FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative




REDUCING POST HARVEST LOSSES

FEED THE FUTURE QUARTERLY MEETING

CAPITAL HOTEL, ADDIS ABABA

16 JUNE 2016

USAID
FROM THE AMERICAN PEOPLE

Agricultural Knowledge, Learning, Documentation and Policy Project (AKLDP-Ethiopia)

The AKLDP provides coordination and technical support to guide improvements in USAID agricultural programming and support national development policies and strategies in Ethiopia. As part of this, the AKLDP facilitates the USAID Feed the Future Quarterly Coordination Meetings, each of which focuses on a specific theme.

In June 2016 the theme of the meeting was Reducing Post-Harvest Losses in Ethiopia. This report includes summaries of the five detailed presentations that were made during the half-day meeting held at the Capital Hotel, Addis Ababa, and highlights the key outputs of the group work and plenary discussions.

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Summary of the meeting

A. Meeting agenda

Tracy Powell of USAID welcomed the participants and provided a brief update on USAID Feed the Future activities. A list of participants is included at Annex 1 and the meeting agenda at Annex 2. Five presentations were made covering some of the key areas of research and program activities currently being carried out on Post Harvest Losses in Ethiopia. Question and answer sessions followed the presentations, and then a period of time allocated for mixed group discussion on the most notable Post Harvest Loss issues and how the Feed the Future community in Ethiopia might address them.

B. Meeting purpose

Globally, one-third of food produced for human consumption is lost or wasted—approximately 1.3 billion tons of food each year, worth nearly one trillion USD. The magnitude of cereal losses in sub-Saharan Africa alone has been estimated to exceed the value of total food aid the region received over the past decade, roughly equivalent to the annual caloric requirement of 48 million people. Reductions in the quality and safety of food also occur after harvest, reducing potential income from the sale of agricultural products and exposing consumers to health risks. Reducing post-harvest losses therefore offers an important pathway to increased food security, improved nutrition, and poverty alleviation. Over the past five years of Feed the Future implementation, USAID's implementing partners have analyzed patterns of post-harvest loss in Ethiopia, introduced new technologies and services designed to reduce food losses, and tackled policy issues designed to address challenges of postharvest loss. This meeting will provide a forum to exchange lessons learned, discuss challenges and best practices, and identify opportunities to further reduce post-harvest losses in Ethiopia in the years to come.

C. Presentations

1. Mitigation of Postharvest Losses in Ethiopia

Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss

The work of the Innovation Lab for the Reduction of Post Harvest Losses, being coordinated by Kansas State University together with a number of Ethiopian agencies, was the focus of the first presentation. Using survey data from farmers in Tigray, Amhara, Oromiya and SNNPR undertaken in 2014, information was presented on specific PHL issues for maize, wheat, chickpea, and sesame. Issues covered included farmers' perceptions about PHL, causes of grain losses, the different postharvest techniques being practiced, storage structures and time periods, methods used to control losses by pests, transportation and marketing, knowledge of pesticides and environmental safety, and the different gender roles in mitigating PHL. Detailed photographs presented the information in context.

The data showed perceived prevalence and severity of storage insect pests in maize to be 94% and 64% respectively, whilst the prevalence and severity of molds in storage was 70% and 31%. Only 26% of 280 maize farmers indicated that they had ever receiving any PHL prevention training; with more than 80% of surveyed farmers expressing a need for training in harvesting, packing, transportation, drying and cleaning; as well in moisture measurement, insect, mold, and vertebrate pest management, the proper storage, use and safe handling of pesticides, and marketing of grain. Maize is currently stored in traditional *gotera* (68% of farmers, n = 276), and stored for 7-12 months. Farmers were found to store wheat in traditional storages, fertilizer bags, jute bags, polypropylene bags and warehouses for 3-12 months, inspecting it visually and by smell. Drying the wheat is the major control method used. The survey details for chickpea and sesame farmers estimated losses, how these occur – threshing, transport, winnowing, storage – plus insect control methods. Training needs were identified as insect identification, pesticide usage and handling, and proper storage. Recognizing that improved PHL prevention methods could reduce losses considerably, the survey conclusion was that reduction methods needed to be evaluated and then demonstrated to farmers for adoption, and information provided on reducing postharvest losses and loss reduction technologies.

The presentation went on to provide details of research carried out during 2015, which covered solar-based drying technology, insect research and Mycotoxin analyses. A solar cabinet dryer, solar bubble dryer and open-air sun drying were each modeled to predict fluid flow, heat flow and pressure drop. The basic designs will be simulated for variables and then optimization carried out for better designs. During the insect research 30 farmers were identified in each region, and samples collected from each. Pheromone traps and probe traps were deployed. Ten warehouses were also identified in each region, and PICS triple bags, Grain Pro Super bags, polypropylene bags, jute bags and metal bins each tested. For the Mycotoxin analyses, Aflatoxin, Fumonisin, DON (Deoxynivalenol), and Ochratoxin were analyzed for four crops. To look at extension training needs an Extension Advisory Team (EAT) was also established in 2015, with 10-12 members, and key concepts identified for a curriculum and training.

The presentation concluded with details of the work in progress during 2016, which has included conducting the same tests as in 2014 and surveying 180 farmers per commodity. Hermetic bags have been provided to 100 chickpea and sesame farmers, and 65 wheat and maize farmers. A workshop on reducing postharvest losses of grains was held on Feb. 25 in Addis Ababa. To bring greater awareness of postharvest technologies to farmers, training programs have been carried out with participation at farmer field days. The role of gender in postharvest loss mitigation is also being assessed. The challenge for 2016 and beyond is to scale up technologies to show reduction in postharvest losses can be reduced from 35% to less than 5%.

2. How big are post-harvest losses in Ethiopia? The case of teff

IFPRI and EDRI

The second presentation, by Bart Minten, Ermias Engida and Seneshaw Tamru, was based on research by the Ethiopia Strategy Support Program (ESSP) and looked at post-harvest losses of teff in rural-urban value chains—specifically between producers and urban retailers in Addis Ababa. Post-harvest losses are increasingly being debated because of food security considerations and environmental implications, but there is wide variation in the estimates of post-harvest losses and wastages. The ESSP research is a challenge to current estimates that tend to be: based on opinions, not surveys; biased towards perishables; and do not focus on products making up the bulk of calories. Teff is the most important cash crop in Ethiopia, grown by 6.6 million farmers. 1,200 farmers were interviewed in five major teff production zones representing 38% of the national teff area and 42% of the commercial surplus. The teff value chain was followed from the farmers to Addis' retailers through 200 rural wholesalers, 75 urban wholesalers and 282 urban retail outlets. Stratified random samples were taken at each level. The research found that (self-reported) post-harvest losses in the teff value chain varied between 2.2 and 3.3 percent of the quantity produced. The teff losses at the farm level were lower than other cereals, but not significantly lower. These findings point to the need to gather solid evidence on post-harvest losses in staple foods to ensure appropriate policies and investments. Getting the evidence right on the extent of PHL is important as reduction of post-harvest losses entail costs that should be weighed against the potential benefits.

3. Post-Harvest Management & Market Competitiveness

AGP-AMDe

The third presentation focused on post-harvest management in the marketing of four Ethiopian crops. The objective of the USAID Agricultural Growth Program - Agribusiness Market Development (AGP-AMDe) is to sustainably reduce poverty and hunger by improving the productivity and competitiveness of value chains for six crops, offering jobs and income opportunities for rural households. The presentation began by stating Ethiopia's average post-harvest losses (PHL) as being: wheat 13.6%, maize 10.9%, honey 21% and sesame 15%; with the main causes being mechanical injury, improper storage and transportation losses. With the overall impact of these losses being less competitiveness in the market place, the AGP-AMDe market development strategy has focused on market linkage with domestic and international buyers, introducing new technologies and a capacity building program. In the maize value chain the activities have included: training, field days, an MSP workshop; provision of a warehouse, maize shellers, quality grading equipment and fumigation sheets; plus trade shows and a focus on one-to-one transactions. For wheat, activities have additionally included the dissemination of wheat threshers. For honey, collection and processing support have been provided; whilst for sesame the new technology provided has included washing facilities, quality grading equipment and a traceability system.

4. Enhancing Agro pastoralists Resilience through Postharvest Technologies and Services

PRIME

Zelalem Belayneh introduced the fourth presentation by stating the greatest percentage of losses are being recorded at pre farm-gate stages—where poor harvesting, drying, threshing and storage of crops occur—and that such inefficiencies are major contributing factors to food insecurity. PRIME has been supporting pastoral and agro-pastoral areas towards improved grain threshing and storage by providing access to motorized multi-crop threshers on a cost-sharing basis with private businesses. This is now successfully reducing grain losses, saving animal/human labor and improving grain quality. In terms of grain storage, 30-40% of losses are estimated to be due to molding from the use of unlined traditional pits. PRIME is now supporting private businesses to manufacture and market pit storage bags, also on a cost-sharing basis. Households and sale agents have been given training on postharvest grain management practices and proper use of storage bags, with vouchers provided to HH to cover 30-40% of the costs of buying the bags. The impacts of the PRIME interventions are: reduced grain storage loss from 30% to nearly 1%, improved germination rate –up to 90%; reduced work load for girls and women – from 10 hours to less than 2 hours; grain now free from mold contamination and safe for home consumption; and better market prices for grain. The use of the cost sharing business/market system approach is seen as a sustainable option in that it is reaching a larger number of beneficiaries, is creating employment opportunities, and is an additional income source for the private businesses/service providers. Challenges still remain however as households have limited access to credit during the harvesting season in order to adopt the pit storage bags; private storage bag producers have limited working capital; and government extension/education for scaling up of best PHL reduction practices are limited.

5. Reducing Post-Harvest Losses in Ethiopia

AGP-Livestock Market Development

The final presentation was based on the AGP-Livestock Market Development (LMD) Program that is targeting reduction in milk rejection rates. With 3.3 billion liters of milk produced per year in Ethiopia, and each sold for US$ 0.5, the estimated wastage rate of 10% is valued at US$ 175 million per year. This wastage is a result of low fat content and high bacterial count, and leads to loss of income for smallholder farmers, processors operating at reduced capacity, and reduced availability of processed fresh milk. LMD interventions include awareness creation, supporting quality control systems, introduction of quality-based payment training, and the provision of equipment. The presentation demonstrated the achievements to date with two case studies: At Ruth and Hiruth 400 households produce 4,500 liters a day. With the rejection rate now down from over 10% to almost 1%, and an additional 0.5 ETB per liter given for higher grade milk, the annual income from increased milk sales is now US$ 200 per household per year, with a premium price of $90 per household per year. Almi dairy processing previously had a rejection rate of 10% (300 liters per day) from the 3,000 liters/day provided by 160 producers. Milk hygiene training for farmers, quality based payment training, 65 aluminum milk cans, a refrigerated van and milk quality testing equipment means Almi is now collecting 5000 liters/day. Smallholder annual income has increased 280 US$ per year with 250 US$ per year due to the quality premium. Next steps with the program include 6 private processors, 2 processing cooperatives and increased chilled collection capacity of 140,000 liters per day to allow formal evening milk sales – i.e. over 70,000 liters of evening milk per day which equals US$ 10 million per year in milk sales.

Summary slides from the five presentations are presented at Annex 3.

D. Q&A session on presentations

1. How is it possible to reduce post harvest losses from >35% to >5%?
   With hermetic bags it was proved that this reduction in losses is feasible.
   It is important to make sure that there are no holes in the bags. It is also important to check the moisture content in the bags.
   Many techniques are now used to lower the oxygen content within the bags and kill the insects. Some leave seeds inside the bag before closing it so that the seeds' breathing lowers the amount of O_2 and augments the amount of CO_2; others like Mitsubishi have put in place "oxygen scavengers" that have the capacity to lower the O_2 for 28 days.

2. Are the bags manufactured in Ethiopia?
   Local companies are now producing triple bags – estimated at 40 ETB.

3. During the assessment – have you paid attention to traditional/indigenous storing practices? What are your findings in this regard?
   Traditional storing practices do exist. Some for example use the "sandwich method". This was the case for chickpea put in between layers of teff. In parallel, as a means for pest control, experience has shown that grains are stored above stoves. In the same context, nim tree leaves,

which are known to be insect repellent, are also used to control the pest. However these practices lack of efficiency and can also be toxic at times.
Comment: reinforcing indigenous knowledge by innovating the existing ones is crucial for a sustainable post harvest loss reduction.

4. Have you made comparison between different grains as to the storing practices?
   No comparison has been made.

5. What should be focused on in terms of post harvest loss reduction - training farmers or warehouse owners?
   Balancing the two trainings is indispensable. No aids are granted before these trainings. A good warehouse design is indispensable to improve warehouse management. This includes:
   - doors that close properly
   - walls and ceiling properly built to avoid birds from coming in the warehouses
   - using the "first in-first out" method to avoid expiration of grains
   - creating gaps between the bags - that are like "canyons" for insects.

6. What is the maximum recommended duration for storing for teff?
   It is not recommended to store teff more than a year, though very limited data exists on the impact of the storage duration on its nutritional contents. It is a work in progress.

7. What is the impact Aflatoxin on the milk market in Ethiopia?
   The demand in milk has gone down. The New Zealand powder milk business has replaced local milk production to a great extent. However, 75% of the locally produced milk is in the norm of the US in terms of Aflatoxin content.

   Comment: Aflatoxin can also come from other food sources than milk. Avoiding locally produced milk cannot be seen as a solution. A full study, therefore, requires identifying the different food sources for Aflatoxin.

8. What is the basic standard for bacterial counts?
   Not known.

9. Is there any mechanism that monitors bacterial counts?
   Not yet.

10. Is anti bacterial counts going to be introduced as well?
    Not yet.

E. Mixed Group Discussion

Questions:

- Looking back on its first 5 years of implementation, has the FtF Ethiopia community generated any compelling development success stories on post-harvest loss reduction? Informative failures? What key lessons should we take from these experiences and apply to new programming?
- Looking ahead, what post-harvest interventions have the highest potential to improve nutrition and food security in Ethiopia?
- How can post-harvest interventions be tailored to achieve the highest impact on different types of farmers—*e.g.* women or men, pastoralist or sedentary, high- versus low-resource?
- Identifying knowledge gaps: What (if any) information do you lack in order to design an effective post-harvest strategy for your future programming?

Responses:

- ***Africa Rising*:** improve storage for feed and forage in order to reduce post harvest losses and wastages.
- ***Aflatoxin*:** the issue should not be handled the way it was (introduction of international powder milk businesses as alternative - Anchor).
- ***Smallholder farmers***: knowledge gap to be reduced to reduce malnutrition.
- ***Post harvest technologies***: post harvest technologies to reduce losses are more focused on cereals. These technologies should also intervene in the horticultural (fruits and vegetables) sector, as the losses are even higher.
- ***Roles of the different actors***: universities should play a role in substantiating the efforts made on post harvest lost reduction.
- ***Chain value***: making the post harvest interventions to fit in the value chains.
- ***Private sector***: to come together to get the system to work effectively.
- ***Small businesses***: to be encouraged by supporting and upgrading their technologies. Also it is important to record best practices. The government should have standards and give subsidies to protect the farmers from price fluctuation.
- ***Central collection points***
- ***Price of commodities to show on boards*:** the farmers will know when is best to sell their commodities.
- ***Grain Management***: information on how to manage grain has not been circulated in a sufficient manner.
- ***Capacity building*:** building the capacity of local partners to make sure that the knowledge stays longer – sustainable / long term changes.

Annexes

1. **List of participants**
2. **Meeting agenda**
3. **Slide handouts of the PowerPoint presentations by:**
    a. **Post Harvest Innovation Lab**
    b. **IFPRI**
    c. **AGP-AMDe**
    d. **PRIME**
    e. **AGP-LMD**

1. **Participants List**

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2 Meeting Agenda

Feed the Future Quarterly Meeting: Reducing Post-Harvest Losses in Ethiopia Capital Hotel – 16 June, 2016		
Meeting purpose: Globally, one-third of food produced for human consumption is lost or wasted—approximately 1.3 billion tons of food each year, worth nearly one trillion USD. The magnitude of cereal losses in sub-Saharan Africa alone has been estimated to exceed the value of total food aid the region received over the past decade, making SSA's cereal losses equivalent to the annual value of its cereal imports, or the annual caloric requirement of 48 million people. Reductions in the quality and safety of food also occur after harvest, reducing potential income from the sale of agricultural products and exposing consumers to health risks. Reducing post-harvest losses therefore offers an important pathway to increased food security, improved nutrition, and poverty alleviation. Over the past five years of Feed the Future implementation, USAID's implementing partners have analyzed patterns of postharvest loss in Ethiopia, introduced new technologies and services designed to reduce food losses, and tackled policy issues designed to address challenges of postharvest loss. This meeting will provide a forum to exchange lessons learned, discuss challenges and best practices, and identify opportunities to further reduce post-harvest losses in Ethiopia in the years to come.		
Session	**Lead**	**Time**
Arrival and coffee	**Capital Hotel**	**8.30**
Welcome & USAID updates	**USAID**	**9.00**
Introductions	**Facilitators**	**9.10**
Presentation 1: Post-harvest losses in Ethiopia—a summary of recent data	**Post-Harvest Innovation Lab**	**9.20**
Presentation 2: Analyzing post-harvest losses in a value-chain context—what can we learn from the success story of teff?	**IFPRI**	**9:50**
Presentation 3: Lessons learned on effective post-harvest loss reduction after 5 years of implementation	**AGP-AMDe**	**10:05**
Moderated discussion (Q&A/clarification)	**Moderator**	**10:30**
Coffee Break		**10.45**
Presentation 4: Enhancing agro-pastoralists' resilience through facilitating access to postharvest technologies and services.	**PRIME**	**10:45**
Presentation 5:	**LMD**	**11:00**
Moderated discussion (Q&A/clarification)	**Moderator**	**11:15**
Opportunities to reduce post-harvest losses under Feed the Future Programming – Mixed Group Discussion Questions: • Has the FtF Ethiopia community generated any compelling success stories in its first 5 years of implementation? Informative failures? What key lessons should we take from these experiences and apply to new programming? • Looking ahead, what post-harvest interventions have the highest potential to improve nutrition and food security in Ethiopia? • How can post-harvest interventions be tailored to achieve the highest impact on different types of farmers—*e.g.* women or men, pastoralist or sedentary, high- versus low-resource? • Identifying knowledge gaps: What (if any) information do you lack in order to design an effective post-harvest strategy for your future programming?	**Facilitators**	**11:30**
Group Presentations	**Facilitators**	**12:00**
Plenary Discussion	**Moderator**	**12:15**
Wrap-up	**USAID**	**12:30**
Lunch		**12:30**

3. Presentations – Slide handouts

a) Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss

PHIL

Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss

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Mitigation of Postharvest Losses in Ethiopia

FTF Quarterly Meeting: Reducing Postharvest Losses in Ethiopia
Capital Hotel, 16 June 2016

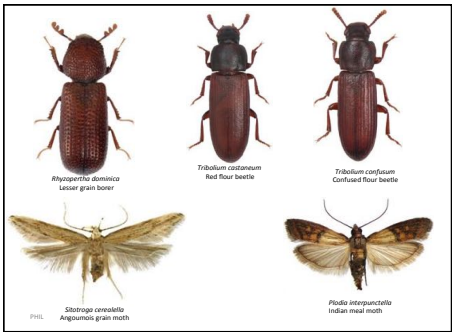
Kansas State University

In-country collaborators and potential partners

- Mekelle University(host), Bahir Dar University, Hawassa University in Ethiopia
- Regional Agricultural Bureaus (Amhara, Tigray, Oromia, SNNP)
- Ministry of Agriculture
- Ethiopian Institute for Agricultural Research
- Agricultural Transformation Agency, Ethiopia
- Hiwot Agricultural Mechanization, Ethiopia
- Grain Pro, Inc.
- Sesame Business Network, Ethiopia
- International Seed Sector Development, Ethiopia
- ACDI-VOCA, Ethiopia
- Farmers, farmer cooperatives, small businesses and USAID mission
- Sasakawa Global 2000
- Africa Rising

Postharvest Research in Ethiopia

- IAR established 1966
- Limited studies in early 1960s (Tropical Stored Products Research Centre, UK)
  - Molds, mycotoxins, and insects
- Efforts to reduce losses under FFHC (UNDP/FAO) in early 1970s
- Walker and Boxall (1974) comprehensive survey of insects [1971-72]Detailed studies by Ethiopian scientists in 1980s at EIAR institutes
- Most surveys on insect pests and to a lesser extent on fungi
- Research on rodents and birds limited
- 100 different insect species recorded from stored grains
- About 10-12 are common
- Stored product beetles more common than moths
- Species associated with stored grain varied with commodity and elevation
- Field infestations were reported



Fungi associated with stored grains

- Common genera
- *Aspergillus*
- *Penicillium*
- *Fusarium*
- 12% of 523 wheat samples tested positive for DON (Dereje 2008)
  - DON levels were 60 – 2500 ppb
- 38% of 2000 maize samples had *Fusarium* and *Aspergillus* and 77% had fumonisins (25 - 4500 ppb) (Hadush et al. 2014)

Number of farmers surveyed by region

Region	Wheat	Maize	Chickpea	Sesame
Tigray	30	51	50	90
Amhara	66	85	60	80
Ooromiya	80	70	60	30
SNNPR	15	74	50	----
Total	191	280	220	200

Postharvest loss assessment survey information

- Crop-specific: Maize, wheat, chickpea, and sesame
- Survey of farmers' perception about PHL
- Information gathered
  - Demography
  - Inputs used in production
  - Causes of grain losses
  - Different postharvest techniques practiced
  - Storage structure and time
  - Methods used to control losses
  - Transportation and marketing
  - Family nutrition
  - Pesticides and environmental safety
  - Role of gender

Cross-cutting issues

- **Gender**
  - Address role of gender in PHL reduction
  - Develop Women Empowerment Agricultural Index and gender dynamics
  - Specific training in gender analysis, tools and methods
  - Integrate gender-sensitive participatory approaches into all stages of the project cycle
- **Nutrition**
  - Measure reduction in PHL on nutritional security
  - Assess impact of PHL reduction strategies on the nutritional status of families
- **Environment**
  - Environmental Mitigation and Monitoring Program (EMMP)
  - Mitigation measures to be followed by project personnel to minimize potential adverse impacts to humans and environments

Farmer perceptions: Maize survey

Prevalence and severity of storage insect pests

Description	Farmer's response	No. responding (%)
Prevalence	Prevalent	169 (93.9)
	Not prevalent	11 (6.1)
Severity	Not severe	28 (10.0)
	Moderately severe	70 (25.0)
	Severe	169 (60.4)
	Not able to judge	13 (4.6)

Farmer perceptions: Maize survey

Prevalence and severity of molds in storage

Description	Farmer's response	No. responding (%)
Prevalence	Prevalent	197 (70.4)
	Not prevalent	83 (29.6)
Severity	Not severe	62 (22.1)
	Moderately severe	47 (16.8)
	Severe	87 (31.1)
	Not able to judge	84 (30.0)

Maize: Some key findings

- Only 26% of 280 farmers indicated ever receiving any postharvest loss prevention training
- More than 80% of surveyed farmers expressed a need for training in harvesting, packing, transportation, drying, cleaning, moisture measurement, insect, mold, and vertebrate pest management, proper storage, use and safe handling of pesticides, and marketing of grain
- 82% (n = 279) farmers measure moisture mostly by biting with their teeth (91%, n = 265)
- 20 and 65% of farmers use malathion and pirimiphos-methyl to protect grain in storage from insects (n = 275)
- Maize is stored in traditional gotera (68% of farmers, n = 276), and it is stored for 7-12 months

Different methods adopted by maize farmers to inspect storage

Storage period varied between 0-12 months

Of the total, 97% of farmers inspect their maize during storage

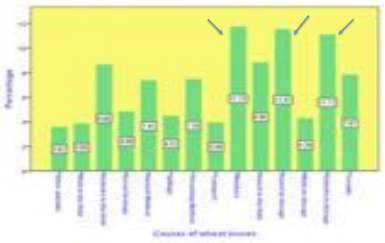
Inspection methods	Respondent farmers	
	Number	Percentage
Visual	269	99
Smell	188	69
Taste	136	50
Other	76	28

Wheat survey: Key findings

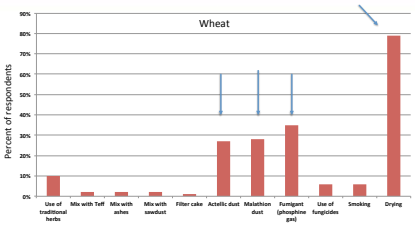
- Farmers store wheat in traditional storages, fertilizer bags, jute bags, polypropylene bags, and warehouses
- Wheat is stored for 3-12 months
- Farmers inspect grain in storage visually and by smell

Traditional gotera

Causes of postharvest losses



Control methods used in storage



Factors affecting selection of control methods

Factor for selection	Respondents (%)
Traditional practice or Custom	79
Ease of use	53
Locally available materials	39
Effectiveness of method	30
Affordable price	28
Prior positive results	17
Received training	10
Others	7

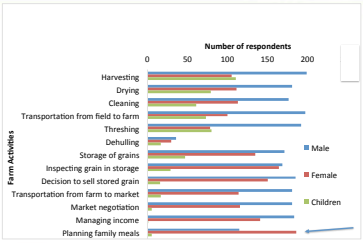
n = 191

Estimated postharvest losses in wheat

Harvest and postharvest stage	Wheat losses (%)*	*n*	Calculated estimates under two scenarios**	
			No rain at harvest	Rain at harvest
Harvesting	6.8	183	6.8	16.3
Threshing	3.5	178	3.5	3.5
Cleaning	2.1	175	----	----
Packaging/bagging	0.2	168	----	----
Transportation (farm to storage)	1.1	165	1.2	1.2
Farm Storage	2.7	180	2.7	2.7
Transportation (storage to market)	0.2	165	1	1
Market storage	0.1	166	2.7	2.7
Milling/Crushing/Grinding	0.4	172	-	-
Total	**17.1**		**14**	**23**

*Calculated by SPSS; **Calculated by APHLIS calculator.

Roles of gender in farming/marketing



Chickpea: Harvest and postharvest losses

- Pod-dropping from plants to ground at harvest was cited as the major cause of loss by 75% of the respondents (*n* = 219)

- Threshing is done by animals (oxen, horses, or donkeys) [75.5% of 174 respondents] or by stick (3.6%)
- Grain loss occurs during threshing (45% of 134 respondents]. Some loss due to consumption by trampling animals. Loss is assumed to be 18.6 kg (*n* = 134)
- Losses occur during cleaning (winnowing) as reported by 53.2% of 138 respondents. Total loss 14.4 kg

- Losses during transportation were 3.4 kg (*n* = 172)
- Storage losses reported by 91 farmers were 29.4 kg
- Only 18.2% of 220 farmers reported receiving any training on postharvest loss issues

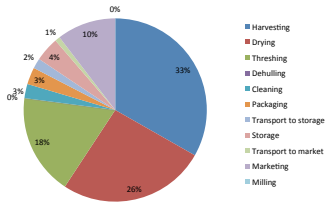
Farmers' training needs

No	Area of training need	Responding farmers	
		Number	Percent
1	Harvesting	148	67.3
2	Threshing	73	33.2
3	Packing	72	32.7
4	Transport	46	20.9
5	Drying	76	34.5
6	Cleaning	107	48.6
7	Insect identification	179	81.4
8	Mold identification	78	35.5
9	Pesticide usage	197	89.5
10	Pesticide handling	179	81.4
11	Proper storage	148	67.3
12	Rodent and other animal control	111	50.5
13	Bird control	55	25.0
14	Marketing	116	52.7

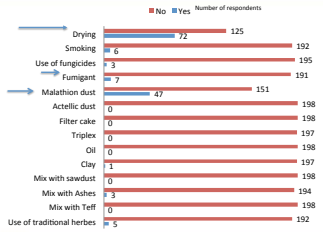
Chickpea insect control methods in storage

No.	Control method	Responding farmers	
		Number	Percent
1	Traditional herb	16	7.3
2	Mix with teff	18	8.2
3	Mix with ash	26	11.8
4	Actellic dust	29	13.2
5	Malathion dust	57	25.9
6	Fumigant (phosphine)	136	61.8
7	Fungicide	8	3.6
8	Smoking	7	3.2
9	Drying	84	38.2
	Total	381	171.2

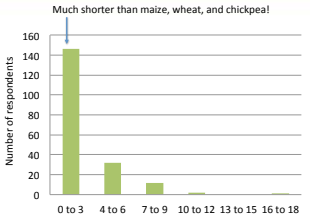
Sesame: Losses at and after harvest



Sesame storage loss prevention methods



Duration of sesame storage



Sesame: Conclusions

- Substantial losses in sesame occur at and after harvest
- The highest losses (33%) occur at harvesting, during in-field drying (26%), threshing (18%), storage (6 %), and marketing (10%)
- Field insects during growth of plants, termites, adverse weather conditions, and theft are major causes of losses
- Improved postharvest loss prevention methods will reduce losses considerably
- Postharvest loss reduction methods should be evaluated, demonstrated to farmers for adoption, along with information on postharvest losses and loss reduction technologies

Research in progress 2015

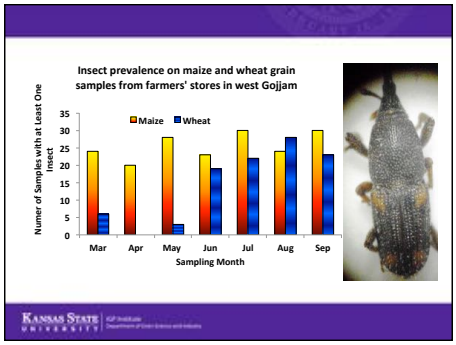
- **Solar based drying technology**
  - Solar cabinet dryer, solar bubble dryer and open-air sun drying
  - Modeling to predict fluid flow, heat flow and pressure drop
  - Basic designs will be simulated for variables and then optimization will be done for better designs
- **Insect research**
  - 30 farmers were identified in each region
  - Samples were collected from each farmer
  - Pheromone traps and probe traps were deployed
  - 10 warehouses were identified in each region
  - PICS triple bags, Grain Pro Super bags, polypropylene bags, jute bags, metals bins
- **Mycotoxin analyses**
  - Aflatoxin, Fumonisin, DON (Deoxynivalenol), and Ochratoxin were analyzed for four crops

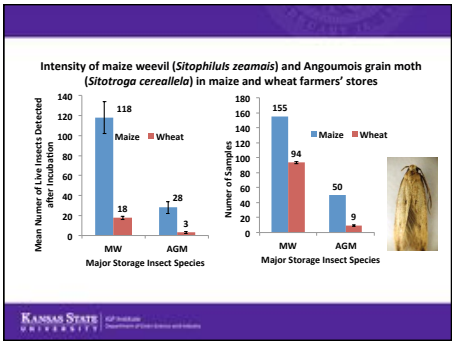
Extension engagement-2015

- Established Extension Advisory Team (EAT)-10-12 members
- First engagement advisory meeting happened in July 2015
- Key concepts identified
  - Harvesting, threshing and shelling are key areas need curriculum and training
  - Drying and mold reduction
  - Storage management (of grain)
  - Insect management
- Target audience: smallholder farmers, development agents, extension personnel
- Secondary audience: storage managers, private sector folks, and input suppliers
- Plans
  - Develop training curriculum
  - Train under leadership of EAT

Capacity building-2015

- Set up two mycotoxin laboratories
  - ✓ At Mekelle University, Tigray and Bahir Dar University, Amhara
- Provided tools for insect sampling
- Provided probes for grain moisture measurement
- Installed the Grain Pro bubble dryers and cabinet dryers
- Shared books, research articles and literature related to PHL
- Both universities now have dedicated stored-products research laboratories
- Recruited three graduate students from each of the Universities
  - ✓ Start date May 2015
  - ✓ Research is being conducted in Ethiopia





Total aflatoxins: Maize 2015

Month of Sampling	No of samples analyzed	Positive samples (%)	Samples ≥ 20 ppb (%)	Observed detection range (ppb)	
				Min	Max
March	30	90	3.3	2.05	29.34
April	30	100	6.6	6.25	22.06
May	30	100	26.7	8.5	26.19
June	30	100	23.3	6.97	23.19
July	30	100	0.0	2.03	7.7
August	30	100	0.0	4.67	12.68
Total	**180**	**98**	**10.0**	**2.03**	**29.34**

Evaluation of different storage technologies

Storage Containers
- Polypropylene bag
- Jute Bag
- Metal Silo
- Plastic Drum
- PICS bag
- GrainPro Super bag
- Jute bag+Filter Cake
- Polybag + Filter Cake

10 kg homogenized grain in each container

Age of Grains (Maize)
- 10 months
- 11 months
- 12 months
- 13months

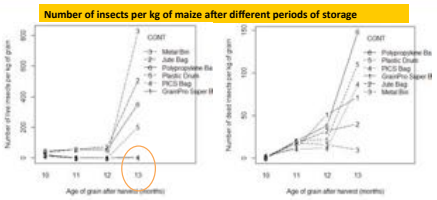
Age of Grains (Wheat)
- 9 months
- 10 months
- 11 months
- 12 months

Exp. Laid out in completely randomized design on lab floor in triplicates (Metal Silo, duplicate),

Hobo Data logger used for Temp and RH recording, data analyzed using R-software.

Evaluation of different storage technologies

Number of insects per kg of maize after different periods of storage



Hermetic bags suppressed insect population growth, while higher live insect populations were record in other containers
Lower insect mortality in metal bin and jute bag, ease of access to oxygen

Research in progress 2016

- Conducting same tests as in 2014
- Surveying 180 farmers per commodity
- Provided hermetic bags to 100 chickpea and sesame farmers and 65 wheat and maize farmers
- Held a workshop on Reducing postharvest losses of grains in Ethiopia, Feb. 25, 2016, Addis Ababa
- Bringing awareness of postharvest technologies to farmers through training programs and participation at farmer field days
- Assessed role of gender in postharvest loss mitigation
- 2016 and beyond: scale up of technologies to show reduction in postharvest losses from >35% to less than 5%

b) How big are post-harvest losses in Ethiopia? The case of teff - IFPRI and EDRI

-

Introduction

- Wastages and post-harvest losses increasingly being debated. Important because of food security considerations and environmental implications
- However, wide variation in estimates in post-harvest losses and wastages
- Problem with current estimates:

1/ Based on opinions, not surveys

2/ Biased towards perishables

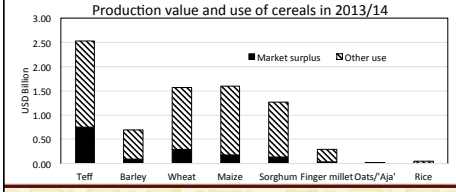
3/ Not focused on products making up bulk of calories

- We look with detailed primary surveys at losses at different levels in the value chain of teff

Background

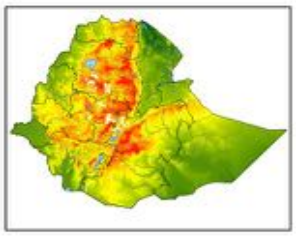
- Teff grown by 6.6 million farmers
- Most important cash crop in the country

Production value and use of cereals in 2013/14



Data and methodology

- 60 kebeles surveyed; 1,200 farmers interviewed
- Follow teff value chain from there to Addis' retailers



Data and methodology

- Stratified random samples at each level:

1. Upstream: 1,200 farmers in five major teff production zones. These five zones represent 38% of national teff area and 42% of the commercial surplus.

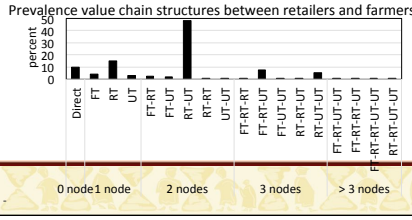
2. Midstream: 200 rural wholesalers and 75 urban wholesalers

3. Downstream: 282 urban retail outlets (83% mills; 10% cereal shops; 7% consumer cooperatives)

Structure of the value chain

- Asked all stakeholders where they obtained teff
- In 85% of the cases, less than 2 nodes between urban retailers and farmers

Prevalence value chain structures between retailers and farmers



Post-harvest losses estimates
(a) Post-harvest losses at the farm level

Losses during threshing

	Unit	Mean	Median
Share of farmers reporting losses	%	56.9	
For those reporting losses			
- quantity lost	qtl	0.25	0.15
- teff harvest	qtl	12.30	8.00
- share lost	%	3.1	1.9
For all farmers			
- quantity lost	qtl	0.14	0.04
- teff harvest	qtl	11.00	8.00
- share lost	%	1.8	0.5

Post-harvest losses estimates
(b) Losses during storage

- Share lost : 1/ at farm level: 0.2%; 2/ by wholesalers/brokers: 0.3%; 3/ by retailers: 0.2%

Losses during storage by farmers

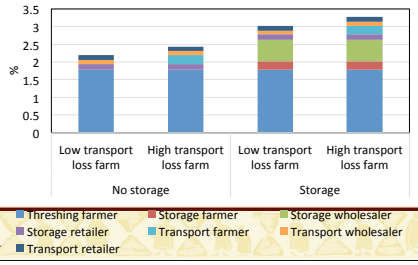
	Unit	Mean	Median
Share of farmers reporting losses	%	11.6	
For those reporting losses			
- quantity lost	qtl	0.24	0.15
- teff harvest	qtl	16.54	12.00
- share lost	%	2.0	1.4
For all farmers			
- quantity lost	qtl	0.03	0.00
- teff harvest	qtl	11.00	8.00
- share lost	%	0.2	0.0

Post-harvest losses estimates
(c) Losses during transportation

- No information at the farm level (assume two scenarios, i.e. 0% and 0.25% of production)
- Share lost : 1/ by wholesalers/brokers: 0.1%; 2/ by retailers: 0.1%

Post-harvest losses estimates
(d) The whole value chain

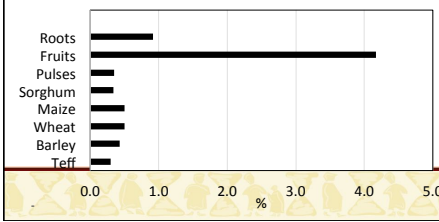
% losses in the value chain



Is teff different to other crops?

- Teff losses at farm lower than other cereals, but not much lower

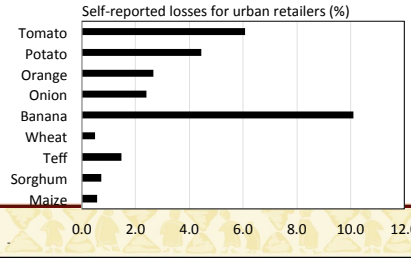
Self-reported post-harvest losses for farmers



Is teff different to other crops?

- Losses higher at the retail level (based on survey of 1,200 urban retailers)

Self-reported losses for urban retailers (%)



Conclusions

- Find that (self-reported) post-harvest losses in teff value chain vary between 2.2 and 3.3 percent of quantity produced [caveat: physical losses, not quality losses; no pre-harvest losses]
- Teff exceptional for staple crops but maybe not that much?
- Implications: Reduction of post-harvest losses entail costs; have to weighed against potential benefits; therefore, getting evidence right on extent of PHL is important.

c) Post-Harvest Management & Market Competitiveness - AGP-AMDe

-

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USAID AGRICULTURAL GROWTH PROGRAM-AGRIBUSINESS MARKET DEVELOPMENT

Objective: Sustainably reduce poverty and hunger by improving the productivity and competitiveness of value chains that offer jobs and income opportunities for rural households.

Regional Focus
Amhara
Oromia
SNNPR
Tigray

Six value chains
Sesame
Chickpea
Coffee
Honey
Wheat
Maize

Improve:
1. Competitiveness of 6 VCs
2. Access to Finance
3. Enabling Environment
4. Cross Cutting Gender, Nutrition and BCC

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Ethiopia's Average Post-Harvest Loss

- Wheat -13.6%
- Maize - 10.9% (based on CSA 2014 survey; Other Sources 25% in 2013
- Honey 21%
- Sesame 15%

Buyers Want Good Quality Product in Sufficient Quantity

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Some of the Main Causes of PHL ??

- Mechanical Injury
  - Puncture
  - Bruises
- Improper Storage
  - Infestation
  - Loss of moisture
  - Contamination
- Transportation
  - Spillage
  - Contamination




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Impact of Post-Harvest Issues

- Poor Quality of Goods Coming to the Market
- Wastage Along the Value Chain
- Increased Transport, Storage, Processing Cost
- Lower Price Offered to Farmers
- Loss of Buyer for the Product
- AFECTS COMMPETITIVNESS IN THE MARKET

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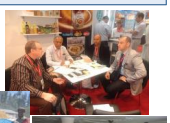
USAID AGP-AMDe Market Development

Improve Competitiveness of Value Chains

- Market Linkage with Domestic and International buyers
- Introduce New Technologies
- Provide Capacity Building Program



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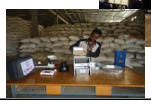
Maize Value Chain

- Capacity Building
  - Training
  - Field Days
  - MSP Workshop
- Dissemination or Investment In New Technology
  - Warehouse
  - Maize Sheller
  - Quality Grading Equipment
  - Fumigation Sheet
- Market Linkage
  - Trade Shows Domestic
  - One to One Transaction



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Maize Value Chain

Cooperative Union	Number of Individuals	Estimated Days Spent	Type Of Support
AGP-AMDe	18	325	Facilitation, Checking Status, Process Support, Review and Discussion
RCPA	2	8	Checking Status, Review and Discussion
Regional Experts	3	23	Checking Status , Process Support
Zonal Experts	3	15	Checking Status , Process Support
Woreda Expert	2	9	Checking Status , Process Support
Total	**28**	**380**	

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Maize Value Chain

Cooperative Unions

- Logistical Challenges
  - Warehouse
  - Fumigation
  - Cleaning
- Financial
  - Loan Application and Approval
  - Collateral and Other Issues
- Communication
  - Consistency
- Commitment

WFP

- Purchase Contract
  - Price
  - Terms and Condition
- Logistical Challenges
  - Inspection
  - Transportation
- Communication
  - Notification and Frequency

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Wheat Value Chain

- Capacity Building
  - Training
  - Field Days
  - MSP Workshop
- Dissemination or Investment In New Technology
  - Wheat Threshers
  - Quality Grading Equipment
  - Fumigation Sheet
- Market Linkage
  - Trade Shows Domestic
  - One to One Transaction

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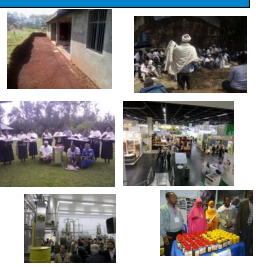
Honey Value Chain

- Capacity Building
  - Training
  - MSP Workshop
  - Experience Sharing Visit
- Dissemination or Investment In New Technology
  - Collection Centers
  - Processing Facilities
- Market Linkage
  - Trade Shows Domestic and International
  - One to One Transaction
  - International Investment



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Sesame Value Chain

- Capacity Building
  - Training
  - Field Days
  - MSP Workshop
- Dissemination or Investment In New Technology
  - Warehouse
  - Quality Grading Equipment
  - Processing Plants
- Market Linkage
  - Trade Shows Domestic and International
  - One to One Transaction
  - International Investment

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Sesame Value Chain

- Capacity Building
  - Training
  - Field Days
- Dissemination or Investment In New Technology
  - Washing Stations
  - Quality Grading Equipn
  - Traceability System
- Market Linkage
  - Trade Shows Domestic and International
  - One to One Transaction
  - International Investment

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d) Enhancing Agro pastoralists Resilience through Postharvest Technologies and Services - PRIME

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Enhancing Agro pastoralists Resilience through Postharvest Technologies and Services

PRIME Project Experience

By

Zelalem Belayneh

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PRESENTATION OUTLINE

- Introduction
- Existing Postharvest practices
- What we did – PRIME Intervention
- Impact of the intervention
- Lessons and Challenge

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INTRODUCTION

- Globally 1/3 of food intended for human consumption is lost
- In sub-Saharan Africa about 40% of staple food are lost before making it to markets
- These losses are being recorded at every stage in the supply chain from production to consumption
  - But the greatest %age of losses were recorded at pre farm-gate stages where ***poor harvesting, drying, threshing and storage*** of crops occur
- In Ethiopia the existing inefficiencies in these segments postharvest represent one of the largest contributing factors to food insecurity

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INTRODUCTION

- In pastoral and agro pastoral areas where PRIME project is operating, Households are losing significant amount of their production due to:-
  - Lack of equipment to implement grain threshing and storage practices
  - Lack of adequate extension education on post-harvest management
- Assessment showed that agro pastoralist lose over 40% of grain produced during ***threshing*** and ***storage*** stages of postharvest supply chain
- Hence PRIME project has supported agro pastoralists to reduce losses at these two stages

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CONTEXT…

Grain threshing

- Grain threshing is done using animal power or human labor - causing about 6% of grain loss due to
  - Grain scattering/ spillage
  - Mix with dirt and stones
  - Physical damage/grain breakage
- The process is also laborious, time intensive, and often keeps children out of school during harvest

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PRIME INTERVENTION

Created Access to Modern Crop threshing Service

- Supported ***Private businesses*** through competitive cost shared grants (50% cost)
  - to provide grain threshing service on payment bases
- Facilitated linkage of private businesses with agricultural research centers to
  - Procure motorized multi crop threshers
  - Get trained on operation & maintenance

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IMPACT…

As a result of the support provided:-

- Grain loss reduced - from 6% to 1%
- Threshing time saved - from 10 to 12 hrs./ ton to 1.5 hrs./ ton
- Cost of threshing reduced – from 90 ETB/ Qt. to 30 ETB/Qt.
- Grain quality improved – no mix with soil and stone
- Created employment opportunity
- Additional income source for business

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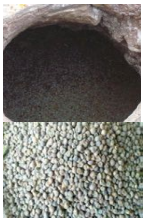
CONTEXT…

Grain Storage

- Traditional underground pits, granaries and sacks are commonly used for storage
  - Use of unlined traditional pit causes 30 to 40% of grain loss due to molding
- Moisture entrance from the surrounding pit wall identified as major factor for grain molding
  - Which is unsafe for consumption due to Mycotoxin/Aflatoxin contamination



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INTERVENTION…

Created Access to Pit Storage Bag

- Supported ***private business*** through cost shared grant for manufacturing and marketing of pit storage bags
- Facilitated linkage between Pit storage bag supplier and sales agents/agricultural input suppliers

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INTERVENTION…

Created Access to Pit Storage Bag

- Facilitated HHs and sale agents training on postharvest grain management practices and proper use of storage bag
- Supported HHs through voucher (covered 30 to 40% cost) to facilitate their access to the pit storage bags

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IMPACT

- Reduced grain storage loss from 30% to nearly 1%
- Improved germination rate –up to 90%
- Reduced work load for girls & women – from 10 hrs. to less than 2 hrs.
- Safe for home consumption – as grain is free from mold contamination
- Good market price compared to grain from traditional pit

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LESSONS & CHALLENGES

Lesson

- Unlike the traditional free handouts approach, the use of **cost shared business/market system approach** has been realized as good & sustainable approach to reach large number of beneficiaries, create employment opportunities and additional income source for the private businesses/service providers - while reducing the prevailing grain losses

Challenge

- HHs limited access to credit services during harvesting season to adopt the pit storage bags
- Limited working capital (private storage bag producer)
- Limited gov't extension education on scaling up of best PH loss reduction practices
- Dependency syndrome

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e) Reducing Post-Harvest Losses in Ethiopia - AGP-LMD

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AGP-Livestock Market Development
Reducing Post-Harvest Losses in Ethiopia

Quarterly USAID Ethiopia Feed The Future meeting, June 16, 2016, Addis Ababa

Photo Credit: Kelley Lynch

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Reducing Milk Rejection Rates

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NATURE OF THE PROBLEM

- 3,3 billion liters of milk per year
- One liter sold for 0.5 US$
- 10% wastage would value 175 million US$ per year
- Milk wastage as a results of low quality: low fat content and high bacterial count.
- Loss of income for small holder farmers
- Processors operating at reduced capacity because of limited supply
- Less availability of processed fresh milk in the market

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AGP-LMD'S INTERVENTIONS

- LMD works with small holder farmers and processors in minimizing milk rejection
- Interventions are awareness creation, supporting quality control systems, introduction of quality based payment, training and the provision of equipment
- The following are two examples of LMD's innovative grantees work in minimizing post-harvest loss in the dairy sector

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RUTH AND HIRUTH

- 400 households, 4,500 liters a day
- Quality payment: 0.5 ETB additional per liter for high grade
- Rejection rate down from over 10% to almost 1%
- Annual Income from increased milk sales: 200 US$ per household per year
- Annual income increase due to premium price: $ 90 per household per year

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Hiruth's Milk Collection Center

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ALMI DAIRY PROCESSING

- Before: 3,000 liters/day from 160 producers
- Rejection rate of 10% (300 liters per day)
- LMD Interventions:
  - Milk hygiene training for farmers
  - Quality based payment training
  - 65 Aluminum milk cans
  - Refrigerated van
  - Milk quality testing equipment

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ALMI DAIRY PROCESSING

- Now: Almi is collecting 5000 liters/day
- Rejection rate of 1.4% (70 liters per day)
- 1 ETB per liter premium for high grade milk (50%)
- Smallholder annual income increased 280 US$ per year due to reduced rejection rate
- Small holder annual income increased 250 US$ per year due to the quality premium

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WAY FORWARD

Minimizing milk rejection by introducing quality based payment with
- 6 private processors
- 2 processing cooperatives

Increase chilled collection capacity with 140,000 liters per day to allow formal evening milk sales (over 70,000 liters of evening per day which equals 10 million US$ per year in milk sales)

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