The Effective Grain Storage for Better Livelihoods of African Farmers Project EGSP

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Food Processing and Post-harvest Handling Innovation Lab

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EGSP I: 2008-2011

- **Objective**: Reduced postharvest losses, increased income and enhanced food security for resource poor farmers
- **Technology**: metal silo
- **Project area**:
  - Malawi
  - Kenya (Homa Bay and Embu)
- **Methods**:
  - Promotion and dissemination
    - Train artisans in metal silo construction
    - Promotion: radio, brochures, manuals, some silos
  - Research:
    - On-station: efficacy
    - On-farm testing
    - Storage loss estimation (Zambia, Kenya)
    - Storage practices (Kenya)
    - Economic analysis of different storage method
    - Adoption and impact
Technology: metal silo and hermetic bags

Project area:
- Malawi, Zimbabwe, Zambia,
- Kenya: (plus Naivasha and Nakuru, surplus areas)

Methods:
- Promotion and dissemination
  - Train artisans
  - Training agrodealers
  - Financing metal silos through commercial, table banking
- Research:
  - On-farm testing
  - Effect of training
  - Economic analysis of different storage method
  - Adoption and impact
Steps in economic analysis of storage

1. Understanding the system
   - Understanding the farming system, seasonality, practices

2. Estimating the problem
   - Estimating the extent (spread, geographic distribution)
   - Estimating the intensity of the problem (levels, damage, loss)

3. Efficacy testing: On-station testing
4. Benefit cost analysis
5. Farmer evaluation: on-farm trials
6. Modeling and Econometric analysis
7. Impact assessment
1. Understanding the problem

Seasonality
2. Estimating losses – Farmers estimates

- Clear pattern and links
- Loss increases with
  - temperature and humidity

![Graph showing farmers' loss estimates in Kenya](image-url)
3. Efficacy of hermetic storage

4. Benefit/cost analysis

- Polypropylene bags US$ 0.6/90 kg bag
- Actellic super: US$ 3.3/bag
- Super grain bag: US$ 5.3/bag
- Metal silos: ~ size
Benefit cost ratio of new technologies

- Assuming constant price of $230/ton, loss of 14%, loss in new methods proportionate to trials
Sensitivity analysis

- What if loss is only 7% (or price half)? Not profitable
- If loss is 7% and price of sales double: same as base
- With low losses and prices, only large silos cost effective
5. On-farm Testing (Randomized Control Trials)
Damage in storage after 2 and 4 months

- Damage is much lower in the hermetic bags than the control bags: 4% of grain

<table>
<thead>
<tr>
<th></th>
<th>No insecticide</th>
<th>Insecticide</th>
<th>Control</th>
<th>Hermetic bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>First round</td>
<td>5.3</td>
<td>7.7</td>
<td>1.8</td>
<td>1.8</td>
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<tr>
<td>Second round</td>
<td>14.6</td>
<td></td>
<td>1.8</td>
<td>4.2</td>
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</tbody>
</table>

- Damage in storage after 2 and 4 months
- On-farm Testing (Randomized Control Trials)
Weight loss in storage after 2 and 4 months

- Weight loss in control: about 1%/month
- Weight loss reduced by insecticide, to 1.5% after 4 months
- In hermetic bags: 0.5% after 4 months
- Farmers’ comments: grain in hermetic bags smells fresh, even after four months
6. Modeling: Extrapolation losses from farmer estimates - Zambia

- Storage losses increase with temperature and humidity
- Not all variance in AEZ III explained by climate

Zambia AEZ:
- I = High rainfall
- II = Intermediate
- III = dry

<table>
<thead>
<tr>
<th>AEZ</th>
<th>Mean</th>
<th>N</th>
<th>STD</th>
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<tbody>
<tr>
<td>I</td>
<td>19.6</td>
<td>174</td>
<td>22.7</td>
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<tr>
<td>IIA</td>
<td>23.7</td>
<td>386</td>
<td>24.2</td>
</tr>
<tr>
<td>III</td>
<td>2.6</td>
<td>286</td>
<td>7.0</td>
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<tr>
<td>Total</td>
<td>15.7</td>
<td>846</td>
<td>21.9</td>
</tr>
</tbody>
</table>

% grain loss in storage

Temperature (C)

High humidity (RG=55)
Medium humidity (RG=45)
Low humidity (RH=35)
Extrapolate losses (in %) and multiply with maize production.

storage losses (in tons)
7. Impact assessment:
Metal silos in Kenya with Propensity score matching

- Household survey of 1344 households, representative over all zones
- Survey of households who adopted metal silos: 124 (105 storing maize)
- We matched (using propensity score matching) adopters and non-adopters on their characteristics (size, income, ..)
  - 105 adopters with 892 non-adopters
Results: Major difference in sales time

- Metal silo users
- Metal silo non-adopters

- Non adopters sell most of their maize at harvest
- Adopters sell much of their grain in the fifth month
- Adopters get higher prices.
Impact of metal silos

- Reduction in storage loss
  - Value of: US$18
- Reduction in Pesticides used:
  - Value of US$134
  - (some adopters still used pesticides).

- Increased storage period
- Households store maize for 2 months longer

- Households are food secure for one month longer

8. Further work

- **Technical**
  - Test for aflatoxins
  - Closure systems for metal silos (tubeless tires)
  - Drying

- **Economics**
  - Benefit cost analysis of metal silos and hermetic bags
  - Impact analysis of hermetic bags using randomized control trials data.
  - Experiment with credit for silos
  - Adoption and impact surveys

- **Policy issues**
  - Train agrodealers and distribute through private sector
  - Reduce costs (tax) of imported inputs
  - Quality control measures,
    - Label for metal silos,
    - Labels for aflatoxin free grain
  - Improve access to metal silos through collective action: farmer groups and credit facilities
  - Support for job creation
Thank you
Pictures storage
Storage pest – cont.

- Natural infestation
- Artificial infestation – ex. Storage pests Kenya
Storag pests – cont.