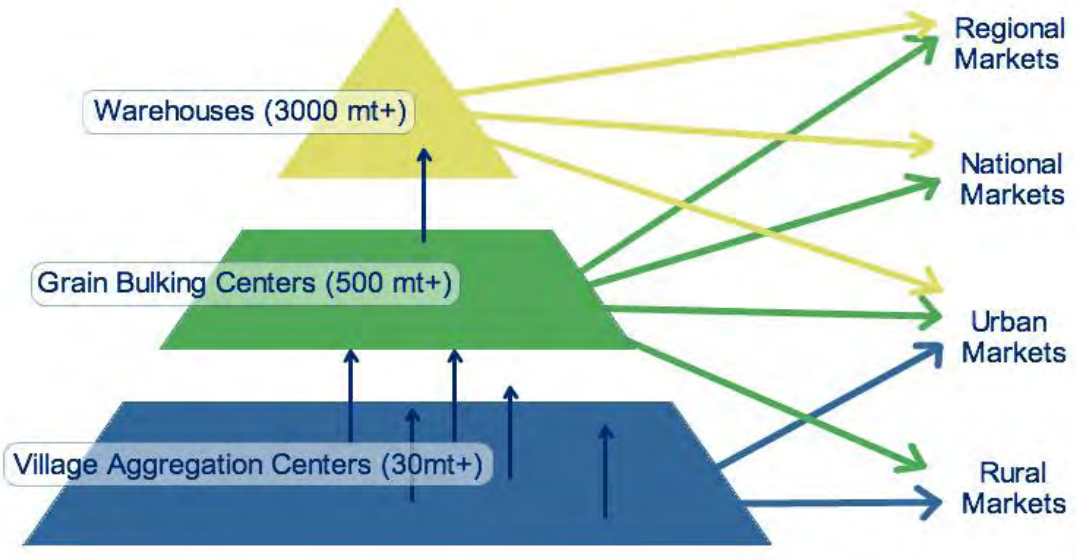
In Burundi, DRC and South Sudan, MLI will work closely with other partners to implement its activities due to weak private sector involvement, physical insecurity, and political uncertainty. This approach is also more cost efficient than hiring permanent in countries where the project will not have many grant activities due to reasons mentioned above. In addition, the approach has the benefit of using partners' employees who understand the operating environment well; such partners included ADRA, WFP, FH, and BRAC.

3 PROJECT STRATEGY

The strategic approach adopted by MLI project is derived from a systemic examination of the major factors that hinder smallholder farmers' access to markets in the target countries. Poor on farm crop conditioning and inadequate storage facilities were identified through stakeholder consultations as key limitations on smallholder farmers' access to markets. Furthermore, smallholder farmers' regular participation in markets is limited by the unreliability of market off take. During the project inception phase, the MLI team undertook a rapid analysis of the context in each of the target countries and identified key opportunities within smallholder farmers' agricultural marketing environment. The project team identified integrated storage systems and increased access to markets as having the best potential of resolving the challenges that hinder small holder integration to markets. The summary findings of the consultative process by MLI team in the target countries are attached in the annex of this report.

The presence of under-utilized storage capacity at national levels spelled unique prospects for integration of smallholder farmers' production within integrated storage systems as illustrated in the pyramid below (figure 3). Under utilization of storage is due in part to poor integration of harvest surplus commodities from the farm level. The project works to catalyze the integration of smaller stores (~30 mt) at the village level with the larger grain bulking centers. These village aggregation centers are generally be operated either by the larger grain bulking center staff, producer groups or SMEs. Larger GBCs and warehouses sustain these VACs are sustained through cash payment for commodities delivered, provision of price information and transportation of bulked commodities.

Figure 3



4 NARRATIVE SUMMARY OF PROGRESS TO DATE

4.1 ADMINISTRATIVE AND PROJECT INCEPTION ACTIVITIES

At the beginning of the year, the MLI team mobilized to Nairobi and Lilongwe office premises. The Nairobi-based team is housed in furnished offices in an insurance building on Milimani road. These offices were identified during the initial trip to Nairobi with Senior CARANA officials. The Malawi team was initially housed in the Agricultural Commodity Exchange premise but later moved to a more spacious building where each staff had enough space convenient for working in area 11. By the end of February 2010, the MLI project had finalized all the registration and acquisition of equipment and staffing.

In terms of staffing, by the end of the year, the project was well staffed with all key positions filled. Staffing needs were reviewed before the end of September 2010 and new positions created for greater project implementation in the project's second phase.

As part of project inception, the MLI team developed and submitted the Performance Management Plan (PMP) early in the year. The PMP document was developed following extensive review of relevant studies and documents, extensive consultations with various project stakeholders in all target countries, including USAID bilateral missions, implementing partners of food security and market development projects, host-country agricultural officers, and key traders in food staples.

The PMP was approved by USAID and has formed the basis for implementation and monitoring project performance. This report therefore draws its contents from the achievements of the set targets in the PMP. Additionally, the midterm review by MLI team resulted in revisions in the PMP which is captured under SECTION 4.5 of this report and revised PMP in the annex.

4.2 TECHNICAL ACTIVITIES

4.2.1 GRANTS IMPLEMENTATION

During the year, MLI received a total of 204 expression of interest (EOI) from potential grantees. This followed a series of grant workshops that was held in Kenya, Uganda, Rwanda and Malawi in addition to advertisements put in newspapers across MLI target countries. Of these EOIs, 9 of them have matured to grants worth US$ 1,066,030 being awarded to successful applicants in the Northern Corridor and Malawi. Additional grants were awarded to business development partners who supported potential grantees in developing their business plans and proposals. By the close of the year, 31 business plans and proposals had been developed with project support with 43,498 projected to benefit from the approved grants. The table below summarizes the achievements of the MLI's grant facility

Figure 4 – MLI Chief of party explain the grant process to workshop participant

Table 2

Country	Number of EOI's/concept notes submitted	Business plans/proposals prepared with MLI support	FY2010 approved GBS related grants and total value	Expected Beneficiaries
Kenya	50	5	2 (US$216,510)	5300
Uganda	60	11	2(US$ 417, 756)	6000
Rwanda	35	5	1(US$ 105,952)	18,000
Burundi	7	0	0	0
DRC	3	0	0	0
South Sudan	1	0	0	0
ACTESA	-	-	1 (US$50,301)	ACTESA
Total NCA	**156**	**21**	**6(US$ 790,519)**	**29,300**
Malawi	48	10	3(US$275,511	14, 198
G. Totals	**204**	**31**	**9(US$ 1,066,030)**	**43,498**

4.2.2 CROP CONDITIONING

The materials collected through stakeholder engagement on crop conditioning best practices in Kenya, Uganda and Malawi have been compiled into a crop conditioning manual. The project has designed a training handbook for improved crop conditioning practices for maize, beans, groundnuts and rice. The information gathered, covers practices including but not limited to harvesting, shelling, husking and winnowing, drying, grading, pests and disease control, mold and aflatoxin control (especially for maize and groundnuts), bagging and packaging. The manual, which was circulated to other implementing partners in Kenya, Malawi and Uganda as

well as to some MLI target beneficiaries, such as farmer organizations has received positive feedback on its contents and expected usefulness in training smallholder farmers.

Figure 5 – Solar drying of groundnuts

Initially, MLI will produce 1000 copies of the handbook for wider circulation and use among key implementing partners and published by ACTESA's farmer training service forum, for free and open access to all "*community of practice*" partners. A copy of crop conditioning handbook is attached as an annex to this report.

4.2.3 STORAGE ANALYSIS

In FY2010, the MLI team compiled the information collected and analyzed through field surveys of existing grain storage facilities (more than 300MT) along the main grain trading routes in Uganda:

- Kampala (Old Industrial Area, Nakawa, Ntinda, Bweyogerere) – Seeta – Mukono – Jinja - Iganga – Tororo – Busia – Kapchorwa – Mbale – Soroti – Lira – Pader – Kalong – Kitgum – Gulu

- Kampala (Maganjo, Kawempe, Bwaise) – Nakaseke – Luwero – Masindi – Kigumba – Bweyale - Amuru

- Kampala – Kiboga – Hoima - Kibale

- Kampala/Nalukolongo Industrial Area – Mityana – Mubende – Kyenjonjo – Fort Portal – Kamwenge – Kasese – Rwimi – Bushenyi

- Kampala – Mpigi – Masaka – Kyazanga – Lyantonde – Mbarara

Figure 6 – Modern grain store ensures good post harvest crop handling

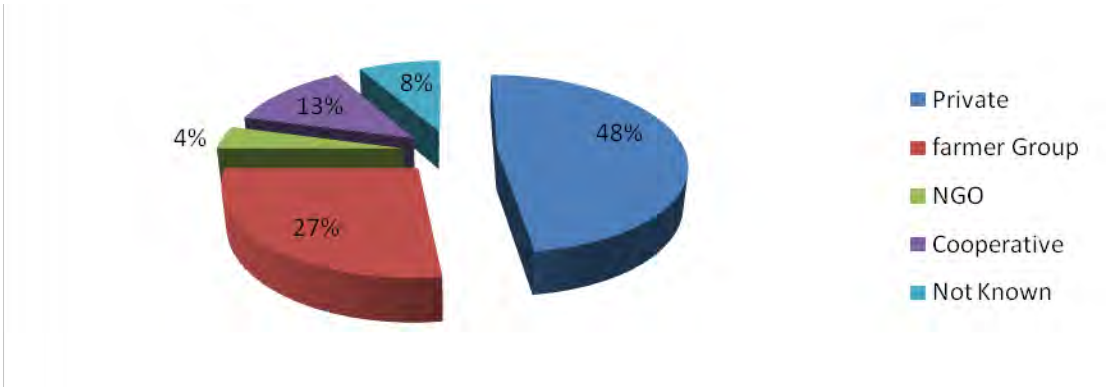
The storage mapping report located a number of grain storage facilities and captured useful data on agronomic practices, farming systems, staple grain commodities stored and land ownership in various districts of the selected routes. In addition, the report highlighted a summary of the total number of active warehouses and their capacities as categorized by potential volumes; 300 – 1000MT, 1001 – 3000MT, 3001MT – 9000MT and over 9000MT capacities. The process has resulted in the production of the following key documents:

- GPS Map of 53 active grain storage facilities – this exercise was carried out with the assistance of the USAID Uganda Mission Database Specialist; and

- Google Map of the above facilities with details. This was accomplished with the support of a GIS specialist and the map is temporarily located at http://marketlinkages.webs.com/

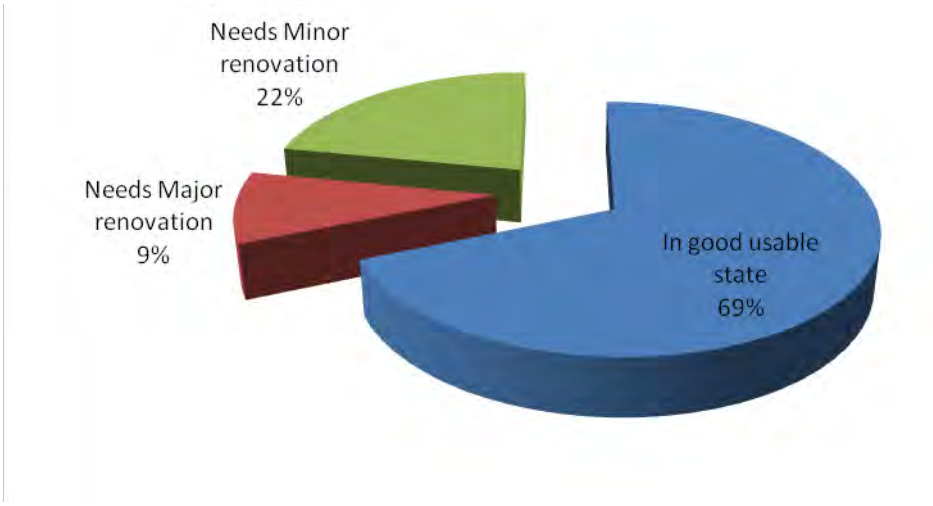
In one of the survey reports, it was found out that 48% of the stores along the target routes were privately owned while 27% were owned by farmer groups, 13% cooperatives and 4% NGO as illustrated in the chart 1 below; 8% of the facilities were categorized as not known because the findings could not establish real owners.

Figure 7 – Category of ownership of stores



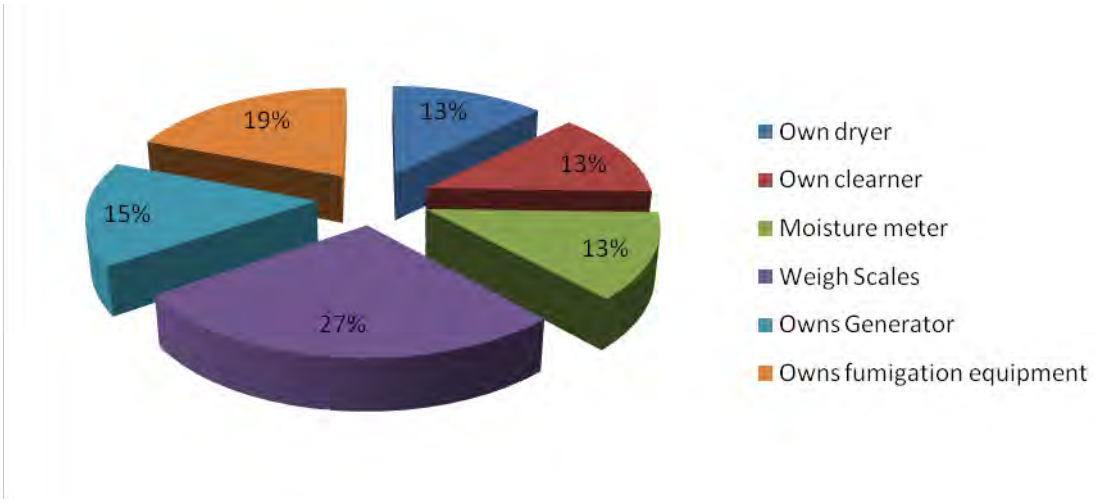
The report further revealed that 69% of the storage facilities surveyed were in good usable state, 22% needed minor renovations and 9% needed major renovations. The findings are illustrated in chart 2 below.

Figure 8 – State of store



In terms of ownership of equipment necessary for the proper handling of grain, the survey showed that 27% own weighing scales which ranged from weigh bridges to hanging and platform weigh scales, 13% own a dryer, cleaner and moisture meter, 19% and 15% owned fumigation equipment and a generator respectively. Chart 3 below illustrates the findings.

Figure 9 – Produce/grain handling equipment owned by stores



The two maps and data analysis has been shared with other partners such as LEAD, COMPETE, WFP P4P and USAID for proper planning and coordination of assistance to grain storage facilities in Uganda. This has resulted in complementarities of development efforts by strategic partners focusing on grain bulking system operators and market actors reducing the chances of effort duplication.

4.2.4 MARKET INFORMATION SYSTEM (MIS) ESTABLISHMENT IN MALAWI

In FY2010, MLI facilitated a stakeholder workshop with MIS partners in Malawi. The process was supported by a consultancy funded by USAID/AFR/SD/EGEA's FACET (Fostering Agriculture Competitiveness Employing Information and Communications Technology) program. FACET consortium member ACDI/VOCA mobilized two experts in market information systems (MIS) and marketing extension, Dr. Shaun Ferris and Dr Andrew Sergeant, to assist MLI-Malawi in identifying an adequate MIS solution. The team of MIS experts held roundtable discussions with private sector partners and other MIS stakeholders including USAID, NGOs, and the government. The consultations resulted in a MIS design report, which recommended a public-private partnership approach to MIS in Malawi; this approach is aligned to Malawi's Agricultural Sector-wide Approach. The following areas formed the basis for MIS service providers' evaluation:

- Ability to provide valued market information to different customer segments in grain bulking systems
- Suitability to be rapidly deployed
- ICT enabled to provide real time information
- Scalability beyond the needs of the MLI project
- Financial profitability and sustainability
- Replicable (i.e. a solution that could be used by other clients in different contexts)

From these criteria, Esoko a market information platform originally developed in Ghana, now with presence in several African countries, emerged as the most practical and commercially-oriented among five options considered that could be realized within MLI's remaining 11 months of program timeframe. Esoko is designed as a commercial market information service that can be rapidly deployed to support smallholder farmers within specific value chains as an embedded service through a number of local companies.

The Esoko platform is currently up and running and MLI team has undertaken market characterization studies to merge current spot price information services into Esoko platform.

Figure 10 – MIS expert explain to stakeholders the different models including Esoko

4.2.5 COMMUNITY OF PRACTICE

MLI has supported ACTESA to work on its communication strategy by identifying and providing a consultant to finalize its communication strategy. The consulting firm, Danya Inc. will undertake the process by:

- Conducting a Strategic Communications Assessment
- Developing ACTESA Communications Plan
- Participating in ACTESA Communications Plan Feedback Session
- Producing final communication strategy for ACTESA

Other areas identified for collaborative work between MLI and ACTESA include:

- Review of FAMIS and its relevancy to ACTESA's objectives
- Establishing 3 – 4 learning alliances – which will be platforms to share lessons learned and best practices. These areas of learning include farmer capacity building, Agro Enterprise Learning Alliance; storage (including warehouse receipts), and a platform to share the lessons learned from the P4P initiative.

4.3 DESCRIPTIVE ACHIEVEMENTS PER KEY RESULT AREA

4.3.1 KEY RESULT AREA 1: GRAIN BULKING SYSTEMS OPERATIONS EXPANDED AND STRENGTHENED IN TARGETED LOCATIONS

MLI devoted significant time upfront to include a broad spectrum of stakeholders in a range of discussions designed to identify key constraints in the commodities market. Input from agro-processors, large and SME traders, farmers' organizations, NGO's, donors and government were all used to develop the MLI strategy of targeting intermediate storage (level 2) as a key constraint in the development of a more competitive commodities sector, as well as the key player in developing improved market linkages with small-holder farmers. This investment of time and resources in an open and participative process resulted in submission of 204 expressions of interest and concept notes from a wide range of organizations. This range and number of responses has allowed the project to focus resources more effectively on those options which offer the greatest sustainable impact on small-holder farmers.

To date, MLI has awarded grants to 9 GBS related grants worth US$ 1,066,030 and a further US$ 72,500awarded to business plan development consultants to support GBS operators come up with sound business plans and proposals. By the close of the year, 31 GBS operators had developed business plans and proposals with support from MLI. The GBS operators will benefit a total of 43,498 smallholder farmers once implemented.

During the year under review, MLI managed to support GBS operators' aggregate 2910 metric tons of grains against a target of 2200 metric tons through village aggregation centers linked to grain bulking centers. This was achieved despite GBCs 55% level of performance in the year due to wide network already established by the supported GBCs in MLI target countries.

4.3.2 KEY RESULTS AREA 2: CAPACITY OF PRODUCER GROUPS AND FARMERS TO INTEGRATE INTO GRAIN BULKING SYSTEMS ENHANCED

MLI has exceeded the 12 month targets in terms of the volume and value of commodities being sourced directly from small-holder farmers at village aggregation centers. The achievement of this target is a result of the exceptional rural buying network of the first MLI GBC grantees, Chitsosa Trading and Nuru Kenya. In the period since grant approval, Chitsosa Trading has purchased 2,100mt of commodities from 30 VACs in addition to 810mt purchased by Nuru Kenya through its network of 13 VACs. These VAC purchases were made from approximately 2,776 small-holder farmers, 826 of whom were females against an initial target of 2200 metric tons to be supplied by 1175male and 350 female farmers.

Despite the sterling performance of the first MLI grantees, the project witnessed delays in awarding grants to implement farmer training program. However, the project has already developed and translated crop conditioning manuals for all targeted crops as well as basic MIS training materials to introduce farmers to the benefits of and prepare them to use project supported MIS. Additionally, a training grant has already been awarded to MALEZA, a local NGO in Malawi and the integration of training component in Nuru and ETU proposals will result to training of 10,500 farmers in Kenya, Uganda and Malawi in FY 2011.

4.3.3 KEY RESULTS AREA 3: GRAIN BULKING SYSTEM OPERATION SUPPORTED BY RELEVANT MARKET INSTITUTIONS

In the first year of the project, MLI has made great progress on investigating, selecting and laying the groundwork for implementation of a sustainable MIS system for Malawi. Early on, the MLI team benefited from a consultancy funded by USAID/AFR/SD/EGEA's FACET (Fostering Agriculture Competitiveness Employing Information and Communications Technology) program. FACET consortium member ACDI/VOCA mobilized two experts in market information systems (MIS) and marketing extension, Dr. Shaun Ferris and Dr Andrew Sergeant, to assist the project identify a MIS solution that would address the needs of farmers and GBCs to improve the efficiency and connectivity of commodity markets. This MIS mission held a roundtable discussion with private sector partners and other MIS stakeholders including USAID, NGOs, and the government. At the request of the government, the project also worked with ACE and MACE in Malawi on improvements in their MIS activities which would be coordinated and supported through the activities of MLI.

FACET's consultations resulted in the development of an MIS design report which in turn informed the selection of Esoko, a 3rd party short message service(SMS) based ICT platform as the basis for MLI's MIS development strategy. Rather than re-invent a public system for data collection and broadcast of market information, MLI through the licensing of the Esoko platform, will increase the existing functionality and sustainability of MIS to include commercially valuable services (polling, targeted marketing, and order matching) which can subsidize the public good aspects of price discovery, extension messaging, weather, etc.

In preparation for expected roll-out in October 2010, Esoko system testing has already been conducted in cooperation with MACE in Malawi. An MIS training manual for farmers has been developed to introduce the concept of MIS, explain its use, and potential benefits. This sensitization of the new technology will be key to the initial adoption by farmers. The project has

also already designed standard profiles which GBC operators will use it to enroll farmers in the MIS system. To ensure initial uptake and piloting of the technology, MLI will explicitly include MIS usage milestones in all GBC grants.

As recommended by the PS for Agriculture and Food Security, Dr. Daudi, MLI has worked intensively with MACE and ACE to develop proposals to incorporate Esoko functionality into the organizations to improve efficiency and develop commercially sustainable services. Both organizations have submitted proposals and MLI is currently refining them prior to approval. MLI is already undertaking market characterization studies which will allow the smooth transfer of existing MACE market spot price information services to the Esoko platform.

Negotiations with Esoko on the country licensing fee and the rate schedule for users are in their final stages and it is expected that Esoko will begin in Malawi early in FY2011. Concurrent with these negotiations, MLI is developing a MIS business model document which will lay out the costs, markets, potential revenues and management issues involved in owning the country license for Esoko. As MLI and partners gain experience in the coming months, this document will be amended, and will eventually serve as a resource for entities that seek to take over the license on a commercial basis.

Despite laying a firm foundation on the MIS project, the project is yet to link 400 users to the Esoko platform owing to delay in training the targeted smallholder farmers.

4.3.4 KEY RESULT AREA 4: INSTITUTIONAL PLATFORM WHICH DISSEMINATES LESSONS LEARNED AND BEST PRACTICES DEVELOPED

MLI has awarded a grant to Danya Inc. to support ACTESA develop its communication strategy. The finalization of this communication strategy will stipulate the prioritized service forums and the number and type of platforms necessary for information sharing among "*community of practice"*. It is expected the ACTESA's communication strategy will be ready by end of November 2010 paving way for the implementation of other intermediate results associated with this outcome. Despite the delay in finalization of ACTESA's communication strategy, other market actors have continued to use a CRS led Agro enterprise platform with MLI technical support through participation of MLI's commodity marketing specialist in board meetings of the platform.

4.4 INDICATOR TRACKING TABLE

Table 3

Indicator	FY2010 target	FY2010 achieved	Achieved/ Target (%)	Variance explanations
MLI Result Area 1: Grain Bulking Systems operations expanded and strengthened in targeted locations				
Volumes of commodities flowing into USAID supported storage(level 2 storage)	6000	3290	55%	Due to delays in the development and approval of GBC grants, full targets have not been reached at the one year mark. However, volumes and values are running at 55% of targets with only 67% of GBC's target reached. This suggests that MLI will significantly meet commodity volume and value targets when all grants have been awarded as in grant pipeline.
Value of commodities(in US Dollars) flowing into USAID supported storage	1080000	592,200	55%	
Number of Grain Bulking Systems supported by MLI	**9**	6	67%	Due to delays in the development and approval of GBC grants, full targets have not been reached at the one year mark. However, based on the current pipeline, the project expects to more than make up for this delay in quarter one of FY2011.
Intermediate Result 1.1: Integrated grain bulking systems established in strategic locations				
Number of business plans developed with project support	30	31	103%	Other grantees were able to develop their proposals with minimal support from MLI.
Number of VAC supplying grain bulking systems	90	47	52%	Again, the variance in this indicator is a direct result of slower than anticipated development and approval of GBC grant agreements; however, similar to the volume and value targets, the project has achieved 52% of the VAC target with 67% of GBC target reached. Therefore, the project is confident that supported networks will meet MLI VAC targets by end of year 2.
Number of new technologies or management practices under field testing as a result of USG assistance	3	3	100%	The project has exceeded the target for this indicator. Project supported GBCs are already applying improved management practices in the form of purchase receipting and record keeping. Additionally, the project has begun field testing of the Esoko platform for MIS which, when widely applied to GBC grantees, will leverage current record keeping practices to power much more sophisticated marketing and supply chain management tools. Nuru Kenya has introduced modern storage management techniques to its GBC

Indicator	FY2010 target	FY2010 achieved	Achieved/ Target (%)	Variance explanations
Intermediate Result 1.2 Enhanced understanding of business environment by grain bulking operators				
Number of GBS operators who report an increased level of understanding of the requirements of large scale traders, processors and warehouse operators	**3**	3	100%	Chitsosa, & UZ investment in Malawi and Nuru Kenya has reported increased understanding in storage management, standardized technical drawings, equipment specifications and materials for grading rooms which will be installed in all supported GBCs. This innovation ensures that GBC operators will not simply talk about requirements and standards, but will have the tools and support necessary to implement them. Standardization allows for project efficiencies while also allowing large scale traders and processors to expect and require the same capabilities from all MLI supported GBCs.
MLI Result Area 2: Capacity of producer groups and farmers to integrated into Grain Bulking Systems enhanced				
Volume of commodity delivered by farmers to USAID supported VAC	2200	2910	132%	The project has surpassed this target due to the fact that the project supported GBCs have extensive VAC networks and excellent relationship with supplying communities. Additionally, project support has encouraged the GBCs to expand their reach and volumes
Value of commodities entering into USAID supported VAC	396000	523,800		
Intermediate Result 2.1: Capacities of small scale farmers and producer groups enhanced				
Number of small holder farmers participating in Grain bulking System operations	1175 males	1950	166%	The project has surpassed this target due to the fact that the first project supported GBCs have extensive VAC networks and an excellent relationship with its supplying communities. Additionally, project support has encouraged the GBC to expand its reach and volumes.
	350 females	826	236%	
Males attending short-term training as a result of USG assistance	2350	0	0%	Due to the delay in awarding grants to GBCs, the training components associated with them are delayed as well. However, as GBC awards are made in the coming weeks, the project is prepared to begin training immediately. The project has already developed and translated crop conditioning manuals for all targeted crops as well as basic MIS training materials to introduce farmers to the benefits of and prepare them to use project supported MIS. Additionally, a training grant has already been awarded to a local NGO in Malawi to deliver training to 5,200 farmers; Nuru Kenya and ETU proposals integrates training of 5300 farmers. The farmer participants have already been identified in discussion with GBCs and training is set to begin in early in FY2011.
Females attending short-term training as a result of USG assistance	717	0	0%	
MLI Result Area 3: Grain Bulking System Operation supported by relevant market institutions				
Number of Market Institutions supported by MLI	**2**	2	100%	MLI provided ongoing technical assistance to EAGC warehouse receipt program while in Malawi, the project has engaged with the government and MACE to coordinate development in a way that will strengthen existing institutions and fit within the framework of government planning. To date, MLI has worked with MACE to test and pilot Esoko as an improved platform for existing MIS activities and to offer new opportunities for revenue generation and financial sustainability.

Indicator	FY2010 target	FY2010 achieved	Achieved/ Target (%)	Variance explanations
Intermediate Result 3.1. Functional market information system that support grain bulking operations developed and implemented (Malawi)				
Usage of price and market information systems as a result of USG assistance	**400**	0	0%	Although the Esoko platform is up and running successfully in Malawi, commercial roll-out has not begun pending the finalization of licensing negotiations with Esoko. These negotiations are expected to be completed in the first weeks of the quarter one, FY2011, with active usage by a range of players beginning soon thereafter.
Intermediate Result 3.2: GBS related market institutions supported				
Number of services offered by market institutions for a fee	**2**	1	50%	Lesiolo grain handling ltd in Kenya is paying for warehouse certification. The full achievement of this target has been impacted by the delays in GBC grant development and approval. However, it is expected that the Esoko powered MIS in Malawi will offer a range of services that offer concrete value to GBC and other players and profit making opportunities for market institutions.
Number of GBS operators paying for market institution services	**3**	1	33%	
MLI Result Area 4: Institutional platform which disseminates lessons learned and best practices developed				
Number of key market actors participating in key service forums	**9**	0	0%	ACTESA service forums are yet to be established owing to the delay in finalizing its communication strategy.
Intermediate Result 4.1: Communication strategy developed and implemented				
Communication strategy for key service forums endorsed and accepted by ACTESA	**1**	0	0%	There was a delay in engaging consultant to support ACTESA develop its communication strategy. The consultant has now commenced the work and it is expected to be finalized by Nov 2010
Intermediate Result 4.2: Market development actors linked to operational service forums				
Number of forum platform established	**3**	0	0%	The delay in finalizing ACTESA's communication strategy affected the mandate to create the service forums. However, development partners are currently using Agro Enterprise Learning Alliance platform initiated by CRS.
Number of market development actors using platforms to share information and experiences	**4**	8	200%	CRS, ACDI/VOCA, World Fish, World Vision, Land O'Lakes, ACTESA, WFP (P4P) and USAID are currently using a platform initiated by CRS. MLI provided technical support through its commodity Marketing Specialist's participation in board meetings of the platform.

4.5 ADJUSTMENTS IN PLANNED ACTION

In an internal review of FY2010 progress, the MLI team made the following changes in FY2011 targets to accommodate any FY2010 carry forward and in reflection of the actual operating context within its target countries. The following table highlights the indicators affected by target revisions. The same changes have been effected in the revised PMP and FY2011 work plans attached to this report in the annex section.

Table 4

Indicator	FY2010 Targets	Initial FY2011 Targets	Revised FY2011 targets	Revised life of Project Targets	Variance Explanations
Key Result Area 1: Grain Bulking System operations expanded and strengthened in target locations					
Volume and value of commodities entering into USAID-supported storage	Volumes in MT				This allows the project to track total volumes passing through USAID supported storage as opposed to tracking marginal volumes as a result of MLI support
	6000	12000	90350	96350	
	Value in US Dollars				Increased volumes above has positive impact on value of commodities
	1,080,000	2,160,000	11926200	12718200	
Intermediate Result 1.1: Integrated grain bulking systems established in strategic locations					
Number of business plans developed with project support	30	32	15	45	Due to low capacity of majority of our potential grantees, it meant that more time will be spend in developing business plans than earlier anticipated hence the downward revision of the targets.
Number of VAC supplying Grain Bulking Systems	90	190	316	406	From our contacts with GBC operators, majority of them will be linked to more VACs than was initially anticipated.
Key Result Area 2: Capacity of producer groups and farmers to integrate into Grain Bulking Systems enhanced					
Volume of commodities entering into USAID-supported village aggregation centers	2200	9800	59775	61775	With more VACs supplying the GBCs, then the total volumes through the VACs is expected to increase.
Intermediate Result 2.1: Capacities of small holder farmers and producer groups enhanced					
Number of small holder farmers participating in Grain bulking System operations	1525	2500	63475	65,000	The increase in the number of farmers participating in GBS operations is attributed to larger number of VACs associated with the GBCs.
Males attending short-term training as a result of USG assistance	2350	3500	8284	10634	The collaboration between NGOs and large scale business operators is expected to lead to increased number of both males and females attending short term training as a result of USG assistance
Females attending short-term training as a result of USG assistance	717	1500	7249	7966	

5 MOST SIGNIFICANT SUCCESS STORIES

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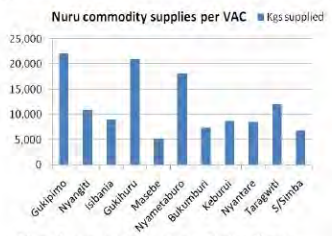
SUCCESS STORY

Nonprofit teams with trader to learn market standards

Vital link for Kenyan farmers gets training in storage management and commodity marketing, thanks to an MLI grant



Scan: MLI

Nuru buys grain from multiple village aggregation centers (VACs) at fair prices and then resells to clients like the World Food Program.

"I feel so honored not only to add knowledge and skills but to be part of a team that will help farmers realize their full potential."

Joseph, Nuru staff

U.S. Agency for International Development
www.usaid.gov

A partnership between a nonprofit and a major trader in Kenya—forged by USAID's Market Linkages Initiative (MLI)—has boosted grain quality in one of the country's poorest districts, leading to better market prices for farmers.

Nuru, a nonprofit working in southwestern Kenya, was already buying surplus grain at fair prices from farmers and village aggregation centers (VACs), stockpiling it in their store and selling it on to clients like the World Food Program (WFP). But mishandling by farmers and VAC staff had contaminated the maize, giving it such a high moisture content that Nuru had to dry it out, which ate up storage space and cost them competitive pricing. When MLI visited in May 2010, Nuru's store was full of weevils, which, when combined with poor record keeping, led the WFP to reject 2,800 bags of maize.

A US$49,788 MLI grant paired Nuru with Export Trading, a large trading and processing company with branches in 12 sub-Saharan countries. The company trained 10 Nuru staff on storage management and commodity marketing so they could better assess potential purchases from the VACs.

In mid-2010, 480 male farmers and 296 female farmers supplied Nuru with nearly 300 tons of grain, which Export Trading inspected to ensure it would meet market standards. Nuru can then sell the grain to WFP or Export Trading at optimum market prices.

Nuru also learned better recordkeeping so that its staff can generate reports to track changes over time. One of its staff told MLI, "I feel so honored not only to add knowledge and skills but to be part of a team that will help farmers realize their full potential."

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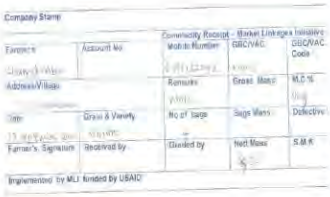
SUCCESS STORY

Grant, training fill gaps in food security chain

Improved storage and record-keeping for Chitsosa Trading means more grain to and from markets



Scan: MLI

Commodity receipts designed and distributed by USAID's Market Linkages Initiative keep track of volumes, origin and quality of grain traded in Malawi

A cost-sharing grant and training helped a trader upgrade warehouses and financial systems, which will improve the flow of grains to regional markets.

U.S. Agency for International Development
www.usaid.gov

Chitsosa Trading Company sells maize, groundnuts and soya to major traders in Malawi and neighboring Tanzania, making it a vital link in the region's food security chain. Yet the company was plagued by poor warehouse conditions that left crops vulnerable to weevils, rot and rats. Financial management was similarly in disarray, with records of grain purchases kept on loose papers that were never filed.

In 2010, Chitsosa became the first recipient of a cost-sharing grant from USAID's Market Linkages Initiative, which broadens small farmers' market access through improved storage and market information. The $87,000 from MLI paid a third of the cost to refurbish Chitsosa's warehouses; work is now underway to put in proper windows, a high roof for stacking and sealed walls to keep out moisture. Better storage means the stock will last for longer periods in clean, dry conditions, allowing Chitsosa to sell at the optimum market price rather than unload grains quickly before they deteriorate.

MLI also helped set up a tracking system for Chitsosa's purchases. Each village aggregation center (VAC) with which he does business now has a commodity management receipt book to record purchase by farmer's name, account code, volumes, grain, gender, grade, moisture content, amount, etc. Each record has three duplicates, including one for the farmer, and will be filed at the close of buying season.

Mr. Chitsosa recently told MLI and a delegation from USAID, the World Food Program and USDA, "Since I started using the receipt books, I have been able to clearly show exact volumes of commodities that have passed through my stores." Since the grant began, he has bought 2480 tons of grain from 2,000 farmers linked to 30 VACs.

To properly document the use of MLI grant funds, the company has opened a designated bank account and will hire a full time accountant. Better financial management systems will also put Chitsosa in prime position to take advantage of Malawi's upcoming market information system platform, which will link farmers with regular price updates and other services.

6 CHALLENGES

This project strives to integrate small and medium warehousing operations, and thus the need to work with small and medium enterprises that usually operate at the semi-formal level. It is quite complicated to operate at this level due to insufficient capacities to clearly identify their business models and how these can work to integrate the smallholder farmers. The project has to build the applicants' capacities to be able to produce grant applications which meet the project objectives, which is a time-consuming exercise.

The project's near total dependence on grants and sub-grants to carry out project activities continues to prove cumbersome due to lack of speed in the execution of grants. Some tasks are better suited to be executed as short term technical assistance, such as business plan development, civil engineering oversight etc. Whereas the using fixed obligation grants for such interventions is feasible, processing of grants for these activities takes much longer time than procuring technical assistance. This challenge is under discussion with USAID over the potential use of other procurement mechanism for service provision and technical assistance to grantees.

The multi stakeholder nature of the MLI project poses a challenge of obtaining timely engagement of project partners that have other mandates and priorities. For example, activities in support of the ACTESA have in some cases fallen behind schedule due to ACTESA's broad mandate and other competing priorities.

Many of the grantees need sophisticated drying plants which require construction and shipment from countries such as Denmark and Brazil, followed by installation. Conservatively this can take between 12 26 weeks. Any unanticipated delay will affect grantees ability to meet their deliverables on time and may cause delays of disbursements and overall achievement of project targets within the remaining project period.

In Southern Sudan, the insecurity due to the Lord's Resistance Army (LRA), uncertainty linked to the upcoming referendum, difficult transport logistics and high costs of goods and services make physical monitoring quite expensive and unsafe. The absence of storage facilities on the face of increased farmer production still calls for MLIs pilot interventions with support of WFP's P4P. In DRC, physical insecurity makes any bulking intervention unpractical. In DRC, physical insecurity makes any bulking of grains as an intervention unpractical.

7 ANNEXES


crop conditioning handbook, Septembe


Summary findings of consultative meetings


PMP Revised September 9, 2010.d


FY2011 Work plans, September 2010.doc

MAIZE

RICE

GROUNDNUTS

BEANS

CROP CONDITIONING HANDBOOK

April 2011

This publication was produced for review by the United States Agency for International Development/East Africa Regional Office. It was prepared by CARANA Corporation in association with ACDI/VOCA.

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- National Smallholder Association of Malawi (NASFAM).
- Food and Agricultural Organization of the United Nations (FAO)
- The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- International Center for Tropical Agriculture (CIAT)
- TechnoServe
- Uganda Export Promotion Board (UEPB)
- USAID Agricultural Productivity Enhancement Program (APEP) and Africa, 2000 Network-Uganda, 2008
- The World Food Programme (WFP)
- World Vision

CONTENTS

INTRODUCTION

The Market Linkages Initiative (MLI) is funded by the USAID's Global Hunger and Food Security Initiative to promote growth in food staples and food security by integrating smallholder staple food producers into national and regional markets.

MLI seeks to identify and overcome key bottlenecks limiting market linkages between smallholder producers (vulnerable but viable farmers) and increase commercial integration of smallholder staple commodities into national and regional markets.

MLI works in East Africa to collect and share lessons and best practices from all market linkage endeavors for replication throughout the region.

While the true extent of post-harvest losses is still not clear in Eastern Africa, they are a well-known challenge to food security and income growth, both through physical losses and through diminished quality of the commodity over time in transit and storage.

Post-harvest losses happen at every stage, from field production and harvesting, through threshing, drying, grading, packaging, preparation for storage, and storage itself. Farmers rarely quantify lost income due to poor crop conditioning and therefore fail to optimize their income potential.

This handbook identifies improved smallholder conditioning practices for *maize*, *beans*, *groundnuts* and *rice*. The USAID/MLI project team assembled different methods of crop conditioning through its implementing and collaborating partners in East Africa.

Having collected the different practices, the MLI project will work with partners such as ACTESA[1] to develop a *"Community of Practice"* in key topical areas. This will involve developing forums where implementing partners (governments, NGOs private partners) share practices and lessons learned, analyze impact results, and disseminate findings to inform future program planning. The USAID/MLI project will bring implementing partners together to identify the most successful crop conditioning practices to ensure as many farmers as possible learn from the best training USAID and others can provide.

Section 1 | MAIZE CONDITIONING

Front: Maize Tab Page

Back: Maize Tab Page

HARVESTING

In East Africa, most farmers harvest maize by hand, plucking cobs from the plant and piling them at the end of the row. In dry season, when the maize matures evenly, farmers pick the maize and transport it by ox carts or trucks for storage at home. In the wet season, when rain occurs almost daily, farmers attempt to harvest their maize when there is a break in the weather, preferably after two to three days without rain.

IMPORTANT TIP

In several countries in the region (including Kenya, Uganda and Rwanda) you cannot leave maize standing on stalks in the field very long because thieves will steal the crop. In these cases, instead of leaving it in the field to dry, stack the cut maize stalks in pyramids near your house, and then follow steps 2-5 in this section.

HARVESTING PROCESS

Harvesting should begin when the ears start to droop and the leaves begin to dry.

- You should harvest when most of the maize husk cover turns to yellow and leaves turn slightly yellowish.
- Cobs should be harvested in dry weather.
- On rainy days if cob collection is not possible, break the stem just below the cob and hang it downwards.
- When a black spot appears in the grain, harvest the cobs.

KEY STEPS AFTER HARVESTING

1. Cut the maize stalks and stack them in pyramid-shaped heaps and leave them in the field to dry for two sunny days.
2. After the maize has dried, remove the ears from the stalks. If possible, establish the moisture content by taking 1 or 2 cobs to a grain buying center for testing.
3. Husk the ears.
4. Transport the husked maize to your home.

SHELLING

Shelling (hand-threshing) can be done with a hand-held sheller.

1. A simple hand-held sheller can be made by a local carpenter using a small piece of hardwood. The wood needs to be of good quality, so it will not crack or split easily.
2. Hold the maize cob with one hand and rotate it against the shelling device held in the other hand. The sheller has teeth that engage and remove the grain from the cob.

IMPORTANT TIP

Hand-threshing has the advantage of being cheap, especially as the sheller can be made from local materials.

Wooden maize sheller

DRYING

DRYING PRINCIPLES

Maize is usually harvested with moisture content in the range of 18–26%, which is considerably higher than the 13.5% maximum commercial standard for East Africa. Thus, drying is required.

- Grain harvested with high moisture content must be dried immediately.
- Maize grain can be dried either on the cob or after it is shelled.
- After threshing, the maize kernels are dried in the sun either on plastic tarpaulins, concrete slabs, or in commercial dryers if available.
- Do not dry your maize directly on the ground to avoid contaminating it with dirt, insects, or other pollutants.

DRYING ON PLASTIC SHEETS

You can dry your maize on plastic sheets as either maize cobs or as shelled kernels.

- The maximum depth of the maize on the sheet should be up to your ankle bone. Any higher and the grain on the bottom of the pile will not dry quickly.
- Heavy-duty polythene sheeting or sheets made from cut-open nylon sacks can also be used.

Solar drying on a clean plastic sheet

- If you turn the grain over several times a day, the grain will dry more quickly.
- Be careful to avoid contamination by dust or soil. Grain stained by soil will receive a lower price.
- Do not allow farm animals such as chickens, goats, and cows to walk through the maize drying area, because they will damage or eat the grain.

DRYING ON CONCRETE SLABS

Maize grain can also be dried on a layer of concrete on the ground that keeps the grain clean. Concrete also heats up quickly, which speeds up drying time.

- Concrete slabs are easy to build and cost-effective. They are usually 5×5 m or 10×10 m and can be enlarged depending on requirements. As they use only solar energy for drying, they are environmentally friendly and low-maintenance.
- Remember to sweep the concrete clean before drying the maize on it.
- The maximum depth of the maize should be up to your ankle bone. Any higher and the grain on the bottom of the pile will not dry quickly.
- In clear, sunny weather, a 5×5 m slab can dry 1,000 kg of maize in one day and a 10×10 m slab can dry up to 4,000 kg of grain in one day.

COMMERCIAL MACHINE DRYING

If you have larger quantities of grain, and require rapid drying, it may be necessary to use a commercial dryer. These facilities receive maize from farmers and collectors to dry and store the grain for sale to traders and commercial buyers.

- Commercial dryers use the generation and suction of heat through the grain mass. This results in water extraction from the grain and reduced moisture.
- Generally you are charged for every 0.5% reduction in moisture. For example, lowering moisture from 18% to 13.5% requires a 4.5% reduction. The fee then will be nine times 0.5%.

Commercial grain dryer

MEASURING GRAIN MOISTURE

Before maize is stored it must be adequately dried.

- Use a moisture meter to test the moisture content of the grain. Moisture meters are available at grain testing centers and some grain warehouses.
- When taking a moisture meter out of a cool store it needs time (about 30 minutes) to warm up to the outside temperature to be able to read moisture levels accurately.

Digital moisture meter

IMPORTANT TIP

Moisture meters need to be regularly calibrated and serviced by qualified technicians in order to ensure that the meters are accurately reporting moisture levels in the grain.

IMPORTANT TIP

There are differences between external and internal maize moisture levels. Maize in warehouse storage will be tested on moisture levels inside the kernel. Less expensive moisture meters found at farms test the external moisture of the maize (i.e. at skin level). External moisture readings often are lower than internal readings, particularly just after the grain has been dried.

- National and commercial grain moisture standards in the East Africa region range from 12-14%.
- Traders do not pay for water and therefore discount the price. For example, if traders are buying at the Kenya Grade II national standard of 13.5% moisture content, and your sample is contains 16% moisture, a 50 kg bag contains 1.25 kg of additional water you will not be paid for.
- Check with your national standards to make sure your grain falls within the moisture limits.
- At moisture levels below 13.5% the grain is basically inert and can be stored effectively for longer periods of time if placed in good storage conditions.

GRADING

Grading procedures to be used by farmers will depend on the target market specifications and requirements. You should attempt to achieve the quality criteria specified by the buyer.

- Each of the national grading standards in East Africa sets limits in each of seven purity attributes.
- EAC Grade 1 and 2 Quality Standards are laid out in the table below.

DESCRIPTION OF PURITY ATTRIBUTES

Foreign Matter: Any material other than maize and fine maize particles that will pass through screen holes of 3 mm diameter.

Broken Maize: Maize that will pass through a circular screen of holes 6.35 mm wide but will not pass through a screen of 3 mm holes.

Pest Damaged Maize: Maize is partly damaged by insects or rodents. Can be detected by visual inspection.

Rotten and Diseased Maize: Maize discolored by heat, fermentation, molds, or disease. Can be detected by visual inspection.

Moisture Content: The moisture content in maize, as measured by a calibrated moisture meter. For Grade 2 in the EAC the moisture level in maize must be below 13.5%.

Aflatoxin Levels: For EAC Grade 2 Maize, there must be less than 10 parts per billion of Aflatoxin detected in the grain. This can only be checked by specialized tests (see pages 9–10).

EAC TRADE QUALITY STANDARDS FOR GRADE 1 & 2 MAIZE (KENYA, TANZANIA AND UGANDA)

Purity Attribute	Maximum Percentage or Quantity by Weight	
	Grade 1	Grade 2
Foreign Matter (max %)	0.5%	1%
Broken Maize (max %)	2%	4%
Pest Damaged Maize (max %)	1%	3%
Rotten and Diseased Maize (max %)	2%	4%
Discolored Maize (max %)	0.5%	1%
Moisture Content (max %)	13.5%	13.5%
Aflatoxin level (ppb)	< 10 ppb	< 10 ppb

Source: East African Community; A guide for Maize Traders on Regulatory Requirements for Imports band Exports of Maize in The East African Community 2005/2006

PROCEDURE FOR GRADING

The grading procedure listed below is quick, simple and applicable to small-scale farmers.

Equipment Needed:

- A 50 ml container
- A 100 ml container
- A wire screen with holes 5.08 mm wide, commonly called coffee tray wire.
- Leveling stick
- Bag sampler (called a spike) if maize is in bags
- Clean bucket or similar-sized container/large shopping bag

Grading Steps:

1. Take a random sample of maize from the shelling point. A quick method: cut the top off a 100 ml water bottle, and then take 10 samples from 10 different places. Each sample should fill the bottle. Empty each sample into the bucket or other container.
2. The sample should be about 1 kg and should be mixed thoroughly.
3. Use the 50 ml container to scoop a "sub sample" from the large container. Make sure the container is full and use a stick to make the sample flat with the top of the container. Generally it is assumed that there are 100 whole maize grains in the 50 ml container.

Filtering maize through coffee tray wire.

4. Transfer the sub-sample to the sieve made of coffee tray wire, and thoroughly sieve the grain by shaking. Catch the material which falls through the sieve either on a flat clean surface or on a sack.
5. Transfer the sample that does not pass through the sieve to a sorting surface that is big enough to measure anything up to 30 cm by 30 cm. Spread the grains out.
6. Find any broken grain and grain fragments and remove by hand. Add them to the sample that is passed through the sieve in step 4 above.
7. Remove by hand any pest damaged grain and keep them separate
8. Remove by hand any rotten, diseased and discolored grain and keep them separate.

9. Remove by hand other colored grains and keep them separate.
10. Count the number of grains in the isolated defective samples from steps 7, 8, 9.

COUNTING, RESULT REPORTING AND INTERPRETATION

Different characteristics of grain are determined as a percentage. National grades or the trader will stipulate what is acceptable. For example, to determine if the grains meet a standard of 3% pest-damaged grains, use the 50 ml container, which should hold about 100 whole maize grains. Any whole grain removed represents 1% of the overall sample. If 5 grains were removed because they had insect holes, this would indicate that 5% of the grain is pest-damaged and could potentially receive a lower price because it does not meet the grade requirements.

Broken Maize: The number of broken grains comes from that sieved out in step 4 and added to the sample in step 6. On a flat surface, put together different pieces so they add up to a whole grain (i.e. four small bits may be equivalent to one whole grain). Count the number of representative whole grains, which is the estimated percentage of broken grains in the original maize.

Pest Damaged Maize: Simply count the number of kernels obtained in step 7. The number of kernels is estimated as the percentage of pest damaged maize.

Rotten, Diseased and Discolored Maize: Count the kernels in step 8. Their count forms the percentage of rotten, diseased and discolored maize.

Other Colored Maize: Count the kernels in step 9. This is the estimated percentage of other colored maize.

PEST AND DISEASE CONTROL

In East Africa, stem borers and stalk borers are among the major pests attacking maize in the field. At the storage level, the black maize weevil (see picture), the Angoumois grain moth, and the grain borer are among the most prominent storage pests.

Black maize weevil

CAUSES OF INSECT INFESTATION IN MAIZE

The main causes of insect infestation are:

- Late harvesting
- Introduction of infested lots
- Migration from rubbish dumps

(continues on next page)

- Cracks and crevices at storage places that give the insects a home to lay their eggs—which can remain from one season to another.
- Lack of cleaning in storage
- Use of infested bags

PEST CONTROL MEASURES

1. Firstly, exercise good storage hygiene and use of crop protection products.
2. Identify the pest that is causing the damage and apply the appropriate product in the right dosage level.
3. Only pesticide products on the official government-approved list should be applied.
4. Carefully follow instructions before applying any pest control treatments and keep the instructions in a safe place to be re-read before any future uses.
5. Keep all pest control chemicals out of the reach of children.

BAGGING AND PACKAGING

(See specific information on how to bag grains properly on page 20).

There are four main types of bag materials used for storing and transporting maize grain in East Africa:

1. Plastic
2. Polypropylene
3. Jute
4. Sisal

PLASTIC

Only use plastic for handling and transporting small quantities of maize for a short distance.

Plastic is not well aerated and will result in deterioration of maize within a quick period of time unless you are using the specially designed hermetically sealed (airtight) plastic bags.

POLYPROPYLENE

Polypropylene bags are made from woven fiber based on petroleum products.

- It is advisable to use polypropylene bags with UV stabilizer because they last longer without getting brittle.
- Polypropylene has gained in usage in East Africa due to its low cost.
- Polypropylene does not allow for circulation of air.

Putting more than the recommended weight in a polypropylene bag causes it to split along the weave at pressure points which increases post harvest losses and potential infestation and rodent problems.

Maize bagged in a sisal sack.

JUTE AND SISAL

Sisal and jute bags are of plant origin and biodegradable, which make them good for the environment.

- Sisal and jute are well aerating, and easier than plastic and polypropylene to fumigate in pest control.
- It is possible to stack jute bags higher than polypropylene bags because the coarser fibers do not slip as easily.
- The main disadvantage of sisal and jute is cost. Otherwise they are the best longer-term storage solution for maize.

BAG CLEANING

1. Ensure that any packaging material used to store the grain (including bags or sacks) is clean and disinfected. Wash bags and disinfect them by boiling them in water for 5 minutes.
2. When disinfecting a polythene sack, make sure that it does not touch the outside of the pot—the heat may damage it.
3. Completely dry all sacks and containers before using them to store grains.

MOLD AND AFLATOXIN CONTROL

Molds are spread by spores which often cannot be seen by the human eye. They are in the soil, on plants, in the air, left on old bags, or in poor storage spaces. When these spores fall onto moist grains, under warm, humid conditions, they start growing. As these fungi grow, they release poisons called mycotoxins.

There are over 500 types of mycotoxins, but the most important in maize are produced by *Aspergillus*, *Fusarium*, and *Pencillium* species. Sometimes you can see the result: black molds on grains. However, the most dangerous mycotoxin, aflatoxin—which can cause death or long-term health problems in both humans and animals—cannot be seen by the human eye, and only special tests will show its presence.

Once aflatoxin is produced on the grain, it is not destroyed by cooking or heating the grain. The only way to prevent these fungi/molds from growing and spreading is to dry the grain quickly at harvest to moisture levels of less than 13.5% and to keep the grain in clean bags, in dry conditions and off the ground of the storage space.

1. It is very important for you to control and check your maize regularly to ensure the moisture level does not increase and allow fungus and mold to grow on the grain.
2. Maize must be dried quickly to 13.5% or below before storage.
3. Grains must also be protected from pest and rodent infestation, since they will damage maize by offering easy access to fungus and mold.
4. Your grain stores should be leak-proof and well ventilated to avoid any sources of water to enter your grain and to allow aeration to take out moisture and heat.
5. While removing grains with obvious mold will improve the quality of the grain, it does not mean you have removed grain with aflatoxin on it.

ENVIRONMENTS THAT ENCOURAGE AFLATOXIN DEVELOPMENT

- Fungi and molds to grow require the following environment to grow:
- Moisture content of 14-30% in grains
- Temperature range of 10-40 degrees Celsius.
- Relative humidity above 70%
- Unclean environment
- Prolonged rains after crop has matured, preventing harvest
- Periods of drought while the plant has been growing.

KEY STEPS THAT PREVENT AFLATOXIN

1. To avoid growth of the fungi and molds which produce mycotoxins, dry your maize quickly at harvest and very well before storage, and keep it in a dry, clean, and well ventilated storage area.
2. Avoid insect and rodent damage which can open up the grain by offering easy access to fungus and mold.
3. Avoid contact of the maize with soil.
4. Do not add water to the maize to add weight before the sale.
5. Handle the maize carefully when harvesting and moving.
6. Store grains in clean sacks on pallets.
7. Ensure sacks are in good condition and are full and well-closed so grain does not fall out.

Stacked maize sacks on pallets

↓ Front: Rice Tab Page

↑ Back: Rice Tab Page

HARVESTING

Paddy is the rice grain enclosed in husks before it is milled to remove the husks. Rice is the same grain after removing the husks.

Timeliness of the paddy rice harvest is a very important factor in determining grain quality and yield. The harvesting period should begin when 90% of the grains (or 9 out of 10 grains) in the main panicles of plants are clear, firm, and straw-colored; the rest of the grains should be hard.

- Harvest when paddy rice grain moisture is less than 20%, about 30-32 days after flowering.
- If harvesting by hand, grasp the plant about 15–20 cm from the soil/ground level and cut with a sickle 15 cm from ground level.
- If harvesting is too early, there will be many immature grains that will reduce head rice yield and quality. Immature rice kernels are very slender and chalky and will result in excessive amounts of bran and broken grains.
- If harvesting is too late, many grains are lost due to shattering or drying out and cracking during threshing. Cracked grains break during milling.
- If moisture content is allowed to vary, grain fissuring (cracking) can occur along with spoilage through yellowing and the development of odors.

Threshing rice over a drum.

THRESHING AND WINNOWING

1. Thresh paddy rice immediately after cutting. The longer cut panicles remain in a stack, the higher their chance of turning yellow and discoloring during milling.
2. Thresh using a drum or a wooden surface also to reduce discoloration. Hit the rice panicle on the drum or wood.

3. Thresh on tarpaulin or canvas. To avoid contamination, never thresh rice on the ground.

4. Remove all kinds of dockage (impurities) from threshed grain such as insects, rice straws, and leaves as soon as possible after harvesting and certainly before storage. Clean grain has a higher value than grain that is contaminated with straws, chaff, weed seeds, soil, rubbish, stones and other non-grain materials.

5. Winnow (remove light and chaffy material) immediately at threshing to avoid contamination and black rice. Modern rice mills with destoners reduce the burden of winnowing; however winnowing is still essential as it will increase the value of the paddy.

Modern rice mill in Uganda.

6. Maintain clean grain to improve the storability of grain; improve milling output and quality, and reduce price penalties at selling.

Spreading rice on a tarpaulin to dry.

DRYING

1. Dry the paddy rice immediately after threshing on the threshing floor.

2. Sun-dry four hours a day for the next 2–3 days.

3. Dry on tarpaulin to reduce dirt and stones. You may dry paddy directly on concrete only if the concrete has been thoroughly swept clean first.

4. Spread grain into thin layers (5–10 cm deep) on the tarpaulin or floor and turn and stir 7–8 times per day. This distributes moisture more evenly and increases the rate of drying (the paddy exhibits better milling quality when dried to a moisture content of 14%).

5. Bite between teeth to test moisture content. If it is soft, continue drying. When it breaks into two, moisture content is around 14–15%.

6. Do not over-dry the paddy since it increases breakage in the rice grain during milling, and reduces quality and the price you will receive.

RICE DRYING HUT

A rice drying hut helps farmers reduce post harvest losses and preserve the quality of the rice. It is a low-cost technology which is easy to apply, and well suited to small-scale farmers.

1. To build the hut, you will need strong bamboos or small logs, large transparent plastic sheets, tarpaulin, wire and rice husks.
2. The size of the hut depends on the available land surface, but usually it will cover an area of 100 square meters.
3. Prepare the floor so it is flat and smooth.
4. Dig a drainage gutter around the floor. It should be 30 cm wide and 30 cm deep.
5. Erect a row of bamboos or logs as support columns in the middle of floor, connected at the top by a log or bamboo as a roof beam. The columns should be about 2.5 m high, with an extra 50 cm buried in the soil.

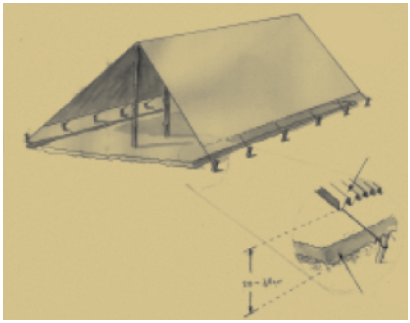


Illustration of a rice drying hut.

6. Fasten small rafters to the roof beam at one end, and allow the other end of each rafter to rest on the ground.
7. Use the transparent plastic sheets to make the roof cover. Attach the cover to the ground with wires.
8. Cover the floor of the hut with rice husks. Place the plastic tarpaulin to dry the paddy on top of the rise husks.

PRECAUTIONS IN BUILDING THE RICE HUT

- The hut must be protected from wind, and should stand with one side facing the direction of the prevailing wind.
- The entrance should not face into the prevailing wind, and rain should not blow into the hut.
- Nylon ropes are stretched over the roof beam of the hut from one side to the other. The ropes should be 60 cm apart.
- The lower part of the roof should be 20 cm above the ground surface, so that water will flow easily into the gutter.
- The four corners of each plastic sheet are fastened to a nylon rope.
- Dry rice husk is spread over the floor to a depth of 5 cm.
- The nylon net/joined polythene sacks/gunny bags (100 kg) or tarpaulin are laid over the husk, and fixed to the ground with bamboo pegs at the edges.

DRYING THE RICE IN THE DRYING HUT

1. Spread the harvested paddy evenly over the tarpaulin. The husks beneath the tarpaulin insulate the paddy from the wet ground, and give the paddy at the bottom a good supply of dry air. The pile of paddy is 20-30 cm deep in the middle, and 15 cm deep at the edges.
2. Regularly once an hour, turn and pile the paddy into long ridges—the paddy will dry in 1-3 days, depending on the weather.
3. If the paddy in the hut is still too wet and the sun has come out, remove some of the plastic sheets temporarily from the roof, to allow the sunlight to enter and to get rid of some of the moisture.

SOME CHARACTERISTICS OF THE RICE DRYING HUT

- The temperature inside the hut is always higher than the temperature outside it.
- Because the temperature inside the hut rises gradually, there is also a gradual loss of moisture from the paddy, so the rice grains seldom crack.
- On sunny mornings, between 9:00 am and 10:00 am, it is 8 degrees C warmer inside the hut than outside it. An hour later, the temperature difference rises to 12 degrees C.
- On rainy days, the difference is 6 degrees C. At night, the difference is 13 degrees C.
- A hut measuring 10 x 10 meters (i.e. 100 m^2) has the capacity to dry 2–2.5 metric tons of paddy at any one time. Usually, the hut is used to dry several batches of paddy, one after the other. It can also be used for drying other produce, such as coffee, maize and beans.

Bagging rice

BAGGING AND PACKAGING

(See specific information on how to bag grains properly on page 20. Information on bag cleaning can be found on page 9).

- Paddy rice should be stored in bags and placed on a raised floor to avoid moisture accumulation.
- Paddy rice must be stored in an environment of 13–14% moisture and must be protected from insects and rodents. Storing rice as paddy has two advantages: (a) rodents and insects struggle to gnaw through the outer covering/husk; and (b) most customers prefer freshly milled rice.

- Store paddy in 50 to 100 kg sacks made from jute, polypropylene or woven plastic, stacked under a roof or in a shed.
- Periodically fumigate to control insects.
- For extended periods of time while maintaining its quality (13–14% moisture content) protect paddy rice from insects and rodents using environmentally recommended fumigants and putting it in bags even when using granaries (made of timber, mud or cement) or large woven baskets; and from absorbing moisture from rainfall or the surrounding moist air.

PEST AND DISEASE CONTROL

Most control methods apply mainly to the crop when still in the field and before harvesting. However, disinfect any used bags using the following steps:

1. Turn the bags inside out and shake them thoroughly so no grains of any kind stick to the inside of the bag.
2. Soak the bags for 10 minutes in hot water.
3. Dry the bags under shade before filling them with paddy.
4. Do not pack your paddy rice if the moisture content is more than 14%; the grain could spoil during storage.

SHELLING AND HUSKING

This is mostly done at the rice mills. Some traditional methods such as pounding in wooden mortars produce many broken grains.

1. Remove any stones and as much foreign material as possible, as these spoil and damage rice mills.
2. Ensure that the paddy is properly dried (but not over-dried) before delivering to the rice mill to avoid too many broken rice grains

CLEANING AND SORTING/GRADING

The purpose of cleaning the rice grains is to:

- Remove impurities such as leaves, broken grains, sand or grit, etc.
- Remove immature, shriveled, unfilled and empty spikelets.

Grain can be cleaned manually by winnowing, which removes only light, chaffy material.

In addition to cleaning and de-stoning, modern rice mills also sort and grade the milled rice.

Section 3 | GROUNDNUT CONDITIONING

Front: Groundnut Tab Page

↑ Back: Groundnut Tab Page

HARVESTING

You should harvest your groundnuts at the right time, when the crop is mature.

- Check by lifting a few pods and look at the inside of the shell.
- Your groundnuts are mature when 70-80% of the inside of the shell is spotted pale brown.
- If your groundnuts are harvested too early, the kernels shrink upon drying, resulting in a lower shelling percentage, poor seed quality and lower oil content.
- Groundnut product quality depends on appropriate handling and storage techniques for the harvested crop.
- Groundnut seeds are protected by a shell, which acts as an excellent natural barrier against pests and diseases. However, this shell should be intact.
- Remove damaged pods.
- Remove crop residues mixed with the pods as they can be sources of contamination.

Solar drying of groundnuts pods on the vine

DRYING

The main objective of drying is to achieve a rapid but steady drying of pods in order to avoid spread of diseases and contaminations such as aflatoxin.

- Harvested plants should be staked in the field to allow them to dry in the sun and air before stripping the pods.
- Avoid drying groundnuts in large stacks which take long to dry.
- You should dry the harvested plants in the field until the moisture content is reduced to 6–8%. This can normally be achieved by drying the pods on the vine in the sun for 6–7 days, taking care to cover them if it rains.
- If pods are exposed to the sun too long, kernel quality will be affected.

THRESHING

Thresh your groundnut pods about 2 to 6 weeks after harvesting, when the pod water content stabilizes at around 10%.

- This operation consists of separating the pods from the vegetative parts of the plants.
- In traditional farming systems, manual stripping is the rule. Pods are individually detached from the vines and therefore dry very quickly, stabilizing at 6–8% moisture content.
- However, threshing is most often done using sticks. These reduce the heap of groundnut plants into a mixture of chopped vines and partially broken pods that are then separated by winnowing.

SIEVING

This operation is generally done on the farm or at the collecting point.

- Most sieves are made of wire or metal bars. The sieve allows part of the trash including sand, straw and broken pods to be eliminated. A standard sieve will have 5 mm openings. When the mesh is shaken, sand, small broken pieces and dust pass through the mesh while whole groundnuts will not pass through the mesh.
- However, sieving cannot eliminate pods of other varieties, empty pods (pops), partially filled or immature pods. This is done by the most basic cleaning operation of hand sorting the good from the bad; taking out extraneous material which has not fallen through the sieve.

SHELLING

Shelling can either be done by hand or by mechanical sheller.

- Some farmers in East Africa wet their hands or soak the groundnuts in water to make the shelling easier. This should not be done. This operation adds too much moisture to the groundnut, and encourages fungi to grow on the nuts inside the moist shell, leading to aflatoxin contamination.
- A mechanical sheller is most effective if it can adjust to shell different sized nuts.

Groundnut shelling in Malawi

GRADING

Some nuts are sold unshelled and ungraded; while others are shelled, winnowed and graded.

1. To grade the shelled nuts, separate whole clean nuts from broken and shriveled and rotten nuts.
2. Separate and grade nuts by eliminating:
   - Foreign matter
   - Damaged nuts
   - Split nuts
   - Blemished nuts
3. You will make more money if you separate out these from the good nuts you are presenting to your buyer.

PEST AND DISEASE CONTROL

Groundnuts are susceptible to a number of pests and diseases that can cause considerable yield losses.

- Recommended protection measures against diseases and insect pests should be regularly followed during the cropping season.
- The most damaging and widespread diseases are Groundnut Rosette and Early Leaf Spot.
- Groundnut Rosette can be controlled by planting rosette-resistant varieties and planting early at the correct spacing.

Grading groundnuts

- Early Leaf Spot can be controlled by early planting, burying all crop residues, and crop rotation.
- The worst groundnut pests are aphids. Aphids can be controlled by planting rosette-resistant varieties, and planting early at the correct spacing.

BAGGING AND PACKAGING

(Information on bag cleaning can be found on page 9).

Groundnut can either be shelled or stored unshelled.

- Groundnuts are best stored unshelled in cool, dry conditions, protected from rain and vermin (particularly rats and mice).
- Groundnut pods can easily be stored in bulk.
- Storage in clean jute or woven polyethylene fiber bags ensures the best protection of groundnuts and allows easy movement of stocks (manual or on pallets).

- Groundnuts should only be stored in bags or drums.
- Bagged groundnuts—whether shelled or unshelled—should not be placed directly on a concrete floor due to risk of dampness that may cause molds to develop. They should be placed on pallets.
- Shelled groundnuts are fragile and are exposed to various agents that cause physical, chemical and biological deterioration.

HOW TO PROPERLY BAG MAIZE, RICE, GROUNDNUTS OR BEANS

Advantages of properly filled bags:

- Will not tear or break when handled.
- Have a uniform shape and size making them easier to stack and estimate the amount of grain inside.
- In stacks it is easier to account for total grain in storage. This also helps determine the correct amount of pesticides when fumigating.
- Big buyers like WFP insist sellers properly pack their commodities.

Badly filled bag

Correctly filled bag

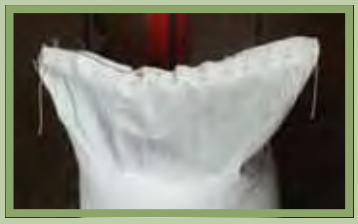
- Pour grain into a 20 liter container until it overflows, leaving a mound on top.
- Pour three of these containers into a 50 kg bag.

A 20 liter container

- Fold the bag mouth 5 to 10 cm inwards to create a "valve" so grain is not forced out when bags are stacked.
- About 16 stitches are required to close a 50 kg bag mouth.
- Knots should NOT be made at both ends of the string; instead, leave a 10 cm extension of the string loose at both ends. The bag can be opened by making a small cut in the middle of the string and then pulling it out from both ends, which causes less damage to the bag, making it commercially reusable.

How to correctly fill and close a 50 kg bag—without a scale.

- A 50 kg empty bag should carry between 48 kg and 52 kg of grain. Three 20-liter containers hold between 48 kg and 52 kg depending on grain density.



A correctly sewn bag with mouth folded inwards and loose ends without knots.

AFLATOXIN CONTROL

Groundnuts can be infested with aflatoxin at two different stages:

- Pre-harvest infestation
- Post-harvest infestation

PRE-HARVEST INFESTATION

Groundnuts can be infested by Aspergillus spores, which when propagated, release aflatoxin in the pre-harvest period by:

- Soil-borne fungus
- Bird, insect, or worm damage which allows spores easier access to the grains
- High temperatures combined with high humidity
- Drought
- Late planting
- Prolonged rains after crop has matured, preventing harvest

POST-HARVEST INFESTATION

Groundnuts can be infested by Aspergillus spores which release aflatoxin in the post-harvest period by:

- Air-borne fungus
- Contact of groundnuts with infected soil
- Liquids or water touching shells during shelling process
- Insufficient drying of groundnuts

IMPORTANT TIP

If you find aflatoxin in your groundnuts:

- Separate the rotten and poorly filled pods during grading. These pods are more likely to have aflatoxin. Burn them. Do not feed them to animals since it can kill them or make them very sick.
- Have the groundnuts tested by a certified laboratory to determine whether they have aflatoxin.

- Bird, insect, or worm damage
- High temperatures in storing rooms
- High moisture in storing rooms
- Damage to nuts during harvesting or transporting

SYMPTOMS OF AFLATOXIN

- Yellowish and greenish marks on groundnut seedling leaves during drought
- Fibrous roots that do not develop on the groundnut plants
- White colored matter inside the pod

Section 4 | EDIBLE DRY BEAN CROP CONDITIONING

Front: Beans Tab Page

Back: Beans Tab Page

This material[4] is intended to be used by small-scale farmers interested in producing common edible dry beans (Phasealus vulgaris) for sale. It is written for farmers who have no formal training or experience in bean production. You may seek assistance in understanding some of the topics covered in this handbook from researchers, extension agents or NGOs.

Graded red beans

HARVESTING

You know that the plants are ready for harvesting when all leaves and pods of upright bush bean varieties are yellow.

- Harvest only those plants that are ready—usually 90–120 days after planting, depending on the variety grown.
- Harvest pods of climbing and trailing beans as they mature.
- Do not harvest bean pods that are touching the soil as they may be infected with disease pathogens found in the soil.

IMPORTANT TIP

Good quality bean grain has the following properties:

- **Well-dried:** moisture 13–15% maximum.
- **Pure:** all are of the same variety and of the same size.
- **Clean:** 1% foreign matter, not mixed with foreign matter such as stones or dirt, or other seeds.
- **Not damaged, broken, shriveled, moldy, or damaged by insects** (bean weevil). Because edible beans are mainly eaten whole (without processing) a few damaged kernels greatly reduce the value of a whole consignment.
- **Not rotten** (may be diseased) and less than 10% discolored/faded (may be diseased).

- Do not leave the beans to dry in the field after they are harvested as they can be affected by disease or eaten by insects and animals.
- Beans left in the sun too long may become too dry for threshing, and if left in the rain, will be too wet for threshing.

DRYING IN PODS

Beans must be dried in the pod before being threshed. If you start threshing immediately after harvesting, you will damage the beans because they are too moist to be threshed.

- Dry the beans on a mat, plastic sheet or tarpaulin, on a raised platform or in a maize crib.
- Do not dry beans on the ground, as they can get dirty, wet, or be eaten by animals.
- Have someone watch the beans while they dry. He/she can cover the beans if it rains and chase away animals.

IN DRYING, FOLLOW THESE STEPS:

1. Sort the seed pods and remove weeds and immature pods.
2. Arrange the pods loosely on the platform, mat, or crib for air to circulate so that the beans do not get moldy.
3. Dry the beans from morning to evening for 2 sunny days.
4. Test the beans to see whether they are dry enough by breaking a few pods open and biting or pinching them with your fingers. If the bean feels hard, it's dry. If soft, it is too moist and needs more drying.

THRESHING

Thresh the beans when they are dry enough. Beans that are too dry or too wet can be easily damaged during threshing.

WHILE THRESHING, DO NOT:

- Break and damage the beans.
- Mix the beans with dirt and rubbish.
- Lose beans.
- Do not thresh on the ground or in a gunny bag as beans will easily be damaged. Broken or cracked beans are more likely to be attacked by insects and mold.

A threshing rack, used to thresh beans or maize.

USING A THRESHING RACK

Thresh on a threshing rack to protect the beans from damage and dirt and prevent them from scattering.

- A threshing rack (shown on previous page) consists of strips of wood arranged on a platform with a wire mesh tray on the bottom to catch the threshed beans, and with high wooden sides to prevent the beans from scattering during threshing.
- The threshing rack can be made by a local carpenter.

DRYING THRESHED BEANS

Threshed beans must be dried again and protected from rain, insects, animals and dirt.

1. Dry threshed beans on mats, plastic sheets or wire mesh trays raised on a platform.
2. Spread the beans thinly on the drying surface to allow air to pass through it.
3. Turn the beans regularly to avoid overheating.
4. Dry the beans for 1-3 sunny days.
5. Avoid the beans getting wet by rain or being damaged by domestic animals.
6. Test the beans to see whether they are dry enough by biting or pinching them with your fingers.

Multi-colored beans

GRADING

1. Winnow to remove chaff, dust and other rubbish from the beans.
2. Remove shriveled, diseased, broken beans and beans of other varieties by sorting.
3. Sort on a platform sorter to make the work easier—no bending required and the wire meshing gets rid of some of the dirt mixed with the beans.

USING A PLATFORM SORTER

A local carpenter can make a platform sorter.

- A platform sorter consists of two wooden funnels with wire mesh trays to catch the beans.
- Different sizes of wire mesh can be used for varieties of different sized beans.
- The sorter is placed on a table and people can sort while seated at the table.

- Pour dried beans that have been winnowed down the funnels.
- Sort by hand beans that fall on the wire mesh screen, as it traps small broken beans and allows dirt and rubbish to be removed easily.

IMPORTANT TIP

Steps for the Salt Test

The salt test is a good way to determine the moisture of threshed beans (it can also be used on other staples, including maize, rice and groundnuts). You will need a clean, dry jar with a lid, some salt and a sample of beans.

1. Use a clean and completely dry jar.
2. Put the salt in the jar (enough salt to fill up a quarter of the jar) and add a sample of beans (enough to fill half of the jar). Put the lid on the jar.
3. Shake the jar well and then allow the beans to settle for about 10 minutes.
4. If after 10 minutes you can see damp salt stuck to the sides of the jar, the seed is too moist, above the 13–15% required for improved bean grain.
5. If after 10 minutes the jar is dry and there is no salt stuck to the sides of the jar, the seed is dry.

MEASURING MOISTURE CONTENT

Determining the moisture content of a bean is more difficult and requires more experience. One way to test for moisture content is by biting the seed with your teeth or by pinching it between your fingers. If the bean feels hard, it means it is dry. If it feels soft, it is too moist and needs more drying.

PACKAGING AND BAGGING

(See specific information on how to bag grains properly on page 20).

Various types of bags are used by the bean industry, including polypropylene and plastic, which are most used in shipments.

- Beans are usually sold loose in open sacks or in clear plastic bags so that the color and quality can be easily seen.

Beans for sale in a market.

TREATMENT AND STORAGE

- Dry beans down to 13–15% moisture before storage.
- Store your dry beans carefully to avoid damaging it; moisture content should not be greater than 13–15%. If salt sticks to the jar when you do the salt test for moisture, dry the beans again before you store them.
- Ensure that any container used to store the beans (including bags or sacks) is clean and disinfected. Wash containers and sacks then disinfect them by boiling them in water for 5 minutes. When disinfecting a polythene sack, make sure that it does not touch the outside of the pot; the heat may damage it.
- Completely dry all sacks and containers before using them to store grains.
- Store beans in sacks or other containers in a clean, dry and well ventilated place.
- The storage place should have no leaks, and rain water should not run down the walls. Close holes where rodents can come in.
- Protect the beans from moisture by keeping it off the ground and away from the walls. Sacks should be at least 1 meter (3 feet) away from the walls, and should be placed on a platform of sticks or pallets.
- Never store newly harvested beans with old beans; if the older beans are infected with insects, they will spread to the beans as well.
- You can also store beans in a large metal bin (called a silo). Well covered silos are of different sizes and protect the grain against insects and moisture. A local welder can make silos to hold different amounts.

PEST CONTROL

- Close all holes and openings where rats, insects and water can get in.
- Fill in cracks in the walls, floor and ceiling.
- Keep the storage area very clean to discourage rats and mice.
- Cut the grass around the storage area as rats do not like to cross open spaces.
- Build rat guards on poles of storage structures to keep rats from climbing them. Take a piece of tin or a flattened tin can, bend it to form a cone with a hole in the centre; and fasten it around the legs of the poles with nails or wire.
- Kill rats and mice with traps and rat poison. Never mix rat poison with the grain; and burn all dead rats and mice. Always keep poisons out of reach of children.

ENDNOTES

INTRODUCTION

1. Alliance for Commodity Trade in Eastern and Southern Africa, an agency of COMESA

SECTION 1: MAIZE CONDITIONING

2. From *Kenya Maize Handbook* (2007) by the Kenya Maize Development Programme. The project is managed by ACDI-VOCA under funding from USAID.

SECTION 2: UPLAND RICE CONDITIONING

3. This chapter is based on field research of the MLI project team and the experiences and expertise of the extension workers and farmers who implemented the "Promotion of NERICA Upland Rice in Uganda for Sustainable Household Food Security and Incomes" project. This project was executed with financial support of UNDP/Uganda, and supervision of Government of Uganda, Office of the Vice President. The Project was implemented by a local NGO, Africa 2000 Network—Uganda (A2N-Uganda) and technical assistance was provided by USAID Agricultural Productivity Enhancement Program (APEP).

SECTION 4: EDIBLE DRY BEAN CROP CONDITIONING

4. This chapter is based upon field research by the MLI project team and is also is based upon a publication developed by the International Centre for Tropical Agriculture (CIAT) called "Bean Seed Production Manual".

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