REPORT ON

POSTHARVEST LOSS ASSESSMENT SURVEY-ETHIOPIA

CHICKPEA POSTHARVEST LOSS ASSESSMENT

BASELINE INFORMATION

BY
DR. MEKASHA CHICHAYBELU

DEBRE ZEIT AGRICULTURAL RESEARCH CENTER
ETHIOPIAN INSTITUTE OF AGRICULTURAL RESEARCH

1. Introduction

Chickpea is among important legumes accounting for over 14% of Ethiopian legumes (4.1 million MT) (CSA, 2013). Chickpea is grown on 2.4million ha, and the cultivated area is 1.7% of that of total field crops' cultivation in the country. It is less labor intensive compared to many field crops as its production is towards the end of the cropping season, late August to December/January, as the farmers' traditional practice is to grow the crop under residual moiture.. That means less weed pressure and less soil management cost (drainage). The crop is known for soil nitrogen enrichment, rotational advantages and less cost of production. Chickpea is an important dietary crop, and it is consumed in Ethiopia in different preparations like snacks, curry, blend, green pea, salads, to mention a few.

Ethiopia is the leading producer, consumer and seller of chickpea in Africa, and is the sixth most important producer in the world. Ethiopian chickpea production is shifting from traditional cultivars to improved varieties and from *desi* types to the *kabuli* types. Other progressive shifts include the use of market-oriented cultivars and enhanced adoption of production packages recommended by research. among which pulling back planting time to late July – early August depending on soil drainage helped much in increasing productivity through provision of longer growing time. Hence production volume of chickpea has shown steady improvement over the last decade (Figure 1). (can we get some numbers please).

Grains may be lost in the pre-harvest, harvest and post-harvest stages. Harvest losses occur between the beginning and completion of harvesting, and are primarily caused by losses due to shattering. Post-harvest losses occur between harvest and the moment of human consumption. They include on-farm losses, such as when grain is threshed, winnowed and dried, as well as losses along the chain during transportation, storage and processing. Important in many developing countries, particularly in Africa, are on-farm losses during storage, when the grain is being stored for in-house consumption or while the farmer awaits a selling opportunity or a rise in prices.

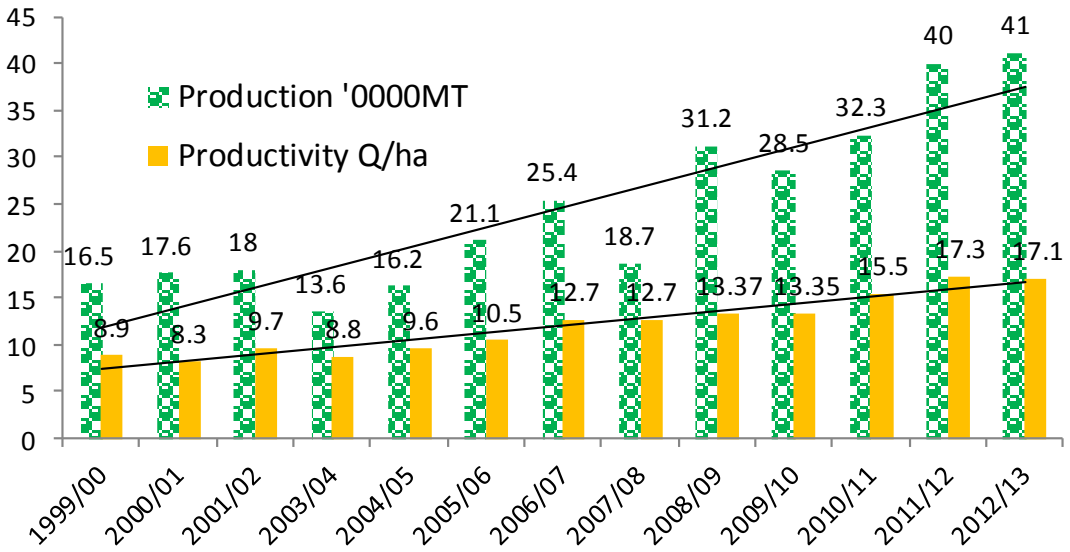

Figure 1. Chickpea production and productivity in Ethiopia

In tropical climates, deterioration of stored material, aided by insect damage and molds, can be rapid. In developing countries much produce is kept in on-farm stores in small quantities under quite primitive or traditional conditions that predispose chickpeas for insect pest infestation. Hence destruction of food by stored grain insect pests is one of the major factors responsible for food insecurity in many tropical countries.

Therefore, a questionnaire-based survey of smallholder farmers was conducted to generate baseline information on the perception of post-harvest loss esand related management practices along the whole value chain, from harvesting to marketing. Major findings of the study are presented hereunder.

2. Methodology

A survey that helps to generate baseline information for the postharvest loss assessment study was undertaken on chickpea by the Debre Zeit Agricultural Research Center (DZARC) of the Ethiopian Institute of Agricultural Research (EIAR) in collaboration with Mekelle University. The survey was undertaken by three teams of enumerators two teams from DZARC covered the Amhara, Oromiya and SNNP regions while a team from Mekelle University collected the data from the Tigray region.

The survey locations (Zone, Woreda) were selected based on their potential in chickpea production and selection of peasant associations was made together with woreda agricultural experts. Maximum care was, therefore, taken to assess potential production areas, though we were constrained by time of the survey. The survey covered four major chickpea producing regional states; namely, Oromia, Amhara, Tigray and South Nations, Nationalities and Peoples (SNNP) regions. A total of 220 farmers were interviewed in the four regions (Table 1), by considering slightly more representation for the Amhara and Oromia regions, as the vast majority of chickpea comes from there.

The collected data were subjected to statistical analysis using SPSS software. Descriptive statistics, mean comparison and multiple response analysis were employed depending on the type of the data. Some of the farmers responded to some of the questions as they "have no idea", especially in areas of giving estimates. Therefore, data from those farmers who provided full information were included in the report.

Table 1. Number of respondents interviewed in the four regions

No.	Region	Respondent farmers	
		Number	Percent[a]
1	Tigray	50	22.7
2	Amhara	60	27.3
3	Oromia	60	27.3
4	SNNP	50	22.7
	Total	220	100.0

[a]Percentages based on total respondents.

3. Demography of Respondent Farmers

The majority of respondent are male (87.3%) and 12.7% (n = 220) are female farmers (Table 2). The average age of the farmers is 44.9 years (22-85) where male and female farmers are 45.7 (24-85) and 39.5 (22-65) years old. As far as education is considered 63.2% (n = 220) of the respondent farmer has education ranging from informal education to a diploma level (Table 3). The remaining considerable proportion of the respondents (36.8%) had no education. In relation to this 64.0% and 63.2% of the farmers has the ability of writing and reading, respectively.

Table 2. Gender and age of respondent farmers

No	Gender	Respondent Farmers		
		Number	Percent	Mean age in years (range)
1	male	192	87.3	45.7 (24-85)
2	female	28	12.7	39.5 (22-65)
3	Total	220	100.0	44.9 (22-85x)

Table 3. Educational status of respondent farmers

No	Description	Category	Respondent farmers	
			Number	Percent[a]
1	Education level	Completed elementary education	81	36.8
		Secondary school	20	9.1
		Diploma	3	1.4
		Informal education	35	15.9
		No education	81	36.8
2	Writing Ability	Able	142	64.5
		Not able	78	35.5
3	Reading Ability	Able	139	63.2
		Not able	81	36.8

[a] Percentages based on $n = 220$.

4. Agro-ecology and Source of Income

As depicted in Table 4 below the majority of the surveyed areas (77.3%; $n = 220$) were characterized as mid-altitude while low land and high lands were represented by 13.6% and 5.9%, respectively. Crop production is the sole primary source of income for almost all of the respondent farmers. Multiple responses were provided by some of the farmers on their secondary source of income (Table 5). Livestock production is secondary source of income for the majority (75.9%; $n = 220$) of respondent farmers and the sector is more prominent in SNNP region (22.3%) followed by Oromia, Amhara and Tigray regions in that order. On the other hand, 14.5% of the respondent farmers do not have secondary source of income. Sources of incomes such as cart transportation business, small shops and masonry are presented under "other" category that averaged to 8.2% of the secondary income of the farmers.

Table 4. Agro-ecology of the surveyed localities

No	Agro-ecology	Respondent farmers	
		Number	Percent[a]
1	Highland	13	5.9
2	Midland	170	77.3
3	Lowland	30	13.6
4	Humid	7	3.2
	Total	220	100.0

[a] Percentages based on *n* = 220.

Table 5. Secondary source of income of the respondent farmers, generated from multiple responses.

No	Source of secondary income	Comparison	Regional State				Total[a]
			Tigray	Amhara	Oromia	SNNP	
1	Livestock	Number of respondents	33	41	44	49	167
		% within income source	19.8	24.6	26.3	29.3	
		% within Region	66.0	68.3	73.3	98.0	
		% of Total	15.0	18.6	20.0	22.3	75.9
2	Self-employment	Number of respondents	5	5	2	0	12
		% within income source	41.7	41.7	16.7	0.0	
		% within Region	10.0	8.3	3.3	0.0	
		% of Total	2.3	2.3	0.9	0.0	5.5
3	Civil servant	Number of respondents	0	2	0	0	2
		% within income source	0.0	100.0	0.0	0.0	
		% within Region	0.0	3.3	0.0	0.0	
		% of Total	0.0	0.9	0.0	0.0	0.9
4	Others	Number of respondents	2	4	6	6	18
		% within income source	11.1	22.2	33.3	33.3	
		% within Region	4.0	6.7	10.0	12.0	
		% of Total	0.9	1.8	2.7	2.7	8.2
5	No secondary income	Number of respondents	10	9	12	1	32
		% within income source	31.2	28.1	37.5	3.1	
		% within Region	20.0	15.0	20.0	2.0	
		% of Total	4.5	4.1	5.5	0.5	14.5

[a] Percentages based on *n* = 220.

5. Production of Target Crops

Table 6 depicts farming experience of the respondents their cumulative mean production of the project target crops for the 2013-14 period. The respondent farmers had mean farming experience of 30 years ranging from 2 to 85. The results indicated that chickpea had the largest production per household (10.6 Quintals (Q)) followed by bread wheat (8.4 Q; range, 0-80Q) and Maize (7.8 Q; range, 0-245Q). Farmers in Oromia region produced the largest amount of

chickpea (22.7 Q; range, 3.5-75Q) while the least production (3.8 Q; range, 0.3-50Q) was recorded by the farmers in Tigray region.

Table 6. Farming experience (years) of respondent farmers and mean production (Quintals) of project target crops, 2013-2014.

Region	Measure	Farm experience (Years)	Average production (Quintals)[a]				
			Chickpea	Maize	Sesame	Bread Wheat	Durum wheat
Tigray	Mean	43.8	3.8	3.6	0	2.0	0
	N	5	50	50	50	50	50
	Min	12	0.3	0	0	0	0
	Max	85	50.0	20.0	0	20.0	0
Amhara	Mean	22.6	6.7	1.4	0.2	6.1	0.8
	N	60	60	60	60	60	60
	Min	3	1.0	0	.0	0	0
	Max	53	30.0	10.5	12.5	60.0	17.5
Oromia	Mean	29.2	22.7	0.7	0	21.8	0.2
	N	60	60	60	60	60	60
	Min	4	3.5	0	0	.0	0
	Max	55	75.0	37.5	0	80.0	9.5
SNNP	Mean	26.0	7.4	28	.050	1.2	0
	N	50	50	50	50	49	50
	Min	2	0.3	0	0	0	0
	Max	45	54.0	245.0	2.5	10.5	.0
Total	Mean	30	10.6	7.8	0.1	8.4	0.3
	N	220	220	220	220	219	220
	Min	2	0.3	.0	.0	.0	.0
	Max	85	75.0	245.0	12.5	80.0	17.5

[a]1Quintal = 100 kg.

6. Causes of Grain Loss

Results on the prevalence of the various causes of grain losses discussed hereafter are based on the total number of respondents (n = 220) while findings on their severity are derived from the number of farmers who recognized the respective causes of losses as their prevalent problem**.**

6.1. Field and storage insect pests

The study attempted to identify causes of grain loss and rated their severity level as perceived by the farmers. Majority of respondent farmers, 96.4% (*n* = 220) and 85.9% (*n* = 220), recognized field and storage insect pests as constraints of their chickpea production, respectively (Table 7). As far as the severity of insect pests is considered greater majority of the farmers (67.9%; *n* = 212) categorize the problem of field insect pests to be sever, while 47.6% and 46.6% (*n* = 189) of them considered storage insect pests to have severe and moderately severe effect. Small proportion of the farmers considered both field insect pests of chickpea either to have no sever damage or no effect at all. Nearly 80% (*n* = 69) of the respondent farmers appreciated the

problem of termites as either field or storage pest with no or moderate severity while 20% of them reported to have sever termite problem.

Table 7. Farmers' response on the presence and severity of field and storage insect pest problem

No	Description	Farmers Response	Field insect pests		Storage insect pests		Termites	
			No. of farmers	Percent	No. of farmers	Percent	No. of farmers	Percent
1	Prevalence	Prevalent	212	96.4	189	85.9	69	31.4
		Not prevalent	8	3.6	31	14.1	151	68.6
2	Severity	Not sever	7	3.3	11	5.8	30	43.5
		Moderately sever	60	28.3	88	46.6	25	36.2
		Sever	144	67.9	90	47.6	14	20.3
		Not recognized	1	0.5	-	-	-	-

6.2. Problem of Rodents, Birds and other animals

The problem of rodents as a field and storage pest has got due consideration by 76.4% and 55% of the respondent farmers, respectively (Table 8). Nearly one third (*n* =168) and 43% (*n* = 121) of the respondent farmers considered the damage by field and storage rodents to be severe, while larger proportion of them (47% for field rodents and 47.9% for storage rodents) rated the effect as moderately sever. The prevalence of birds and other animals as a production constraint of chickpea has been perceived by 30% and 25% of all the respondent farmers, respectively. Birds and other animals were reported to cause severe damage to 27.3% (*n* = 66) and 20% (*n* =55) of the respondents while no or moderately severe damage was perceived by the majority of the farmers.

Table 8. Farmers' response on the presence and severity of rodent, birds and other animals

No	Description	Farmers Response	Field rodents		Storage rodents		Birds		Other animals	
			No. of farmers	%	No. of farmers	%	No. of farmers	%	No. of farmers	%
1	Prevalence	Prevalent	168	76.4	121	55.0	66	30.0	55	25.0
		Not prevalent	52	23.6	99	45.0	154	70.0	165	75.0
2	Severity	Not severe	38	22.6	11	9.1	19	28.8	21	38.2
		Moderately severe	79	47.0	58	47.9	28	42.4	22	40.0
		Severe	50	29.8	52	43.0	18	27.3	11	20.0
		Not recognized	1	.6	-	-	1	1.5	1	1.8

6.3. Field and storage mold

The prevalence and severity of both field and storage molds on chickpea has less recognition by respondent farmers (Table 9). About a quarter of the farmers (*n* = 220) responded to have some mold problem in the field at times of unfavorable weather (untimely rain) during harvesting, the effect of which is occasional and not that serious. One fifth of them (*n* = 220) also pointed out that the problem can sometimes occur in the storage, if chickpeas are not fully dried prior to storage. Only 32.8% (*n* = 58) and 6.5% (*n* = 46) of the farmers recognized severe effet of field and storage molds. In general farmers do perceive that mold is less prevalent and severe on chickpeas, both at field and storage levels.

Table 9. Farmers' response on the presence and severity of field and storage mold problem

No	Description	Farmers' Response	Field mold		Storage mold	
			No. of farmers	Percent	No. of farmers	Percent
1	Prevalence	Prevalent	58	26.4	46	20.9
		Not prevalent	162	73.6	174	79.1
2	Severity	Not sever	15	25.9	19	41.3
		Moderately sever	24	41.4	24	52.2
		Sever	19	32.8	3	6.5

6.4. Non-pest causes of grain loss

Farmers' perception on non-pest causes of grain loss is presented in Table 10. The majority of farmers (60.5%) responded to have theft problem in chickpea especially while the crop is in the field. The farmers rated theft problem as not being severe (47%; *n* = 132), moderately severe (34%) and severe (18.2%). Chickpea farmers (55.5%) also recognized the prevalence of unfavourable weather, occasional rain particularly occurring after the crop matures, to cause damage to their crop where only 27% of them perceived severe effect. Grain loss due to spillage and broken grains was acknowledged by 41.4% and 48.2% of the farmers, respectively. Over 60% of the farmers realized that their traditional methods of harvesting and threshing cause grain loss with mostly low to moderate severity. Grain loss during transportation was recognized by lesser proportion (34.5%) of the farmers.

Table 10. Non pest causes of grain loss

No	Damage cause	Respondent farmers	Farmers Response					
			Prevalence		Severity			
			Prevalent	Not prevalent	Not severe	Moderately severe	Severe	Not recognized
1	Theft	Number	133	87	62	46	24	
		Percent	60.5	39.5	47	34.8	18.2	
2	Unfavourable weather	Number	122	98	26	60	33	3
		Percent	55.5	44.5	21.3	49.2	27	2.5
3	Spillage	Number	91	129	44	40	6	1
		Percent	41.4	58.6	48.4	44.0	6.6	1.1
4	Broken grain	Number	106	114	64	33	9	
		Percent	48.2	51.8	60.4	31.1	8.5	
5	Harvesting method	Number	148	72	39	102	7	
		Percent	67.3	32.7	26.4	68.9	4.7	
6	Threshing method	Number	138	82	49	81	6	2
		Percent	62.7	37.3	35.5	58.7	4.3	1.4
7	Transportation means	Number	76	144	54	19	2	1
		Percent	34.5	65.5	71.1	25.0	2.6	1.3

6.5. Grain loss at post-harvest operations

While interviewing the farmers it was found difficult for the majority of them to make estimates of losses during the various post-harvest operations, though they know losses to occur. Therefore, data from those who attempted to estimate were used for the following discussions. Grain losses considered hereunder at various post-harvest operations are estimates made for the 2013-2014 production years.

6.5.1. Grain loss at harvesting

According to 85.3% (n = 163) of the respondent farmers harvesting of chickpea is performed by cutting with sickle, while nearly 10% of them harvest by hand pulling and few farmers use both methods (Table 11). Dropping of pods is the major cause (75%; n =219) of grain loss at harvesting. Nearly one fourth of the farmers did not on how losses at harvesting could occur while negligible responses were given on grain loss to occur due to spoilage and consumption by animals.

On the average respondent farmers estimated to lose 42.2 kg (n = 164), out of their annual production (Table 11). The highest mean loss estimate at harvesting was recorded by respondent farmers of Oromia region (64.5 kg) while the least (7.3 kg) was from Tigray region.

Table 11. Method of chickpea harvesting and related grain loss

Harvesting method	Respondent farmers		Ways of loss	Respondent farmers		Region	Grain loss at harvest	
	Number	Percent		Number	Percent		Loss (kg)	Number
Cutting with sickle	139	85.3	Pod dropping	165	75.0	Tigray	7.25	12
Hand pulling	21	12.9	Spoilage	1	0.5	Amhara	34.56	43
Both (1 & 2)	3	1.8	Animal	1	0.5	Oromia	64.52	60
Total	163	100.0	No response	52	23.6	SNNP	30.94	50
			Total	219	99.5	Mean	42.18	164

6.5.2. Grain loss at drying

About half of the respondent farmers (*n* =219) allowed the chickpea field to fully dry before they harvest (Table 12). Large proportion of the farmers (40%) did not respond on the method of drying while 6.8% and 0.9% of them do pile the harvest in the field or on threshing floor, respectively, for some days to allow further drying.

Pod dropping was considered to be highest (48.2%; *n* = 220) means of grain loss at drying while negligible proportion of the respondents (1.4%) attributed the losses to birds' attack (Table 12). On the other hand half of the respondent farmers do not acknowledge losses that could occur at drying operation.

Respondent farmers on average perceive to lose 23.5kg grain of annual chickpea production during drying, the highest (33.75kg) being from Tigray region and the least (15.5kg) from SNNP region (Table 12).

Table 12. Method of drying and related grain loss

Drying method	Respondent farmers		Ways of loss	Respondent farmers		Grain loss at drying		
	Number	Percent		Number	Percent	Region	Respondent farmers	
							Loss (kg)	Number
Allow to dry before harvest	114	51.8	Pod dropping	106	48.2	Tigray	33.75	4
Piling in the field	15	6.8	Bird	3	1.4	Amhara	22.26	21
Pile on threshing floor	2	0.9	Not recognized	111	50.5	Oromia	29.31	48
No response	88	40.0	Total	220	100.0	SNNP	15.51	37
Total	219	99.5				Mean	23.49	110

6.5.3. Grain loss at threshing

Threshing of chickpea is performed by either trampling with animals (usually oxen and in cases of oxen shortage cows, donkeys and horses) or beating with stick (Table 13). The majority of the farmers do perform threshing by trampling with animals (75.5%; *n* =174) and only 3.6% of them thresh their chickpea by beating with stick.

Spillage of grains out of the threshing floor while trampling with animals and beating with stick is perceived to be the major way of grain loss (45%; *n* = 134) during this operation (Table 13). Smaller proportions of farmers also attribute grain losses at threshing to result from eating by trampling animals (7.3%), contamination with dung of trampling animals (4.1%), grain breakage (3.2%) and mixture with soil (1.4%).

According to the farmers' estimate (*n* = 134) an average of 18.6 kg of chickpea grain was lost from a farmer's production per season (Table 13). Farmers from Oromia region responded to suffer the highest loss (22.4 kg) while the least loss (3 kg) was recorded from Tigray region.

Table 13. Method of threshing and related grain loss

Threshing method	Respondent farmers		Ways of loss	Respondent farmers		Region	Grain loss at threshing	
	Number	Percent		Number	Percent		Respondent farmers	
							Loss (kg)	Number
Trampling with animals	166	75.5	Spillage	99	45.0	Tigray	3.00	5
Beating with stick	8	3.6	Dung contamination	9	4.1	Amhara	17.05	30
Total	174	79.1	Mixture with soil	3	1.4	Oromia	22.38	56
			Grain breakage	7	3.2	SNNP	16.91	49
			Eaten by trampling animals	16	7.3	Total	18.63	140
			Total	134	60.9			

6.5.4. Grain loss on cleaning

Cleaning of grain is normally handled by winnowing operation after threshing under natural wind. This is confirmed by almost all (*n* = 200) respondent farmers (Table 14), while only 0.9% of them responded to hand pick inert matters to clean their grain.

Grain moving by wind with the chuff during winnowing was reported to be the major way of grain loss at cleaning, according to 53.2% (*n* = 138) of the respondent farmers (Table 14). Spillage of grains out of the threshing floor was also considered by 9.5% of the farmers to contribute to grain loss during cleaning process.

In general farmers expect to have lost on average 14.4 kg (*n* = 138) chickpea grain from their 2013-2014 production (Table 14). The result showed that farmers from Oromia suffered much grain loss (18 kg) at cleaning compared to the other regions.

Table 14. Method of cleaning and related grain loss

Cleaning method	Respondent farmers		Ways of loss	Respondent farmers		Region	Grain loss at cleaning (Respondent farmers)	
	Number	Percent		Number	Percent		Loss (kg)	Number
Winnowing	218	99.1	Moved by wind	117	53.2	Tigray	7.50	6
Hand picking	2	0.9	Spillage	21	9.5	Amhara	10.46	24
Total	220	100.0	Total	138	62.7	Oromia	18.02	58
						SNNP	12.97	50
						Total	14.42	138

6.5.5. Grain loss during packing and transportation

Farmers believe that grain losses during packing and transportation are not significant (Table 15). The commonly used packing material is polyethylene bag. Only 16 farmers made an estimate on grain losses at packing that averaged to 13Q out of a farmer's production per season.

Most of the farmers transport their grain by donkey (93.4%; *n* =137), while few of the use cart or carry it by themselves. According to the estimated from 172 farmers, they lost an average of 3.4 kg chickpea grain during transportation per head per production. They attribute such low losses to the care they take in using intact materials for packing and transporting their produce.

Table 15. Farmers perception on packing and transportation related grain losses

Region	Grain loss at packing (Respondent farmers)		Transportation method	Respondent farmers		Region	Grain loss at transportation (Respondent farmers)	
	Loss (kg)	Number		Number	Percent		Loss (kg)	Number
Tigray	10.0	1	Donkey	128	93.4	Tigray	13.25	4
Amhara	9.30	5	Human labour	6	4.4	Amhara	2.54	59
Oromia	15.50	10	Cart	3	2.2	Oromia	5.25	59
Total	13.22	16	Total	137	100.0	SNNP	1.36	50
						Total	3.38	172

6.5.6. Grain loss at storage

According to the respondent farmers insect damage is the major cause of grain loss (70.7%; *n* = 92) during storage of chickpea produce (Table 16). Rodents were also believed to cause considerable loss (25%) during this operation. Few farmers consider losses caused by grain leakage from punctures on packaging or storage materials by rodents.

Among the post-harvest operations the largest grain loss per farmer's seasonal production, following the loss at drying, was estimated to occur on storage (29.4kg; *n* = 91) (Table 16). Farmers from Oromia region reported the largest storage loss (45.3 kg) while the least loss estimate (16.5 kg) was made by farmers from SNNP region.

Table 16. Ways of grain loss at storage and related losses

Ways of loss	Respondent farmers		Region	Grain loss at storage (Respondent farmers)	
	Number	Percent		Loss (kg)	Number
Insect damage	65	70.7	Tigray	17.5	10
Rodent damage	23	25.0	Amhara	26.3	22
leakage	4	4.3	Oromia	45.3	33
Total	92	100.0	SNNP	16.5	26
			Total	29.4	91

6.6. Farmers' Capacity Building

Assessment was made to investigate efforts made on building farmers' capacity in terms of knowledge related to harvest and post-harvest loss prevention. To the enquiry on whether they have ever received related training or not only 18.2% (*n* =220) of them provided positive response (Table 17). This might indicate that the emphasis given to post-harvest loss management is minimal. Out of these farmers the greatest majority (67.5%; *n* =40) were trained by experts from the Ministry/Bureau of Agriculture. Fifteen percent of the farmers reported to have been trained by Research Institutions while 5% each acknowledged the provision of such training by Universities and NGOs.

Table 17. Farmers' training on harvest and post-harvest loss prevention

No	Receipt of training	Respondent farmers	
		Number	Percent
1	Received	40	18.2
2	Not received	180	81.8
	Total	220	100.0
	Trainer		
1	Ministry/Bureau of Agriculture	27	67.5
2	Research Institutions	6	15.0
3	Universities	2	5.0
4	NGOs	2	5.0
5	Farmers' Unions	1	2.5
6	Unknown	2	5.0
	Total	40	100.0

Respondent farmers attempted to indicate the knowledge they acquired on the trainings they received. Almost all of the farmers who received trainings responded to have been advised to harvest their chickpeas before it is over-dried in the field to minimizes losses due to dropping of pods and allow to fully dry on threshing floor or later. Use of clean threshing floor, minimizing contamination by dung from trampling animals and covering the harvest with a canvas or similar material while beating with stick are reported by the farmers to be the lessons learnt for minimizing losses at threshing. Use of tight and clean materials for packing and transportation is one of the points raised on trainings. Concerning storage they were trained on the importance of cleaning the store before bringing in new harvest, storing in aerated and moisture free areas, piling grains in bags on a wooden platform and use of chemical (dusts and fumigants) to prevent grain losses. Farmers also responded to have been trained to sell their produce to farmers unions or sell in group looking for better market.

The study tried to investigate farmers' training needs in areas related to prevention of postharvest losses (Table 18). According to the respondent farmers areas of top training priorities are pesticide usage (89.5%; n =220), insect identification and pesticide handling, each with 81.4% respondent farmers. Larger majority of farmers (67.3%) also emphasized on the need of training on harvesting and proper storage. Nearly half of them also reported training needs on grain marketing (52.7%), control of rodents and other animals (50.5%) and cleaning (48.6%).

Table 18. Farmers' areas of training need for postharvest loss prevention

No	Area of training need	Respondent farmers	
		Number	Percent
1	Harvesting	148	67.3
2	Threshing	73	33.2
3	Packing	72	32.7
4	Transport	46	20.9
5	Drying	76	34.5
6	Cleaning	107	48.6
7	Insect Identification	179	81.4
8	Mold identification	78	35.5
9	Pesticide usage	197	89.5
10	Pesticide handling	179	81.4
11	Proper storage	148	67.3
12	Rodent and other animal control	111	50.5
13	Bird control	55	25.0
14	Marketing	116	52.7

6.7. Inspection of storage by farmers

As shown in table 19 below, 90% (*n* =220) of the farmers responded that they inspect their grain store for pest damage. On average farmers reported to inspect their store for about 16 times per annum. As to the method of inspection farmers replied to use multiple methods (Table 20). Almost all farmers (98.6%; *n* =220) use visual observation to inspect their store. About 11% of the farmers smell stored chickpeas to check for pest infestation. They also inspect their stored chickpeas by sensing the heat developed in it due to pest infestation by inserting their hand in to the bulk or listen to the sound of pest movement within the storage structure.

Table 19. Farmers' inspection of storage for pest attack

Parameter	Farmers response	Respondent farmers	
		Number	Percent
Store inspection	Inspect	198	90.0
	Do not inspect	22	10.0
	Total	220	100.0

Table 20. Method of store inspection by farmers

No	Inspection method	Comparison category	Respondent farmers				
			Regional State				Total
			Tigray	Amhara	Oromia	SNNP	
1	Visual	Number	44	59	56	48	207
		% within Visual	21.3	28.5	27.1	23.2	
		% within Region	97.8	100.0	98.2	98.0	
		% of Total	21.0	28.1	26.7	22.9	98.6
2	Smell	Number	19	2	1	1	23
		% within Smell	82.6	8.7	4.3	4.3	
		% within Region	42.2	3.4	1.8	2.0	
		% of Total	9.0	1.0	0.5	0.5	11.0
3	Test	Number	16	0	0	0	16
		% within Test	100.0	0.0	0.0	0.0	
		% within Region	35.6	0.0	0.0	0.0	
		% of Total	7.6	0.0	0.0	0.0	7.6
4	Heat/sound	Number	0	4	6	7	17
		% within Heat/sound	0.0	23.5	35.3	41.2	
		% within Region	0.0	6.8	10.5	14.3	
		% of Total	0.0	1.9	2.9	3.3	8.1

6.8. **Storage Structures Used by Farmers (I think this should come before pest control practices)**

As far as storage structure used by the farmers is considered, farmers (*n* =220) use multiple options (Table 21). Polyethylene bags (68.4%) are the most commonly used materials to store chickpea grains. Small cylindrical structure, called *Shirfa* or *Kefo*, made of bamboo splits or thin sticks woven into a basket and plastered with mud mixed straw, are used by 19.6% of the farmers in Tigray and Amhara regions together. Respondent farmers in the four regions (18.7%) use traditional *Gotera,* a bigger structure constructed from woods and sticks fixed together in cylindrical or rectangular form or splits of bamboo woven into a big basket and all plastered with mud mixed straw. The use of improved *Gotera* is low. *Gota* is used by 17.2% of the farmers, the dominant practitioners being farmers in Amhara region. *Gota* is a structure made from short cylindrical ring structures constructed from a mixture of mud reinforced with straw and fixed into one another using mud as a mortar to make a bigger container.

Table 21. Storage structures used by farmers

No	Storage structure	Measure	Regional State				Total
			Tigray	Amhara	Oromia	SNNP	
1	*Gota*	Number	2	32	1	1	36
		% within *Gota*	5.6	88.9	2.8	2.8	
		% within Region	5.1	53.3	1.7	2.0	
		% of Total	1.0	15.3	0.5	0.5	17.2
2	Traditional *Gotera*	Number	15	4	9	11	39
		% within Traditional *Gotera*	38.5	10.3	23.1	28.2	
		% within Region	38.5	6.7	15.0	22.0	
		% of Total	7.2	1.9	4.3	5.3	18.7
3	Improved *Gotera*	Number	4	0	3	2	9
		% within Improved *Gotera*	44.4	0.0	33.3	22.2	
		% within Region	10.3	0.0	5.0	4.0	
		% of Total	1.9	0.0	1.4	1.0	4.3
3	*Lekota*	Number	5	2	0	0	7
		% within *Lekota*	71.4	28.6	0.0	0.0	
		% within Region	12.8	3.3	0.0	0.0	
		% of Total	2.4	1.0	0.	0.0	3.3
4	*Shirfa/Kefo*	Number	22	19	0	0	41
		% within *Shirfa/Kefo*	53.7	46.3	0.0	0.0	
		% within Region	56.4	31.7	0.0	0.0	
		% of Total	10.5	9.1	0.0	0.0	19.6
5	Polyethylene bag	Number	9	30	58	46	143
		% within Poly bag	6.3	21.0	40.6	32.2	
		% within Region	23.1	50.0	96.7	92.0	
		% of Total	4.	14.4	27.8	22.0	68.4
6	Jute bag	Number	15	4	2	1	22
		% within Jute bag	68.2	18.2	9.1	4.5	
		% within Region	38.5	6.7	3.3	2.0	
		% of Total	7.2	1.9	1.0	0.5	10.5

6.9. Farmers' Storage and Pest Control Practices

Farmers were asked on the length of time they store their chickpea grain. The majority of the farmers (n = 220) responded to store their chickpea produce for a period of four months to one year (Table 22). On the other hand small proportion of the farmers reported to store for less than 4 months and longer than on year.

Pictures of common storage insect pests were shown to the farmers in order to assess whether they can differentiate the pest that attacks chickpea grain or not. Accordingly 75% of them were not able to identify (Table 23) while only 2.7% and 1.8% of them correctly identified as *Callosobruchus chinensis* female and male, respectively.

Table 22. Duration of chickpea grain storage by farmers

No	Storage duration (months)	Respondent farmers	
		Number	Percent
1	0 - 3	25	11.4
2	4 - 6	73	33.2
3	7 - 9	50	22.7
4	10 - 12	57	25.9
5	13 - 15	12	5.5
6	22 - 24	2	0.9
7	Over 24	1	0.5
	Total	220	100.0

Figure 23. Pictorial identification storage insect pests by farmers

No	Insect species	Respondent farmers	
		Number	Percent
1	Bean weevil (*Acanthoscelides obtectus*)	10	4.5
2	The pulse beetle/Cowpea bruchid (*Callosobruchus chinensis* (female))	6	2.7
3	The pulse beetle/Cowpea bruchid (*Callosobruchus chinensis* (male))	4	1.8
4	Cowpea weevil (*Callosobruchus maculatus* (female))	10	4.5
5	Cowpea weevil (*Callosobruchus maculatus* (male))	17	7.7
6	Rice moth (*Corcyra cephalonica)*	8	3.6
7	Could not identify	165	75.0
	Total	220	100.0

The assessment made on storage pest control practices to prevent losses revealed that farmers (*n* =220) in the surveyed localities use multiple control methods (Table 24). Application of fumigants is the most commonly used (61.8%) control method followed by drying (38.2%). Considerable proportion of the respondent farmers apply malathion dust (25.9%) and pirimiphos-methyl (Actellic) dust (13.2%) to protect their chickpeas from damage by bruchids. Mixing chickpea grain with ash (11.8%) and tef grain (8.2%) is reported to be used by the farmers to protect storage insect pests. Farmers also practice application of traditional herbs (7.3%), smoking (3.2%) and fungicides (3.6%) for storage pest control. This is supported by the findings of Abraham and Senayit (2013) that states that the most common traditional practices for insect control in storage as reported by the farmers include the use of plant materials, admixing with ash, mixing with tef or finger millet.

Table 24. Storage pest control methods

No	Control method	Respondent farmers	
		Number	Percent
1	Traditional herb	16	7.3
2	Mix with tef	18	8.2
3	Mix with ash	26	11.8
4	Actelic dust	29	13.2
5	Malathion dust	57	25.9
6	Fumigant	136	61.8
7	Fungicide	8	3.6
8	Smoking	7	3.2
9	Drying	84	38.2
	Total	381	171.2

6.10. Grain moisture content measurement

Farmers were asked whether they measure or determine moisture content of their chickpea grain or not. The result indicated that 68.8% (*n* =218) of them do measure or determine grain moisture content (Table 25). As to the time of measurement (Table 26) the majority of respondent farmers (58%; *n* = 150) replied to perform after harvesting followed by measurements after drying (22.7%). Method of grain moisture content measurement used by 150 respondent farmers is depicted in Table 26. The data showed that biting with teeth (59.3%) and visual observations (30.%) are the methods commonly used by the farmers to measure or determine moisture content of their grain. Only 8.3% and 1.3% of the farmers replied to use moisture meters and salt and glass method of moisture content measurement or determination.

Table 25. Response of farmers on grain moisture content measurement

Question	Response	Respondent farmers	
		Number	Percent
Do you measure grain moisture content?	Yes	150	68.8
	No	68	31.2
	Total	218	100.0

Table 26. Time of grain moisture content measurement by farmers

No	Time of measurement	Respondent farmer		Method of measurement	Respondent farmers	
		Number	Percent		Number	Percent
1	After harvest	87	58.0	Moisture meter	14	9.3
2	After drying	34	22.7	Biting with teeth	89	59.3
3	During storage	21	14.0	Salt method	2	1.3
4	Before harvest	8	5.3	Visual	45	30.0
	Total	150	100.0	Total	150	100.0

6.11. Farmers' Reasons for Choosing Control Options

Farmers have reasons for choosing the postharvest loss prevention method they are using. As can be seen from table 27 effectiveness of the method (68.6%; *n* = 220) and its ease of use or application (67.7%) are the prior reasons of the farmers for choosing postharvest management options. Following these farmers put affordability of price (54.1%) and local availability (49.1%) of a particular management option as worth considering in making choice. Training has been rated as the least factor to affect choice of their management option.

Table 27. Farmers' reasons for choosing postharvest management options

No	Reason for choosing control method	Respondent farmers (*n* = 220)	
		Number	Percent
1	Price affordability	119	54.1
2	Effectiveness of method	151	68.6
3	Ease of use	149	67.7
4	Local availability	108	49.1
5	Tradition	49	22.3
6	Prior result	84	38.2
7	Training	18	8.2

6.12. Farmers' Chickpea Production and Its Utilization

Chickpea varieties grown by the respondent farmers and their harvesting time are depicted on table 28. Almost equal proportion of the farmers reported to produce either local or improved varieties of chickpea. All the farmers in Tigray region responded to produce only local varieties of chickpea while almost all farmers in Oromia region produce improved varieties. The majority of the farmers in the surveyed areas harvest their chickpea in December and January, though few farmers reported to harvest from November to May.

The majority of the farmers (65.5%) put yield per hectare or productivity as a reason for producing the variety they are growing (Table 2). Following this 38.6%, 33.6% and 31.1% of them considered drought resistance, growing period and cost of seed, respectively, as a reason of growing their chickpea varieties. In addition to reasons listed in table 27 few farmers reasoned out that they are producing local chickpea varieties because they could not get seed of improved varieties.

Table 28. Chickpea varieties under cultivation and harvesting time

No	Regions	Number of respondent farmers											
		Variety				Harvesting time							
		Improved	Local	Both	Total	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
1	Tigray	0	48	0	48	2	11	23	3	1	4	5	49
2	Amhara	29	28	3	60	5	16	33	4	2	0	0	60
3	Oromia	56	2	2	60	2	45	12	1	0	0	0	60
4	SNNP	17	30	3	50	0	18	31	1	0	0	0	50
	Total	102	108	8	218	9	90	99	9	3	4	5	219

Table 29. Farmers' reasons for growing their chickpea variety

No	Reason for growing chickpea variety	Respondent farmers (*n* = 220)	
		Number	Percent
1	Cost of seed	70	31.8
2	Yield per hectare	144	65.5
3	Growing period	74	33.6
4	Insect resistance	53	24.1
5	Drought resistance	85	38.6
6	Resistance to water logging	27	12.3
7	Disease resistance	55	25.0
8	Lodging resistance	50	22.7
9	Salt tolerance	9	4.1
10	End use quality	29	13.2
11	Only variety known	62	28.2
12	Demonstration	55	25.0

Table 30 shows farmers' chickpea production and its utilization. The average land size allocated for chickpea production by respondent farmers **(***n* = 215) was 0.7 ha with a range of 0.03 - 6 ha. Farmers in Tigray region allocated largest area of land (0.9 ha) for chickpea while SNNP region covered the least area (0.4ha) with the crop. An average chickpea production of 10.4 Q **(***n* = 220) per farmer was recorded ranging from 0.3 - 60 Q, where the highest production was by farmers from Oromia region (20.9 Q) and the lowest production was from Tigray region. The data showed that productivity of chickpea in Tigray region is low (3.7 Q ha^{-1}).

Respondent farmers reported to sell an average of 1.7 Q **(***n* = 220) of their chickpea produce at harvest, ranging on average from nil to 41.7 Q. The quantity of chickpea grain stored for late sale averages to 5.6 Q, ranging from nil to 57 Q **(***n* = 220). Farmers from Oromia region, which produce larger quantity of chickpea, were also found to keep larger amount to sale late (13.7 Q) when the crop fetches better price. So long as household consumption is considered, an average of 1.5 Q chickpea is used within the family. About half quintal of chickpea was reported to be stored for emergency food and 1.1 Q is saved as seed for the next season's planting.

Table 30. Chickpea production by farmers and utilization

No	Description	Region				
		Tigray	Amhara	Oromia	SNNP	Total
1	Area (ha)	0.9	0.6	0.8	0.4	0.7
2	Quantity produced (Q)	3.7	8.1	20.9	7.2	10.4
3	Quantity sold at harvesting (Q)	1.5	1.7	1.7	2.0	1.7
4	Quantity stored for late sale (Q)	0.9	3.7	13.7	3.1	5.6
5	Quantity stored for consumption (Q)	0.8	2.1	1.8	1.0	1.5
6	Quantity stored for emergency food (Q)	0.1	0.1	1.4	0.3	0.5
7	Quantity kept for seed (Q)	0.9	0.6	2.1	0.8	1.1

6.13. Cost of Production Inputs

Table 31 shows cost of production inputs as reported by respondent farmers. According to 175 respondent farmers chickpea seed costs 9.6 Eth. Birr kg^{-1} on average, with a range of 2-30 Eth. Birr kg^{-1}. Lower prices of chickpea seed might be costs of local varieties while higher prices would be fetched by seeds of improved varieties. The high cost of seed in Oromia (10.6 Eth. Birr kg^{-1}) followed by Amhara region (10.2 Eth. Birr kg^{-1}) could be attributed to the better utilization of improved chickpea varieties in the regions, as indicated in section 6.2 above.

Only 38 farmers responded on the cost of fertilizer used (Table 31). This might be because farmers do not use fertilizer for chickpea production. The average cost of fertilizer per quintal was reported to be 1459.9 Eth. Birr, ranging from 800 to 2800 Eth. Birr per quintal. The highest cost of fertilizer (1579.3 Eth. Birr Q^{-1}) was recorded in SNNP region while the lowest cost (1276.7 Eth. Birr Q^{-1}) was reported in Tigray region.

As far as field pesticides and herbicides are considered, farmers could not provide information on prices per unit of product because they buy the amount they need for their plot of crop to be treated. Hence, they reported the cost they incurred on pesticide spraying for the season (Table 31). Accordingly farmers on average incurred 232.2 Eth. Birr (n = 107) on pesticides to control field insect pests, particularly African Boll Worm (*Helicoverpa armgera*), with a range of 45 to 660 Eth. Birr. Field pesticides were found to be used by larger proportion of farmers in Oromia and Amhara region.

Respondent farmers reported to expend 218.8 Eth. Birr, ranging from 30 to 660 Eth. Birr, (n = 115) on herbicides for the control of weeds (Table 31). Utilization of herbicide was also found to be more prominent in Oromiya and Amhara regions. Herbicides are used for the control of weeds in cereal crops.

Table 31. Cost of production inputs

Region	Respondent farmers							
	Cost of seed (Eth. Birr/ kg)		Cost of fertilizer (Eth. Birr/Q)		Cost of field pesticide used		Cost of herbicide used	
	Mean (Min,Max)	Number	Mean (Min,Max)	Number	Mean (Min,Max)	Number	Mean (Min,Max)	Number
Tigray	7.5 (2.0,30.0)	24	1276.7 (800,1500)	12	107.2 (50,320)	7	107.2 (50.0,320.0)	7
Amhara	10.2 (3.0,28.8)	44	1400.0 (1200,1500)	3	200.4 (50,535)	31	190.6 (40.0,535.0)	33
Oromia	10.6 (3.0,27.0)	59	1556.3 (1400,2800)	16	277.4 (45,600)	54	261.0 (30.0,600.0)	58
SNNP	8.7 (2.1,20.0)	48	1579.3 (1200,1900)	7	193.9 (45,660)	15	175.5 (30.0,660.0)	17
Total	9.6 (2.0,30.0)	175	1459.9 (800,2800)	38	232.2 (45,660)	107	218.8 (30.0,660.0)	115

6.14. Information Related to Chickpea Marketing

Farmers were asked on whether they clean their chickpea grain before sale or not and as to where they sell (Table 32) their produce. One quarter of the farmers (n = 214) reported that they do perform cleaning before sale while the remaining majority do not clean before sale except the cleaning process they perform at threshing. The large majority of respondent farmers (89.7%; n = 194) do sell their chickpea grain at market while 7.7% of them sell at home and the remaining 2.6% of the farmers responded to sell both at home or market.

Table 32. Chickpea grain cleaning before sale and place of selling the grain

Description	Response	Respondent farmers	
		Number	Percent
Cleaning grain prior to sale	Cleaned	54	25.2
	Not cleaned	160	74.8
	Total	214	100.0
Place of grain sale	At home	15	7.7
	At market	174	89.7
	Both	5	2.6
	Total	194	100.0

Information on types of package and transport for marketing, distance to marketing and cost of transport are depicted on Table 33. The large majority of the farmers (87.8%; n = 188) pack their chickpea grain for marketing with polyethylene bags while only 12.2% of them use jute bag. Donkey, the common pack animal in the country, is used to transport chickpea grain to market by 44.1% (n = 186) of the farmers while considerable proportion (33.9%) of them use cart drawn

by animals. Small proportion of the farmers use car (12.9%) or carry themselves (9.1%) to transport chickpea to the market.

Responses on the distance to market were given by 180 farmers. According to these farmers the average distance to the market was 6.4 km. The result showed that long distances of 8.3 km and 7.5 km have been travelled by farmers in Tigray and Oromia regions, respectively. The average cost of transportation of chickpea grain to the market is found to be 12.8 Eth. Birr per quintal (*n* = 110). Farmers in Tigray region also reported that they suffer the highest cost of transportation (23.6 Eth. Birr Q^{-1}) that could be attributed to the long distance to the market. The lowest cost of transportation is recorded from Amhara region.

Table 33. Chickpea package and transportation to market

Package			**Transport**			**Distance to market in km**			**Cost of transport in Eth. Birr Q^{-1}**		
Type	**Respondent farmers**		**Type**	**Respondent farmers**		**Region**	**Respondent farmers**		**Region**	**Respondent farmers**	
	Number	**%**		**Number**	**%**		**Mean (Min,Max)**	**Number**		**Mean (Min,Max)**	**Number**
Polyethylene bag	165	87.8	Donkey	82	44.1	Tigray	8.3 (1,18)	32	Tigray	23.6 (10,40)	8
Jute bag	23	12.2	Cart	63	33.9	Amhara	4.7 (1,20)	44	Amhara	9.8 (4,20)	28
Total	188	100.0	Car	24	12.9	Oromia	7.5 (1,27)	57	Oromia	12.6 (3,30)	38
			Human labour	17	9.1	SNNP	5.5 (1,20)	47	SNNP	12.8 (5,30)	36
			Total	186	100.0	Total	6.4 (1,27)	180	Total	12.8 (3,40)	110

The study assessed the reasons why farmers sell their chickpea grain (Table 34) and what hinders them from selling (Table 35). The results from multiple responses of the farmers indicated that securing money to buy agricultural inputs (65.8%; *n* = 190) like fertilizers and pesticides was the main reason for selling chickpea grain followed by the need to cover basic household expenses (55.8%) such as purchasing household utilities and food staff other than what they produce. Farmers also sell their chickpea grain to cover educational expenses for their children (38.9%), family clothing (32.6%) and land rental (24.7%). Tax payment, purchasing of animals, particularly oxen, saving, storage pest control and health care, in decreasing order of importance, are the reasons of the farmers for selling grains, though their magnitude is low.

The respondent 175 farmers reported to have some reasons that hinder them from selling their chickpea grain (Table 35). Low price of the crop was rated to be the most important reason for

not selling chickpea grain by the majority of the farmers (64%). Nearly 40% of the farmers put yield shortage as a factor that limits them to sell their chickpea produce. One third of the farmers also save their chickpea grain from selling in order to reserve for emergency cases while 5% of the farmers reported that grains damaged by storage insect pests lack market.

Table 34. Farmers' reasons for selling chickpea grain

N0	Reason for sale	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
		Number	13	22	17	10	62
1	Buy cloths	% within Region	48.1	38.6	28.3	21.7	
		% of Total	6.8	11.6	8.9	5.3	32.6
		Number	22	37	24	23	106
2	Household expense	% within Region	81.5	64.9	40.0	50.0	
		% of Total	11.6	19.5	12.6	12.1	55.8
		Number	12	29	54	30	125
3	Buy farm inputs	% within Region	44.4	50.9	90.0	65.2	
		% of Total	6.3	15.3	28.4	15.8	65.8
		Number	0	7	7	2	16
4	Pay Tax	% within Region	0.0	12.3	11.7	4.3	
		% of Total	0.0	3.7	3.7	1.1	8.4
		Number	12	12	27	23	74
5	Educational expense	% within Region	44.4	21.1	45.0	50.0	
		% of Total	6.3	6.3	14.2	12.1	38.9
		Number	0	5	7	2	14
6	Buy animals	% within Region	0.0	8.8	11.7	4.3	
		% of Total	0.0	2.6	3.7	1.1	7.4
		Number	0	12	20	15	47
7	Land rental	% within Region	0.0	21.1	33.3	32.6	
		% of Total	0.0	6.3	10.5	7.9	24.7
		Number	0	2	2	0	4
8	Saving	% within Region	0.0	3.5	3.3	0.0	
		% of Total	0.0	1.1	1.1	0.0	2.1
		Number	0	1	1	1	3
9	Storage pest	% within Region	0.0	1.8	1.7	2.2	
		% of Total	0.0	0.5	0.5	0.5	1.6
		Number	0	1	1	1	3
10	Health care	% within Region	0.0	1.8	1.7	2.2	
		% of Total	0.0	0.5	0.5	0.5	1.6
	Total	Number	27	57	60	46	190
		% of Total	14.2	30.0	31.6	24.2	100.0

Percentages and totals are based on190 respondents.

Table 35. Farmers' reasons for not selling chickpea grain

No	Reason for not to sale	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
		Number	17	25	12	15	69
1	Low yield	% within Region	94.4	50.0	20.0	31.9	
		% of Total	9.7	14.3	6.9	8.6	39.4
		Number	0	19	58	35	112
2	Low price	% within Region	0.0	38.0	96.7	74.5	
		% of Total	0.0	10.9	33.1	20.0	64.0
		Number	2	9	27	21	59
3	Emergency reserve	% within Region	11.1	18.0	45.0	44.7	
		% of Total	1.1	5.1	15.4	12.0	33.0
		Number	0	7	0	0	7
4	Pest damage	% within Region	0.0	14.0	0.0	0.0	
		% of Total	0.0	4.0	0.0	0.0	4.0
	Total	Number	18	50	60	47	175
		% of Total	10.3	28.6	34.3	26.9	100.0

Percentages and totals are based on 175 respondents.

The price at harvest and the highest possible price of chickpea grain, as reported by respondent farmers, are presented in Table 36. Chickpea grain was reported to fetch an average market price of 790.3 *Eth. Birr* Q^{-1} (*n* = 193) at harvest, ranging from 200 to 2500 Eth. Birr Q^{-1}. The highest price of chickpea at harvest (1034.6 Eth Eth. Birr Q^{-1}) was reported by farmers in Tigray region while the crop sales for lowest price (684.4 Eth. Birr Q^{-1}) in SNNP region.

Farmers also reported that chickpea has attained an average highest price of 1004.9 Eth. Birr Q^{-1} (*n* = 187) on later sales with a range of 450-3000 Eth. Birr Q^{-1}. Farmers in Tigray region also responded to have the highest possible price (1214.8 Eth. Birr Q^{-1}) of chickpea grain. In general, the results showed that chickpea is important crop that fetches best market price.

Table 36. Market price of chickpea grain at harvest and its possible market price

Region	Price at harvest in Eth. Birr Q^{-1}		Highest possible price in Eth. Birr Q^{-1}	
	Mean (Min,Max)	Number of respondents	Mean (Min,Max)	Number of respondents
Tigray	1034.6 (200,2500)	33	1214.8 (450,3000)	31
Amhara	804.9 (400,1150)	54	996.8 (600,1300)	48
Oromia	725.3 (500,950)	58	976.7 (600,1300)	60
SNNP	684.4 (500,900)	48	912.6 (600,1400)	48
Total	790.3 (200,2500)	193	1004.9 (450,3000)	187

6.15. Information Related to Chickpea Grain Marketing

Only 45 respondent farmers reported the amount of chickpea grain they cleaned prior to marketing (Table 37). An average of 6.6 Q, ranging from 0.2 to 57 Q, chickpea grain is cleaned by these farmers. The largest quantity of chickpea grain was cleaned by farmers in Oromia region (25 Q) while the least was from Tigray (1.9 Q). The majority of the respondent farmers use winnowing (59.1%; *n* = 44) while 29.5% of the farmers hand pick foreign matter to clean chickpea grain prior to marketing (Table 37).

In response to the question ‘who performs cleaning?’ 56 farmers provide multiple responses (Table 38). Accordingly, cleaning of chickpea grain is mostly performed by women (73.2%) followed by men (46.4%). Children also participate in chickpea grain cleaning to a lesser extent.

Table 37. Amount of chickpea grain cleaned prior to market and cleaning methods used by farmers

Region	Quantity cleaned in Q (Min,Max)	Number of respondents	Cleaning method	Respondent farmers	
				Number	Percent
Tigray	1.9 (0.2,8.4)	19	Winnowing	26	59.1
Amhara	4.4 (0.5,11.0)	15	Sieving	5	11.4
Oromia	25.0 (4.0,57.0)	7	Hand picking	13	29.5
SNNP	5.8 (1.0,10.0)	4	Total	44	100.0
Total	6.6 (0.2,57.0)	45			

Table 38. Performer of chickpea grain cleaning

No	Who performs cleaning	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Men	Number	10	11	3	2	26
		% within Region	34.5	68.8	42.9	50.0	
		% of Total	17.9	19.6	5.4	3.6	46.4
2	Women	Number	25	7	6	3	41
		% within Region	86.2	43.8	85.7	75.0	
		% of Total	44.6	12.5	10.7	5.4	73.2
3	Children	Number	9	2	1	3	15
		% within Region	31.0	12.5	14.3	75.0	
		% of Total	16.1	3.6	1.8	5.4	26.8
Total		Number	29	16	7	4	56
		% of Total	51.8	28.6	12.5	7.1	100.0

Percentages and totals are based on 56 respondents.

6.16. Farmers' Food and Feeding Conditions

Assessment was made on the type of foods farmers commonly consume and if they have special diet for pregnant women, children under age of five and elderly family members. Table 41 depicts the types of food consumed by the farmers. Various food types that are commonly consumed as a staple are starch rich types (98.6%, *n* = 217); to mention some are the traditional thin bread made of teff (*Erragrostis tef*) grain called '*Injera*', bread made of wheat and porridge made from barley or wheat flour. The breads are eaten with curry prepared from flour of beans and peas, among which chickpea is the commonest. In addition to this beans and peas are also eaten raw after being boiled or roasted as a supplementary food, thus serve as a major source of protein. Small proportion of the farmers reported to consume protein rich foods such as eggs (6%), meat (13.8%) and milk (8.8%) and vegetables (6.9%). The numbers of meals farmers have per day are shown in table 41. The majority of the farmers reported to take three meals per day (90.45; *n* = 219) while lesser proportion of them had two or four meals per day.

Table 40. Types of foods consumed by respondent farmers

No	Food type	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Starch	Number	48	57	60	49	214
		% within Region	100.0	96.6	100.0	98.0	
		% of Total	22.1	26.3	27.6	22.6	98.6%
2	Egg	Number	1	6	5	1	13
		% within Region	2.1	10.2	8.3	2.0	
		% of Total	0.5	2.8	2.3	0.5	6.0
3	Meat	Number	0	14	8	8	30
		% within Region	0.0	23.7	13.3	16.0	
		% of Total	0.0	6.5	3.7	3.7	13.8
4	Milk	Number	0	5	1	13	19
		% within Region	0.0	8.5	1.7	26.0	
		% of Total	0.0	2.3	0.5	6.0	8.8
5	Vegetable	Number	0	9	3	3	15
		% within Region	0.0	15.3	5.0	6.	
		% of Total	0.0	4.1	1.4	1.4	6.9
	Total	Number	48	59	60	50	217
		% of Total	22.1	27.2	27.6	23.0	100.0

Percentages and totals are based on 217 respondents.

Table 41. Number of meals per family per day

Number of meal per family per day	Respondent farmers	
	Number	Percent
2	16	7.3
3	198	90.4
4	5	2.3
Total	219	100.0

Farmers use various parameters to select chickpea grain intended for consumption (Table 42). About 65% and 61% of the respondents replied to use grain color and kernel size to select chickpea grain to be used for consumption. Grain breakage, staining and damage by insect pests are also reported by over 80% of the respondent farmers each as criteria for the selection grain intended for consumption.

Table 42. Parameters used by farmers to select grain intended for consumption

No	Response	Parameters of selection (Respondent farmers)									
		Grain color		Broken grain		Kernel size		Insect damage		Stained grain	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	Applicable	141	65.3	177	80.8	131	60.9	190	87.2	182	83.9
2	Not applicable	75	34.7	42	19.2	84	39.1	28	12.8	35	16.1
	Total	216	100.0	219	100.0	215	100.0	218	100.0	217	100.0

Percentages are based on total number of respondents

Information based on 220 farmers on whether they have special food to provide to pregnant women, children under age of five and elderly family members are shown in Table 43. The majority, over 69%, of the farmers do not provide special food for the aforementioned needy members of their family. Only 34.2%, 36.4% and 25% of the farmers reported to have special food for pregnant women, children under age of five and elderly family members, respectively.

Table 43. Provision of special food for women, children and elderly members of the family

Provision	Respondent farmers					
	Special food for pregnant women		Special food for children		Special food for elderly	
	Number	Percent	Number	Percent	Number	Percent
Provide	75	34.1	80	36.4	55	25.0
Not provide	145	65.9	140	63.6	165	75.0
Total	220	100.0	220	100.0	220	100.0

Farmers provided multiple responses on the types of special foods for pregnant women, children under five years and elderlies, whose data are presented in tables 44, 45 and 46, respectively. A soup like preparation made from Rye, *Secale cereal*, or barley, *Hordeum vulgare*, flour is reported by relative majority (46.8%; $n = 79$) as a special food taken by pregnant women (Table 44). Nearly 40% of the farmers reported to provide fruits and vegetables to pregnant women followed by porridge (38%) prepared from barely or wheat flour. Meat, milk and eggs were also foods that are taken by pregnant women. Women take porridge and soup like preparation especially after birth.

Milk and eggs have been considered by greater majority, 71.2% and 60% of the respondent farmers, respectively, ($n = 80$) as a special diet fed to children under five years (Table 45). Soup like preparations known as *mitin* (balanced) that is made from mixture of grains (cereals and pulses) has also been reported by considerable proportion (28.8%) of the respondent farmers to be a special food provided to their children. Some farmers also responded to feed their children with fruits and vegetables, meat and biscuits.

Farmers also responded that their family had special food for the elderly members (Table 46). Porridge, soup and milk are the types of food listed as special diet for elderlies by 46.2%, 25% and 23% ($n = 52$) of the farmers, respectively. They also prepare soft foods (21.2%) called *fitfit*, for elderlies having chewing problem. Milk, egg, meat and fruits and vegetables were also reported to be provided to elderly members of the family.

In general, larger proportion of farmers in Oromia region (40.5%) reported to have special food for pregnant women, children under age of five and elderly family members.

Table 44. Types of special food for pregnant women

No	Type of food for pregnant women	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Porridge	Number	4	7	16	3	30
		% within Region	30.8	38.9	50.0	18.8	
		% of Total	5.1	8.9	20.3	3.8	38.0
2	Soup	Number	4	10	17	6	37
		% within Region	30.8	55.6	53.1	37.5	
		% of Total	5.1	12.7	21.5	7.6	46.8
3	Egg	Number	5	5	2	5	17
		% within Region	38.5	27.8	6.2	31.2	
		% of Total	6.3	6.3	2.5	6.3	21.5
4	Meat	Number	4	4	11	8	27
		% within Region	30.8	22.2	34.4	50.0	
		% of Total	5.1	5.1	13.9	10.1	34.2
5	Milk	Number	6	6	4	2	18
		% within Region	46.2	33.3	12.5	12.	
		% of Total	7.6	7.6	5.1	2.5	22.8
6	Fruit and Vegetable	Number	6	2	14	9	31
		% within Region	46.2	11.1	43.8	56.2	
		% of Total	7.6	2.5	17.7	11.4	39.2
Total		Number	13	18	32	16	79
		% of Total	16.5	22.8	40.5	20.3	100.0

Percentages and totals are based on 79 respondents.

Table 45. Types of special food for children under five years

No	Type of food for children	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Soup	Number	4	10	3	6	23
		% within Region	28.6	55.6	10.7	30.0	
		% of Total	5.0	12.5	3.8	7.5	28.8
2	Egg	Number	9	8	22	9	48
		% within Region	64.3	44.4	78.6	45.0	
		% of Total	11.2	10.0	27.5	11.2	60.0
3	Meat	Number	4	1	3	0	8
		% within Region	28.6	5.6	10.7	0.	
		% of Total	5.0	1.2	3.8	0.0	10.0
4	Milk	Number	12	7	23	15	57
		% within Region	85.7	38.9	82.1	75.0	
		% of Total	15.0	8.8	28.8	18.8	71.2
5	Fruit and vegetables	Number	1	2	3	4	10
		% within Region	7.1	11.1	10.7	20.0	
		% of Total	1.2	2.5	3.8	5.0	12.5
6	Biscuits	Number	0	1	0	1	2
		% within Region	0.0	5.6	0.0	5.0	
		% of Total	0.0	1.2	0.0	1.2	2.5
Total		Number	14	18	28	20	80
		% of Total	17.5	22.5	35.0	25.0	100.0

Percentages and totals are based on 80 respondents.

Table 46. Types of special food for elderly family members

No	Food type	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Porridge	Number	1	3	15	5	24
		% within Region	25.0	37.5	65.2	29.4	
		% of Total	1.9	5.8	28.8	9.6	46.2
2	Soup	Number	0	4	6	3	13
		% within Region	0.0	50.0	26.1	17.6	
		% of Total	0.0	7.7	11.5	5.8	25.0
3	Egg	Number	1	1	4	0	6
		% within Region	25.0	12.5	17.4	0.0	
		% of Total	1.9	1.9	7.7	0.0	11.5
4	Meat	Number	2	1	2	4	9
		% within Region	50.0	12.5	8.7	23.5	
		% of Total	3.8	1.9	3.8	7.7	17.3
5	Milk	Number	3	2	4	3	12
		% within Region	75.0	25.0	17.4	17.6	
		% of Total	5.8	3.8	7.7	5.8	23.1
6	Fruits and	Number	0	1	3	1	5
		% within Region	0.0	12.5	13.0	5.9	
		% of Total	0.0	1.9	5.8	1.9	9.6
7	Soft foods	Number	0	1	5	5	11
		% within Region	0.0	12.5	21.7	29.4	
		% of Total	0.0	1.9	9.6	9.6	21.2
Total		Number	4	8	23	17	52
		% of Total	7.7	15.4	44.2	32.7	100.0

Percentages and totals are based on 52 respondents.

6.17. Availability of food and water

Inquire was made to know if farmers have food shortage in some parts of the year (Table 47) and availability of water (Table 48). About a quarter of the respondent farmers (n = 220) reported to have no food shortage at all. The majority of the farmers (46.4%) had food shortage from June to August followed by 22.7% who reported to suffer from food shortage from September to November. According to these farmers August to September are the months of critical food shortage. The majority of them attributed food shortage to the low productivity and production of their farming.

So long as availability of water is considered 61.8% (n = 212) of the farmers reported to have access to water while the rest have problem. Those who have no or less access to water put absence of tap water, system wreckage and failure to maintain and farness of springs and rivers from their dwellings, as major reasons for the problem.

Table 47. Period of farmers' of food shortage

No	Time of food shortage	Respondent farmers	
		Number	Percent
1	June to August	102	46.4
2	Sept to Nov	50	22.7
3	Dec to Feb	3	1.4
4	March to May	9	4.1
5	No food shortage	56	25.5
	Total	220	100.0

Table 48. Farmers' access to water

No	Access to water	Respondent farmers	
		Number	Percent
1	Yes	131	61.8
2	No	81	38.2
	Total	212	100.0

6.18. Safety and Protective Measure Taken by Farmers

Farmers were asked if their family ever consumed chickpea grains having defects of various types (Table 49). Majority of the farmers (76.7%; *n* = 219) replied that they do not eat discolored grain while the remaining farmers do eat at times of food shortage. Considerable proportion of the farmers (44.5%; *n* = 220) reported to use chickpea grain for consumption if the damage by storage insect pest is light. Large majority of the farmers reported that they never consumed chickpea grain with heavy insect damage (95%), foul odor (80.9%) and chemical odor (72.3%). In relation to consumption of damaged grain only 8.6% of them experienced sickness after eatin such grains. This shows that farmers generally do care of consuming grain that is safe or not damaged.

Table 49. Farmers' response on the consumption of damaged grains

Response	Have your family ever consumed										Sickness from eating damaged grain	
	Discolored grain		Light insect damaged		Heavy insect damage		Foul odor		Chemical odor			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Yes	51	23.3	98	44.5	11	5.0	42	19.1	61	27.7	19	8.6
No	168	76.7	122	55.5	209	95.0	178	80.9	159	72.3	201	91.4
Total	219	100.0	220	100.0	220	100.0	220	100.0	220	100.0	220	100.0

Fumigants are the most commonly used pesticides (69.6%, *n* = 56) to control storage insect pests of chickpea. Considerable proportion of the farmers mix chickpea grain with dust formulations such as Malathion (10.7%), Actellic (3.6%) and unknown dust (8.9%) to protect it from storage

insect pests. Farmers also reported to use hazardous product, DDT (5,4%); a practice that is dangerous and needs to be avoided. Farmers treat chickpea grain with pesticides either inside their home (26.4%) or outside (73.6%). This shows that farmers' pesticide application is not safe.

Table 49. Types of pesticides used and place of grain treatment by farmers

No	Type of pesticide	Respondent farmers	
		Number	Percent
1	Fumigant	39	69.6
2	Malathion dust	6	10.7
3	Actelic dust	2	3.6
4	DDT	3	5.4
5	Dust (unknown)	5	8.9
6	Any	1	1.8
	Total	56	100.0
	Place of treatment		
1	Inside home	55	26.4
2	Outside home	153	73.6
	Total	208	100.0

Farmers' experience in wearing protective garments during application of pesticides either in the field or storage was found to be poor (Table 50). Only 23.2% and 16.7% of the farmers reported to wear protective devices while applying pesticides in the field and storage, respectively. Even these farmers do not use all types of protective devices and the majority of them reported to use a piece of cloth to cover their nose and mouth, while some use gloves and eye goggles and few wear overall or overcoat and boots while applying field pesticides. On the other hand farmers mostly use a piece of cloth to cover their nose and mouth and gloves for their hands during applications of pesticides in the store. Considering sanitary measures taken by the farmers after pesticide application 94.5% of them do wash their hands and only half of them wash their cloth.

Efforts should, therefore, be made in creating awareness to the farmers on the use of recommended pesticides and safe application methods so that farmers avoid using pesticides that are not recommended, treating grains inside home, and wear appropriate protective devices while applying pesticides and take proper sanitary measures thereafter.

Table 50. Protective and sanitary measures taken by farmers during pesticide application

No	Response	Use protective during pesticide application				Wash after spraying pesticide			
		in the field		in storage		Hand		Cloth	
		Number	%	Number	%	Number	%	Number	%
1	Yes	49	23.2	35	16.7	208	94.5	110	50.0
2	No	162	76.8	174	83.3	12	5.5	110	50.0
	Total	211	100.0	209	100.0	220	100.0	220	100.0

Table 51 depicts multiple responses of farmers on disposal mechanism of pesticide package. The result showed that farmers do not have safe disposal, rather dangerously dispose or use them for other purposes. Only 43.8% of the farmers burry empty packages underground and 5% of them does burn them. Farmers use empty pesticide packages to store food (7.9%), store other products (18.5%) or carry water (6.2%) or simply leave on the ground (23.6%) or throw into water (5.6%). Concerning disposal of grains unfit for consumption farmers do feed such grains to animals (74.9%) or burry underground or simple discard on the ground (Table 52).

Table 51. Disposal mechanism pesticide package by farmers

No	Disposal of pesticide package	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Storing food	Number	2	2	6	4	14
		% within Region	5.4	4.3	10.9	10.3	
		% of Total	1.1	1.1	3.4	2.2	7.9
2	Carrying water	Number	1	10	0	0	11
		% within Region	2.7	21.3	0.0	0.0	
		% of Total	0.6	5.6	0.0	0.0	6.2
3	Storing other products	Number	6	6	12	9	33
		% within Region	16.2	12.8	21.8	23.1	
		% of Total	3.4	3.4	6.7	5.1	18.5
4	Bury underground	Number	24	19	20	15	78
		% within Region	64.9	40.4	36.4	38.5	
		% of Total	13.5	10.7	11.2	8.4	43.8
5	Leave on the ground	Number	6	11	15	10	42
		% within Region	16.2	23.4	27.3	25.6	
		% of Total	3.4	6.2	8.4	5.6	23.6
6	Throw into water	Number	0	0	7	3	10
		% within Region	0.0	0.0	12.7	7.7	
		% of Total	0.0	0.0	3.9	1.7	5.6
7	Sell at market	Number	1	1	1	0	3
		% within Region	2.7	2.1	1.8	0.0	
		% of Total	0.6	0.6	0.6	0.0	1.7
8	Burn	Number	3	4	1	1	9
		% within Region	8.1	8.5	1.8	2.6	
		% of Total	1.7	2.2	0.6	0.6	5.1
Total		Number	37	47	55	39	178
		% of Total	20.8	26.4	30.9	21.9	100.0

Percentages and totals are based on 178 respondents.

Table 52. Disposal of grain unfit for food

No	Means of disposal	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Bury underground	Number	17	4	1	0	22
		% within Region	38.6	8.5	1.7	0.0	
		% of Total	8.9	2.1	0.5	0.0	11.5
2	Burn	Number	2	2	1	1	6
		% within Region	4.5	4.3	1.7	2.4	
		% of Total	1.0	1.0	0.5	0.5	3.1
3	Leave on the ground	Number	6	2	4	10	22
		% within Region	13.6	4.3	6.9	23.8	
		% of Total	3.1	1.0	2.1	5.2	11.5
4	Feed to animals	Number	21	40	51	31	143
		% within Region	47.7	85.1	87.9	73.8	
		% of Total	11.0	20.9	26.7	16.2	74.9
5	Throw in water	Number	2	0	1	0	3
		% within Region	4.5	0.0	1.7	0.0	
		% of Total	1.0	0.0	0.5	0.0	1.6
6	Use for sale	Number	0	4	3	2	9
		% within Region	0.0	8.5	5.2	4.8	
		% of Total	0.0	2.1	1.6	1.0	4.7
Total		Number	44	47	58	42	191
		% of Total	23.0	24.6	30.4	22.0	100.0

Percentages and totals are based on 191 respondents.

6.19. Farmers' Support

Farmers belong to various organizations (Table 53). Farmers' unions, where majority of farmers (64.7%; *n* = 153) belong to, support them in availing farm inputs such as fertilizers and facilitating marketing of their produce. The majority of the farmers, 64.6%, belong to farmers' unions. Considerable proportion of the farmers belongs to peasant associations and seed growers' associations while few of them are members of saving associations.

Farmers were asked on local individuals/organizations that provide them information they would trust about crop production (Table 53; *n* = 185) and stored grain management (Table 54; *n* = 171). Agricultural experts were reported to provide trustable information to the majority of the farmers on crop production (87.6%) and stored grain management (86%). Farmers' unions, research institutions, universities, seed producers, input suppliers, farmers' training centers, traders and fellow farmers are local individuals/organizations that provide information to the farmers, though reported by small number of farmers.

Farmers' preference on the means of receiving new information is shown in Table 56. Out the total 220 respondents the great portion of them (85.5%) preferred to receive new information on large meetings while 54.1% of them prefered to see new technologies on demonstration trials. Fellow farmers and radio programs are considered by 44.1% and 33.2% of the farmers,

respectively, as preferred means of receiving new information. Input suppliers and religious leaders have also been given due consideration as sources of new information transfer to farmers.

Table 53. Organizations to which farmers are belonging

No	Organization	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Peasant Association	Number	25	7	3	0	35
		% within Region	80.6	26.9	5.2	0.0	
		% of Total	16.3	4.6	2.0	0.0	22.9
2	Farmers' Union	Number	8	12	48	31	99
		% within Region	25.8	46.2	82.8	81.6	
		% of Total	5.2	7.8	31.4	20.3	64.7
3	Seed Growers' Association	Number	0	9	13	3	25
		% within Region	0.0	34.6	22.4	7.9	
		% of Total	0.0	5.9	8.5	2.0	16.3
4	Saving Association	Number	0	1	0	4	5
		% within Region	0.0	3.8	0.0	10.5	
		% of Total	0.0	0.7	0.0	2.6	3.3
Total		Number	31	26	58	38	153
		% of Total	20.3	17.0	37.9	24.8	100.0

Percentages and totals are based on 153 respondents.

Table 54. Local individuals/organizations that provide information farmers would trust about crop production

No	Individuals/organizations	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Agricultural experts	Number	22	34	58	48	162
		% within Region	66.7	75.6	98.3	100.	
		% of Total	11.9	18.4	31.4	25.9	87.6
2	Farmers' unions	Number	0	2	5	2	9
		% within Region	0.0	4.4	8.5	4.2	
		% of Total	0.0	1.1	2.7	1.1	4.9
3	Research Institutions	Number	0	10	2	1	13
		% within Region	0.0	22.2	3.4	2.1	
		% of Total	0.0	5.4	1.1	0.5	7.0
4	Universities	Number	0	0	0	2	2
		% within Region	0.0	0.0	0.0	4.2	
		% of Total	0.0	0.0	0.0	1.1	1.1
5	Seed producers	Number	0	2	1	0	3
		% within Region	0.0	4.4	1.7	0.0	
		% of Total	0.0	1.1	0.5	0.0	1.6
6	Fellow farmers	Number	0	2	1	1	4
		% within Region	0.0	4.4	1.7	2.1	
		% of Total	0.0	1.1	0.5	0.5	2.2
7	Input suppliers	Number	0	0	1	0	1
		% within Region	0.0	0.0	1.7	0.0	
		% of Total	0.0	0.0	0.5	0.0	0.5
8	Farmers Training Centers	Number	11	0	0	0	11
		% within Region	33.3	0.0	0.0	0.0	
		% of Total	5.9	0.0	0.0	0.0	5.9
Total		Number	33	45	59	48	185
		% of Total	17.8	24.3	31.9	25.9	100.0

Percentages and totals are based on 185 respondents.

Table 55. Local individuals/organizations that provide information farmers trust about stored grain management

No	Individuals/organizations	Measure	Respondent farmers				Total
			Tigray	Amhara	Oromia	SNNP	
1	Agricultural experts	Number	18	34	52	43	147
		% within Region	69.2	85.0	91.2	89.6	
		% of Total	10.5	19.9	30.4	25.1	86.0
2	Farmers' unions	Number	0	3	1	5	9
		% within Region	0.0	7.5	1.8	10.4	
		% of Total	0.0	1.8	0.6	2.9	5.3
3	Research institutions	Number	0	3	4	1	8
		% within Region	0.0	7.5	7.0	2.1	
		% of Total	0.0	1.8	2.3	0.6	4.7
4	Universities	Number	0	0	0	3	3
		% within Region	0.0	0.0	0.0	6.2	
		% of Total	0.0	0.0	0.0	1.8	1.8
5	Seed producers	Number	0	2	3	0	5
		% within Region	0.0	5.0	5.3	0.0	
		% of Total	0.0	1.2	1.8	0.0	2.9
6	Trader	Number	0	0	2	2	4
		% within Region	0.0	0.0	3.5	4.2	
		% of Total	0.0	0.0	1.2	1.2	2.3
7	Farmer	Number	0	1	1	5	7
		% within Region	0.0	2.5	1.8	10.4	
		% of Total	0.0	0.6	0.6	2.9	4.1
8	Input supplier	Number	8	0	1	1	10
		% within Region	30.8	0.0	1.8	2.1	
		% of Total	4.7	0.0	0.6	0.6	5.8
Total		Number	26	40	57	48	171
		% of Total	15.2	23.4	33.3	28.1	100.0

Percentages and totals are based on 171 respondents.

6.20. Role of Farmers' Family Members in Chickpea PH Value Chain

Roles of men, women and children in chickpea post-harvest value chain were assessed and the results presented in table 57. The results indicated that the whole family members had role in every activities of chickpea post-harvest value chain.The role children in market decision making, managing family income and planning family meal is minimal. Even these lower roles might be attributed to those played by elder children. Men had the highest role in every activities of the value chain except that of store inspection and planning of family meal which are dominated by women.

Farmers tried to indicate the amount of money (Eth. Birr) they allocate for the following each year (table 58. They, on average, allocated the largest amount (10,850.7 Eth. Birr) with a range of 100 to 98,000 Eth. Birr for holidays followed by 6,497.3 Eth. Birr allocated for various

ceremonies and 3,487.4 Eth. Birr allocated for buying family clothes. The least allocation (823.2 Eth. Birr) is allocated for transportation.

Table 56. Farmers' preference on the means of receiving new information

No	Priority level	Respondent Farmers (Means of receiving new information)																	
		Large meetings		One-on-one delivery		Demonstration trials		Radio programs		Television programs		Cell phone		Input supplier		Religious leader		Fellow farmer	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
1	First	74	43.3	17	45.9	71	59.7	4	5.5	2	12.5	1	6.3	8	16.0	1	2.7	29	29.9
2	Second	69	40.4	11	29.7	32	26.9	27	37.0	3	18.8	9	56.3	12	24.0	11	29.7	33	34.0
3	Third	28	16.4	9	24.3	16	13.4	42	57.5	11	68.8	6	37.5	30	60.0	25	67.6	35	36.1
	Total	171	100.0	37	100.0	119	100.0	73	100.0	16	100.0	16	100.0	50	100.0	37	100.0	97	100.0
% out of 220 respondent		85.5		16.8		54.1		33.2		7.3		7.3		22.7		16.8		44.1	

Table 57. Roles of men, women and children in chickpea post-harvest value chain

Gender	Measure	Respondent farmers (Roles in)										
		Harvesting	**Drying**	**Cleaning**	**Threshing**	**Storage**	**Inspection**	**Market decision**	**Transporting to market**	**Market negotiation**	**Managing family income**	**Planning family meal**
Male	Number	201	209	202	209	196	172	198	198	200	197	179
	%	93.1	97.2	93.5	96.8	90.7	80.0	93.8	93.8	93.5	92.9	84.4
Female	Number	138	125	100	101	146	192	187	162	155	165	204
	%	63.9	58.1	46.3	46.8	67.6	89.3	88.6	76.8	72.4	77.8	96.2
Children	Number	152	116	113	135	93	46	11	44	29	5	6
	%	70.4	54.0	52.3	62.5	43.1	21.4	5.2	20.9	13.6	2.4	2.8
Total	Number	216	215	216	216	216	215	211	211	214	212	212
	%	100	100	100	100	100	100	100	100	100	100	100

Table 58. Amount of money (Eth. Birr) allocate by the farmers for the following each year

Region	Respondent farmers (Allocation category)																	
	Cloth		Education		Food		Health		Transportation		Ceremony		Holiday		Saving		Social value	
	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N	Mean (Min,Max)	N
Tigray	3448.9 (200,45000)	45	472.9 (30,2000)	35	1482.3 (40,3800)	43	670.7 (100,4000)	43	391.8 (10,1500)	40	1591.7 (50,6000)	24	2963.3 (100,20000)	45	1399.4 (80,5000)	42	313.3 (15,800)	32
Amhara	3684.6 (1000,10000)	13	2576.9 (700,10000)	13	2258.3 (400,4000)	12	2963.6 (200,14000)	11	1065.0 (150,4000)	10	9952.0 (20,20000)	10	13900.0 (1800,30000)	11	1357.1 (500,3000)	7	1730.9 (60,10000)	11
Oromia	3767.8 (1000,10000)	59	2788.0 (300,10000)	50	2879.3 (200,10000)	58	2087.7 (200,12000)	52	1055.5 (200,4000)	58	10691.7 (120,70000)	46	15415.5 (5000,98000)	58	2946.8 (150,50000)	31	992.9 (60,5000)	59
SNNP	3132.7 (400,16000)	49	1646.9 (120,6700)	42	2357.4 (100,6000)	49	1124.0 (200,10000)	48	853.3 (100,5000)	45	3530.8 (120,26000)	37	12109.0 (2000,26400)	45	1004.0 (100,3500)	25	1300.6 (36,23000)	49
Total	3487.4 (200,45000)	166	1847.3 (30,10000)	140	2304.6 (40,10000)	162	1454.2 (100,14000)	154	823.2 (10,5000)	153	6497.3 (20,70000)	117	10850.7 (100,98000)	159	1759.3 (80,50000)	105	1002.5 (15,23000)	151