Po

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

Report for Sesamae Pos-Harvest Loss study in Ethiopia

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Project: Alliance for Food Security through Reduction of Post- Harvest Loss and Food Waste

Baseline Survey report

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Crop: Sesame

Executive summary

In collaboration with The Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss, the survey was conducted to assess Sesame post-harvest losses and their determinant factors in Ethiopia (Tigray, Amhara, and Oromiya). The survey allocated 200 farm households (90 for Tigray, 80 for Amhara, and 30 for Oromiya). In each study area, respondents were selected using a random sampling approach. The data were analyzed using descriptive statistical approaches. Key findings of the survey are summarized as follows:

- **Household Sesame production activities:** Average crop coverage from Sesame was about 16 hectares per household. The average coverage was higher in Tigray (25 hectares) followed by Amhara (9.7 hectares) and Oromiya (5.58 hectares). The aggregate production statistics indicates that the average Sesame production is about 44 quintals per household. The region

specific data shows that the average Sesame production per household is high in Tigray (62 quintals) followed by Amhara (31.3 quintals) and Oromiya (21.4 quintals). However, yield per hectare was higher in Oromiya region. Production variability among producers seemed to be high in Tigray ranging from about 0.8 to 1500 quintals per producer. This might be because the survey included investors in Tigray region. The grain use management result indicates that, on average, quantity sold at harvest was higher than the quantity stored for later sale.

- **Estimated Post-harvest losses**: The survey result shows that there are substantial post-harvest losses in the study areas. The average post harvest loss amounted to be about 33 Kgs per hectare with great variability among the farm households ranging from about 0 to 368.3 kgs per hectare. In percentage terms, the average loss in the study areas was about 13% of the total crop produced. At household level, the average estimated loss was 1.8 quintal implying a financial loss of birr 5632 to 6840 per household. The area specific result shows that post-harvest losses were high in Tigray (38.38 Kgs/ha) followed by Amhara (32.5 Kgs/ha) and Oromiya (13.5 Kgs/ha). Looking in to the different stages, significant losses occurred during harvesting (33%), drying (26%) and threshing (18%).
- **Causes of post-harvest losses:** Weather condition, termites, insects in field, shattering and rodents in storage were identified as major loss casing factors across all the study areas. In Oromiya, birds and spillage were added as major post-harvest loss casing agents.
- **Crop Marketing:** The marketing process and market infrastructures are factors that can affect crop post-harvest losses. In the study areas, farmers travel an average of 9.1 Kms to market places though it varies across the study areas. In Amhara, the average distance to market is about 15 Kms but there is a possibility of travelling up to 180 KMs by some farmers. In Oromiya and Tigray, the average distance to market places is about 5 Kms. The longest market distance for Oromiya and Tigray are 50 and 70 Kms respectively. Many of the respondents (51%) used animal pulled cart for grain transportations. Producers use either donkey or tracks for long market distances.
- **Household food consumptions:** The household food consumption frequency indicated that majority of the households (96%) ate three times per day. Their food diversities, however, were limited to the consumption of starches and legumes. Dairy, meat, eggs, vegetables, and fruits were insufficiently taken by most of the households.

1. Introduction

Sesame is strategically important to Ethiopia, as it consistently ranks as a top performing export crop. In Ethiopia oilseed is the 3rd largest crop sector in area coverage after cereals and pulses, and sesame ranks 1st from the oil seeds sectors with a total land coverage of 239,532.34 ha in 2012/13 cropping season and estimated production of about 1,813,760.51quintals (CSA, 2013). Ethiopia is 2rd sesame exporter in the world and sesame is first export (79%) from oil seeds and 2nd (20%) agricultural export next to coffee in Ethiopia (Ministry of trade, 2013). Tigray (36%), Amhara (31%), Oromiya (17%) and Benishangul Gumuz (15%) are the main sesame producing regions in the country (Adefris, et al., 2011). In Ethiopia, the amount of area under sesame, production and productivity has been increasing consistently during 1995-2011 (CSA 1995-2011). During 2011, 253,747 tons of sesame seed worth of 346 million USD was exported (Ethiopian Customs Authority 2013).

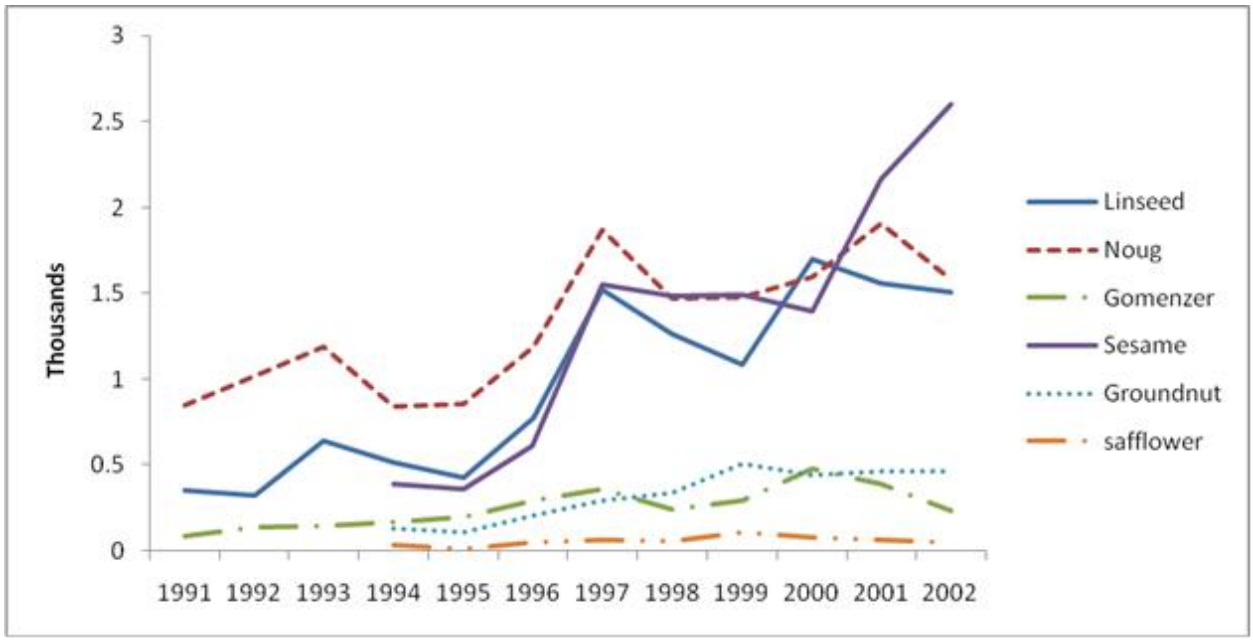


Figure 1. Production of oil seeds from 1991 to 2002 EC (Source CSA 1991-2002 EC)

Table 1.Production of sesame in Ethiopia during GTP-I period. 2000-2012

Year	Area in '000 ha	Production in '000 quintal	Productivity quintals/hectare
1999/00	38.19	156.3	4.1
2000/01	42.37	107.9	6.6
2001/02	58.78	388.9	6.6
2002/03	91.53	614.6	6.7
2004/05	136.22	1 153.9	8.5
2005/06	205.15	1 488.6	7.3
2006/07	211.31	1 493.8	7.1
2007/08	185.91	1 867.7	10.1

2008/09	277.99	2 167.4	7.8
2009/10	315.84	2 605.3	8.3
2010/11	384.68	3 277.4	8.5
2011/12	3 37.50	2 447.8	7.3
2012/13	2 71.72	1 813.7	7.3
2013/14			

Source: (CSA 2009-2013)

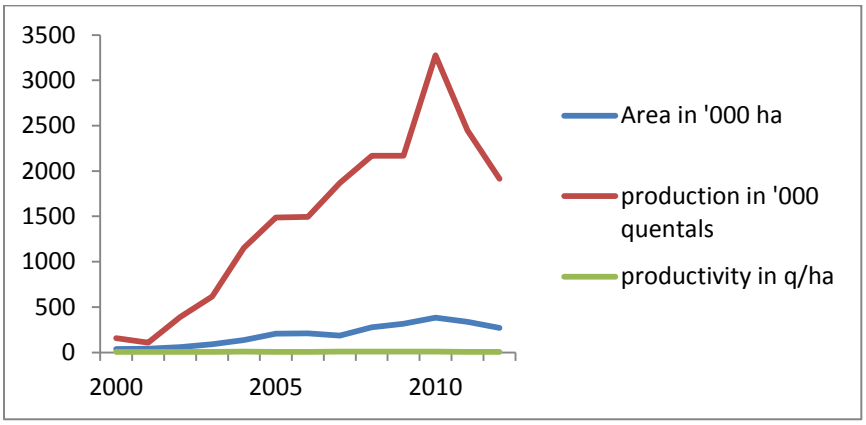


Figure 2. Area in '000 ha, production in '000 quintals and productivity in quintals/ha of sesame during 2000-2010 (CSA 2010).

Sesame seed is chiefly used for the oil extraction. The oil is colorless with distinctive nutty sweet flavor. Sesame oil is considered as prime vegetable oil in South East Asian dishes particularly China and Japan (Wijnands et al. 2007). In Addition sesame is used in confectionery, tahini, halva and Pharmaceutical industries.

Sesame is sensitive to biotic and abiotic factors and its shattering character is the most important problem in its post harvest period. In addition being very small of its seeds is also another problem during transportation and storage period.

Among the various challenges that thesesame sector faces in northwest Ethiopia, post-harvest losses are one of the most pressing issues. Given that sesame farmers spend about four months of

the year working in a grueling way, it is striking that they lose much of their sesame on the piling and threshing points. The losses do not stop there, but continue to occur in the multiple loading and unloading activities, in transporting to either to warehouses or home and then to market centers. It is generally assumed that 30% of harvestable sesame is lost. Action research has been conducted to substantiate this claim. The study revealed that 13% losses occur, mainly at field level. Although the research did not cover all the important stages, this number represents a very important loss that is a value of more than 1 billion ETB (40 million Euro) (SBN,2014).

Although Sesame is an increasingly important cash crop to the Ethiopian agricultural economy, and currently the 2nd most significant earning agricultural export for Ethiopia, this agricultural sub-sector has substantial potential for improvement both on the side of productivity and in improving quality for accessing higher value markets.Since farming production, storage and supply management differ from one chain to another, understanding these inefficiencies is key to improving management for reducing harvest losses, the costs incurred and the potential economic-gains missed. For studing sesame post harvest loss in Ethiopia a project proposal is developed in collaboration with The Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss.

The Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss is a five year project supported by the United States Agency for International Development (USAID) to assess factors contributing to post-harvest losses in four feed the future countries (Bangladesh, Ethiopia, Ghana, and Guatemala) and develop research-based solutions to reduce such losses. The project in Ethiopia is a collaborative effort between several US Universities, Ethiopian Universities, several Ethiopian Institutes of Agricultural Research, International Seed Sector Development, Sesame Business Network, Regional agricultural Bureaus, and several private businesses supporting the postharvest sector.

This report presents base line survey results on Sesame post-harvest losses and the determinant factors for Ethiopia (Tigray, Amhara and Oromiya). The report is divided in to four main sections. Section 2 presents the methodological approaches followed in the study. Issues related to site and respondent selection, and analytical approaches are discussed. In section 3 of the

report, descriptive and analytical survey results are presented. The last section presents concluding points of the study.

2. Methodology

2.1 Sampling and data collection

The survey was conducted in three regions of Ethiopia; Tigray, Amhara and Oromiya from October to November 2014. Discussion was held with research team members to identify these potential Sesame producing areas. Based on their Sesame production activities, survey sites were identified by the research team. Total of 200 respondents were shared among to each study region and site (see table 1). In each study site, respondents were selected using random sampling approach.

Table1 Site and respondent sampling

Region	Woreda	Kebele/site	DA	Paricipnats to be interviewed
Tigray	K.Humera	Mykadra	1	10
		Bereket	1	5
		Rawyan	1	5
		Baeker	1	5
		Adebay	1	10
		Myweni	1	5
		Adigoshu	1	5
		Ruwasa	1	5
		Investors	1	10
	Tseedea	Division	1	10
		Dansha	1	10
	Wlkayt	Mygeba	1	5
		Korarit	1	5
Sub Total				**90**
Amhara		Mirab Armacho	Abderafie	1	10
			Abreha Jira	1	10
			Kor	1	10
		Tach Armacheho	Sanja	1	10
		Shinfa	Shinfa	1	10
		Metama	Gelego	1	10
		Quara	Quara	1	10

Sub Total				**80**
Western Oromiya				30
Total				**200**

The household questionnaire mainly ,but not limited to, focuses on variables related to the farmers' Sesame production behaviours, post-harvest losses, causes of losses, farm and household level post-harvest loss management methods, and household consumption behaviour. The production and loss data were collected for the 2013/14 production year.

3. Survey Results

3.1 Household characteristics

Age: Descriptive statistics for the respondents' age group are given in table 2. The age of the respondents ranges from 22 to 75 years with an average of 43.5 years. Many of the respondents belong to the middle age (25-48 years). The average age ranges from 40 years (Oromiya) to 46 years (Tigray). This is in line with average age of farmers in the country, which is about 45 years.

Gender: The survey result shows that about 92% of the total respondents were males (see table 3). Looking across the study areas, female household heads were fairly represented in Tigray (15.56%).

Table 2 descriptive information for age of respondents

Region	Obs	Mean	Min	Max
Amhara	78	42	22	60
Oromiya	30	40	23	62
Tigray	90	46	26	75
Aggregate	198	43.5	22	75

Table 3 descriptive information for gender of respondents

Region	Male	%	Female	%
Amhara	77	98.72	1	1.28
Oromiya	29	96.67	1	3.33
Tigray	76	84.44	14	15.56
Aggregate	182	91.92	16	8.08

Educational level of respondents: Table 4 gives the educational level of respondents both at the aggregate and area specific sample levels. Out of the 198 respondents, the proportion of illiterate farmers (with zero education) covers about 27%. Looking in to the cumulative percentage, about 50% of the respondents have educational level of below than grade four. Farmers who completed primary school take about 41% .

Table 4 descriptive information for educational level of respondents

	Amhara		Oromiya		Tigray		Aggregate	
Variable	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
No education	31	39.7	8	26.7	14	15.6	53	26.8
< grade 4 /informal education	21	26.9	16	53.3	9	10.0	46	23.2
Complete primary school	22	28.2	2	6.7	57	63.3	81	40.9
Secondary school	3	3.9	4	13.3	10	11.1	17	8.6
Diploma	0	0.0	0	0	0	0	0	0
Degree	1	1.3	0	0	0	0	1	0.5
Totals	78	100	30	100	90	100	198	100

Family size: The average household size is about 6 (see table 5). The lower average family size was recorded in Amhara (6) while the maximum was in Oromiya (7). Children cover about 60% of the household size. The lower value of the average proportion of children was recorded in Amhara (52%) and the higher mean value was in Oromiya (68%). Probably, higher proportion of children indicates higher family dependency ratio. The gender composition data shows that, on average, females took 48% of the family members. In Oromiya and Tigray, this value is higher taking 52% and 51% respectively.

Table 5 descriptive information for respondents' family size

Variable	**Amhara**	**Oromiya**	**Tigray**	**Aggregate**
Household size	5.9	7.4	6	6.2
Proportion of children	0.52	0.68	0.62	0.6
Proportion of females	0.44	0.52	0.51	0.48

3.2 Crop Production activities

Table 6 gives the mean values for Sesame production and grain use activities in the 2013/2014 production season. The average crop coverage seems higher in Tigray, which is about 25 hectares per producer. This might has been influenced by the presence of investor respondents in

the region. Without the investors, the average crop coverage would be about 10 hectares per household, which is equivalent to that of Amhara region. The region wise production summary indicates that all respondents were able to produce Sesame in the 2013-2014 production seasons. The aggregate production statistics indicates that the average Sesame production is about 44 quintals per household. The region specific data shows that the average Sesame production per household is high in Tigray (62 quintals) followed by Amhara (31.3 quintals) and Oromiya (21.4 quintals). However, yield per hectare was higher in Oromiya region (see table 6). Production variability among producers seems to be high in Tigray ranging from about 0.8 to 1500 quintals per producer. This is because the survey included investors in Tigray region. The grain use management result indicates that, on average, quantity sold at harvest is higher than the quantity stored for later sale. In some cases, quintiles sold at harvest seem to be higher than the average quantity harvested, which somebody does not expect. This is because of the presence of extreme values in the data.

Table 6 Mean values for Sesame production activities (in quintals) for the 2013-2014 production seasons

Variable	Aggregate	Amhara	Oromiya	Tigray
Hectares covered	16.01	9.72	5.58	25.00
Quantity harvested	43.63	31.33	21.39	61.85
Production per hectare (Quintals)	3.71	3.57	5.30	3.29
Quantity sold at harvest	37.35	54.86	3.38	33.31
Quantity stored for sale	15.45	1.90	8.89	29.52
Quantity stored for consumption	0.04	0.00	0.00	0.08
Quantity stored for emergency	0.02	0.00	0.00	0.03
Quantity held for seed	1.69	0.41	2.60	2.50

3.3 Sesame grain loss

3.3.1 Causes of grain losses

As can be seen from figure 4, weather condition is the most loss casing agent. Respondents explain that winds and intensive rainfall are the common elements of weather condition for grain losses. Insects in field, termites, shattering, threshing, theft, harvesting, and rodents in storage are also the loss causing factors perceived by more than 50% of the respondents. Table 7 gives the

severities of the grain loss factors both for the whole sample and regional data. The total number of observations attached to each grain loss causing factor are those who only say "yes" to each factor. The remaining farmers are those who either did not perceive the causal effects of the factors or simply failed to respond the questions. Looking in to the who sample data, more than half of the observations responded that weather condition, termites, insects in field, theft, shattering, and rodents in storage are the factors causing *severe* grain loss effects. In the region specific information, the above mentioned factors are also true to Tigray and Amhara. In Oromiya, the severe grain loss causing factors are birds, spillage and insects in field.

Figure 4 Respondents' frequency distribution by causes of grain losses

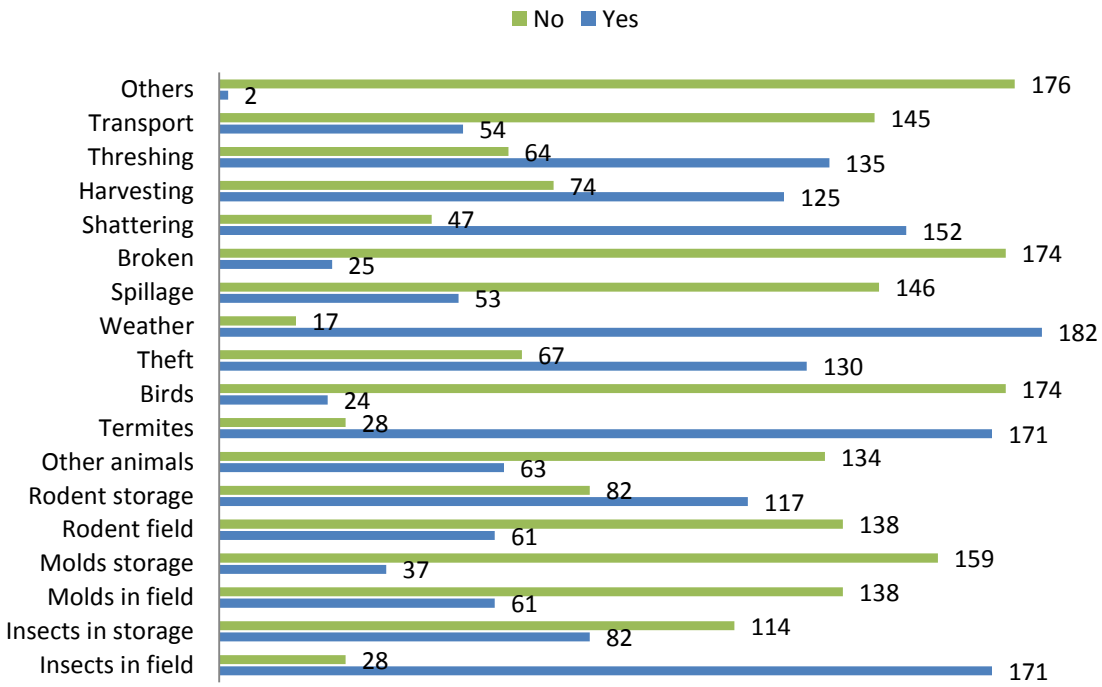


Table 7 severity of grain loss factors (0 = Not Severe, 1 = Moderately Severe, 2 = Severe)

	Aggregate		By region					
			Tigray		Amhara		Oromiya	
	Obs.	Mean	Obs.	Mean	Obs.	Mean	Obs.	Mean
Insects in field	171	1.34	76	1.29	67	1.37	28	1.39
Insects in storage	85	0.86	43	0.84	39	0.90	3	0.67
Molds in field	61	1.05	24	0.92	25	1.16	12	1.08
Molds storage	37	0.81	14	0.79	18	0.78	5	1.00
Rodent field	61	1.00	23	0.91	27	1.04	11	1.09

Rodent storage	117	1.22	57	1.23	46	1.26	14	1.07
Other animals	65	1.02	37	0.97	11	1.09	17	1.06
Termites	171	1.46	73	1.45	77	1.53	21	1.24
Birds	24	1.00	4	0.75	18	1.00	2	1.50
Theft	132	1.30	50	1.24	60	1.43	22	1.05
Weather	182	1.63	79	1.66	75	1.76	28	1.21
Spillage	54	0.93	30	1.10	22	0.64	2	1.50
Broken	25	0.64	0		14	0.36	11	1.00
Shattering	152	1.24	67	1.21	57	1.33	28	1.14
Harvesting	125	0.97	60	0.95	53	0.98	12	1.00
Threshing	135	0.89	75	1.11	55	0.58	5	1.00
Transport	53	0.85	30	0.87	21	0.81	2	1.00
Others	23	0.91	12	1.08	8	0.63	3	1.00

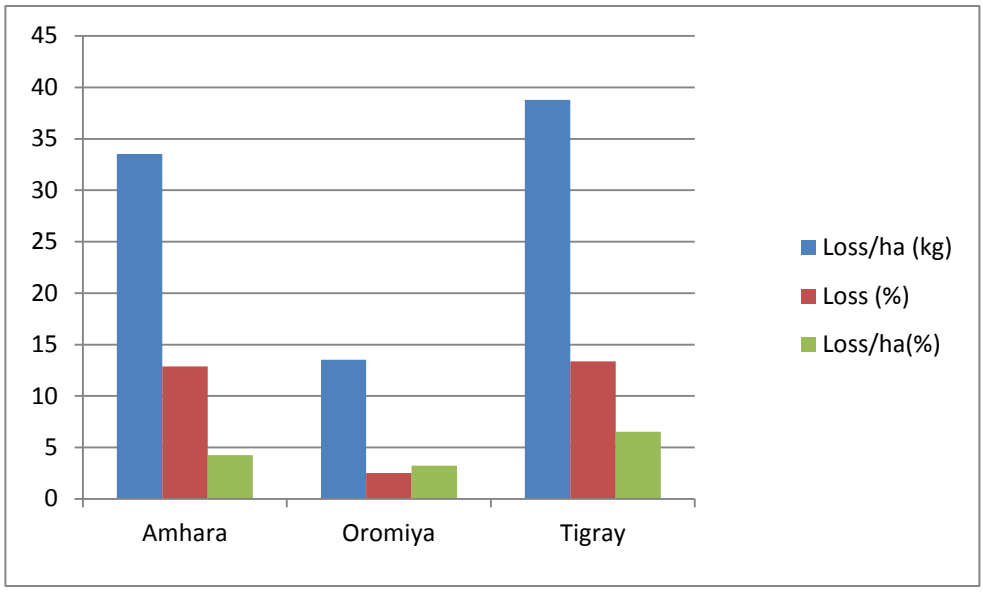
3.3.2 Estimated grain losses

The survey result shows that substantial post-harvest losses occur in the study areas. The average post harvest loss amounts to be about 33 kgs per hectare with great variability among the farm households ranging from about 0 to 368.3 kgs per hectare (see table 8). In percentage terms, the average loss in the study areas is about 13%. At household level the average estimated loss is about 1.8 quintals implying a financial loss of birr 5632 to 6840 per household. Figure 5 shows the region specific post-harvest loss information recorded in the 2013/14 production season. Post harvest-losses are high in Tigray (38.8 kgs/ha) followed by Amhara (32.5 kgs/ha) and Oromiya(13.5 kgs/ha). Translating these results in to economic terms, the financial losses are about 1350-1513.2, 1038.5- 1299.8, and 316.7- 442.8 birr per hectare for Tigray, Amhara and Oromiya respectively. Similarly, high percentage losses were recorded in Tigray.

Table 8 estimated grain post-harvest losses for Sesame for the 2013/2014 production season

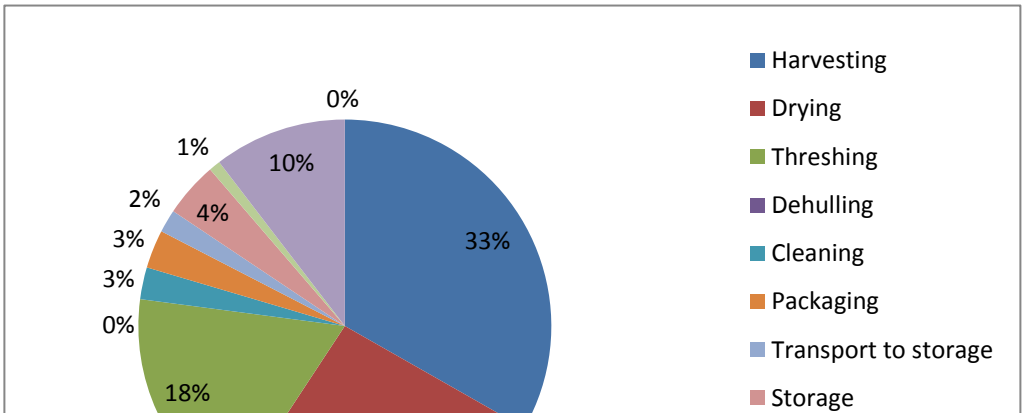
	Loss (kg)	**Loss/ha (kg)**	**Loss (%)**	**Loss/ha (%)**
Mean	181.12	32.89	13.05	5.36
Median	60	15.65	6.25	1.57
Standard Deviation	397.83	50.88	27.03	11.14
Kurtosis	35.87	15.98	80.57	29.45
Skewness	5.42	3.54	7.71	4.75
Minimum	0	0	0	0
Maximum	3400	368.33	315.71	97.50

Figure 5 average post-harvest losses by region



Post-harvest losses occur at different stages of the post-harvest management operations. Figure 6 gives the household level average losses at each stage of post harvest management. The harvesting, threshing and drying stages together make about 77% of the post-harvest losses. Substantial loss (33%) occurs during harvesting followed by drying (26%) and threshing (18%). Considerable losses also occur during the marketing and storing stages taking about 10% and 6.4% respectively. Respondents explained that the losses in the harvesting stage are mainly attributed to factors like the capsules remaining in the field, untimely harvest (early and late harvests), unskilled labor, and weather conditions like wind and rain. Farmers explain that the losses during the drying stage come from the crop shattering due to wind and rain, human and animal contact with *hillas*, and insects and rodents. One of the causes of the losses in the threshing stage is when *hillas* are moved to the threshing floor. While in storage, rodents are the major causes of post-harvest losses. The substantial losses during marketing occur during sample taking from containers. The region specific data confirms similar experience across the study areas (see table 9). For all study regions, the verage loss is high at the harvesting stage.

Figure 6 Percentage of post-harvest losses at different stages



Picture 1. Over maturity (left) and Threshing (right)

Table 9 Region specific Sesame Post-harvest losses (kg) in different farm oepration stages for 2013-14

Farm operation stage	Region											
	Tigray				Amhara				Oromiya			
	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
Harvesting	61.49	150.04	0	1000	100.30	366.18	0	3000	13.55	36.93	0	200
Drying	58.56	159.34	0	1000	69.99	169.59	0	1000	1.23	2.67	0	10
Threshing	61.72	120.92	0	800	23.34	40.28	0	200	0.90	1.84	0	7
Dehulling	0	0	0	0	0.57	3.58	0	25	0.00	0.00	0	0
Cleaning	7.81	25.66	0	200	4.22	14.60	0	100	0.18	0.46	0	2
Packaging	13.01	105.62	0	1000	0.90	5.81	0	50	0.00	0.00	0	0
Transport to storage	7.07	31.52	0	200	1.51	6.78	0	50	0.01	0.05	0	0.25
Storage	14.08	48.83	0	300	6.74	20.08	0	100	0.22	0.67	0	3
Transport to market	3.98	31.75	0	300	0.04	0.26	0	2	0	0	0	0
Marketing	43.32	368.96	0	3500	5.33	32.31	0	270	0	0	0	0
Milling	0	0	0	0	0	0	0	0	0	0	0	0

3.4 Controlling methods for grain losses in storage

It seems that many of the farmers in the study areas do not use the mentioned loss controlling methods. Some farmers, however, explain that drying and Malathion dust are used as loss controlling mechanisms at their storages. For example out of the 199 respondents, 72 explain that they use drying mechanisms and 47 respondents use the Malathion dust (see figure 7).

Figure 7 Respondents' frequency distribution by grain loss controling methods in storage

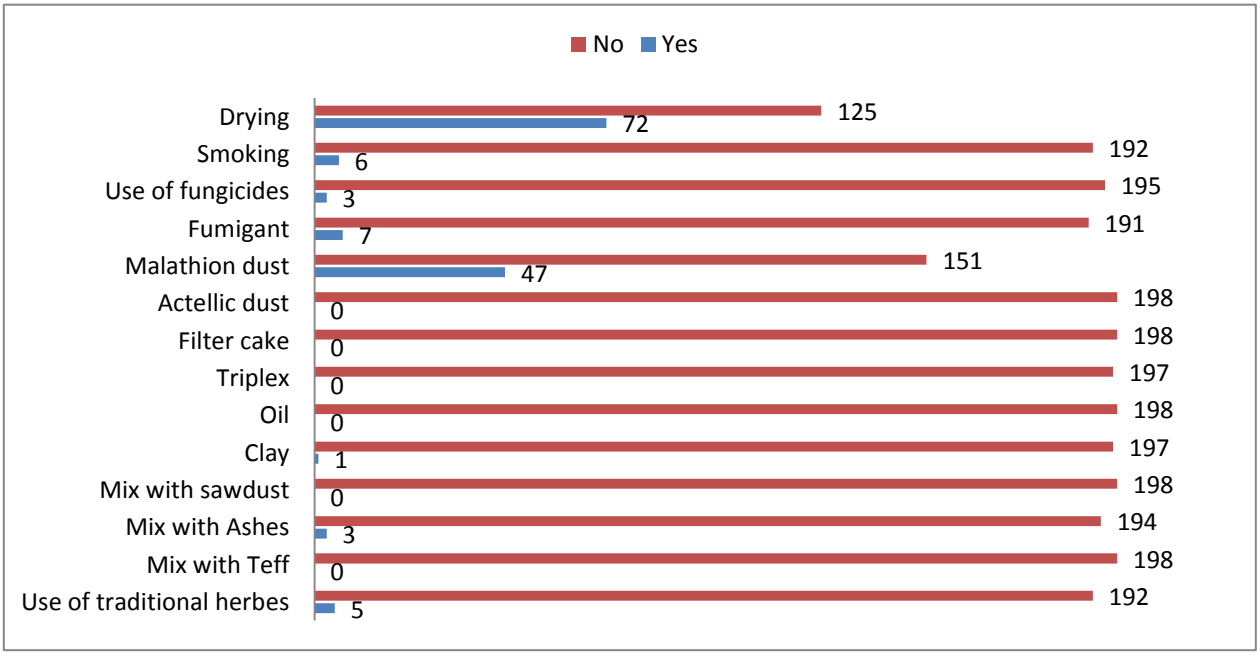
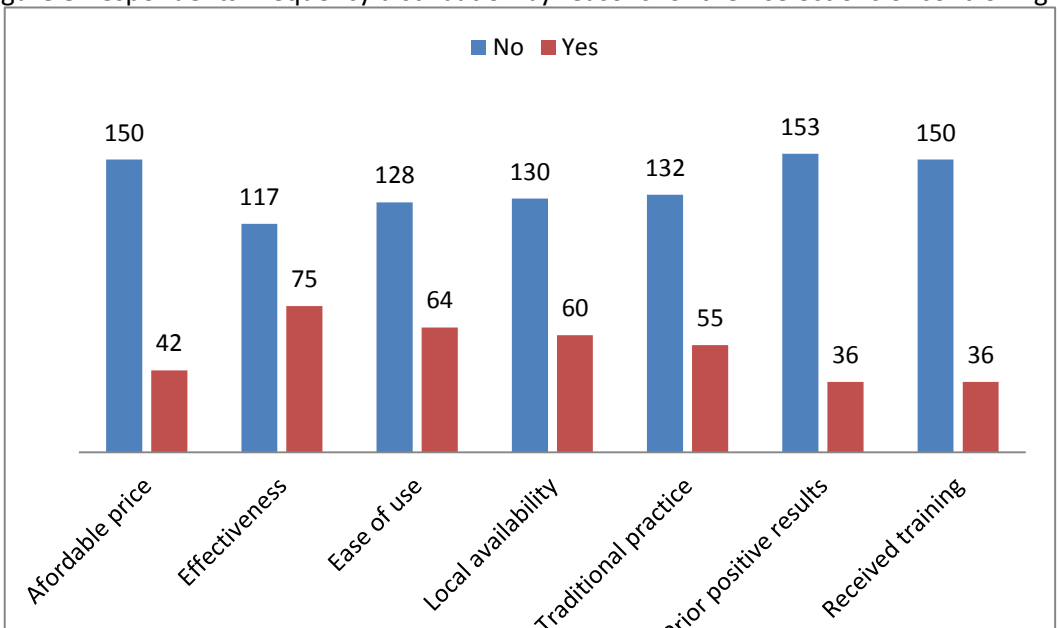


Figure 8 presents factors that influence farmers' selection of grain loss controlling mechanisms in storages. Effectiveness, easiness of use, local availability and traditional practices are some of the factors that influence farmers' choice of controlling mechanisms. On the other hand, prior positive results and training were the influencing factors stated by few farmers pointing that scientific interventions and awareness creation schemes are less in the study areas.

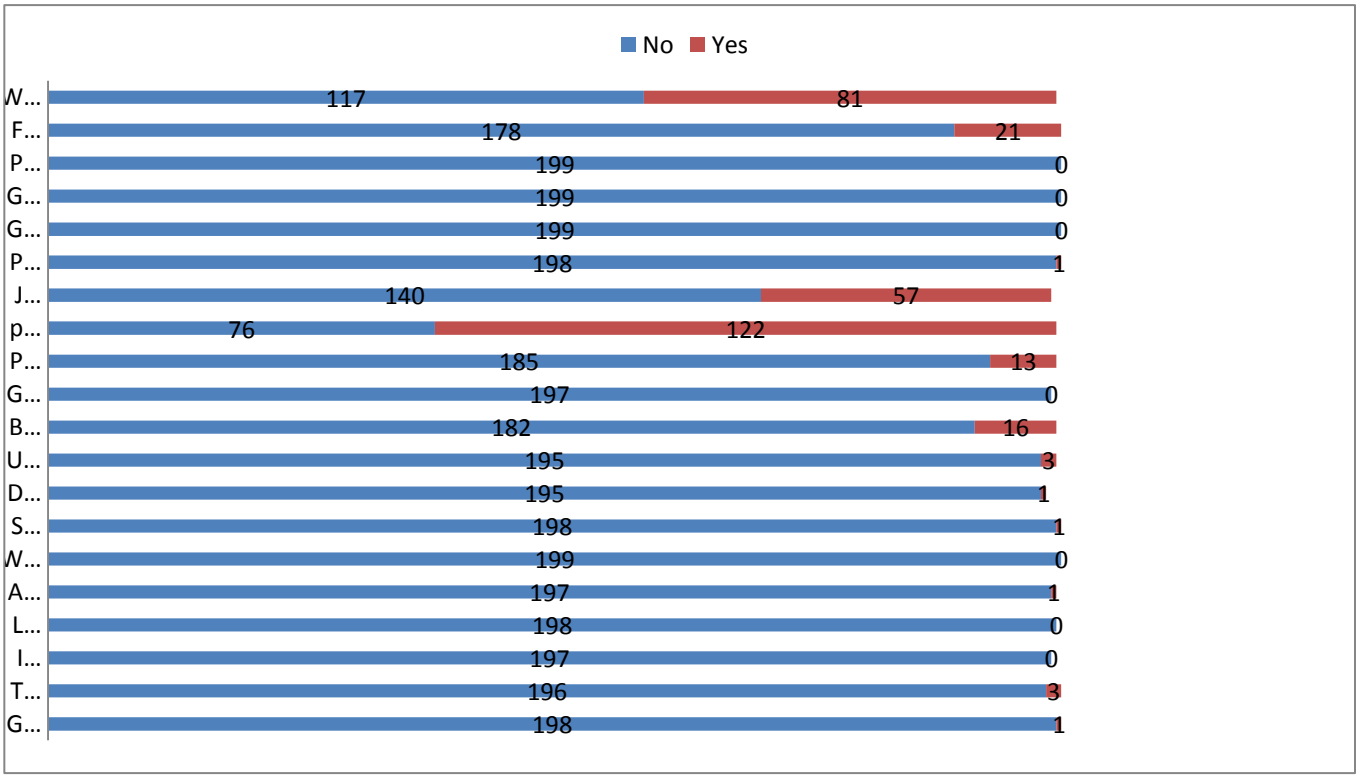
Figure 8 Respondents' frequency distribution by reasons for their selections of controlling methods



3.5 farmers' grain storage types

Figure 9 shows the frequency of respondents by their types of grain storages for Sesame in the study areas. The survey result indicates that farmers use very limited number of storage types. About 61% of the respondents explain that they use Polypropylene bag to store their Sesame

Figure 9 Respondents' frequency distribution by types of grain storage

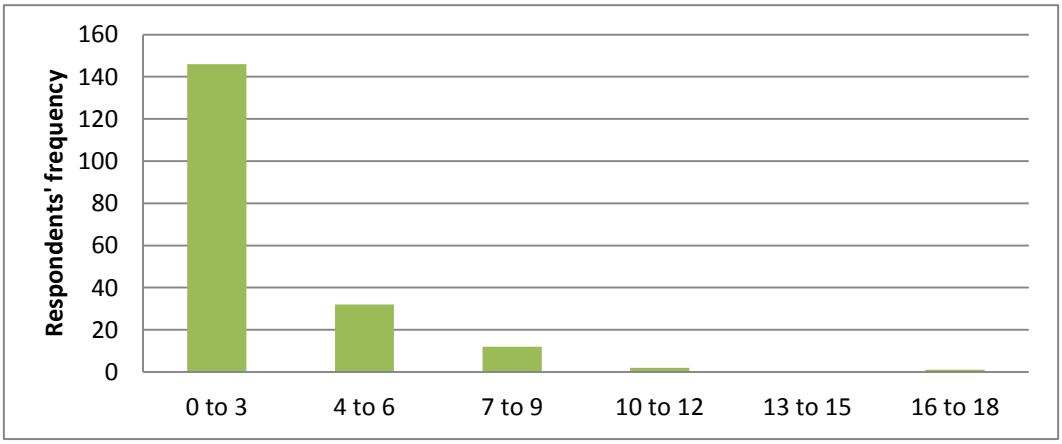


grain followed by ware houses (40%) and Jute bag (28.6%). Other storages like fertilizer bags, balcony, and plastic bags are also used by few respondents.

The maximum number of months that farmers put their grain in storage is indicated in figure 10. The frequency distribution graph shows that about 73% of the respondents put their Sesame

grain in storages not for more than 3 months. This seems in line with duration of storage that scientific studies recommend for Sesame. There are also respondents who store their grain up to 18 months, although they are outliers.

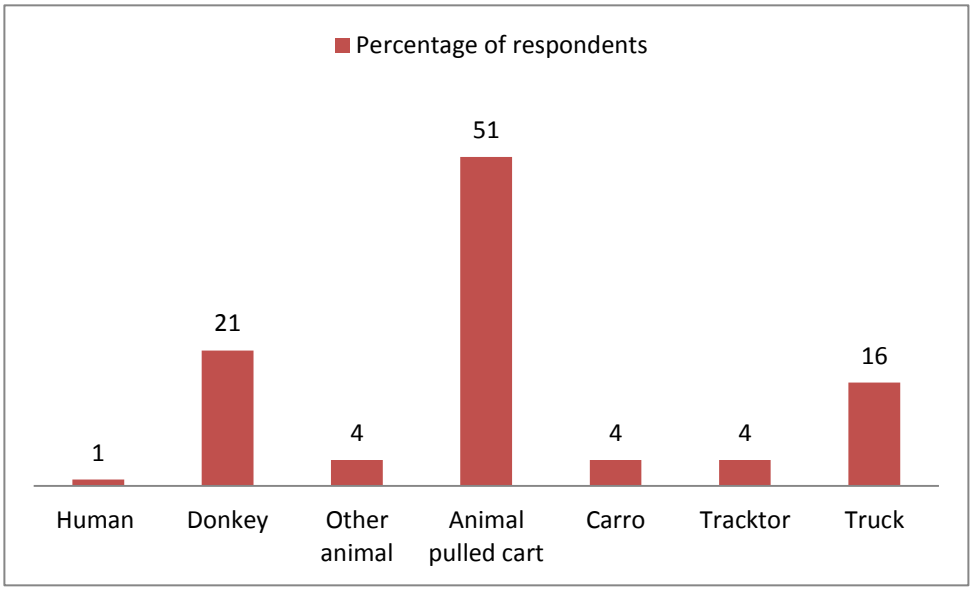
Figure 10 Frequency distribution of farmers' duration of grain storage for Sesame



3.6 Grain marketing for Sesame

Farmers can sell their grain to private business men, local cooperatives or nearby Ethiopian Commodity Exchange office. About 78% of the respondents explained that they sell their product from the market by travelling a fairly long distance. In Amhara, the average distance to market is about 15 Kms but there is a possibility of travelling up to 180 KMs by some farmers. In Oromiya and Tigray, the average distance to market places is about 5 Kms. The longest market distance for Oromiya and Tigray are 50 and 70 Kms respectively. Many of the respondents (51%) used animal pulled cart for grain transportations. Producers use either donkey or tracks for long market distances.

Figure 11 Percentage of respondents by the type of transportations



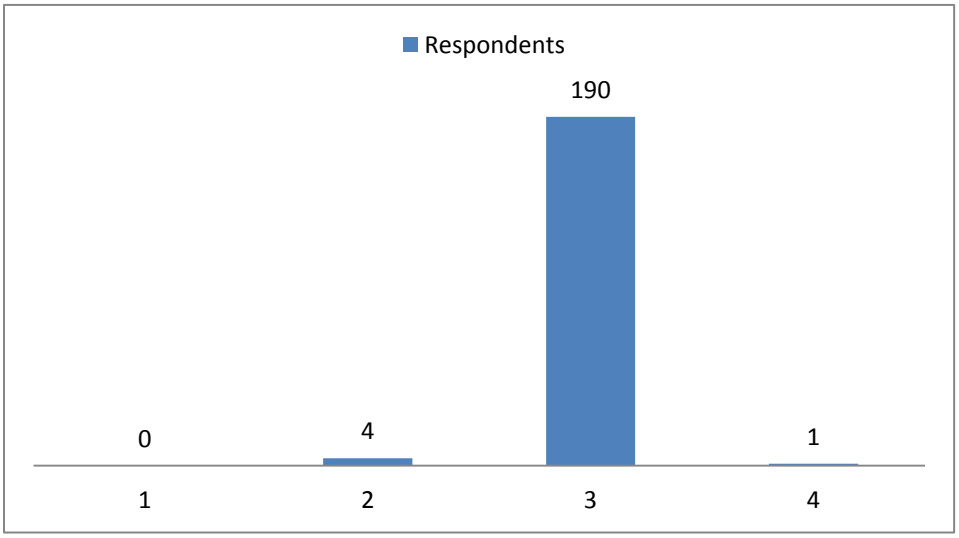
On aggregate the average selling and highest possible price levels for the 2013/14 production years were birr 31.29 and 38 per Kg respectively. Market prices are, however, different for products of the study areas. For Humera (Tigray), the average selling price was about birr 34.8 per Kg where as the highest possible price was averaged to be birr 39 per Kg. The price levels were slightly lower for the product in Amhara region. The average selling and highest possible price levels for Sesame produced in Amhara region were birr 31 and 38.8 per Kg respectively. These values get lower for the product in Oromiya taking birr 23.46 to 32.8 per Kg.

3.7 Household Consumption behavior

3.7.1 Household meals and consumption frequency

Respondents vary in their choices of food items but *injera, wot*, bread, meat and vegetables are among the commonly mentioned food types. Figure 12 presents respondents' frequency of food consumption per day. About 96% explained that they eat three times per day while very few (4%) consume two times per day.

Figure 12 frequency distribution of respondents by consumption frequency/day



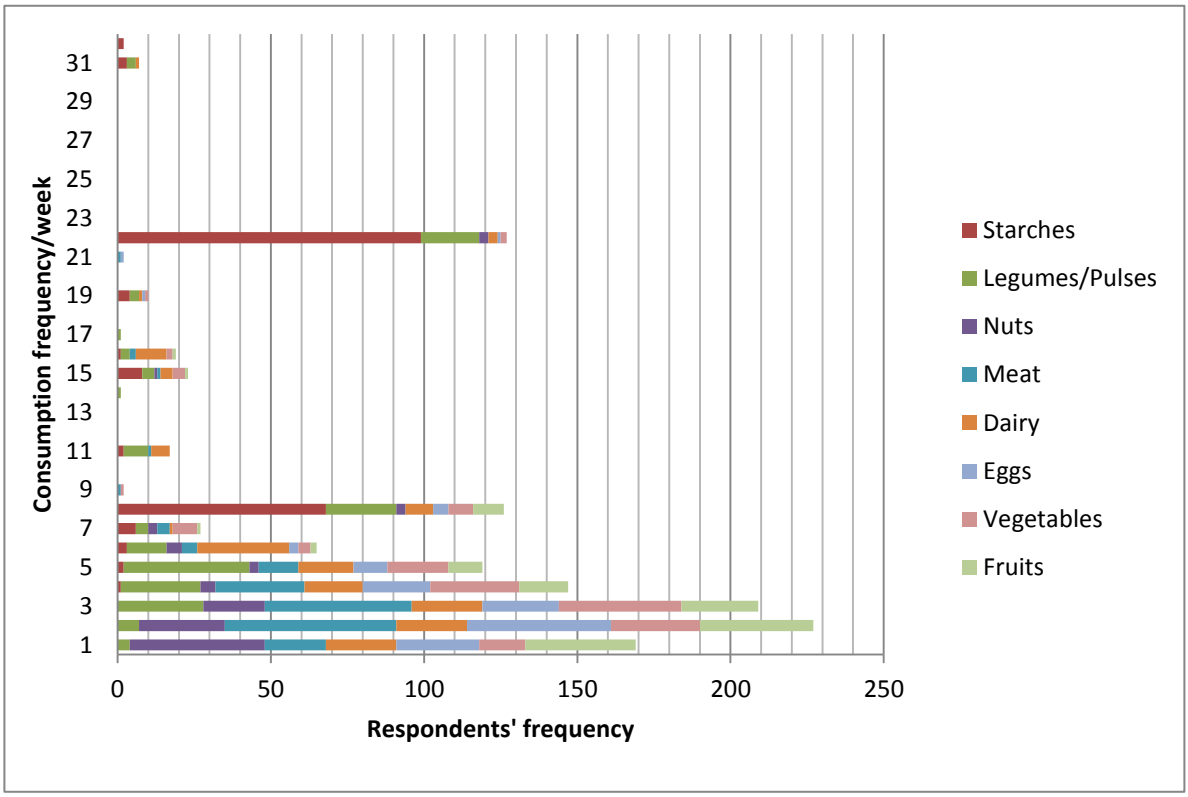
On average, starches were consumed 15 times in 21 days (see table 10). Every household took starches at least 3 times in 21 days. Legumes were consumed about 7 times, dairy 4.6 times, and vegetables 3.4 times. Nuts, fruits and eggs were consumed less frequently in 21 days.

Table 10 average times a food item was consumed in 21 days

	Obs.	Mean	Min	Max
Starches	198	14.93	3	31
Legumes/Pulses	188	6.96	0	30
Nuts	115	2.05	0	21
Meat	181	2.33	0	20
Dairy	171	4.64	0	30
Eggs	143	2.21	0	21
Vegetables	163	3.40	0	21
Fruits	140	2.1	0	15

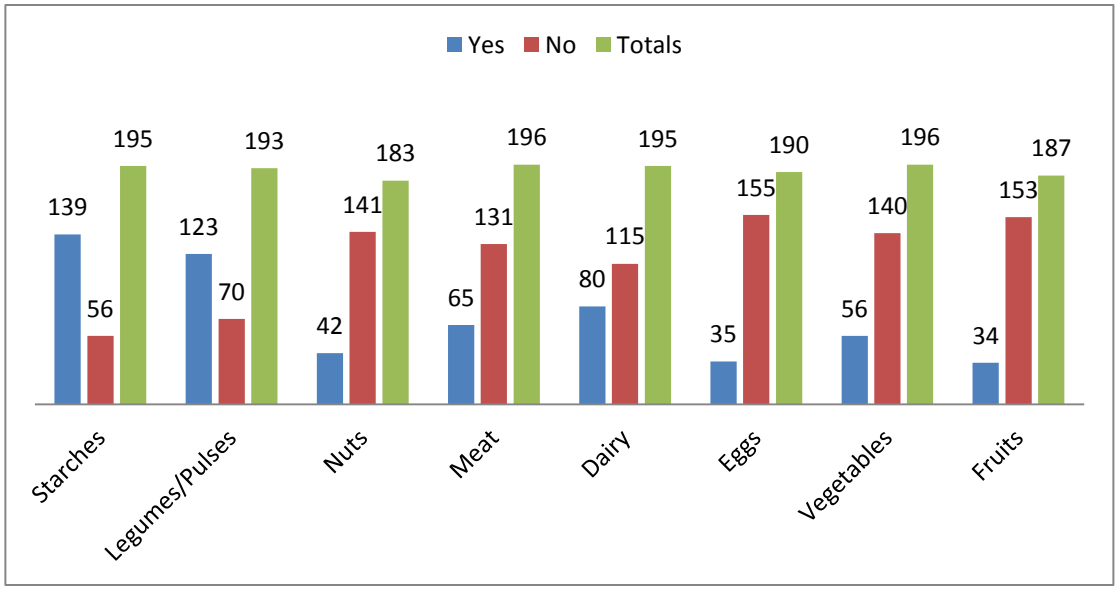
The graphical depiction for frequency distribution of respondents by the number of times they consumed food item in 21 days is given in figure 13. About 99 respondents explained that they consume starches 21 times in 21 days. That is at least once in a day. 68 consumed starches 7 times in 21 days. Legumes were consumed 21 times by 19 respondents and 7 times by 23 respondents. In general starches, legumes, dairy and vegetables were the food items that many respondents consumed at least 3 times in 21 days.

Figure 13 respondents' frequency distribution for food consumption frequencies/week



Except for starches and legumes, respondents perceived that their consumption frequencies were not sufficient for all food items (see figure 14). For starches, 195 respondents gave their opinion on sufficiency of starch consumption in their families. About 72.3% explained that their consumption frequency were sufficient in the 21 days. For legumes/pulses about 63.7% (out of 193 respondents) perceived that they had sufficiently consumed the food items in 21 days. Eggs, fruits, vegetables, nuts, meat and dairy were perceived as insufficiently taken food items.

Figure 14 respondents' perception on sufficiency of food items



4. Conclusions and recommendations

In collaboration with The Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss, the survey was conducted to assess Sesame post-harvest losses and their determinant factors in Ethiopia (Tigray, Amhara, and Oromiya). The survey allocated 200 farm households (90 for Tigray, 80 for Amhara, and 30 for Oromiya). In each study area, respondents were selected using a random sampling approach. Data were descriptively analyzed.

From the survey results we put the following concluding points

- The survey result shows that there are substantial post-harvest losses in the study areas. The average post harvest loss amounted to be about 33 kgs per hectare with great variability among the farm households ranging from about 0 to 368.3 kgs per hectare indicating the possibility of bringing farmers to very low post-harvest losses in the areas.
- Substantial loss (33%) occurred during harvesting followed by drying (26 %) and threshing (18%). Considerable losses also occur during the marketing and storing stages taking about 10% and 6.4% percents respectively pointing that improved post-harvest management technologies at these stages of operation will greatly reduce considerable food losses in the study areas.
- Insects in the field, termites, weather condition and theft are among the causes of post-harvest losses that most respondents labeled them as "*highly severe*". Addressing these agents of food losses should be the home work of researchers and other stake holders.
- The household consumption behavior result indicated that food items for majority of the households are limited to starches and legumes. Dairy, meat, eggs, vegetables, and fruits are insufficiently taken by most of the households. Food diversity interventions are urgently recommended if food security problems are to be tackled in the areas.

5**. Notes for further works**

- Analyzing panel information so that more robust conclusions can be drawn
- Conducting experments to come up with more statistically plausible conclusions.
- Introducing and applying different post-harvest management technologies and food security interventions
- Conducting impact analyses for introduced technologies

Financial Expenditure Report

Budget Summary

Activities	Cost (ETB)
Per diem for team members (researchers), DAs, enumerators, , Drivers and financial Personnel	161,300.00
Time compensation for Crop leader	12,800.00
Sesame seeds Laboratory analysis	12,200.00
Car rent	16,000.00
Fuel and Lubricant	33,074.56
Transport (Including Air ticket)	8,000.00
Stationary	9,000.00
Training and workshop	47,980.00
Report compilation	10,000.00
Total	**310354.56**

Budget Utilization; Over 99% of the budget is utilized.
N.B: the budget line for sesame seeds Laboratory analysis is transfered to Report compeletion.

Annex 1. Budget transfer Letter

Ref. No 4296/ዓሠ.003-07
Date 26/02/2015

To Commercial Bank of Ethiopia
Mekelle branch
Mekelle

Subject –Transfer of fund

By debiting our account No.Gov-3506(1000012077053) Tigray agricultural research Institute ; Transfer the sum of ETH .Birr 310354.56 (Three hundred ten thousand three hundredfifty four birr &56 cents only) to under mentioned Agricultural research center .The amount indicated is its name being for PHIL (Post harvest reduction innovation Lab)Project .

Please deduct your service charge from this amount .

S/No.	Name	Bank Address	Bank A/C No.	Amount ET.Birr	
				Birr	Cent
1	Humera Agricultural research center	Humera Branch	1000080332878	310354	56
				310354	56

Sincerely

ዳንኤል ሃይሉ
Daniel Hailu
ውጥኒ ደጋፊ ከይዲ ስራሕ ፅዮጋ
ፋይናንስን ምምሕዳር ንብረትን
Procurement Finance and Proper
Administration Support Process Owner

Tigray Agricultural Research Institute Procurement and property administration Service

CC

Finance and budget section (TARI)
Mekelle
Humera Agricaltural research center
Humera