

Original Research Article

Status Of Postharvest Operations In Upper East Region of Ghana: The Case Of Maize Producers

ABSTRACT

A baseline survey was conducted in the Upper East of Ghana to assess current postharvest practices and factors influencing long and bulk storage. The research tools employed were field survey, farm visits and key informant interviews. Twenty farmers were randomly selected from each community making a total of 120 farmers. Household structure on average is made up 7±5 individuals, mean age of household heads was 45-47 years compared to their wives 35 to 38 years. Maize is mostly stored in polypropylene sacs and jute sacs on raised platform in household stores. Majority of respondents indicated that post-harvest losses during storage are critical challenges to production and household food security. The main causes of loss were insect pest, rodents and grain moulds. Majority of farmers store maize for 5-8months. Though some local and synthetic grain protectants were used, post-harvest losses in 1 year of storage were still beyond acceptable limits. However, there was high willingness to adopt new efficient methods of crop protection like biological control. The idea of community storage methods was still not a technology farmers may adopt; due to a myriad of socio-cultural reasons. The results of the baseline study will guide the implementation of the project as well as serve as reference point for future impact assessment. Overall, integrated strategies involving clean farm operations, use of appropriate storage technologies and provision of improved storage structures are required to reduce current losses.

Key words: Maize farmers, postharvest losses, storage and biological control

INTRODUCTION

Maize (*Zea mays* L.) has become an important staple food crop in all parts of Ghana. Currently, maize based cropping systems have become dominant in drier northern savanna areas of Ghana where sorghum and millet were the traditional food security crops. According to SRID (2011), maize is the most cultivated in Ghana, occupying up to 1,023,000ha on arable land compared to rice (197,000ha), millet (179,000ha), sorghum (243,000ha), cassava (889,013ha), yam (204,000ha) and plantain (336,000) (SRID, 2012). Currently, Ghana is net-importer of maize even though it has great potential to be self-sufficient and net-exporter. Per capita consumption of maize is estimated at 44 kg/person/year (FAOSTAT, Feb 2013). Declining yields of maize are now observed due to decreasing soil fertility and high cost of fertilizer. Over the last 2 decades, a myriad of maize varieties, cultivars and hybrids have been released. These genotypes possess traits such as early maturing, drought

46 resistance, diseases and pest resistance, striga resistance, as well as additional nutritional values
47 such as quality protein, yellow and sweet corn. Grains of these genotypes possess diverse textural,
48 physical and compositional characteristics which relate differently to light, moisture and temperature
49 as well as susceptibility to pests and disease pathogens; particularly during prolonged storage. This
50 requires commensurate postharvest techniques and strategies to contain harvested surpluses. Also,
51 due to intensification and productivity increase, the need for bulk and prolonged storage has become
52 critical. This increase can be attributed to government and donor assisted projects such as providing
53 subsidies on agricultural inputs. Nonetheless, current storage methods are suited for small-holder
54 farmers requiring storage of less than 1 ton. Interventions to introduce large storage units such as
55 community warehousing, community grain banks or metal silos which can contain several tons of
56 grain is still constrained by national agricultural policies as well as low adoption from farmers.
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58 Generally, stored maize can be damaged by insect pests if they are not properly conditioned and
59 protected. This challenge may be exacerbated due to cropping intensification and introduction of
60 hybrid cultivars. Maize is harvested towards the cessation of rainy season and stored during the drier
61 months of the year. Maize is often stored on cob in traditional grain silos or shelled into jute and
62 polypropylene sacs with or without protection for storage. However, pest infestation is a perennial
63 constraint; the conditions favorable for grain storage are as well suitable for insect pest reproduction.
64 On-farm infestation of notorious storage pests such as larger grain borer
65 (*Prostephanustruncatus*), lesser grain borer (*Rhyzoperthadominica*), maize weevil
66 (*Sitophiluszeamais*), granary weevil (*S. granaries*) as well as mycotoxins accumulation, are a threat
67 in grain storage. Indiscriminate use of common grain protectants such as Actellic (Pirimiphos methyl),
68 bioresmethrin (pyrethroid) phostoxin and Gastox (Aluminium phosphate) is widespread among small-
69 holder farmers (Sugri et al 2010). Most farmers acquire agro-chemicals from non-accredited input
70 dealer without any training on appropriate use. There is the need to integrate production and
71 postharvest practices to achieve quality food for consumers. Integration of good agronomic
72 operations, pest management and appropriate storage techniques to minimize pest damage is
73 therefore very essential. This project seeks to improve agricultural productivity and farm family
74 livelihoods by deploying improved storage and handling practices to reduce postharvest losses of
75 smallholder farmers in the Upper East Region of Ghana.
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79 **MATERIALS AND METHODS**

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81 A baseline survey was conducted in 3 districts of the Upper East Region of Ghana to assess current
82 postharvest practices and factors influencing long and bulk storage of maize. The research tools
83 employed were field survey, farm visits focus group discussion and key informant interviews
84 (Chambers, 1993). A purposeful and multi-stage sampling approach targeting maize producing
85 communities and households was adopted. Two communities per district were purposively selected
86 based on their involvement in maize production. Twenty farmers were randomly selected from each
87 community making a total of 120 farmers.
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94 **RESULTS AND DISCUSSION**

96 **Demographic Information**

97 *Table 1-4* provide a summary of the demographic structure of the households sampled. In all, 42% of
98 respondents were female farmers and 58% male farmers (*Table 4*). Household structure on average
99 was made up of 7±5 individuals (*Table 2*). The mean age of household heads was 45-47 years
100 compared to their wives whose mean age was 35 to 38 years. The results also showed that migration
101 of household members was not common during the rainy season but up to 10% migrate down south

102 when agricultural activities decline. The observations indicate that most of the household heads (99%)
 103 were involved in crop production.

104 **Table 1: Gender of Respondents**

Gender	Frequency	Percentage
Female	50	42
Male	70	58
Total	120	100

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106 **Table 2: Composition and age of households sampled**

Description	Variable	Mean	Standard Deviation	Minimum	Maximum
Head (N = 120)	HH size	7	3	2	22
	Age (HHH)	47	14	26	78
	Age (WHH)	38	10	18	70
Partner (wife) (N = 120)	HH size	7	3	1	17
	Age (HHH)	45	14	27	75
	Age (WHH)	35	10	19	65

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108 **Table 3: Income status of households**

Income(GHS 000)	Freq.	%
1-20	31	26.1
21-40	14	11.8
41-60	26	21.8
61-80	26	21.8
81-100	22	18.5
Total	119	100

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110 Majority of respondents (63%) had no formal education, only 26% had basic education and 10% had
 111 post-basic education (Table 4). Livestock rearing is considered as an occupation by very few
 112 households (1%). Majority (84.2%) of the respondents were crop farmers, 2.5% were students, a few
 113 were engaged in various forms of trade, and only 4% unemployed (Table 5).

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119 **Table 4: Educational Status of respondents**

Education level	Freq.	%
None	75	63
Primary	15	13
JHS/Middle school certificate	16	13
SHS/Technical school	12	10
Non-formal	2	1
Total	120	100

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121 **Table 5: Primary Occupation of Respondents**

	Freq.	%	
Student	3.0	2.5	122
Unemployed	4.0	3.3	123
Farmer	101.0	84.2	124
Teacher	1.0	8.0	125
Nurse	1.0	8.0	126
Retired	1.0	8.0	127
Self employed	5.0	4.2	128
Pastor	1.0	8	129
Kente weaving	3.0	2.5	130
Total	120.0	100.0	131

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137 **Cropping Systems**

138 Majority (89%) of respondents were engaged in crop production while a little minority were involved
 139 in animal (7%) and tree (4%) production as the main livelihood strategies (Table 6). Major livelihood
 140 crops include maize, sorghum, millet, soybean, cowpea, rice, sweet potato and vegetables (Table 7).
 141 Maize is cultivated on up to 4 acres and a maximum land size of 15 acres. The range for cowpea is 2-
 142 12 acres, while bambara beans, groundnut and sweet potato recorded the least production area of 1,
 143 2 and 2 acres, respectively.

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145 **Table 6: Main farming systems in the study area**

Farming type	Freq.	%
Crop production	107	89
Tree crop Production	5	4
Livestock marketing	8	7
Total	120	100

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Table 7: Main crops and acreage of production

Crops	Acreage Mean	(Ha) Min.	Max.
Maize	4	0	15
Sorghum	1	0	4
Soyabeans	2	0	5
Cowpea	2	0	12
Vegetable	2	0	3
Pearl Millet	2	0	9
Groundnut	1	1	2
Bambarabeans	1	1	1
Sweet Potato	1	1	2
Total land size of HH	8	1	45

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Post-Harvest Operations and Losses

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174 In Table 8 below, 95.8% perceive high levels of post-harvest losses in recent times while 4.2 % of the
175 respondents were adamant. The main causes of damage were insect pests (69.2%), rodents (16.2%)
176 grain moulds (6.7%), weight loss (5.7%) and loss of flavor/nutrition (1.7%). Only 1.7% of the
177 respondents recorded no incidence of post-harvest losses and pest infestation at storage (Table 9).

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179 **Table 8: incidence and estimated of postharvest losses under farmer storage**

Incidence of produce infestation at storage			Quantities of losses incurred (%)		
	Freq.	%		Freq.	%
Yes (incidence)	115	95.8	0 - 8	29	24.2
No (incidence)	5	4.2	10 – 25	67	55.8
			27 - 60	24	20
			TOTAL	120	100

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Table9: Description of major causes of postharvest losses

Main causes of losses	Freq.	Percentage (%)
Insects infestation	83	69.2
Rodents	20	16.7
Grain moulds	8	6.7
Weight loss	5	4.2
Quality (taste/ aroma/colour)	2	1.7
No incidence	2	1.7
Total	120	100.0

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Maize Storage Methods

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186 Table 10 describes the various storage methods used in the study area. Majority of farmers, 40% and
187 27.3%, store maize in poly-sacs and jute sacs respectively. The use of poly-sacs has gradually
188 replaced jute sacs due to low cost and readily availability. Though, the use of PICS sacs has recently
189 been introduced, only few champion farmers opt for them apparently due to high initial cost. Up to
190 16.7% of farmers store their maize for 1-4months, 64.2% store maize for 5-8months, and 17.5 store

191 up to 12months (Table 11). Only 1.7% store maize store maize beyond 12 months confirming that
 192 they produce in small quantities for subsistence. Only small quantities 1-3bags are stored by 37.5 %
 193 of respondents and up to 37.5% store 4-10bags, only about 8.3% stored more than 25bags of maize
 194 (Table 11).
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196 **Table 10: Maize storage methods**

Maize storage methods	Freq.	%	Ranked	Reasons for selection
Bare floor	15	12.6	3	Easy to store, affordability
Stored in jute sacs	33	27.3	2	Availability, durability,
Stored in poly-sacs	48	40.3	1	Availability, durability, low cost
Stored mud silos	10	8.4	5	Common traditional method, regulate grain use
Stored in maize ban	14	14	4	Regulates use of maize/ reduce wastage
Total	119	100		

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198 **Table 11: Duration of maize at storage**

Duration of storage			Volume of produce stored		
	Freq.	%	Bags	Freq.	%
Storage period					
1-4 months	20	16.7	1-3bags	45	37.5
5-8 months	77	64.2	4-10bags	45	37.5
9-12 months	21	17.5	11-25bags	20	16.7
1-2 years	2	1.7	Above 25 bags	10	8.3
Total	120	100	Total	120	100

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Pest Management Strategies Adopted Farmers

212 The focus group discussions indicated that farmers' prior knowledge on the type, severity and time of
 213 pest infestation in different commodities guided their choice of pest management. Table 12 provides a
 214 summary of approximate time of pest infestation and management options for different crops. Close
 215 44.2% of the respondents noticed pest infestation within 1-4 months, 33.3% within 5-months, while
 216 12.5% noticed no pest incidence. From the group discussions, over 50% of respondents alluded that,
 217 except in cowpea and bambara nuts, pest infestation occurred late at 6 months after storage. Farmers
 218 therefore applied postharvest chemicals few months after storage or when some level of infestation
 219 was noticed. Where storage was anticipated above 4 months, over 50% of farmers used some kind of
 220 protection in cowpea and bambara nuts. The use of biological control was not a familiar term;
 221 probably this control measure has not been introduced into the area. Only 1.7% of farmers resorted to
 222 the use of botanicals such as *neem* products, pepper, *mahogany* bark, *Jethropha* and other local oils.
 223 Majority use insecticidal dust (43.3%) and phostoxin (13.3%) for pest management. It was realized
 224 that only 1 respondent use ash to actually prevent pest attack. The common grain protectants were
 225 *Actellic* (Pyriphos methyl), *bioresmethrin* (pyrethroid) *phostoxin*, *Gastox* (Aluminium phosphate),
 226 *Wander77 powder*.
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Table 12: Period of pest infestation and common pest management strategies

Months after storage	Freq.	%
1-4	53	44.2
5-8	40	33.3
After 8	12	10
No pest incidence	15	12.5
Total	120	100
Methods of crop protection	Freq.	%
Only drying	48	40
Botanicals (neem, mahogany etc)	2	1.7
Photoxin tablet	16	13.3
Insecticidal dust	52	43.3
No measure taken	1	0.8
use of ash	1	0.8
Total	120	100

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Farmers expressed their willingness to adopt both the poly-tank storage method and the biocontrol storage method. Those who indicated they will agree to adopt the poly-tank method were about 45% while those who strongly agreed also scored 45.5%. 55.5% of the farmers indicated they will agree to adopt the biological control method while 31.1% said they strongly agree to adopt the biological control method. From all indications the farmers are willing to adopt both the poly-tank and biological control method of maize storage in the Bawku municipality as shown in table 13 below.

Table 13: Willingness to adopt new storage techniques

I will adopt a new poly-tank storage method		
	Frequency	Percent
Strongly Disagree	1	0.8
Disagree	1	0.8
Neither agree nor disagree	9	7.5
Agree	54	45
Strongly agree	55	45.8
Total	120	100
I will adopt biocontrol storage method		
Strongly disagree	1	0.8
Disagree	2	1.7
Neither agree nor Disagree	13	10.9
Agree	66	55.5
Strongly agree	37	31.1
Total	119	100

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Conclusion and Recommendation

In all, 42% of respondents were female farmers and 58% male farmers. Household structure on average is made up of 7±5 individuals, mean age of household heads was 45-47 years compared to

248 their wives 35 to 38 years. Majority of the household heads and their wives had no education and
 249 their primary occupation was crop production. Household wealth was largely concentrated on
 250 Livestock inventory. Maize is mostly stored in polypropylene sacs (48%) and jute sacs (33%) on
 251 raised platform in household stores. Close to 95.8% of respondents indicated that post-harvest losses
 252 during storage are critical challenges to production and household food security. The main causes of
 253 loss were insect pest (69.2%), rodents (16.2%) grain moulds (6.7%), weight loss (5.7%) and loss of
 254 flavor/nutrition (1.7%). Up to 16.7% of farmers store their maize for 1-4months, 64.2% store maize for
 255 5-8months, and 17.5% store up to 12months. Only 1.7% store maize beyond 12 months; confirming
 256 that they produce in small quantities for subsistence.

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 258 The idea of community storage methods is still not a technology farmers may adopt; due to a myriad
 259 of socio-cultural reasons. The results of the baseline study was expected to guide the implementation
 260 of the project as well as serve as referencepointfor future impact evaluation. Overall, integrated
 261 strategies involving clean farm operations, use of appropriate storage technologies and provision of
 262 improved storage structures are required to reduce current losses.

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 264 Major crops produced include: maize, millet, peanuts, Bambara nuts, soy beans, rice, and cassava.
 265 Though some local and synthetic grain protectants were used, post-harvest loses in 1 year of storage
 266 were still beyond acceptable limits. However, there was high willingness to adopt new efficient and
 267 effective methods like biological control and poly-tank storage methods being introduce to them. The
 268 idea of community storage methods was however still not a technology farmers may adopt; due to a
 269 myriad of socio cultural reasons. Integrated strategies involving clean farm operations, use of
 270 appropriate storage technologies and provision of improved storage structures may have to be
 271 adopted to reduce current losses.

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 273 It is recommended that integrated strategies involving clean farm operations, use of poly-tank and
 274 biological control storage technologies are used by farmers to reduce current postharvest losses in
 275 the area.

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