

Awareness of the Small Scale Holders to the Post-Harvest of Sorghum: Evidences from Tokar, Eastern Sudan

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Abstract

The study aim to investigate the Small Scale Holders on the knowledge and skills on the post-harvest operational management and to describe the aspect of post-harvest losses and management of sorghum in Western Sudan Tokar locality. The paper depends on the secondary data sources including record and documents from the Ministry of Agriculture of Sudan. The primary data were collected through structured questionnaires of randomize sampling techniques. A total sample of 62 Small Scale Holders of farmers (39 male and 23 female) had been interviewed on the knowledge and aspects of the post-harvest losses. A set of research tool including descriptive statistic, frequency distribution and customs table were used. The results revealed the aspect of farmer do not understand the grain quality and grade of; adequate, good, poor, excellent and very poor were 29%, 24%, 18%, 16% and 13% respectively. While for the grain damage during threshing/shelling and various options threshing; were adequate, good, poor, very poor and excellent with 33%, 24%, 18%, 14% and only 11% respectively. They did not understand how to dry the sorghum without contamination or damage, sundry, using the plastic sheets were 30% adequate, 26% poor, 20% very poor and only the smallest proportion of 9% as excellent. Moreover, they did not know the moisture content in sorghum were 33% poor, 29% adequate, 17.5% very poor, 12% good and only 8.5 were excellent. For the grain storage and facilities were 35% as poor, 27% very poor, 22% adequate, 9% good and only the smallest number of 7% as excellent. Findings from this study is recommend more attention and the research direction should be farmers on training sessions and capacity building; this could be possible through to the so called (FFSs) and to increase the knowledge and skills of the small scale farmers as well as to improve post-harvest losses of grain quantities, quality and the overall of the food security.

Keywords

Post-Harvest Losses and Management, Sorghum and Millet Losses, Losses to the Food Security

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1. Introduction/Background

1.1. Introduction

Today, one of the main global challenges is how to ensure food security for a world growing population whilst ensuring

long-term sustainable development. According to the FAO, food production will need to grow by 70% to feed world population which will reach 9 billion by 2050. Further trends like increasing urban population, shift of lifestyle and diet patterns of the rising middle class in emerging economies along with climate change put considerable pressure strain on

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the planet's resources: declining freshwater resources and biodiversity, loss of fertile land, etc. Consequently, there is a need for an integrated and innovative approach to the global effort of ensuring sustainable food production and consumption (Nellemann et al., 2009; World Economic Forum 2009; FAO, 2011; and ACF, 2014). There seems should be working jointly and interactively targeting they whom be expected to be shared and under part of Post – Harvest Losses and management (PHLM). In particularly, the small holders farmers participation and their direct involvement under taking the lead of the whole (PHLM) that the reasons related the food security safety and nutritional added value that to change in practices to reduce the loss of harvesting crops. (Redr Uk, report, 2018).

Sorghum is remains the main stable crops of most of Sudanese people (Red sea Tokar locality) of population. Sorghum is growing through the flooded system in Toakr [surrounded the valley] after it's flooded during the period of October November. They are using the local verities which take place in a growing season of about 3-4 months to be harvest. In contrast, most of sorghum varieties have high yielding hybrid which take place 90-115 days to be as short mature of [*Arfa Gadamak, Tabat, Wad Ahmed and Ingaz*]. These are not favorably having the chosen by people as being preferable due to many attitude and behaviors including the consumer preferences and testes. People tend to grow the local variety of sorghum grains specially, the Western part of the Red Sea community farmers. Nowadays, interventions in PHLM reduction are seen as an important component of the efforts of many agencies to reduce food insecurity. PHLM is increasingly recognized as part of an integrated approach to realizing agriculture full potential to meet the world's increasing food and energy needs. Therefore, reducing PHL along with making more effective uses of today's crops, improving productivity on existing farmland, and sustainably bringing additional acreage into production is critical to facing the challenge of feeding and increased world population. (ACF, 2014).

1.2. Some Definitions and Concepts: Sorghum Harvested and Management

Manually, by cutting the entire plant or remove the ear-heads first, sometimes after cutting the ear-heads plant cutting followed and heads takes on. It has to be putting in an open area; sun shines or fenced for the duration of about 30-45 days and more in some local and traditional methods. The threshing take to be done manually by beating the ears heads [handling sticks]. Then the threshed grain of sorghum sorted, cleaned, dried for about 3-7 days and more it's depend on the how the quantity is big for the moistures of to be 13-15% of sorghum. The sorghum package in gunny bags, warehousing

and the local of traditionally storage of underground (*Matamura* a hole) in the areas of Western Sudan Kordofan and Darfur.

1.3. Losses

Losses are a measurable reduction in foodstuffs and may affect either quantity or quality (Tyler and Gilman, 1979). They arise from the fact that freshly harvested agricultural produce is a living thing that breathes and undergoes changes during postharvest handling. Loss should not be confused with damage, which is the visible sign of deterioration, for example, chewed grain and can only be partial. Damage restricts the use of a product, whereas loss makes its use impossible. Losses of quantity (weight or volume) and quality (altered physical condition or characteristics) can occur at any Supply Chain and Stage in the Post-Harvest Operational and Management (Figure 1). Food losses refer to the decrease in edible food mass (dry matter) or nutritional value (quality) of food that was originally intended for human consumption (FAO, 2013).

1.4. Post Harvest and Operational Management

Pre-harvesting operation: including the time of harvesting is determined by the degree of maturity. With cereals and pulses, a distinction should be made between maturity of stalks (straw), ears or seedpods and seeds, for all that affects successive operations, particularly storage and preservation. After determining the crop, timing for the harvest operation is an important consideration that farmer to assess of when to harvest and determine the methods of harvesting.

Drying: ensures good preservation but also increases the risk of loss due to attacks by pests (birds, rodents, and insects) and moulds not to mention theft. On the other hand, harvesting before maturity entails the risk of loss through mould development leading to the decay of seeds.

Threshing, packaging, Processing and transportation: If a harvest is threshed before it is dry enough, this operation will most probably be incomplete. Furthermore, if grain is threshed when it is too damp and then immediately heaped up or stored (in a granary or bags), it will be much more susceptible to attack by micro-organisms, thus limiting its conservation. (ACF, 2014).

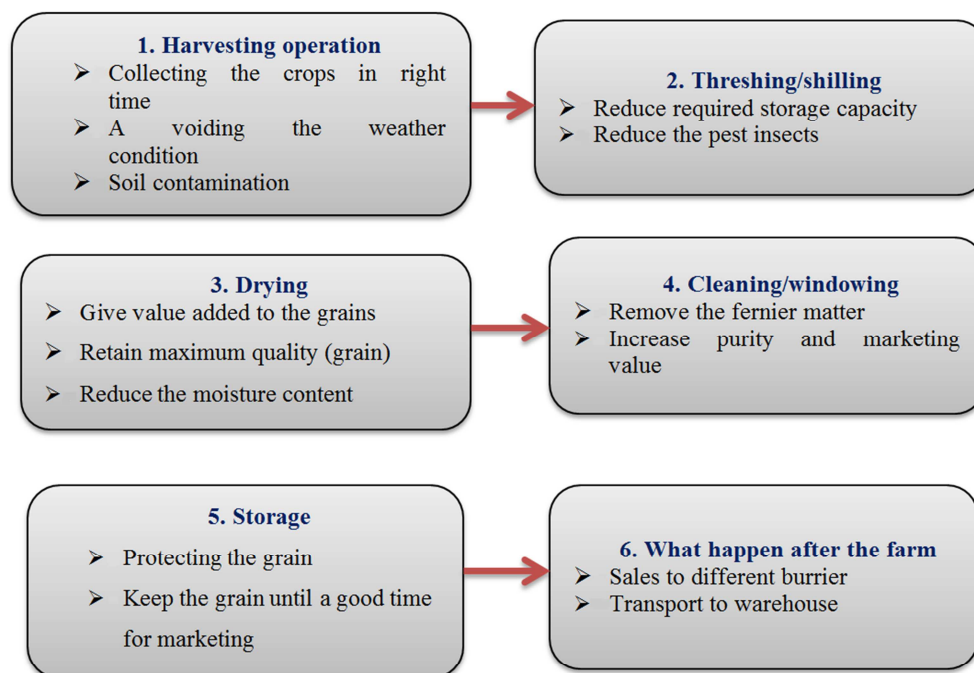
Warehousing/Storage and Marketing: Storage is the art of keeping the quality of agricultural materials and preventing them from deterioration, specific period of time, beyond their normal shelf life. Different crops are harvested and stored by various means depending on the end utilization. Whether the seed will be used for feeding, foods, new plantings the following year, or even for crops to be developed for a

special use, the grower must be aware of harvesting and storage requirements toward a quality product. Marketing is the final and decisive element in the post-harvest system, although it can occur at various points in the agro-food chain, particularly at some stage in processing. Moreover, it cannot be separated from transport, which is an essential link in the system. (Mohmed Musa *et al.* 2015).

Many surveys and studies have been carried out in past years on the methods, conditions and effects of storing cereals, particularly millet and sorghum, in farm or village granaries, traders' storehouses and public or private storehouses, warehouses or silos. They have considered the variety of products, methods and objectives, without forgetting socio-economic and political changes as these affect the agricultural and rural sector, as well as the international market and the agricultural and food trade. In the case of small-farmer or village storage, particularly in semi-arid regions where millet and sorghum are the main crops, these studies agree on the validity of ad hoc methods and the effectiveness of traditional granaries, thus contradicting what has very often been recommended. (FAO, 2018). Grains crops of Sorghum and millet requires the right post-harvest

management to prevent loss result because of scattered, eaten by birds, as well as post-harvest pests and diseases. Post-harvest handling is one of the important linkages that need attention in the farming of cereals crops of sorghum and Millet.

Reducing postharvest losses is a more resource-efficient way of increasing food availability than expanding grain production. Postharvest losses of cereal grains and supply chain when they have reached physiological maturity and the crops will be collected in right time considering the weather and soil condition. (1). Followed by pilling and then threshing to reduce the storage capacity (2), and then followed by drying, grading and packaging in the field, i.e. (3), furthermore, it will be cleaned in (4), and transported from the field to the house and then storage (5). Finally, the farmers will take the right decision of the seed/cereals for food, feeding, buying and for the seed of the next year and this chain has at least six links from harvest to market place (6). At each link, there are usually some dry matter weight losses when grain is scattered or spilt or as a result of grain becoming rotten or consumed by.



Own structured 2018.

Figure 1. Supply Chain and Stage in the Post-Harvest Operation and Management.

2. Problem Statement

2.1. Research Problem

In Africa, post-harvest losses from harvest to market sale amount to around 10-20%. Approximately 40% of these

losses storage at the farm and market, 30% during processing (drying, threshing, and winnowing), 20% in transport from the field to the homestead/farm, and the remaining 10% during transport to market. (APHLIS, 2018). Millet of earlier harvest have 9.5% losses and 4.2% loss of the late one, 7.4 transport; whereas the Sorghum at the field level have 4.5%

losses and 0.9% losses of transportation. These losses and damage occurring either by rats and mice, insects and mold that damage the stored grains. (IAARD, 2018). Although there is currently no standard of quality in sorghum trade but the implementation of good post-harvest technologies, especially at the farm level, is needed to make the yield more competitive. The ministry of Agriculture supported by the UN of FAO; jointly assess a year and seasonally the overall performance of the agricultural season in terms of crops production and to estimate the food security availability and using the FAO Food Balance of Sheet of; 146 kg/year, 2% losses of transportation, 5% animal consumption and 20% substance of grain. (FAO and MoAs, Sudan 2018). Thus the aspects of post-harvest handling needs special attention, because the information and technology on sorghum postharvest has not been widely known, such as harvesting, drying, bleaching and cleaning, also storing. The quality and quantity of the sorghum yields very much determined by the timing of planting and harvest, how to harvest, and post-harvest handling.

2.2. The Main Objective

The overall and broad objective is to study the smallholder farmers to better access of marketing their crops and link the farmers to the market and the economic valued added.

The specific objectives were as bellow:

1. To increase the HHs food availability by reducing pre-farm gate losses, which enable smallholders to store grain throughout the year?
2. To increase HHs income by empowering smallholders to sell surplus grain at higher prices
3. To empowering smallholders to good quality of sorghum and grain the market value added
4. To increase food safety, storage, health and nutrition through good hygiene and storage management
5. To create awareness, align market incentives, and motivate the private sector to serve a newly created market for hermetic storage.
6. To understand the storage and facilities management including the silos/ hermetic bags, gunny bags, damage etc.

2.3. Research Question

1. To what extend your understanding and why it is important to provide good-quality grain?
2. To what extend your understanding of good practice for threshing and cleaning grain?
3. To what extend your understanding of drying the grain and

safely?

4. Do you understand how to check the moisture content of grain and why this is important?
5. Do you understand how to use the storage methods including [hermetic sacks and silos?

2.4. Research Hypothesis

1. Farmers using poor storage system of traditional granaries, gunny sacks which do not preserve grain quality and quantity.
2. Farmers are still practicing poor facilities of cutting, harvesting, drying, threshing, cleaning and storage
3. Farmers lacking the knowledge of moisture, proper storage, and transport the grain from field the house.
4. Farmers do not understand precaution of; pre-harvest and the right time to take during the harvest.
5. Farmers are lacking the economic value of the good quality of the grain at the market.

2.5. The Importance of the Study

Cereal grains such as maize, rice, millet and sorghum are the main food staples of most countries in Sub-Saharan Africa (SSA) Sudan. It has special relevance to the current situation where agriculture is being challenged to produce ever more food for a rapidly growing world population in the face of limited physical resources and the negative impacts of climate change. This is because reducing the losses that occur in the postharvest chain for cereals offers a resource efficient means of increasing food availability without further use of land, water and other agricultural inputs. Reliable PHL figures are essential for better targeting of loss reduction programmes, monitoring the success of these programmes and estimating food availability in countries threatened by food insecurity. (APHLIS). Thus the finding of the study will help the Post -Harvest Assessments (PHAs) to make reliable assessments of cereal grain weight losses after harvest; through reducing postharvest losses is a more resource-efficient way of increasing food availability than expanding grain production since it does not rely on yet greater use of agricultural inputs such as land, labour and fertilizer.

3. Research Methodology

3.1. Area of Study

The study was carried out at Tokar locality during the period of March-April, 2018. The area so called full name is Tokar Delta a name given to small area of Delta approximately, 161,000 hectares situated in the southern area of the Red Sea in Eastern Sudan. It has the coordinates at Latitude [18° 25'

31° N 37° 43' 45" E and longitude at 18.42528° N 37.72917]; with It a total population of (183449 people; WFP, 2018. The area has a potential of agriculture and about 80% of the people are farmer producers and surplus and cover to the Port Sudan capital state. The Delta including *Khur Baraka and Delta Tokar*. Nowadays, the area is fully attacked by a massive growing of mesquite trees covers more than half of the delta area, decreased the cultivable land in the delta and created risk to the environment and livelihood of the people in the area. Mahgoub Suliman *et al.*, (2015).

3.2. Data Collection and Sampling

A field survey was conducted during March-April, (2018) in the area surrounded; Tokar and Delta Tokar. Both primary and secondary data methods were used in this study. Primary data was collected during the field survey through using semi-open ended and structured questionnaire. Simplified random sampling was used and selects the members of 62; (39 male and 23 female). The field survey provided data for many indicators including Household (HH) information (or socio-characteristics of HH); e.g. age, marital status, HH size, education level, type of employment. Whereas the secondary data were taken from different sources; published papers, Journal, researches articles, books and relevant information from institutional government; Ministry of Agriculture Red Sea (MoA), Agricultural Administration Planning (APA), Abu Haddia Farmer School in Tokar. The sources include the UN agencies of (UNDP, WFP, FAO and USAID and ACF.)

3.3. Analytical Techniques

A set of the research analysis including the descriptive statistic, frequency distribution and rank of percentile were used; the *Logistic regression analyses of predictive analysis* between a categorical dependent variable and a set of independent (explanatory) variables. Dependent variable has three or more

unique values thus, a practical procedure and the of aspect of Post-harvest management; Excellent, Good, Adequate, poor and the very poor were used and applied the Customs Table and ranking to provide a column graph of the aspect investigated.

4. Results and Discussion

4.1. Household Social Characteristics Discussion

The descriptive statistics of (HH) Socio-characteristics considered in this study were gender; male and female, age in years, marital status, HH size and the education level. A field survey of the sample members of 62 respondents (39 male and 23 females; 63% and 37% respectively). The study showed the participant's age group of 35-40 year represents the highest percentage of (30.5%); followed by age group of 30-35 year (22.5%), 40-45 year (19%), 25-30 year (16.7%) and 20-25 year represents the smallest number of (11.3%). The marital status of the sample members reported the highest of (46.75%) married, (27.5%) were single, (14.5%) divorced /separated and only the smallest number of 11.25 were widowed. The number of HH and composition including the children were ranged (35.5%) 5-7 persons, (29%) were 3-5 persons, (21%) 7-9 persons and the only smallest number including the newly house of family (14.5%) were less than three persons at the housing and of living. The educational generally in the Eastern part is seem to be the highest problem among the community Small Scale Holders of farmer; thus its reported the highest of (29%) literacy, (21%) had the basic school, (17.74%) had secondary school, (14.5%) *Khalwa* of Quran School, (12.90%) had university and (4.86%) had the degree of post graduate. A various jobs and employment were reported; (42%) were purely farming, (29%) both farming and livestock, (19.5%) farmer and fishing around the Red Sea of *Sahil* (southern part) and only (9.5%) were engaging and trade of agricultural crops. (See Table 1).

Table 1. Personal Characteristics of the Sample Members = (62 farmer).

Variables	NUMBER	VALID PERCENT%
Gender		
M	39	63
F	23	37
Total	62	100
Age in years	NUMBER	VALID PERCENT%
35-40	19	30.5
30-35	14	22.5
40-45	12	19
25-30	10	16.7
20-25	7	11.3
Total	62	100
Marital Status	NUMBER	VALID PERCENT%
Married	29	46.75
Single	17	27.5
Divorced or separated	9	14.5
Widowed	7	11.25

Variables	NUMBER	VALID PERCENT%
Total	62	100
Size of Household (Adults and Children)	NUMBER	VALID PERCENT%
5-7 persons	22	35.5
3-5 persons	18	29
7-9 persons	13	21
Less than 3 persons	9	14.5
Total	62	100
Level of Education	NUMBER	VALID PERCENT%
Literacy	18	29
Basic school	13	21
Secondary	11	17.74
<i>Khalwa</i> school	9	14.5
University	8	12.90
Graduate degree	3	4.86
Total	62	100
Participants: Type of Employment	VARIABLES	NUMBER
Purely farmer	26	42
Farmer and livestock	18	29
Farmer and fishery (Red Sea) <i>Saheil</i>	12	19.5
Farmer and trader	6	9.5
Total	62	100

Sample members N = 62 respondent
 Source: Field survey, (2018).

4.2. The Aspect Measured for the PHL and Management

A total sample of 62 members in Tokar area were asked to fill the structured questionnaires on the post-harvest aspect of; do they understand why it is important to provide Good Quality of grain (sorghum) including grade, quality and the factor lower the quality; from the total respondent of 62 were reported adequate, good, poor, excellent and very poor by 29%, 24%, 18%, 16% and 13% respectively. According to the (WHH) of Red Sea; whom has been secondary sources that's the area of Toakr were a fully potential with agriculture product however, more than 70% were lacking the skills and meaning to the post-harvest which will led to big losses in the area. (WHH, 2018). Generally, the farmer did not understand properly why it is important to provide good-quality of grain these were due to community lacking the PHA awareness and its related knowledge.



Figure 2. Shows the farmers and knowledge to understand the important and provide good-quality grain.

Source: Field survey, (2018).

Regarding the aspect of farmers; do they understand the good practice for threshing and cleaning grain sorghum including; the precaution to avoid grain damage during threshing/shelling and various options threshing; were adequate, good, poor, very poor and excellent with 33%, 24%, 18%, 14% and only 11% respectively. Generally, the farmers were poor and very poor of knowledge of PHA; reported some of them were using the threshing in the land directly the crops were mixed with the sand and its will take long time consuming to clean and package in bags.

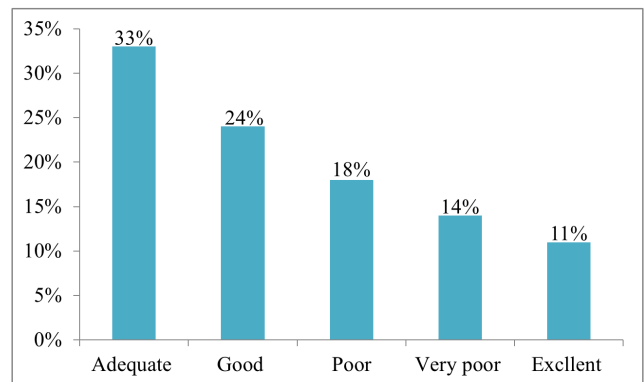


Figure 3. Shows the farmers do not understand good practice for threshing and cleaning grain.

Source: Field survey, (2018).

For the aspect of farmer's; on how to dry the grain of sorghum without contamination or damage, sundry of sorghum, using the plastic sheets and the grain precaution of good drying. They reported the 39% adequate, 26% poor, 20% very poor, 15% good and the smallest proration of 9% were excellent. Generally, the severe drops of understanding the knowledge of grain drying and management.

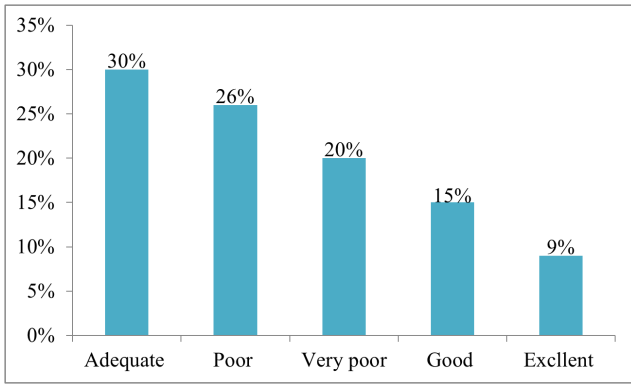


Figure 4. Gives information percentage% of the farmers understand how to dry grain safely.

Source: Field survey, (2018).

The biggest challenges on how to know and check the moisture content of grain and it's important (13%) or less before storage including tarpaulin, soil, keeping animals away and never storage the grain when moisture is above (13%) of the agricultural cereals crops. Thus they reported lacking of agricultural extension services in namely the Farmer Field Schools (FFSs) its worldwide linkage the farmers to all the aspect of agricultural including the PHAs and management. They were 33% poor, 29% adequate, 17.5% very poor, 12% good and only the smallest fraction of 8.50% who were reported as excellent. This result is typically the assumption of about a half of small scale in Tokar were not able to do a proper moisture content during the harvesting and threshing time. Adding to that the CBOs who are recently operating in the area were sacrificed and carried only one session for about (15) participants from the farmers community (Abu-Hadia Organization) this one is highly recommended in case of jointly collaboration in the near future.

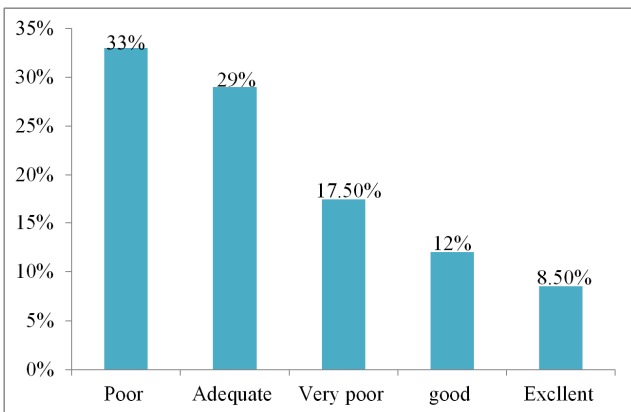


Figure 5. Give information percentage% of the farmers understand the moisture and it is important.

Source: Field survey, (2018).

Grain storage equipment's, traditional methods, storage

capacity for the home, and the correctly position and utilize storage facilities were reported; 35% as poor, 27% very poor, 22% adequate, 9% good and only the smallest number of 7% as excellent. This result is supported the study conducted by the ministry of agriculture Red Sea jointly with WFP in 2017. Which reported the overall, Toaker locality is lacking the agricultural services namely the farmer lacking the knowledge of post-harvest operation compared to the other side of Agig and Sinkat localities.

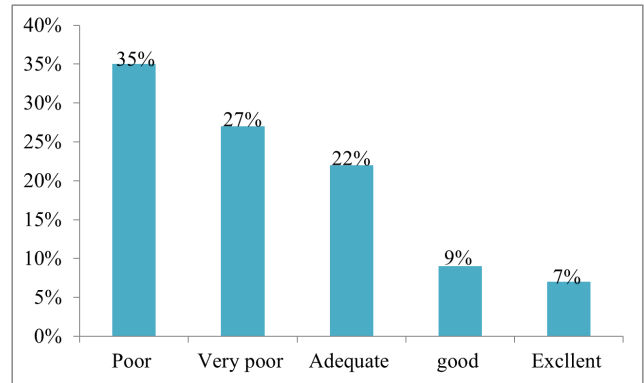


Figure 6. Illustrates how the famers understand the storage methods including [hermetic sacks and silos?

Source: Field survey, (2018).

The overall, aspect of farmer to understand the post-harvest operation management were 29% as adequate, 26% poor, 17.7% were very poor, 16.8% as good and the only small number of 10.9% were excellent. The area have very good potential of agricultural flood farming system from the Delta however, the area have big gap and the farmers lacking the opportunity to promote and enhancing the food security of the post-Harvesting losses of crops production particularly; the Agro processing, post-harvest management and establishing the storage facilities of grains in Tokar locality.

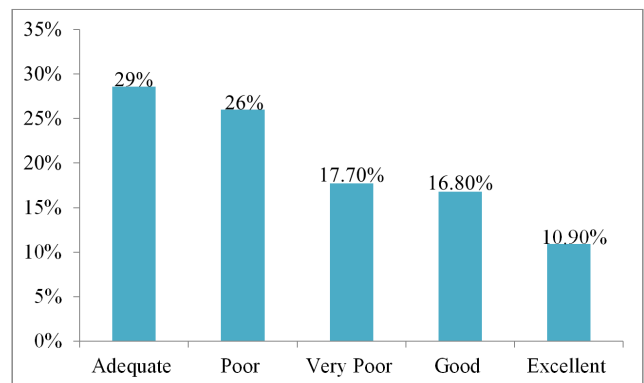


Figure 7. An average% of farmers understand the aspect of PHL.

Source: Field survey of January, (2018).

5. Conclusions and Recommendations

The concept of post-harvest losses and management considered in the paper is to know more about the knowledge of Small Scale Holders of their skills and understanding of the PHLM in relation to the food security related matter. Results of the present study revealed that, the overall, aspect of the farmer and understanding to the post-harvest operation management were 29% as adequate, 26% poor, 17.7% very

poor, 16.8% good and the only small number of 10.9% were excellent. More attention and further work (Research and Direction) is required and to conduct details post-harvest loses in Agig, Sinkat and Hyaa then to provide training need assessment of the farmers including the capacity building; this could be possible through to the so called (FFSs) and to increase the knowledge and skills of the small scale farmers as well as to reduce the post-harvest losses and improve the food security in the area.

Appendix

Small Scale Holders Questionnaire

Name of area/village: _____ Date of Interview: _____ Questionnaire No: _____

1. Demographic Data and information: Please tick (√)

(1) Gender: Male [] Female []

(2) Age in years:

20-25y [] 25-30y [] 30-35y [] 35-40y [] 40-45y []

(3) Marital Status:

Married [] Single [] Divorced/Separated [] Widowed []

(4) Size of Household (Adults and Children)

Less than 3 pers 3-5 persons [] 5-7 persons [] 7-9 persons []

(5) Level of HH education level

Illiteracy [] *Khallwa* [] Basic school [] Secondary [] University [] Post graduate []

(6) Participants: Type of Employment

Purely farmer [] Farmer and livestock [] Farmer and fishery *sahil* [] Farmer and trade []

2. Quantitative Data

Table A1. Shows aspects of Post-Harvest Management among the assessed farmer.

Aspects	Number	Excellent	Good	Adequate	Poor	Very poor
1. To what extend your understanding and important to provide good-quality grain crops of sorghum Total number of participants And%						
2. To what extend your understanding of the good practice for threshing and cleaning grain (sorghum) Total number of participants And%						
3. To what extend your understanding to the drying of grain and methods Total number of participants Total number of participants And%						
4. To what extend your and how to check the moisture content and why it's important for your grain Total number of participants And%						
5. To what extend your understanding do on how to use storage methods and facilities Total number of participants And%						

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