Post-production practices, grain losses and perceptions in maize-based smallholder farming systems of Zimbabwe

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INTRODUCTION

- Maize is a staple cereal for southern Africa
- Unimodal rainfall pattern emphasises PHM importance to overall maize supply throughout the year
- Household grain storage is a major food and nutrition security strategy
- Maize grain is also a major source of income
- In Zimbabwe, maize postharvest losses estimates: 5 year average cumulative maize **15.5-17.5%** (APHLIS, 2014)

Study Objectives

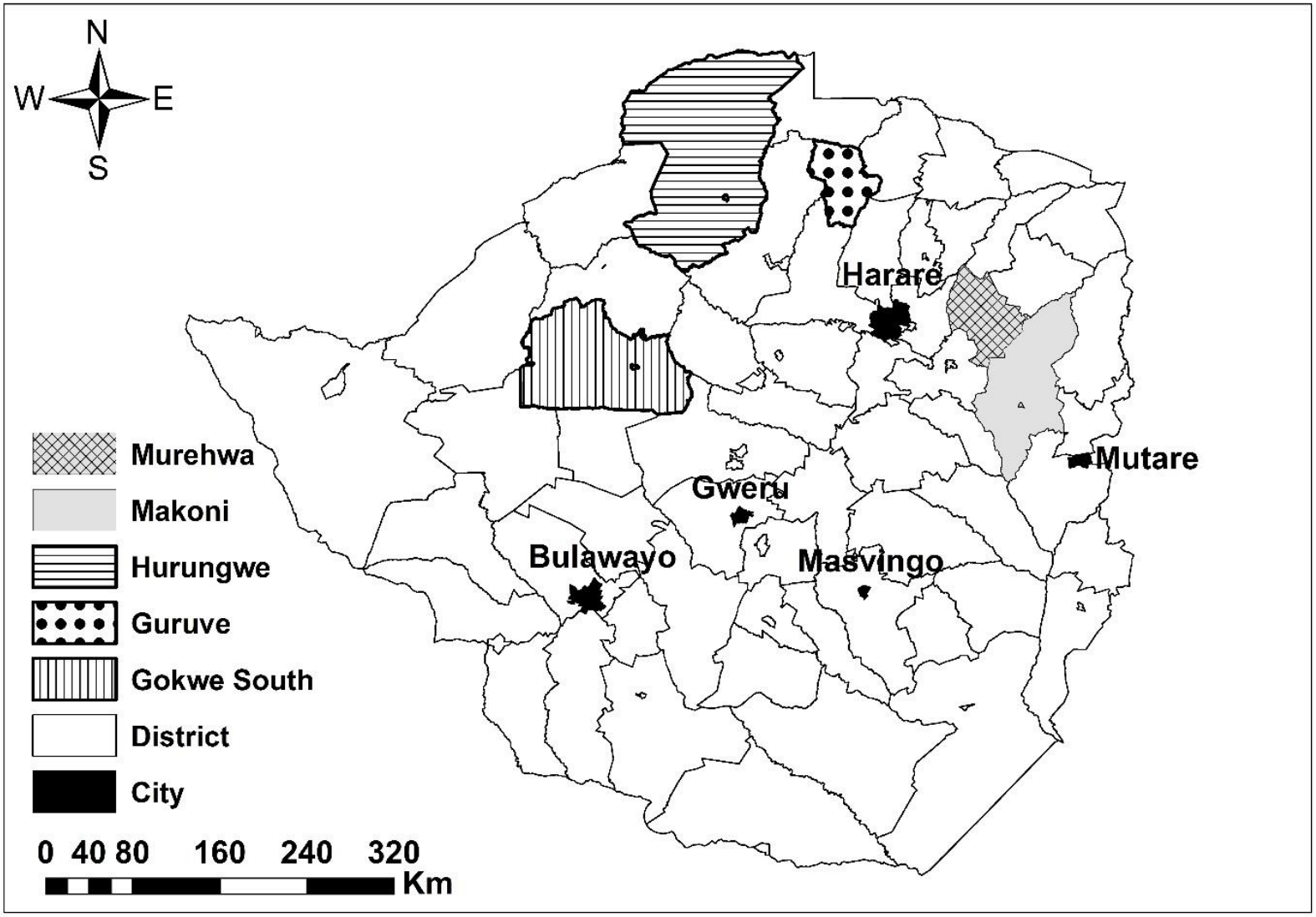
- To obtain a clear understanding of the weak points in maize food supply chains
- To identify interventions to reduce food losses and improve the efficiency of the supply chain

METHODOLOGY

SURVEY SITE SELECTION

- SIGNIFICANT MAIZE PRODUCTION
- PROVINCIAL REPRESENTATION
- PREVIOUS RELEVANT INTERVENTIONS
- LARER GRAIN BORER AFFECTED AREAS

STUDY GEOGRAPHICAL COVERAGE



STUDY LEVELS

- HOUSEHOLD LEVEL
  - FARMERS/PRODUCERS
  - GRAIN SAMPLING
- FOCUS GROUP DISCUSSIONS (FGDs)
- KEY INFORMANT INTERVIEWS – WARD LEVEL
- DISTRICT STAKEHOLDER INTERVIEWS

Round 1 Visit (June/July 2015)

No. of Household Respondents by Farming Sector

Farming Sector	No. of Respondents	% of Respondents
Communal Area (CA)	163	52.6
Old Resettlement (OR)	54	17.4
New Resettlement (A1)	93	30.0
Total	**310**	**100**

- **310 HH**
- **373 farmers in FGDs (50% M; 38 % F; 12% Mixed)**
- ***59* District stakeholders interviewed**
- **36 Local key informants interviewed**

- ***Total of 778 Respondents interacted with***

Round 2 Visit (Nov 2015)

District	Farming Sector	Selected Wards	No. of HH respondents	No of Stakeholder Respondents
Gokwe South	CA	16, 21	25	9
Hurungwe	CA	12, 22	9	6
Guruve	A1	2,21	20	8
	Total		**54**	**23**

- ***Total of 77 Respondents interacted with***

RESULTS

Highlights of Generic Issues

- Compared to other varieties, Pioneer varieties :
  - Less susceptible to storage insect pests attack at harvest and during storage; no con rots => tight husk cover
  - Less susceptible to cracking during threshing/shelling
  - Have very good taste as green mealies and as “sadza”
  - Excellent for popping
- Local grain prices tend to increase as the season progresses but LGB presence influences the length of storage period
- In some areas, prices tend to plunge in January as people sell grain to pay for school fees
- In other areas, prices are highest in January because of grain scarcity

- Barter exchange common:
  - Women trade for essentials that benefits the whole family
  - Men are known to trade for their self interests only
- The young generation do not prefer construction of storage structures so tend to use bag storage in ordinary rooms
- There is lack of skill on the construction of storage structures among the younger generation
- Granary designs not sensitive to PLWD
- Availability mechanisms of improved or modern storage facilities not clear to farmers

- Recommended pesticide application procedures and safety precautions not being followed in many areas and cases of pesticide failure reported.
- Traditional grain protection methods reported
  - Farmers don't have confidence in them
  - There are no recommendation packages
- There is gender equity among young couples in the distribution of postharvest activities
- There is widespread fear of theft during storage
  - contributed to change in choice of grain storage system
- Sporadic occurrence of LGB in the same districts
  - LGB is silent assassin

GRAIN SAMPLE ANALYSIS

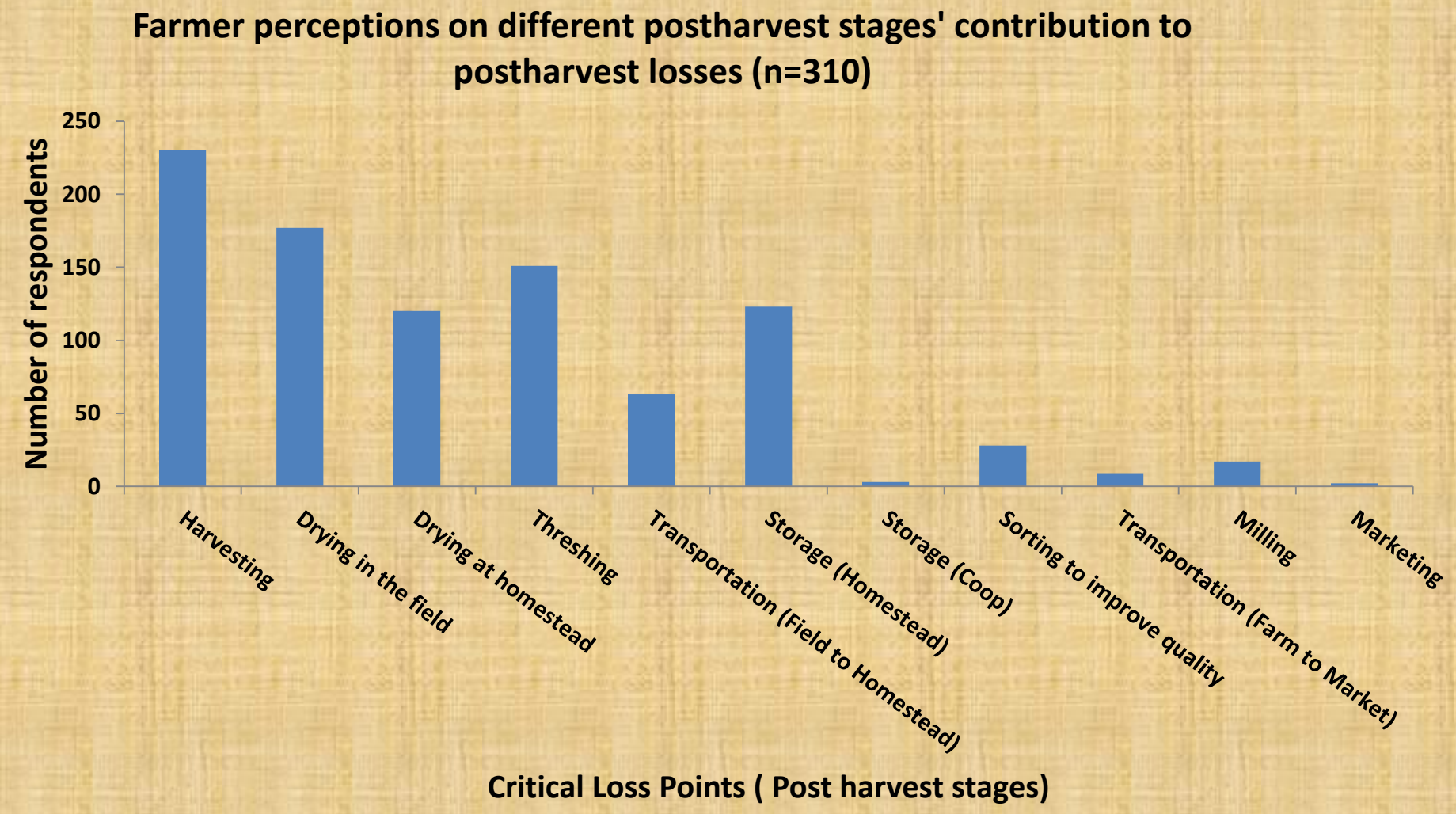
INITIAL GRAIN CONDITION

District	Grain Form	No. of Samples Analysed	Mean % Damage (±SEM)	Mean % Weight Loss (±SEM)	Mean % Rotten Kernels (±SEM)
Gokwe South	Dehusked Cobs	16	4.2±0.95	0.4±0.16	0.4±0.17
	Shelled Grain	7	7.2±2.19	0.6±0.69	0.6±0.21
Guruve	Dehusked Cobs	26	2.4±0.70	0.1±0.19	0.5±0.35
	Shelled Grain	13	5.0±0.97	0.9±0.37	1.2±0.41
Hurungwe	Dehusked Cobs	11	2.1±0.69	0.3±0.09	0.0±0.01
	Shelled Grain	20	3.5±0.53	0.5±0.07	0.6±0.13
Makoni	Dehusked Cobs	16	0.8±0.41	0.2±0.07	0.9±0.56
	Shelled Grain	22	2.7±0.57	0.3±0.10	0.5±0.21
Murehwa	Dehusked Cobs	10	0.8±0.25	0.1±0.03	0.3±0.33
	Shelled Grain	8	4.2±1.37	0.4±0.19	0.1±0.06

Insect nos. of each spp. per kg maize

District	Grain Form	No. of Samples Analysed	LGB		Maize Weevil		Grain Moth	
			Live	Dead	Live	Dead	Live	Dead
Gokwe South	Dehusked Cobs	16	0	0	5	7	14	41
	Shelled Grain	7	0	0	51	16	7	29
Guruve	Dehusked Cobs	26	1	0	16	6	1	3
	Shelled Grain	13	1	0	21	7	10	15
Hurungwe	Dehusked Cobs	11	0	0	12	6	5	11
	Shelled Grain	20	0	0	21	9	2	17
Makoni	Dehusked Cobs	16	0	0	20	5	0	4
	Shelled Grain	22	0	1	15	7	0	7
Murehwa	Dehusked Cobs	10	0	0	5	3	0	1
	Shelled Grain	8	2	5	11	6	1	23

CRITICAL POSTHARVEST LOSS POINTS



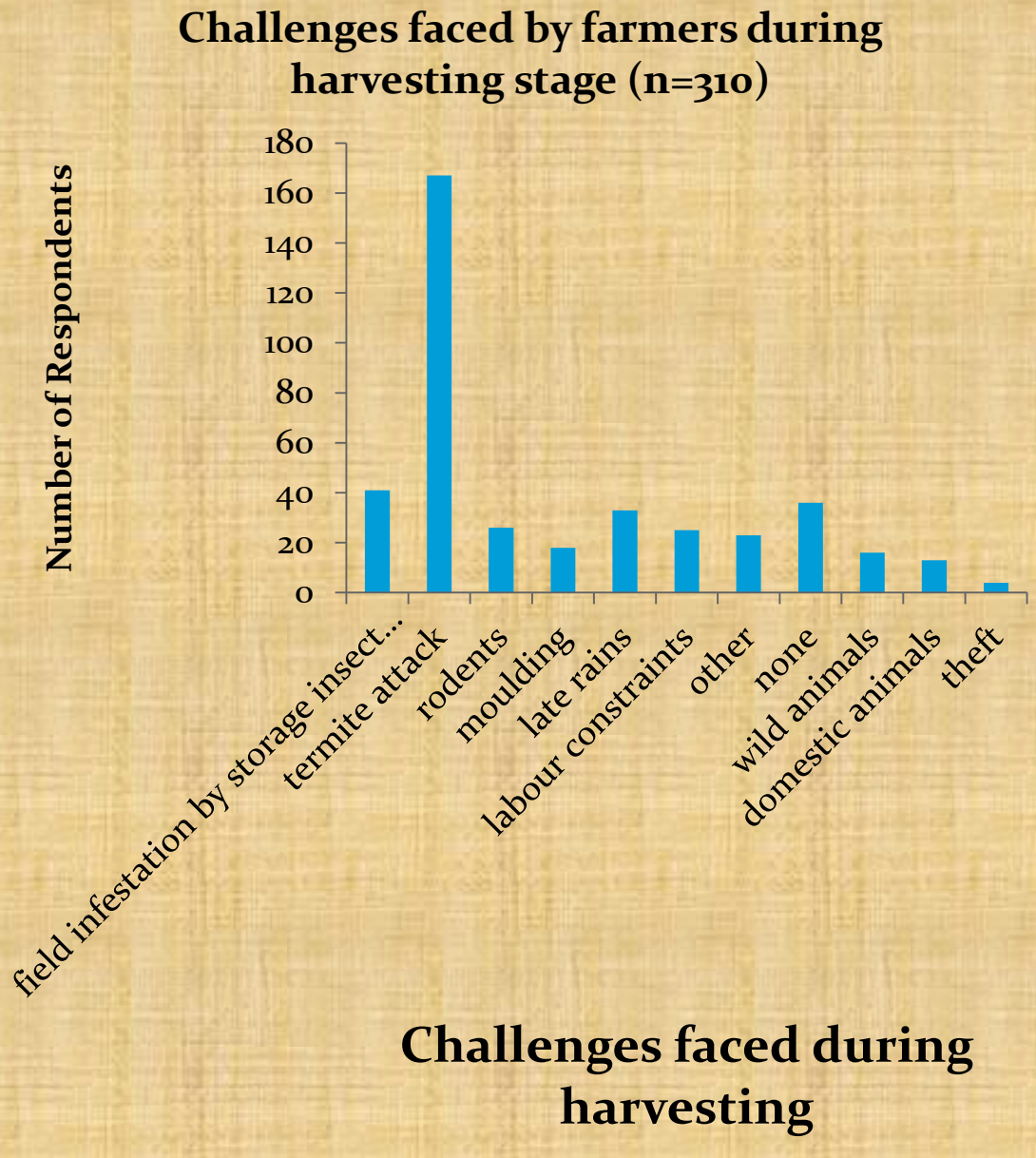
Critical Postharvest Loss Points

Postharvest Stage	Farmer Perceptions : Loss Levels(%)
Field Losses	13.9
Homestead Drying	7.2
Transportation (Field to Homestead)	4.6
Threshing	3.0
Storage (Homestead)	9.4

Harvesting - A maize stook

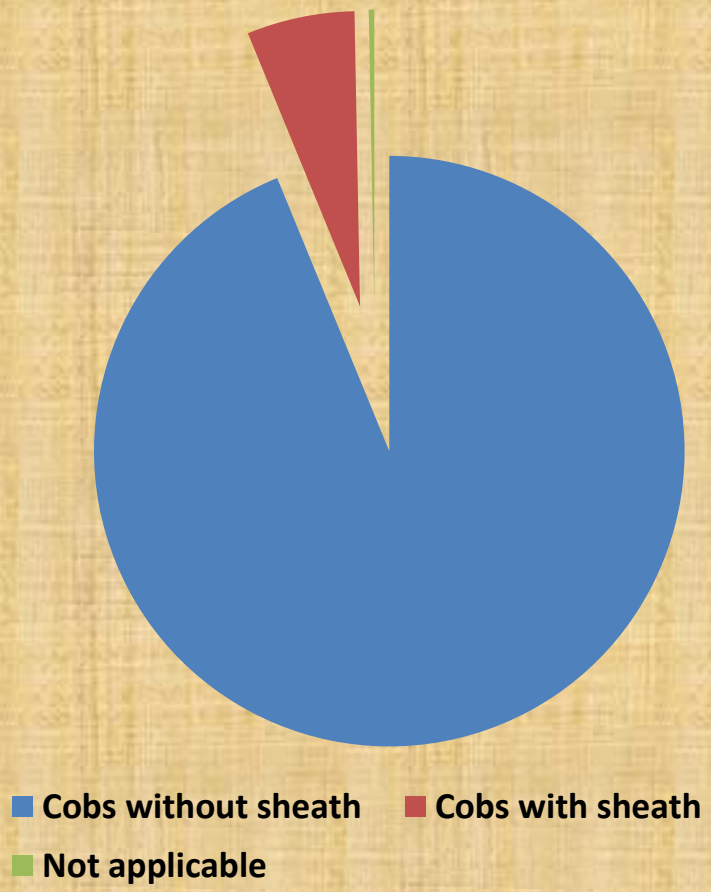
Loss is minimised by some farmers through putting a plastic or tent at the stook where the cobs will be thrown or through putting the maize cobs in 50Kg bags when de-husking.

Challenges faced during harvesting



- Termites are the major pest after physiological maturity
- Late rains and field infestation are also perceived to be key challenges

Homestead drying practices



- 93.8% dry dehusked cobs
- 5.9 % dry cobs in sheath

Shelling

- Beating cobs using sticks:
  - prepared platform (female and male).
  - In old polypropylene bags
- Shelling by hand or rubbing the cob on a stone

Storage

- All respondents indicated that they store maize
- Although in some few cases men were involved in treating maize against pests, in most cases women are responsible for this activity.

Reasons for storing maize

- Mainly for HH consumption
- Storage is also for marketing since grain production is a source of livelihood (take advantage of price dynamics)
- Currency for labour payment

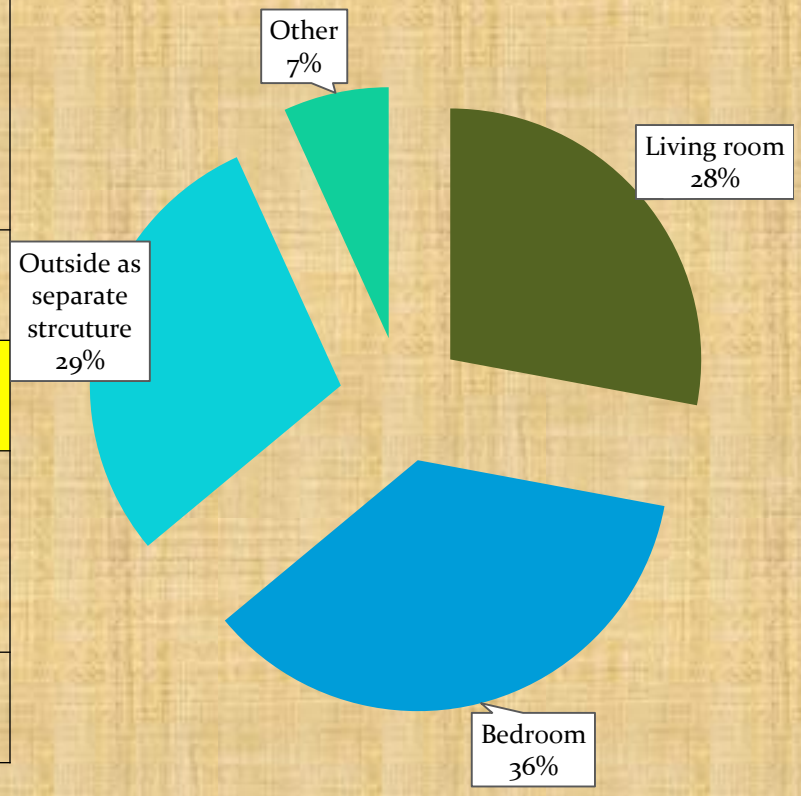
Household grain requirements till the next harvest (n=310)

Grain Quantity (x 50kg)	Sector food requirements (%)			Total (%)
	Communal	Old Resettlement	A1	
1-10 bags	27.0	25.6	19.6	24.5
11-20 bags	52.3	69.2	56.7	55.8
21-30 bags	13.8	5.1	15.5	13.2
more than 30 bags	6.9	0.0	8.2	6.5

- 18.7% respondents require at least 1MT to take them to next harvest

Storage Structures Used (n=308)

	Sector (%)			All Sectors Combined (%)
	CA	OR	A1	
Living room	26.2	25.6	32	27.9
Bedroom	37.8	38.5	32	36
Outside as separate structure	29.7	30.8	27.8	29.2
Other	11.0	5.1	8.2	6.8

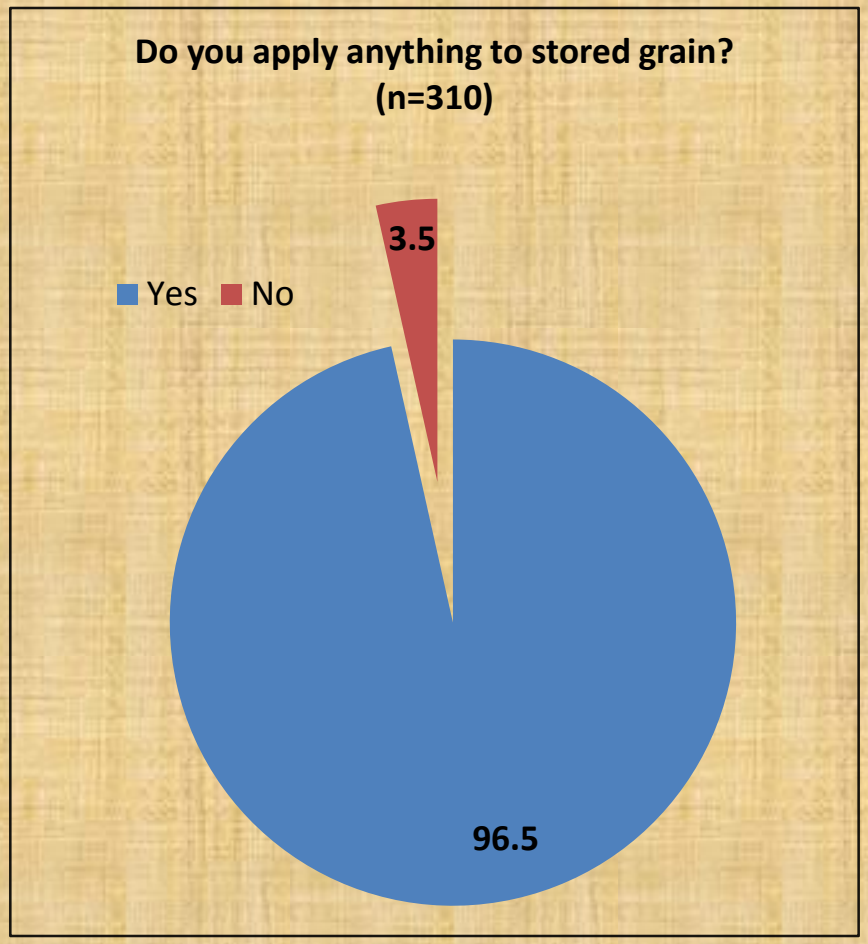


Storage Facilities Used

	Sector			Total
	Communal	Old resettlement	A1	
Polyproylene sacks	130	32	84	246
Jute sacks	8	2	0	10
Traditional pole and mud granary	15	2	1	18
Metal drums	1	0	0	1
Brick granary (grass thatched)	13	5	9	27
Brick granary (with corrugated sheets)	7	0	2	9
Metal silo	0	0	1	1
Other	1	0	1	2
Total	169	39	96	304

Grain protection practices

Pesticide Use



Type of protectant used

	Sector			Total
	Communal	Old Resettlement	A1	
Actellic Dust	32	3	26	61
Shumba Super Dust	100	30	42	172
Chikwapuro	21	0	7	28
Ngwena yeDura	1	1	0	2
Phostoxin	27	5	20	52
Cob ash	5	0	0	5
Other	7	0	3	10
Total	171	37	91	299

Pesticide application frequency

	Sector			Total
Frequency	Communal	Old Resettlement	A1	
Once	113	23	58	194
Twice	61	13	37	111
Three times	12	3	2	17
>Three times	1	0	1	2
As required	2	0	0	2
Total	167	37	91	295

- Majority of farmers apply once across the 3 sectors
- Applying twice is also common in all the 3 sectors

Roles in storage (Grain Treatment)

	Sector (%)			Total (%)
	Communal	Old Resettlement	A1	
No response	0	0	1.1	0.3
Men	45.1	40.5	58.7	48.7
Women	48	54.1	27.2	42.4
Boys	2.3	5.4	1.1	2.3
Workers	0.6	0	3.3	1.3
Whole family	4	0	7.6	4.6
Other	0	0	1.1	0.3

- Women and men are mostly involved in grain treatment
- More women & children treat grain in Old Resettlement areas compared to other sectors

Roles in storage (Store Maintenance)

Storage

- There is gender equity among *young couples* in the distribution of postharvest responsibilities
- Widespread fear of theft during storage
  - contributed to change in choice of grain storage system
- Availability mechanisms of improved or modern storage facilities not clear to farmers
- The process of application of pesticides is a health risk
  - Not being done properly

- Challenges in dealing with storage pests esp, LGB
  - Sporadic occurrence in the same district
  - LGB =>*silent assassin*
  - Farmers using health risky efforts

  Eg increasing the pesticide dosage applied, mixing and applying a no. of pesticides at the same time, use of wrong pesticides, *use of fumigants*.

- Early varieties harvested at same time as late varieties
  - Exposed to insect pest field infestation for longer periods and tend to have higher infestation load at time of harvest
- Traditional timber-intensive PH structures declining
  - Depletion of natural resources
  - Fear of theft
  - Under threat by Larger Grain Borer

Insect Infestation

The LGB Factor: From Grain to Dust

Highlights of
GENDER AND SOCIAL ISSUES

General social Highlights

- Women compared to men are more involved in the production and postharvest management systems.
- Men compared to women are mostly involved in cash crops production and post harvest processes such as tobacco, soya beans.
- Women often experience time poverty due to competing demands for their labour resulting in:
  - Delays in performing certain post harvest tasks
  - Inadequate time to pay attention to PH details

General social Issues *continued*

- Women are the major actors in maize production and post harvest management which is dominated by smallholder producers in communal areas.
- Children (boys and girls) are often involved in the entire postharvest management chain (inl pesticide application) except for marketing.
- Reported **cases of death of children** as a result of fumigants applied to grain which was kept in rooms where family members were sleeping in Gokwe and Murehwa.
- **Young women and men farmers** lack (agric assets land, farm equipment) and assets for use in post production processes eg scotch carts and cattle to transport harvested produce.
- Maize production has not presented a good opportunity for generating income and employment for the youth especially because of the post harvest marketing challenges currently being experienced

MARKETING & ECONOMICS

Preferred market channels:

- Current Market Channels Preferred are those that pay Cash for deliveries
- Traders (29% of farmers reporting)
- On farm Sales (23%)
- Village Markets (11%)
- Farmers are no longer delivering maize to GMB due to non-payment (some have not been paid for deliveries dating back to 2011).
- Although GMB is still offering $390/MT, little or no deliveries (only 17% of famers preferred delivering to GMB) - see Table

Preferred marketing channel for maize by District, Maize PHL Survey 2015

	Gokwe South	Hurungwe	Guruve	Makoni	Murehwa	Total
Number reporting	47	35	70	58	37	247
% reporting preferred marketing channel is:						
On farm sales	12.8	28.6	7.1	39.7	35.1	23.1
Village markets	17	8.6	11.4	8.6	10.8	11.3
GMB	6.4	0	40.0	10.3	13.5	17.0
Traders	40.4	25.7	35.7	17.2	21.6	28.7
Contractors	10.6	2.9	2.9	6.9	8.1	6.1
Processors	0	0	1.4	3.4	0	1.2
Missing	12.8	34.3	1.4	13.8	10.8	12.5

Decision making and responsibility for maize marketing by District, Maize PHL Survey 2015

	GS	HR	GR	MK	MR	Total
Number reporting	51	44	67	59	35	256
% reporting the following makes decisions on maize to be marketed:						
Men	17.6	27.3	31.3	22.0	25.7	25.0
Women	21.6	18.2	32.8	33.9	34.3	28.5
Both	41.2	9.1	23.9	35.6	37.1	29.3
Missing	19.6	45.5	11.9	8.5	2.9	17.2
Responsible for maize marketing:						
Number reporting	42	23	59	56	34	214
% reporting the following are responsible for maize marketing:						
Men	42.9	34.8	50.8	41.1	23.5	40.7
Women	23.8	39.1	33.9	41.1	52.9	37.4
Both	31.0	21.7	13.6	14.3	23.5	19.6
Other	2.4	4.3	1.7	0	0	1.4
Missing	0	0	0	3.6	0	0.9

Possible Interventions identified

1. Training of Extension Personnel and farmers in post harvest management

2. Promote Effective Storage Technologies

- Metal Silos – 1MT
- Improved brick granaries – 3.2MT
- Hermetic Grain Bags – 50kg
- Grain Safes “Cocoon” – 1 MT

3. Other Interventions

- Breeding pest resistant varieties
- Effective drying technologies
- Appropriate shelling options

Financial Benefit Cost Analysis of the Possible Interventions

- Most of the technologies are profitable
- Makoni has higher BCR compared to the other FSCs
- The Farmers Estimated Storage Post Harvest losses for Makoni were 15.23%, which was the highest of all the five districts

Intervention	GS	HR	GR	MK	MR
Training (and 1 Model Metal Silo per Ward)					
Cost of Intervention ($/year)	48,290	43,380	47,120	48,940	47,640
Profitability of solution ($/year)	216,752	227,294	58,995	533,407	191,836
BCR	**4.54**	**4.79**	**1.86**	**9.84**	**4.16**
Metal Silos					
Cost of Intervention ($/year)	325,759	275,600	150,920	331,734	207,797
Profitability of solution ($/year)	341,416	415,821	116,198	1,465,908	395,021
BCR	**1.69**	**2.07**	**1.46**	**3.65**	**2.4**
Improved Granaries					
Cost of Intervention ($/year)	162,879	162,879	75,459	165,870	103,898
Profitability of solution ($/year)	504,296	528,541	191,657	1,300,041	498,920
BCR	**3.39**	**3.51**	**2.93**	**7.31**	**4.8**

Hermetic Grain Bags (HGBs)					
Cost of Intervention ($/year)	313,230	265,000	145,115	318,975	199,805
Profitability of solution ($/year)	436,200	511,665	154,935	1,327,661	477,335
BCR	**1.98**	**2.42**	**1.71**	**4.27**	**2.8**
Grain Safes					
Cost of Intervention ($/year)	480,286	406,333	222,510	489,095	306,368
Profitability of solution ($/year)	269,144	370,332	77,540	1,157,542	370,771
BCR	**1.29**	**1.58**	**1.11**	**2.78**	**1.83**

INSTITUTIONAL & POLICY ISSUES

- **Coordinate & synergise** service delivery
- **Opportunities** for manufacturing affordable shellers
- **PHM Training** - new agricultural area not adequately covered in conventional curricula in agricultural colleges where extension staff are trained
  - Refresher courses or follow up training sessions are required
- Policy to emphasise on **safe and effective use of pesticides** including monitoring and legislative/regulatory enforcement
  - Use promoted in some areas by state and non-state actors
  - Fumigant informally sold packaged in very thin plastic without any instruction labels
- Need a clear and sustainable strategy to facilitate farmer access to improved storage facilities
- Urgent policy required for GMB to pay the farmers in order to restore farmer confidence

Recommendations

- Training and followups (PHM and Agribusiness)
  - staff and farmers, artisans and builders
  - include in Master Farmer Training
- Proper and safe use of synthetic pesticides
- Continue to identify alternative pest control options
- Promote improved storage facilities (metal silos , hermetic bags)
- Facilitation of access to loans by farmers in groups to invest in improved storage facilities
- PPP for sustainable development
  - stimulate demand for storage facility
  - group formation and training in group dynamics and leadership skills
- Consider WRS/ Food Banks (community granaries)
- Coordination: Institutional; Farmers for collective bargaining

STUDY TEAM

- Prof. Brighton Mvumi – Team Leader & Postharvest Expert
- Mr Tafireyi Chamboko – Agricultural Economist and Marketing Expert
- Mrs Shinga Mupindu – Social and Gender Expert
- Mr Alex Chigoverah – Research Assistant
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- Mr Walter Makotore – Agribusiness, AGRITEX HQ
- Mr Creighton Chenzara – Head of Postharvest Branch, Dept of Mechanisation
- Mr Rainos Chingwe – Postharvest Technician, Dept of Mechanisation

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Moisture related losses

Storage


200 g
PELLETS
DANGER
TO CAUSE A HAZARD
DISPOSAL OF THIS
WARNING
PRECAUTIONS
SYMPTOMS OF
WARRANTY
JUN
JUL
AUG
SEP
OCT
NOV

THANK YOU FOR LISTENING