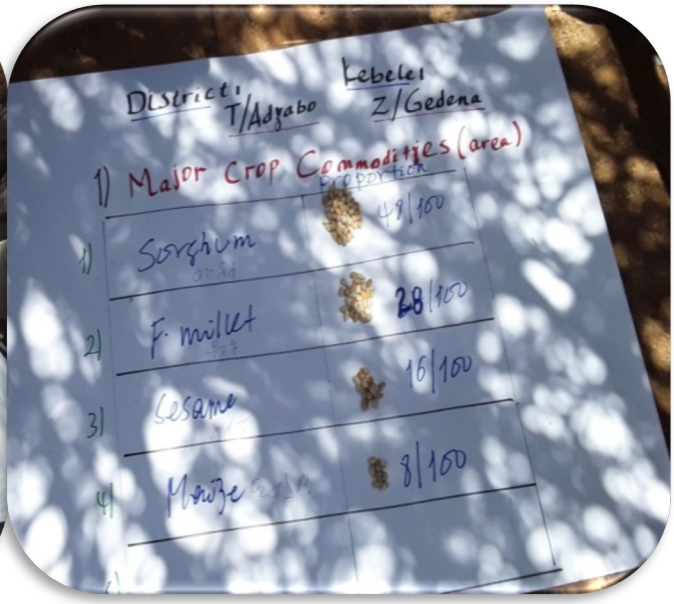
PARTICIPATORY GENDER ROLE ANALYSIS IN SORGHUM PRODUCTION: A CASE STUDY AT TAHTAY ADYABO DISTRICT, TIGRAY REGION, NORTHERN ETHIOPIA



Study Team

Daniel Desta: Agricultural Economist (Socioeconomics Associate Researcher) and Team Leader

Desale Gebretsadik: Agricultural Economist (Socioeconomics Associate Researcher)

Mekonen Ataklti: Junior Crop Protection Researcher

Brhane Mekonen: Junior Soil and Water Conservation Researcher

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Executive Summary

A Participatory Rural Appraisal (PRA) study was conducted by in two kebeles (Lemlem and Zban Gedena) within the Tahtay Adyabo district in the northwestern zone of Tigray region, which also afforded the opportunity for comparisons in gender roles in the Kunama and Habesha Tigray nationalities. The study analyzed gender roles in sorghum production in Tahtay Adyabo by identifying the regional sorghum production calendar and activities, analyzing gender roles and responsibilities in sorghum production and assessing the major constraints hindering production and productivity of sorghum in the study district.

According to the FGD participant farmers, sorghum is one of the major crops grown in the study area and was ranked first in its area coverage, though its production and productivity was reported to be constrained by many factors. Sorghum was primarily used for human food in the region was at times mixed with other cereals such as teff and finger millet, in different proportions.

In the study area, women and girls were large contributors to sorghum production, although their decision-making power and resource ownership was limited. Women did spend significantly more time on domestic, production and community-based activities than men in the study area, but no difference in roles and responsibilities between Kunama and Habesha Tigray nationalities was observed. Any observed differences in roles and responsibilities were gender-based, which infers a disparity in the gender roles and responsibilities in the study area. To ensure gender equity while improving the income of sorghum-producing farmers and protecting their food security, governmental and non-governmental organizations should aggressively work to create gender equity and to develop the sorghum value chain.

Study participants were selected from various household types within the community: male-headed households, married women from male-headed households and women from female-headed households. Some PRA tools utilized were focus group discussions, proportional piling, seasonal calendars, and pair-wise ranking. Data collected from primary and secondary sources were analyzed using descriptive statistics, such as percentages. For the purpose of data analysis, STATA (version 13.1) software was employed as an analytical tool.

1. Introduction

1.1. Background and Justification

Approximately 80% of Ethiopia's population depends on the agricultural sector. While both men and women actively participate in agricultural activities, the growth of the agricultural sector has remained slow. Agricultural extension techniques are still limited and have not addressed gender-based needs and problems. A whole-country shift toward agricultural development that distinguishes and caters to the differences between male and female farmers requires a robust framework providing procedures, setting inspectional standards, and enforcing an engendered agriculture sector with which all stakeholders comply.

Note that some figures and other data refer to the Ethiopian calendar (E.C.). This calendar differs from the Gregorian calendar used in most countries around the world. A year in the E.C. is 13 months long: 12 months have 30 days each, and the last month of the year has five days in a common year (six days during a leap year). This results in a calendar that is seven to eight years behind the Gregorian calendar.

1.2. Objectives of the Study

This study, undertaken by specialists in agricultural economics, crop protection, and soil and water conservation, analyzed the gender role in sorghum production in Tahtay Adyabo. Specifically, this study:

1. Identified the sorghum production calendar and activities undertaken in the study district;
2. Analyzed the gender roles and responsibilities in sorghum production in the study district and;
3. Assessed the major constraints hindering the production and productivity of sorghum in the study district.

1.3. Study Scope and Significance

Both men and women in Tahtay Adyabo, a district located in the Tigray region, collaborate to grow sorghum. This study focused on sorghum production activities in two kebeles[1]: Lemlem and Zban

[1] The smallest administration unit with its own jurisdiction

Gedena. Due to limited financial and time resources, the changes in gender roles and responsibilities over time were not included in this study.

It is hoped that this study will benefit not only the study kebeles' farming communities, but also other areas with similar farming systems, as well as humanitarian organizations and governmental bodies to either amend existing policies and strategies or to use the results of this study to create new policies. The results of this report may also be useful as a reference for researchers who may want to pursue their own studies in related areas.

2. Research Methodology

2.1. Data Types, Sources and Methods of Data Collection

This study made use of both primary and secondary data sources. Primary data were collected from selected farm households within two kebeles of Tahtay Adyabo. Secondary data, including qualitative and quantitative data, were collected from the Tahtay Adyabo district Office of Agriculture and Rural Development.

Primary data were collected using PRA tools, including focus group discussions (FGD) and key informant interviews (KII) administered by trained enumerators using a checklist. The FGD and KII checklists had two components: one component focused on crop production and cropping calendars, while the other focused on gender roles and responsibilities within the community for different productive and reproductive services. Both FGD and KII participants were informed about the study's objectives and relevance and reassured about confidentiality.

Note that some figures and other data refer to the Ethiopian calendar (E.C.). This calendar differs from the Gregorian calendar used in most countries around the world. A year in the E.C. is 13 months long: 12 months have 30 days each, and the last month of the year has five days in a common year (six days during a leap year). This results in a calendar that is seven to eight years behind the Gregorian calendar.

2.2. Sampling Technique and Sample Size Determination

In Tahtay Adyabo, heads of household are responsible for any day-to-day decision-making regarding farm, non-farm and off-farm activities. Therefore, this study sampled farm households within the study area to determine units of analysis, crop production, cropping calendar, and gender roles and responsibilities in different productive, reproductive and community services. A three-stage sampling technique was employed in this study. The first stage used secondary information generated from the district Office of Agricultural and Rural Development to subdivide the district into different crop clusters: namely, sesame and sorghum clusters. In the second stage, kebeles within the sorghum cluster were further subdivided in to Kunama and Tigray nationalities to highlight any differences in gender roles and responsibilities for crop production practices. In the

third stage, two kebeles (Lemlem and Zban Gedena) were identified. Within these Kebeles, 12 male-headed households (MHH), 12 female-headed households (FHH) and 12 married women from MHHs were selected and contacted to participate in FGDs.

2.3. Methods of Data Analysis

Data collected from primary and secondary sources were analyzed using descriptive statistics, such as percentages. For the purpose of data analysis, STATA (version 13.1) software was employed as an analytical tool.

3. Results and Discussions

3.1. Study Area Overview

The study was conducted in Tahtay Adyabo district. Tahtay Adyabo is one of eight districts found in the northwestern zone of Ethiopia's Tigray Regional State (Figure 1). It is composed of 17 rural kebeles and one urban kebele. Tahtay Adyabo is located about 405 kilometers from Mekelle and 95 kilometers from Shire-Endaselassie, the region's capital.

The district has a total population of about 100,958, divided evenly between males and females (CSA, 2013). Approximately 24% of the district's land area is cropland, 17% is covered by forest and the rest is homestead and wasteland. The district is divided into three major agro-ecological zones: 70% of the district is considered hot to warm semi-arid lowlands, while 18.75% is considered tepid to cool moist mid-highlands. The remaining 11.25% of the district is hot to warm sub-moist lowlands. The region is at an elevation of 800-1500 meters and has an average annual temperature of 31° C (TADoARD, 2015).

According to a 2015 study by the Tahtay Adyabo District Office of Agriculture and Rural Development, crop farming mixed with livestock husbandry dominates the district's economy. The major crops produced in the district include sorghum, finger millet, maize, and vegetables, with sesame as the area's important cash crop commodity. The district is suitable for livestock production especially for goats, sheep and the Begait cattle breed.

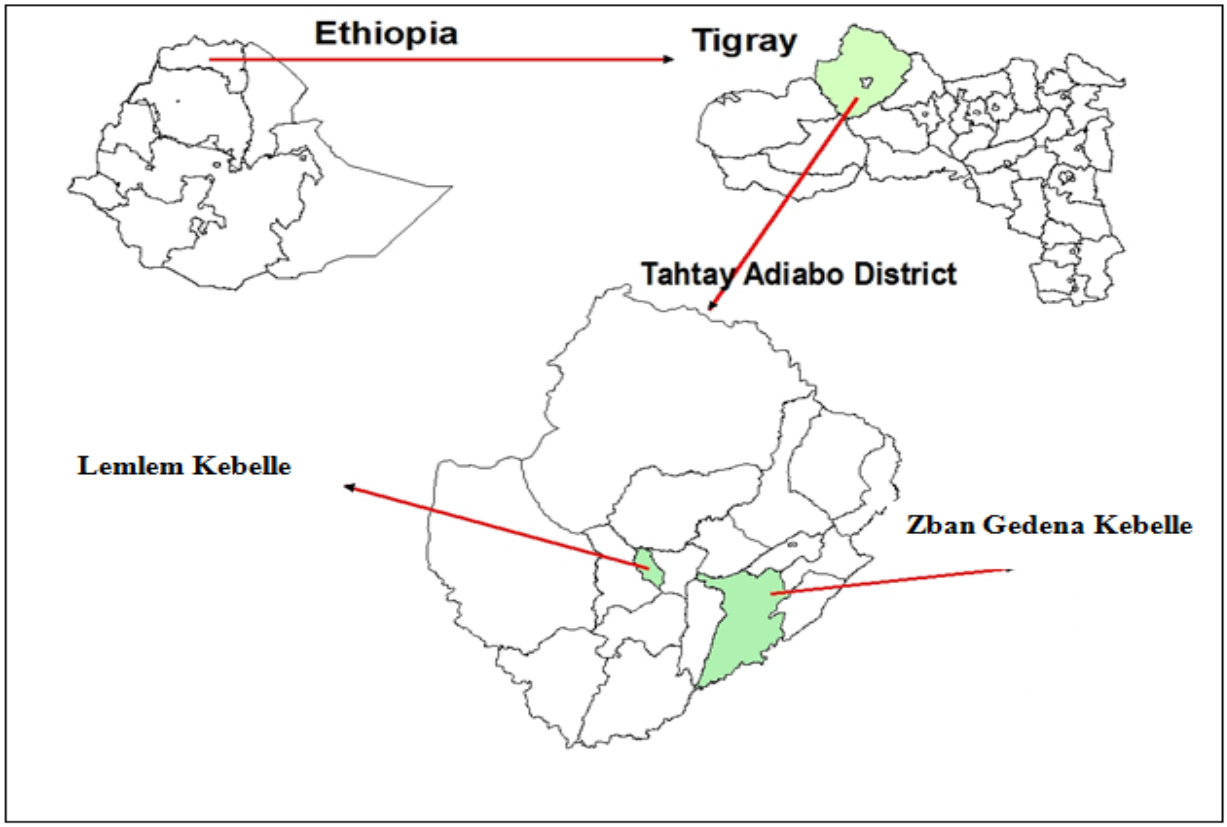

Figure 1. Map of study area.

3.2.Study Group Data on Sorghum Production

Trends of sorghum area coverage, productions and productivity.

The area covered by sorghum remained stable, except for an increase in coverage area between 2001- 2002. (Figure 2). This was possibly due to either the expansion of cultivable area or shifting cultivation; farmers may have shifted to grow more sorghum than other crops during these years or, in the case of a decline, shifted toward another crop.

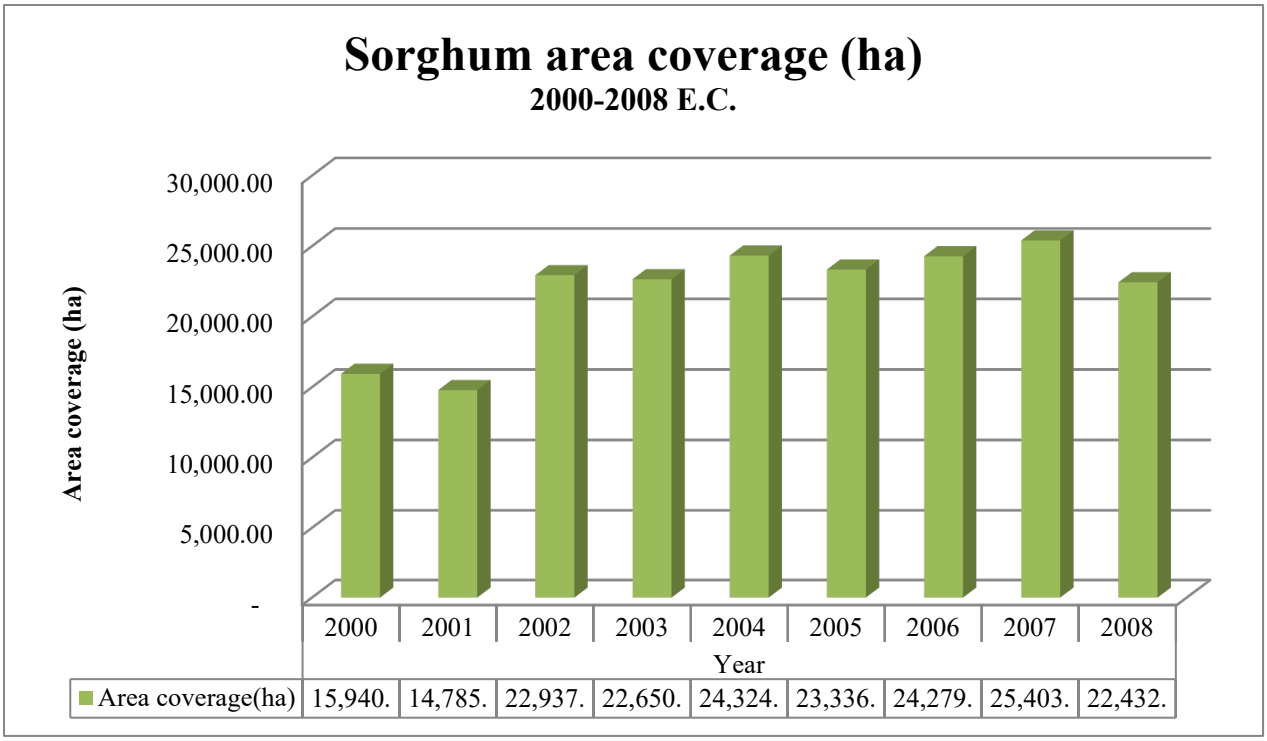

Figure 2.Sorghum area coverage (ha) during 2000- 2008 E.C.

The total annual sorghum production (quintal) during 2000 - 2008 E.C. also showed steady production, with a large increase during 2001 - 2002 and again in 2005 - 2006 (Figure 3). These increases could have been due to an expansion of cultivable area, an increase in sorghum productivity, or the use of technology packages enhancing sorghum productivity. Total annual sorghum yield was observed to decline during after 2006, which may have been because the total area coverage of sorghum had declined as well.

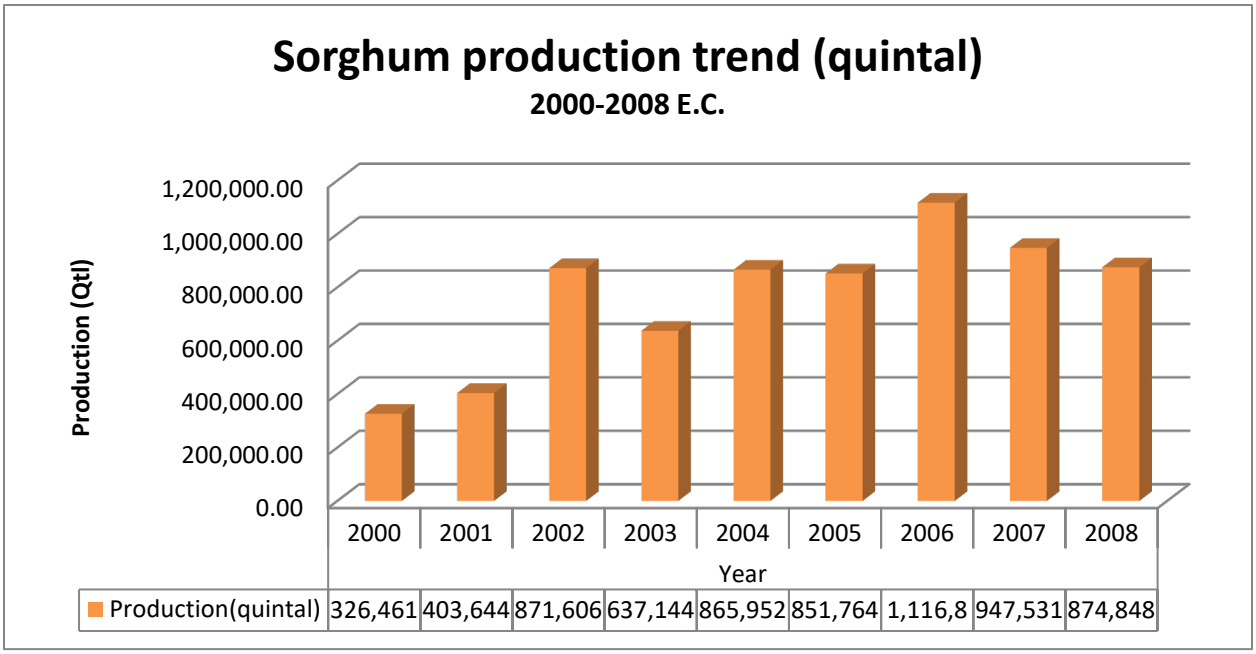

Figure 3. Sorghum area production trend (quintal), in the years 2000- 2008 E.C.

The average levels of annual sorghum productivity during 2000 - 2008 E.C. increased, though some fluctuation was observed (Figure 4). Possible reasons for this trend include good rainfall amounts or other technology packages that enhanced sorghum productivity. During the years showing a productivity decline (2007 E.C and 2008 E.C), farmers may have experienced poor rainfall or had a decline in use packages that normally would have enhanced sorghum productivity.

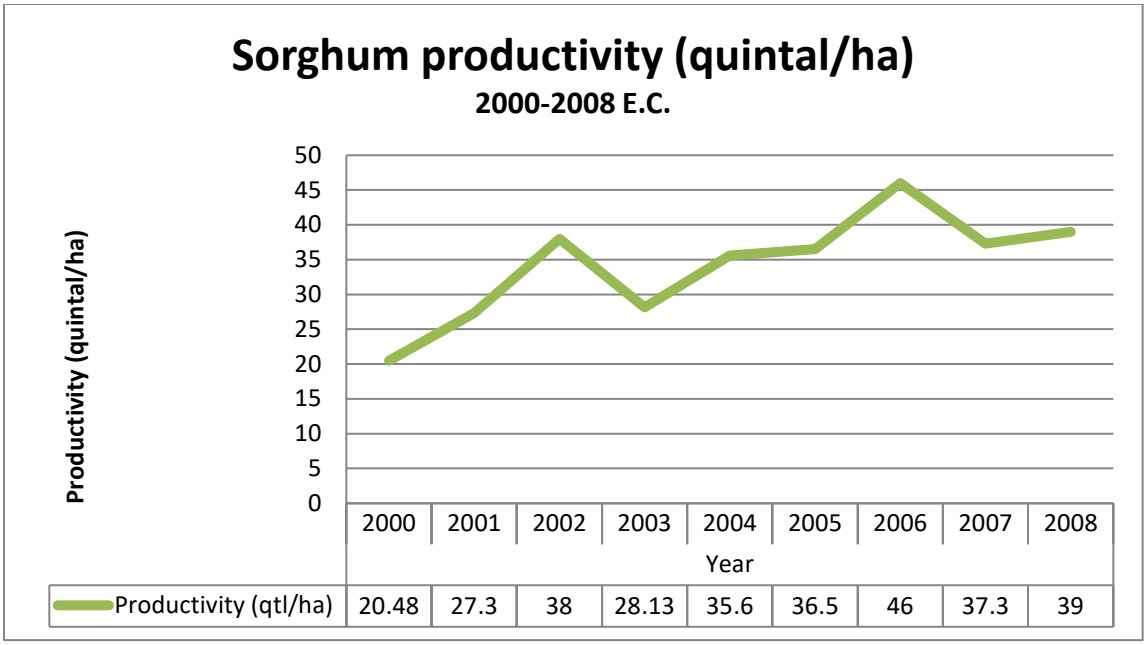

Figure 4. Sorghum productivity trend (quintal/ha), 2000- 2008 E.C.

Cropping calendars of major crop commodities grown in the study area.

Tahtay Adyabo's major agricultural commodities – sorghum, finger millet, sesame and maize – have different cropping calendars. According to FGD participants, land clearing and first cultivation for sorghum was accomplished mostly in May, though first cultivation sometimes extended into June. Planting usually began in June, but sometimes extended into July, depending on the rainfall availability. First weeding for sorghum started mostly in July, but second and third weeding was not commonly practiced; FGD participants reported that this was due to lack of labor and fear of moisture stress. Farmers said that if they weeded their sorghum farm based on the recommended weeding frequency, it could hinder the crop's growth since the area was considered moisture stressed and had mostly clay soil. Farmers in the study area discounted the negative effect of sorghum weeds and believed the weeds could serve as mulch. There were some cleaver framers who practiced three weedings, however. If farmers included additional weedings, the second and third weeding was completed in August and September, respectively. Sorghum harvest was in November, with threshing and winnowing following in December. In some cases, farmers harvested sorghum during October as well, depending on the maturity length of the variety they had sown. If there was a surplus, produce marketing was completed mostly January through April (Table 1).

Table 1. Cropping Calendars of Major Crop Commodities Grown in the Study Area

Crop	Months												Activities
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sorghum	12	12	12	12	1,2	2,5	5,6	7,8	8	9	9	10,11	1. Land clearing 2. 1st Cultivation 3. 2nd Cultivation 4. 3rd Cultivation 5. Planting 6. 1st Weeding 7. 2nd Weeding 8. 3rd Weeding 9. Harvesting 10. Threshing 11. Winnowing 12. Marketing
Finger Millet	10,11	1,5	12	12	12			6		9		10,11	
Sesame	12	12	12	12	1	2,5	2,5,6	2,5,6,7	7,8	9,10,11	10,11	12	
Maize	10	10	10	10	1	2,3,5	6,7	8	9	9			

Major crops grown in the study area.

Tahtay Adyabo's main farming was a mixed (crop and livestock) system. Different types of crop commodities were grown in the district, including sorghum, finger and pearl millet, sesame, maize, pepper, bean, peas and others. Although each of these crops can be grown in the study area, FGD responses indicated that sorghum, finger millet, sesame and maize were the crops most widely grown in the study district. Sorghum was the most important, followed by finger millet, sesame, and maize (Figure 5).

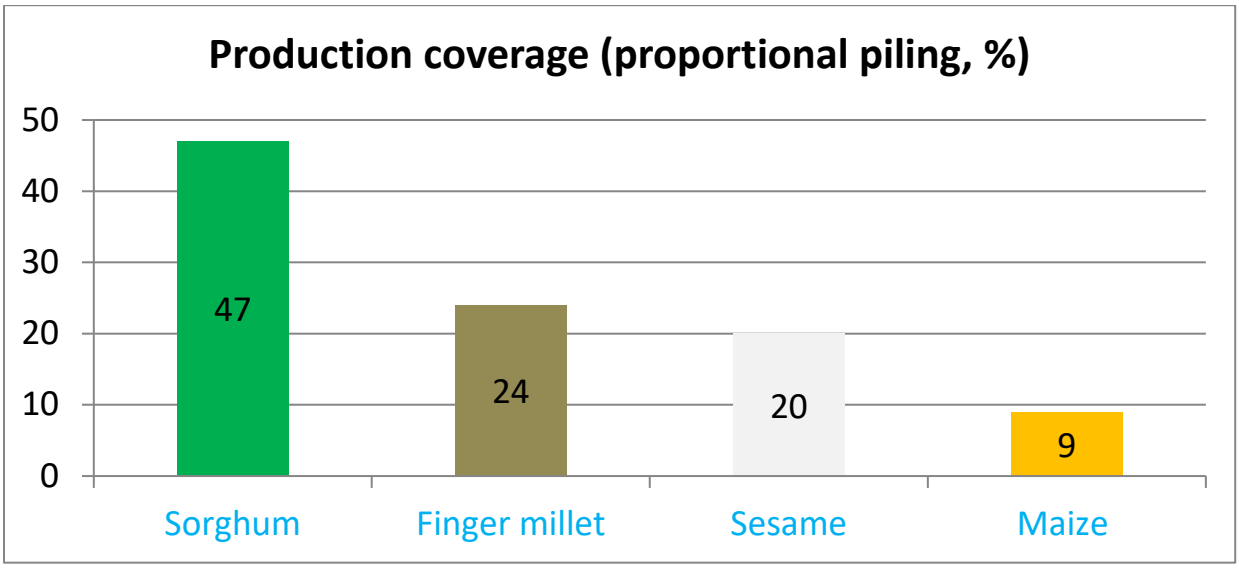

Figure 5. Production coverage of major crops in the study area.

Importance of sorghum compared to other cereals.

Farmers in the study area did produce crop commodities for different purposes and had different preferences for the major crop commodities grown. According to FGD responses, farmers preferred growing sorghum, even though it fetched a lower price compared to the other main crops grown in this district. Farmers grew sorghum because it was less vulnerable to the area's low rainfalls in comparison to other crops. Sorghum also was considered a high-yielding crop that can feed family members for months. Following sorghum, farmers in the study area preferred to grow sesame, maize, finger millet and maize (Table 2).

Table 2.Preference Ranking of Crops Grown in the Study Area

R.N		Sorghum	Finger millet	Sesame	Maize	Preference score	Preference rank
1	Sorghum		1	1	1	3	1
2	Finger millet			3	2	1	3
3	Sesame				3	2	2
4	Maize					0	4

Sorghum availability: Main sources of sorghum seed.

Farmers in Tahtay Adyabo depend on many sources for their sorghum seeds. According to FGD responses, both MHH and FHH depended heavily on stored seed from other farmers who maintained improved sorghum seeds for the next production season (Figure 6). However, there was a significant difference between household types when looking at seeds sourced from extension services. While only 13% of MHHs reported that they depended on seeds from extension, 32% of FHHs received their sorghum seeds from extension. On the other hand, while 24% of MHHs in the study area depended on the market for their sorghum seeds, only four percent of the FHHs received their seeds from the market. This indicates that MHHs had a better capability to buy sorghum seeds from the market, regardless of seed quality.

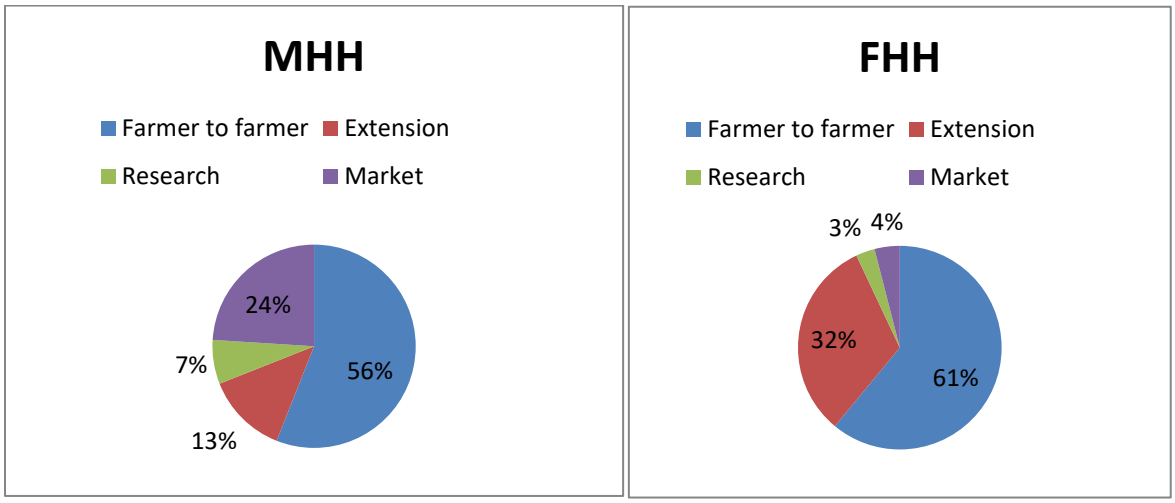

Figure 6. Main sources of improved sorghum seeds.

Main sources of sorghum for consumption.

Farmers in Tahtay Adyabo depend on many sources for their sorghum grain. Although both MHHs and FHHs reported similar percentages for sourcing sorghum from their own farm production, from credit and from aid/support, there was a notable difference in the number of households reporting that they purchased sorghum grain. FHHs reported 24% purchasing sorghum grain from the market, compared to 11% of MHHs (Figure 7). This indicates that FHHs produced less sorghum grain or had a smaller acreage allocated for sorghum because of smaller land holdings.

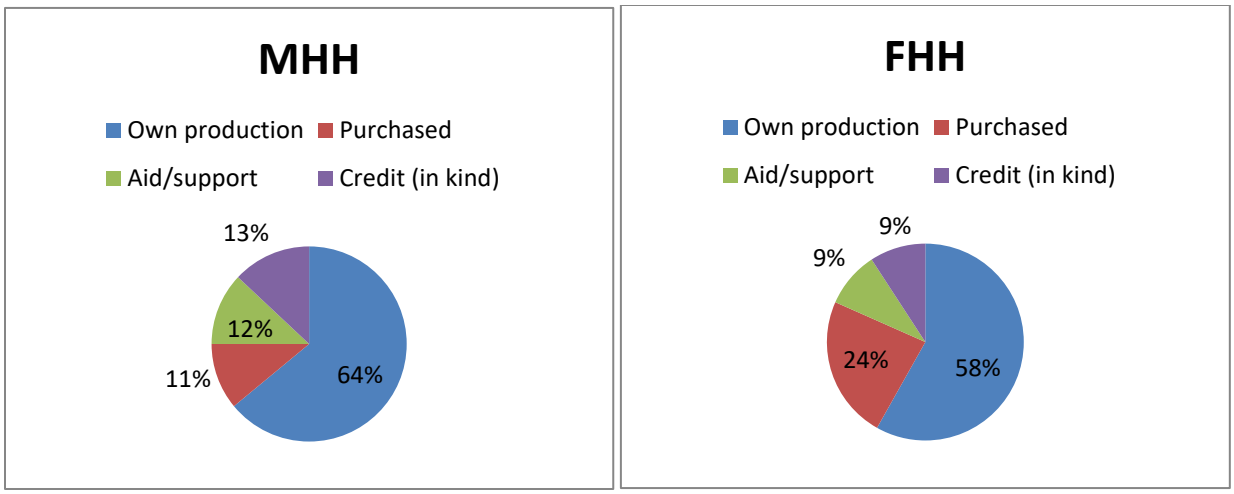

Figure 7. Main sources of sorghum grain.

Annual sorghum consumption.

FGD participants were asked various questions regarding the annual utilization of sorghum products in the study district. After the sorghum harvest, the largest proportion was consumed during December and January (Table 3). FGD participants indicated that this was due to the fact that many festivities, such as weddings and memorials, were arranged during these months. Based on the information generated using proportional pilling from FGD participants, almost no difference was observed in annual sorghum utilization between MHHs and FHHs.

Table 3. Consumption Distribution of Sorghum

No	Household type	Months (proportional piling, %)											
		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	MHH	02	02	100	17	21	08	08	07	10	06	05	04
2	FHH	02	02	100	19	20	10	09	08	09	05	05	05

MHH= Male Headed Households FHH= Female Headed Households

Input utilization and agronomic practices in sorghum production.

FGD participants were asked various questions regarding the input utilization and agronomic practices in sorghum production. Both MHHs and FHHs reported that they utilized fertilizer on their farms. MHHs used mostly chemical fertilizer and animal dung (Figure 8). In FHHs, animal dung and chemical fertilizer were also the most widely used (Figure 9), although the preference was opposite

from MHHs. There was also a difference in the combined use of chemical fertilizer and animal dung. In MHHs, 20% of respondents indicated that they used this combination on their farms. For FHHs, only seven percent indicated that they used this fertilizer combination.

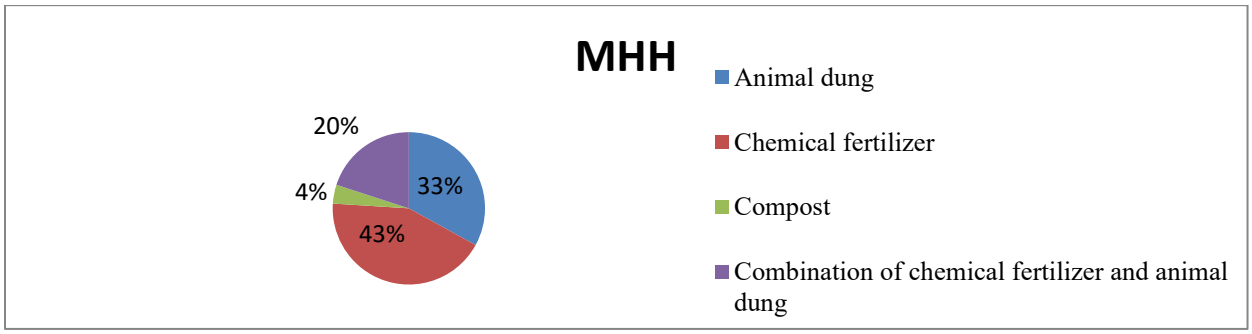

Figure 8. Input utilization practices of MHHs.

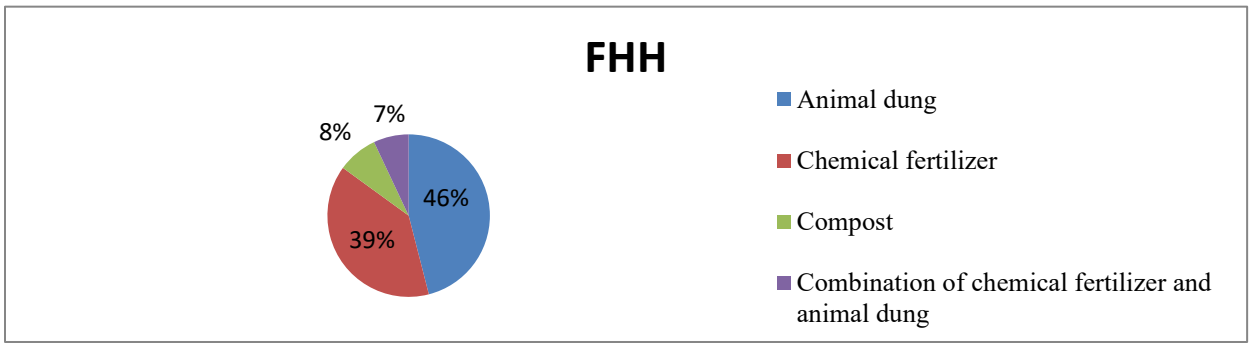

Figure 9. Input utilization practices of FHHs.

According to FGD responses, the majority of all household types utilized broadcast planting for sorghum production, while the remaining used row planting (Figure 10). FGD results indicated a smaller proportion of FHHs practiced the broadcasting method of sowing in sorghum production, compared to MHHs.

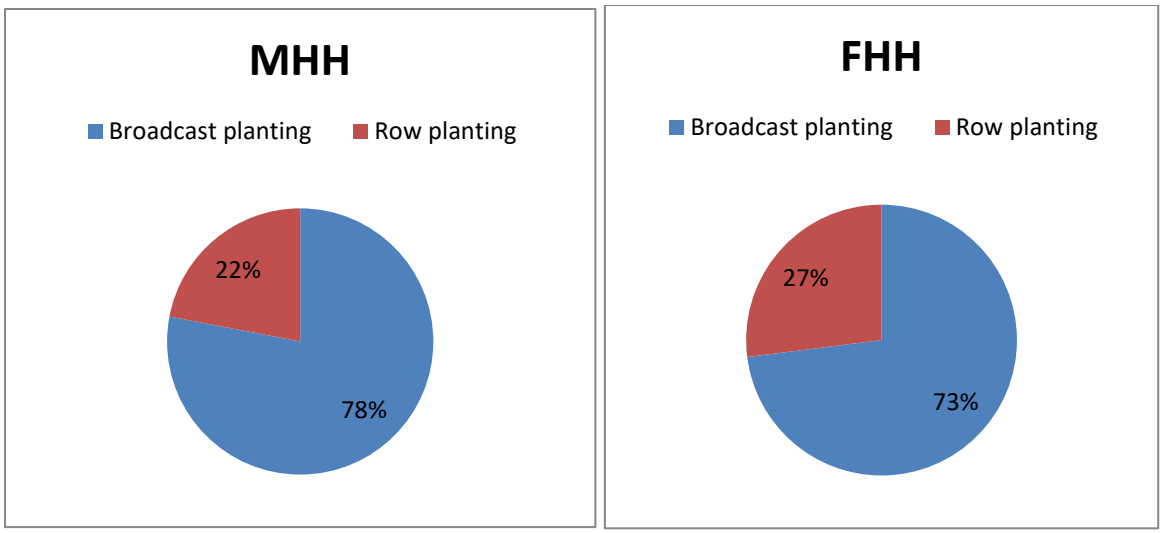

Figure 10. Sex-disaggregated agronomic utilization practices in sorghum production.

Sorghum variety preferences in the study area.

Farmers in Tahtay Adyabo grow different sorghum varieties. Local cultivars included *Merewey*, *Dagnew*, *Wedi Aker*, *Tsaeda Chumrey*, *Keyih Chumrey*, *Tewzale*, *ZeriGebru* and *Deberkasa*. Improved cultivars included *Machia*, *Abshir*, *Birhan*, *Gobye*, *Melkam* and *Dekeba*. FGD participants ranked these varieties using criteria such as *injera*-making quality (taste and shelf life), water-holding capacity, beer-making quality, and palatability and biomass yield as animal feed (Table 4). *Dagnew* had the greatest number of top rankings for *injera*-making quality and water-holding capacity. *Zeri Gebru* also had high rankings; FGD participants preferred it for its high biomass and straw palatability. *Wedi Aker* was ranked first for its beer-making quality.

Table 4. Preferences of Sorghum Varieties Given Different Commodity Attributes

Criteria	Rank of sorghum varieties					
	Merewey	*Dagnew*	*Wedi Aker*	*Chumrey*	*Tewzale*	*ZeriGebru*
Injera-making quality (Taste)	2	1	5	3	6	4
Injera-making quality (Shelf life)	2	1	6	3	5	4
Water holding capacity	3	1	6	4	5	2
Local beer-making quality	6	4	1	2	3	5
Palatability (animal feed)	3	5	1	4	6	2
Biomass yield (animal feed)	1	6	3	4	5	2

3.3. Sorghum Utilization Practices and Proportion of Sorghum Products Used in Different Forms

In the study area, farmers produced sorghum for use in various food products, including *injera*, *kita*, *genfo*, *kolo*, *nifro* and *tela*. According to FGD participants (Figure11), more than half of the total sorghum produced in the study area was used to make *injera*. This was followed by *tela* (16%) and *kita* (10%). Production of *nifro*, *kolo* and *genfo* had a nearly equal proportion.

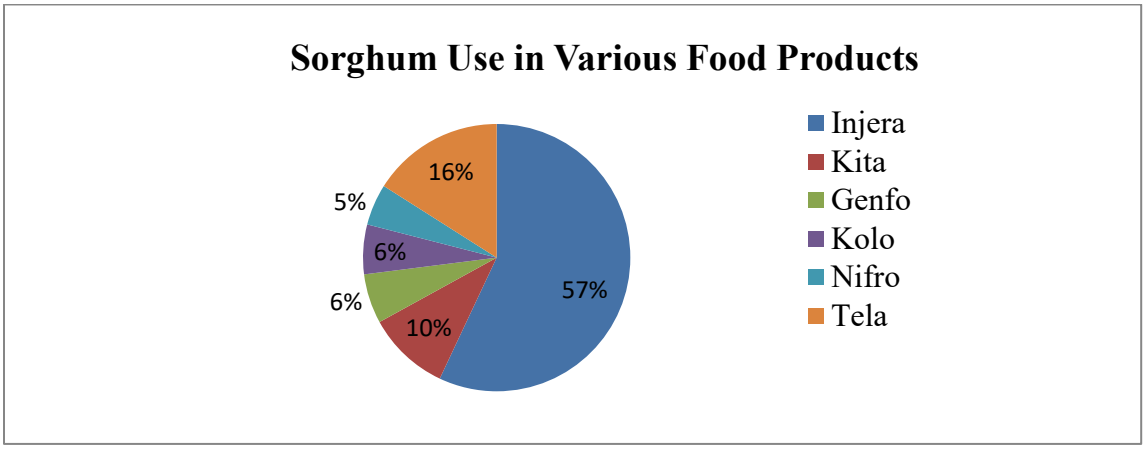

Figure 11. Sorghum utilization practices.

Proportion of sorghum in different utilization practices.

Within the two selected kebeles, FGD participants reported similarities in the percentage of farmers – regardless of gender or household – who prepared *injera* by mixing sorghum with other cereals. The results are presented together. When preparing *injera*, 80% of farmers used only sorghum. Ten percent of farmers mixed sorghum with teff, six percent mixed sorghum with finger millet, and the remaining four percent mixed sorghum with maize (Table 5). Those farmers who used a combination of cereals to prepare *injera* used a majority of sorghum mixed with a smaller proportion of other cereals. FGD participants explained that they mixed sorghum with other cereals (particularly with teff) to make the *injera* softer and more absorbent, as well as for health reasons and to make the *injera* more pleasant to hold. Respondents said they lacked the financial capacity to buy teff, which is why it was not used for making *injera* more often.

Table 5. *Injera*-making Ingredients and their Proportions

Mixing status						
Sorghum only (%)	Teff (%)		Finger millet (%)		Maize (%)	
80	10		6		4	
	Proportion		**Proportion**		**Proportion**	
	Sorghum	Teff	Sorghum	F. millet	Sorghum	Maize
	75	25	65	35	55	45

3.4. Sorghum Processing and Marketing Practices

Farmers in the study area no longer use traditional milling stones to process their grain. Instead, all of the farm households in the study area indicated that they used modern milling machines.

Area farmers preferred sorghum because its production carried less risk while producing more per unit area so that farmers could feed their families more easily. However, sorghum did face a relatively higher price fluctuation problem. The minimum and maximum selling price of sorghum ranged from 300 ETB/quintal to 700 ETB/quintal. On average, it fetched 500 ETB/quintal which was a lower price in comparison to other major commodities such as finger millet, sesame and maize, which also were grown in the study area. Sorghum's selling price decreased to 300 ETB/quintal from December through February because more fresh produce was supplied to the market during those months. Prices increased to 700 ETB/quintal from March through May because farmers' sorghum stock became depleted: either they stored the sorghum for family consumption purposes, or they ran out of stock. FGD participants reported a "medium" price for sorghum in June through October, after which the selling price decreased because fresh sorghum produce was supplied to the market in sufficient amounts.

3.5. Extension Services in Relation to Sorghum Production

Farmers in the study area learned about new sorghum varieties from other farmers, from extension, or from research. A larger proportion (61%) of MHHs received information on new sorghum varieties from other farmers. Just over a third of MHHs received information about sorghum from extension, while only three percent received information from research (Figure 12). This breakdown was similar for FHHs. More than half of the total sorghum-producing FHHs received information on new sorghum varieties from other farmers, while 43% received information from extension. The

remaining 5% received information about new sorghum varieties from research. Farmers in MHHs had a better chance to meet and mix outside of the home for different occasions, which could explain the why more male households reported that they received information from their peers.

Figure 12. Sex disaggregated sources of information on improved sorghum variety.

On the other hand, more female-headed farm households reported that they received information on new sorghum varieties from extension, as compared to MHHs. This can be due to the fact that FHHs were given more exposure to extension services in the study area. This suggests that while demonstrating a new sorghum-related technology, focus should be on the quality of the demonstration trial, not on the number of participant farmers as information can be easily and effectively disseminated from farmer to farmer.

3.6. Gender Roles and Responsibilities in Sorghum Production and Utilization

Activity profile in sorghum production and utilization by gender.

Community members held different responsibilities in productive, reproductive/domestic and community services activities, though their level of engagement varied. This study consulted members of male-headed households, married women, and female-headed households from both *Tigray* and *Kunama* nationalities in two kebeles.

Zban Gedena kebele.

In Zban Gedena, FGD results indicate that, except for weeding and marketing, men and boys under took the larger proportion of responsibility for sorghum productive activities. FGD responses did indicate that males from the Tigray nationality took the lead for activities such

as sowing, pesticide and fertilizer application, and transporting the harvest from the field. However, there were differences in the male and female responses: for example, in MHHs, responses indicated that household males were responsible for sowing 86% of the time, but married women said that males were responsible for sowing only 60% of the time. (Table 6). In MHHs, household males reported that they were responsible for pesticide application 73% of the time and were responsible for fertilizer application 92% of the time. Married women reported differently, indicating that men were responsible for pesticide and fertilizer application 59% and 46% of the time, respectively. This could indicate a difference in perspective between genders in the same households. In FHHs, women and boys took the larger proportion of responsibility in every activity for sorghum production. Some activities, such as weeding and harvesting, were split fairly evenly among Tigrayan family members, male and female, young and old. In FHHs, mothers and children also shared responsibility for weeding and harvesting, but more girls helped with weeding, and more boys helped with transporting the harvest from the field.

Table 6.Gender Analysis in Families' Productive Activities in Zban Gedena Kebele

Activities	MHH (%)				Married Women (%)				FHH (%)		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Land preparation	25	9	45	21	26	5	35	34	73	0	27
Sowing	06	08	63	23	25	15	34	26	61	16	23
Weeding	34	29	18	19	26	31	20	23	66	22	12
Pesticide application	11	16	47	26	27	14	38	21	73	09	18
Fertilizer application	08	NA	52	40	28	26	22	24	66	17	17
Bird-scaring	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Harvesting	22	25	27	26	21	16	29	34	45	15	40
Transporting harvest from field	06	07	46	41	24	4	40	32	48	12	40
Threshing	NA	NA	55	45	14	6	39	41	59	10	31
Winnowing	NA*	NA*	63	37	8	4	44	44	62	05	33
Marketing	47	18	27	08	39	25	23	13	78	12	10

*Not Applicable

Except for building and maintenance of houses/fences, females took on a larger proportion of responsibility in domestic activities (Table 7). Some discrepancies between responses did exist, specifically about food preparation, washing utensils, child rearing and house cleaning.

Where male respondents indicated that those activities were the sole responsibility of the household females, married women said that males did take part in these activities. In fact, married Tigrayan women said that males were responsible for child rearing 25% of the time, which was a significant difference from the MHH responses. Respondents from FHHs indicated that female household members were responsible for homestead activities, although male children did participate in all but house cleaning.

Table 7.Roles and Responsibilities of Zban Gedena Kebele Families' Reproductive and/or Homestead Activities

Activities	MHH (%)				Married Women (%)				FHH (%)		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Food preparation	63	37	NA*	NA*	45	32	11	12	62	32	06
Washing utensils	58	42	NA*	NA*	38	39	09	14	39	47	14
Washing clothes	51	32	06	11	33	44	11	12	45	45	10
Child bearing and rearing	62	38	NA*	NA*	42	31	13	15	61	35	04
Cleaning house, etc.	57	43	NA*	NA*	45	42	07	06	41	59	NA*
Building and maintenance of houses/fences	06	10	49	35	21	16	40	23	53	11	36
Fetching water	23	38	19	20	18	42	10	30	35	43	22
Collecting fire fuel	23	20	22	35	25	20	25	30	14	34	52

**Not Applicable*

There were marked differences in the perceived roles and responsibilities of Tigray family members when it came to community services (Table 8). For example, while married women in MHHs indicated that girls and boys were involved in NGO projects (19% and 22%, respectively), MHH respondents indicated that no children were involved in NGO projects. In an opposite result, MHH respondents indicated that household children were involved in community leadership organizations (29%), while married women indicated that children were involved in these organizations only eight percent of the time. There were also significant differences between men and married women in MHHs on the subject of cleaning water sources: male respondents indicated that women were not involved in this activity, whereas married women indicated that female household members were involved 23% of the time. Married women respondents also indicated a greater involvement and membership in

community leadership organizations, reporting that women were involved 51% of the time, where male heads of households said that women only were involved about 30% of the time.

Table 8.Roles and Responsibilities of Zban Gedena Kebele Family Members in Different Community Services, by Gender

Activities	MHH (%)				Married Women (%)				FHH (%)		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Water committee meetings	43	NA	57	NA	44	03	44	09	71	11	18
Cleaning water source	NA	NA	53	47	13	10	32	45	76	19	05
Care for old/sick persons	47	NA	35	18	31	17	28	24	82	NA	18
Weddings	51	16	9	24	29	24	24	23	68	12	20
Memorial festivities	46	09	28	17	33	11	32	24	79	08	13
Involvement in Village meetings	30	08	42	20	41	04	37	18	81	03	16
Involvement in public works (government)	22	29	16	33	29	18	30	23	69	11	20
Involvement in NGO projects	45	NA	55	NA	32	19	27	22	53	21	26
Involvement in political activities	24	09	46	21	37	06	40	17	61	12	27
Membership in community organizations	33	09	39	19	51	03	36	10	78	06	16
Involvement in community leadership organizations	30	15	36	19	51	0	41	08	79	03	18

Lemlem Kebele.

The FGD results from Kunama households indicated that many sorghum production activities, except for weeding and winnowing, were considered to be male responsibilities. Respondents did show some difference when talking about certain activities (Table 9). For example, MHHs reported that 40% of the bird scaring was accomplished by boys, while married women said that the majority of bird scaring was accomplished by men (41%) and boys (29%). MHHs reported that men and women had nearly equal responsibility for harvesting, but married women reported that women had significantly more of the responsibility than men. And, while MHHs reported that they had some responsibility for winnowing (34%), married women said that it was significantly less (11%). FHH respondents indicated that women were responsible for the majority of activities in their households, except for bird scaring, which was done mainly by household children.

Table 9. Roles and Responsibilities of Family Members in Lemlem Kebele for Different Productive Activities, by Gender

Activities	MHH				Married Women				FHH		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Land preparation	19	09	45	27	20	6	58	16	73	12	15
Sowing	15	14	40	31	27	14	35	24	71	15	14
Weeding	44	13	19	24	37	19	21	23	63	23	14
Applying pesticides	16	18	39	27	16	14	44	26	56	12	32
Applying fertilizers	14	14	49	23	22	18	37	23	66	14	20
Bird-scaring	14	38	08	40	19	11	41	29	40	28	32
Harvesting	38	13	37	12	48	17	27	8	81	10	9
Transporting harvest from field	19	30	13	38	19	9	54	18	72	19	09
Threshing	15	22	15	48	24	8	43	25	53	14	33
Winnowing	43	11	34	12	31	37	11	21	73	13	14
Marketing	34	09	50	07	19	11	50	20	79	11	10

The FGD results about roles in domestic activities showed that Kunama females took on the majority of responsibility for most activities (Table 10). In fact, male respondents said that females had greater responsibility for domestic work than reported by married females. For example, male respondents said that females were responsible for washing utensils (81%) and washing clothes (84%), while females reported slightly lower numbers (74% and 63%, respectively.) In fact, married women said that men were responsible for washing clothes 19% of the time, while their male counterparts said they were responsible for that task only six percent of the time. In female-headed farm households, all domestic activities were largely the domain of women and girls, although boys did participate more in building, fetching water and collecting fire fuel.

Table 10.Sex Disaggregated Roles and Responsibilities of Lemlem Kebele Families' Reproductive and/or Homestead Activities

	MHH				Married Women				FHH		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Food Preparation	57	33	06	04	47	28	13	12	58	35	07
Washing utensils	48	33	07	12	49	25	15	11	59	41	0
Washing clothes	47	37	06	10	32	31	19	18	68	25	07
Child bearing/ rearing	51	27	13	09	37	29	18	16	53	40	07
Cleaning house, etc	50	31	11	08	54	33	04	09	37	63	0
Building and maintenance of houses/fences	13	09	47	31	14	16	37	33	53	11	36
Fetching water	42	37	12	09	34	35	14	17	34	34	32
Collecting fire fuel	44	27	15	14	42	36	12	10	47	32	21

When examining the roles men and women played in different community services in Tigray nationality households, there were many instances of shared responsibility. FGD respondents indicated that the genders played an equal – or nearly equal – role in water committee meetings, memorial festivities, involvement in NGO projects and involvement in political activities (Table 11). Responsibility for cleaning water sources was described by FGD participants as a male responsibility, although MHHs said that men were responsible for this task 56% of the time, while married women respondents said that men were responsible 34% of the time. The genders disagreed on the participation of boys, with the men saying boys did not clean water sources often (nine percent), while married women said that boys had a greater responsibility for this activity (19%). While participation in many community

services was equal for males and females, leadership roles were still considered a male responsibility.

Table 11.Sex Disaggregated Roles and Responsibilities of Lemlem Kebele Family Members in Different Community Services

	MHH				MW				FHH		
	Women	Girls	Men	Boys	Women	Girls	Men	Boys	Women	Girls	Boys
Water committee meetings	29	21	38	12	32	18	29	21	46	25	29
Cleaning water source	20	15	56	09	28	19	34	19	48	28	24
Care for old/sick persons	46	13	31	10	36	14	29	21	71	12	17
Working or participating weddings	43	20	27	10	31	22	27	20	71	13	16
Working or participating memorial festivities	42	12	25	21	37	18	31	14	58	29	13
Involvement in village meetings	47	15	30	08	46	09	33	12	51	28	21
Involvement in public works (government)	31	21	16	32	28	17	36	19	29	35	36
Involvement in NGO projects	23	27	14	36	31	20	22	27	59	18	23
Involvement in political activities	33	17	34	16	34	08	36	22	66	11	23
Membership in community organizations	37	22	28	13	32	06	44	18	70	09	21
Involvement in leadership of community organizations	31	07	53	09	27	02	60	11	73	06	21

Daily activity calendar of men and women.

Men and women had clearly defined daily roles and responsibilities in farm households, whether the activity is productive or domestic. To define these roles, a daily activity calendar (Table 12) was created with input from a group of MHHs, FHHs and married women from both Kunama and Tigray nationalities. The information generated was compiled and reported in a single time table (T-Table) depicting daily activities shouldered by males and females. This calendar assumed the rainy season as a peak season. Men had daily responsibilities for feeding cattle (oxen), preparing and assembling farm implements, farm work, collecting animals, and disassembling and storing farm implements. Men worked a daily reported average of 12.5 hours.

Women were responsible for a higher number of daily tasks. These included fetching water, house cleaning, food preparation, milking cows, coffee preparation, firewood collection, making beds, washing utensils, sorting out equipment, and preparing for the following day. Women worked a daily reported average of 16.5 hours.

Table 12.Daily Activity Calendar, by Gender

Men		Women	
Activities undertaken	**Time**	**Time**	**Activities undertaken**
Wake up	5:30 AM	4:30 AM	Wake up
Feeding cattle (oxen)	5:31- 6:00	4:30-5:00 AM	House cleaning
Preparing and assembling farm implements	6:01-6:30 AM	5:01-5:30 AM	Fetching water
Eating breakfast and coffee	6:31-7:00 AM	5:31-6:00 AM	Food preparation
Traveling to and working at farm	7:01 AM-1:00 PM	6:01-6:30 AM	Milking
Break for lunch	1:01-2:00 PM	6:01-6:30 AM	Serving foods to family and washing utensils
Working at farm	2:01-5:30 PM	6:31-7:00 AM	Coffee preparation and serving
Traveling back home and collecting animals	5:31-6:30 PM	7:00 AM-12:00 PM	Working at farm
Feeding animals at homestead	6:31-7:00 PM	12:01 AM-1:00 PM	Lunch preparation
Disassembling and storing farm implements	7:01 -7:30 PM	1:01 -2:00 PM	Serving lunch and washing utensils
Having dinner	7:31 -8:00 PM	2:01-5:00 PM	Working at farm
Coffee with family while planning for the following day	8:01-8:50 PM	5:01-7:30 PM	Going back home, fetching water and dinner preparation
Go to bed	9:00 PM	7:31 - 8:00 PM	Serving diner and washing utensils
		8:01 -8:50 PM	Preparing and serving coffee while talking and planning for the following day
		8:51:9:00 PM	Making bed to family members
		9:01- 10:00 PM	Sorting equipment and preparing for the following day
		10:00 PM	Go to bed
Total daily working hours	12:30 hours	16:30 hours	
Difference in working hours: 4:00 hours			

3.7. Participation in Household Decision Making

Access to different resources

Access to different productive resources was a determinant factor for the socio-economic status of a given household or individual. In the study area, there were differences in male and female access to different productive resources including extension education, improved sorghum varieties, chemical fertilizers, and income from the sale of sorghum produce. For both nationalities (Tigray and Kunama), FGD participants indicated that in most cases, men had better access to the aforementioned productive resources (Tables 13 and 14). In nearly every case, however, married women reported that they had greater access to resources than reported by the male heads of households. FHHs did report that they have access to all the services or resources.

Table 13.Sex Disaggregated Access to Different Resources (Zban Gedena Kebele)

R.N.	Types of services/ resources	MHH		MW		FHH	
		women	men	women	men	women	children
1	Extension education	32	68	36	64	62	38
2	Improved sorghum variety	27	73	31	69	51	49
3	Chemical fertilizer	36	64	29	71	58	42
4	Income from sorghum	24	76	32	68	61	39

Table 14.Sex Disaggregated Access to Different Resources (Lemlem Kebele)

R.N.	Types of services/ resources	MHH		MW		FHH	
		women	men	women	men	women	children
1	Extension education	28	72	39	61	42	58
2	Use Improved sorghum variety	21	79	38	62	63	37
3	Chemical fertilizer	30	70	40	60	30	70
4	Income from sorghum	31	69	36	64	36	64

Decision-making power within the household.

In the study area, men and women reported that the genders had different decision-making powers. FGD participants from the Tigray nationality indicated that in most

cases, men had greater decision-making powers than women (Table 15). When examining the responses, however, there were some interesting discrepancies between male responses and those of the married women in the same household. Male respondents reported that they made most of the decisions about the sale of sorghum products; married women respondents noted a greater number of decisions about sorghum sales were made jointly. There was also a big difference between how male and female respondents viewed decision-making power for the use of improved technologies. Married women FGD participants indicated a significantly higher number of male decision-making power (62%) than did respondents from MHHs (40%). The same was true for decisions about allocating income from the sale of sorghum: married women reported that men mostly were responsible for these decisions (66%), while men reported that they were responsible for these decisions 44% of the time.

In FHHs, decision-making regarding sorghum-related activities was a family event. For all categories, female heads of household reported that they made decisions jointly with their children (Table 15).

There was a difference between Tigray and Kunama nationalities in how decisions were reached. While decision-making power was mostly male for the Tigray nationality, the Kunama nationality used consensus to make decisions relating to sorghum production. In all cases, decisions were made jointly through discussion (Table 16). However, male and female respondents still showed a difference in how they perceived decisions were made about allocating income from sorghum sales. Male heads of household reported that these were mostly joint decisions (60%), but married women said that men made the decisions about income about a third of the time, and joint decisions were made less than half of the time (Table 16).

Table 15. Decision Making Power of Male- and Female-headed Households in Zban Gedena Kebele

	MHH			Married Women			FHH	
	Women	Men	Jointly	Women	Men	Jointly	Women	With Children
Variety selection	36	42	22	25	47	28	28	72
Sale of sorghum products	21	66	13	29	47	24	42	58
Use of improved technologies	31	40	29	21	62	17	35	65
Area allocation for sorghum	25	56	19	18	64	18	25	75
Allocation of income generated from sale of sorghum	33	44	23	18	66	16	32	68

Table 16. Decision Making Power of Male- and Female-headed Households in Lemlem Kebele

	MHH			MW			FHH	
	Women	Men	Jointly	Women	Men	Jointly	Women	With Children
Variety selection	23	24	53	21	26	53	26	74
Sale of sorghum products	20	21	59	26	31	43	22	78
Use of improved technologies	24	22	54	23	28	49	26	74
Area allocation for sorghum	24	26	50	28	23	46	26	74
Allocation of income generated from sale of sorghum	20	20	60	21	31	48	39	61

3.8. Major Constraints in Relation to Sorghum Production, Utilization and Marketing

Sorghum was one of the most widely grown food crops in the study area, although the crop was constrained by many factors. FGD participants were asked to rank these constraints to sorghum production, utilization and marketing (Table 17); they indicated that, though limited theoretical and technical training was provided every year, technical backstopping was not provided adequately at the time of sowing. FGD participants ranked this as the biggest

constraint that negatively affected sorghum production and productivity in the study area. If farmers in the study area had access to strong technical support at ground level, then they could manage issues as they arise.

FGD participants recognized the lack of improved seed as another of the economically-important challenges hindering the production and productivity of sorghum in the study area. Though farmers used improved varieties such as *Macia*, *Dekeba*, *Melkam*, *Abshir*, *Gobye*, *Birhan* and others, their supply was low. The third major challenge was rainfall shortages. The regional rainfall pattern is erratic and inadequate, which had an adverse effect on the production and productivity of sorghum in the study area. In addition to poor rainfall, FGD participants said weeds also created challenges when producing sorghum. The most common weeds affecting sorghum production in the study area included (in order of importance): *Zemed Begie*, *Humeray*, striga and *Sari Ambelay*. Market-related problems were ranked fifth. Market-related problems included low demand for sorghum produce, which was interpreted by a lower selling price ranging between 300-700 ETB/quintal in the study area.

FGD participants also indicated that the lack of improved farm implements (e.g., row planters, harvesters and threshers), limited awareness about improved sorghum production packages and sorghum diseases (anthracnose, smut, blight and shamla), also limited sorghum production in the study area. Participants ranked insects, the lack of input supply (i.e., reasonably-priced chemical fertilizer), effective and adequate extension services, and the lack of soil test-based chemical fertilizer as the least important factors constraining sorghum production (Table 17).

Table 17.Major Constraints in Relation to Sorghum Production, Utilization and Marketing

R.N	Challenges	1	2	3	4	5	6	7	8	9	10	11	Score before tie breaking	Score after tie breaking	Rank
1	Insects		2	3	4	1	6	7	1	1	10	1	4	4	9
2	Diseases			3	4	2	6	7	2	2	10	2	5	5	8
3	Weeds				4	3	6	3	8	3	3	3	7	7+1+1=9	4
4	Rainfall shortage (RF)					4	6	4	8	4	4	4	8	8+1+1=10	3
5	Input supply (IS)						6	7	8	5	5	11	2	2	10
6	Technical backstopping							7	6	6	6	11	8	8+1+1+1+1=12	1
7	Lack of awareness								7	7	10	11	6	6	7
8	Lack of improved seed supply									8	8	11	7	7+1+1+1+1=11	2
9	Lack of soil test based chemical fertilizer utilization										10	11	0	0	11
10	Lack of improved farm implements (row planter, harvester and thresher)											11	4	4+1+1+1=7	6
11	Market problems												6	6+1+1=8	5

4. Conclusions and Recommendations

4.1. Conclusions

- The majority of the farmers in the study area were using local sorghum cultivars.
- Within the study area, usage of improved sorghum-related packages was poor.
- Farmers used traditional crop production-related activities and used traditional farm implements.
- Sorghum was the most preferred crop commodity for human food, animal feed and shade construction purposes in the area and was mostly consumed in the form of *injera* and *kita*.
- On average, sorghum coverage and production increased for the last nine years.
- Sorghum was constrained by different factors, including poor technical backstopping and lack of adequate supply of improved sorghum seed.
- In comparison to other major crop commodities, sorghum ranked the highest in area coverage, productivity and production, while receiving the lowest price at market.
- There was a gap in roles and responsibilities of male- and female- headed farm households in relation to productive, homestead and community service activities.
- Women and girls were more overburdened than men and boys.
- Female-headed farm households had less access to productive resources.
- Except for certain decision-making processes, there were few differences in the roles and responsibilities across the two ethnic groups (*Kunama* and *Habesha Tigray*).

4.2. Recommendations

- Any research and developmental endeavors should focus on alleviating the most economically important factors hindering sorghum production and productivity, since the crop is widely used in the study area.
- Research endeavors should to focus on generating improved sorghum varieties that can be best used in the form of *injera* and *tela*, a local beer/ alcoholic beverage.
- There are many different sorghum varieties and improved cultivars grown in the study region. Research and development should engage actively to enhance production and productivity of sorghum using locally-available sorghum cultivars preferred by farmers.

These cultivars should include those that are drought-, disease- and insect-resistant/tolerant.

- District extension workers should organize community demonstration activities to educate farmers in the study area about the importance of improved sorghum packages and how to utilize them.
- Because female heads of household often allocate smaller acreages for sorghum because of smaller land holdings, any research and/or development endeavors should enhance female-headed farm households' sorghum productivity and land holdings.
- Improved farm implements (e.g., row planter, harvester, thresher) need to be developed, demonstrated and distributed.
- Policymakers, researchers and organizations should work to strengthen the sorghum value chain.
- Policy makers should focus on bridging the existing gap in the roles and responsibilities between male- and female-headed farm households in relation to productive, homestead and community service activities.
- The gender disparity in daily work hours suggests that women in the study area are overburdened by productive and homestead activities. A more effective intervention plan needs to be developed to create awareness of this inequality in the farm households' daily responsibilities. This could also include the introduction of improved technologies such as water lifting technologies, milk churner, upgraded stoves, and other tools that could save women energy and time.
- Policy makers should create awareness to boost women's and girls' access to productive resources.
- Scientific researchers should be fully engaged in solving the sorghum-related challenges highlighted by FGD and KII participants.

5. REFERENCES

CSA (Central Statistical Agency). (2013). *Population Projection of Ethiopia for All Regions*. At District Level from 2014 – 2017, Addis Ababa, Ethiopia. Accessed on https://www.scribd.com/document/343869975/Population-Projection-At-Wereda-Level-from-2014-2017-pdf

Tahtay Adyabo District Office of Agriculture and Rural Development. (2015). *Annual report.* Sheraro, Ethiopia: Author.