PARTICIPATORY GENDER ANALYSIS IN SORGHUM BASED FARMING SYSTEM; THE CASE OF ASSOSA DISTRICT IN BENISHANGUL GUMUZ REGION OF ETHIOPIA

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List of Acronyms

AsARC	Assosa Agricultural Research Center
CSA	Central Statistics Agency
DAs	Development Agents
EIAR	Ethiopian Institute of Agricultural Research
FGDs	Focus Group Discussion
FHHs	Female-Headed Households
KAs	Kebele Administrations
MHH	Male-Headed Households
NGOs	Non-Governmental Organizations
PRA	Participatory Rural Appraisal
SMIL	Sorghum and Millet Innovation Lab

Executive Summary

Sorghum is the major food crop in area cultivation and production in Benishangul Gumuz region in general and in Assosa woreda in particular. Thus, sorghum has multiple values for smallholder farmers in terms of food, feed and fuel for cooking. However, the major constraints of sorghum production, marketing and utilization have not yet been studied. Consequently, this research identified the production, marketing and utilization constraints along the sorghum value chain and the role of gender in sorghum-based farming systems in indigenous and settler communities in Assosa woreda. Biotic and abiotic factors constraining sorghum production were also identified.

With these factors in mind, this research also analyzed the reproductive and productive roles of household members by gender. It was determined that women and girls contributed significantly to the agriculture sector at a micro level by engaging in productive, reproductive and community services. However, their contribution was not recognized. Consequently, though the labor contribution of women remained at its highest level, research, extension and development interventions were skewed towards men. For this reason, women's participation in extension services, such as access to credit, improved seeds and fertilizers, and control over productive factors such as land was limited.

Therefore, it is suggested that research and development endeavors focus on solving the major production and marketing constraints along sorghum value chain to improve production and productivity of sorghum. This could be achieved by generating high-yielding varieties with disease and pest resistance. We also suggest that further empirical evidence is needed on the role of gender in agriculture at the regional level, in order to craft appropriate policy and strategies to mainstream gender. Access to extension services and productive resources such as inputs, improved farm implements, extension education and credit should be created especially for women, especially those in female-headed households. Training on sorghum productive activities should be targeted, based on the labor contribution of different genders and households to improve production and productivity.

1. Introduction

Sorghum is one of the staple food crops for both indigenous and settler communities in the Benishangul Gumuz region in general, and Assosa woreda in particular. This region is the center of diversity for sorghum, and the crop is grown in agro-ecological zones ranging from *Kurmuk (*hot to warm moist lowland plains) with altitudes ranging from 500-1200 m, to Mao-komo special woreda with maximum altitudes ranging up to 1900 m. Moreover, the Assosa and Kamashi zones and the Mao-komo special woreda are mid-altitude zones (between 1600 and 1900 m) and dry lowlands and wet lowlands with elevations of less than 1600 m, according to sorghum-growing agro-ecology classifications.

In Assosa, sorghum is the second staple crop next to maize in terms of production, and the livelihood of the area's smallholder farmers highly depends on it. Although sorghum remains an important crop providing farmers with both food and economic benefits, it could give a better yield in marginal land, unlike other cereal crops. Moreover, relative to other crops' agricultural practices (e.g., land preparation and weeding) sorghum production consumes less human power and it is also easy to thresh. The per-capita consumption of sorghum has increased in areas affected by adverse climate conditions that favour the production of sorghum (as a drought-tolerant crop) instead of other cereals in Ethiopia (Demeke, 2013).

In Benishangul Gumuz, the role of gender in sorghum production is as yet undetermined. Preliminary survey results showed that farmers relied mainly on manual methods of labor for sorghum cultivation, supplied mostly by family labor. Especially in the region's indigenous communities, men and women, as well as children, play a tremendous role in food security. For instance, most household members are involved in all agricultural activities such as plowing by hand, hoeing, weeding, harvesting and threshing (AsARC, unpublished 2006). In addition to these activities, women cared for children, fetched water, gathered firewood, cooked, processed milk and kept animals.

Gender division of labour is not only related to the work done by men and women but also recognizing that men and women do different work and, hence, possess different types of indigenous knowledge. In addition to on-farm activities and household duties, women in Assosa dominated the marketing activities for sorghum production. Women often threshed and winnowed sorghum, while the

fabrication of hoe handles and construction of storage sheds were activities solely for men. Women had more knowledge of cooking, food processing, preservation and storage.

This research was conducted under guidance and training given by senior EIAR staff and improved by key stakeholders. Accordingly, a team of researchers from various disciplines (agricultural economist, breeder, agronomist and crop protection) was established, and data were collected using PRA techniques. This research provides the details of the major constraints and the role of gender along sorghum value chains.

2. Methodology

2.1.Description of the study area

Assosa Zone has seven districts, and the research group selected Assosa district due to its sorghum production potential. Assosa district is inhabited mostly by indigenous (Berta) and settlers from Amhara, Tigray and Oromia. Assosa district has 78 KAs; 38 of them are indigenous and the remaining 76 are settlers. These communities have their own long-developed farming and livestock practices and natural resource management (forestry and soil). Socio-economic resources such as land holding and farming implements are different between the two communities. Depending on these criteria, two major sorghum growing Kebele Associations (KAs), namely Nebar Komeshga (indigenous) and Selga 24 (settlers) were selected for this study.

Table 1. Sampled Households

Group type	**# of residents**	**Type of Community**
FHH	8	Indigenous
Married Women	12	Indigenous
MHH	12	Indigenous
FHH	12	Settlers
Married Women	9	Settlers
MHH	12	settlers
Total	**65**	

The results were based on data collected using PRA tools selected from major sorghum-growing kebeles located in Assosa during the 2017 cropping season. Farming systems were stratified into KAs (settlers and indigenous) and sorghum growers were selected based on their experience, knowledge and gender in consultation with DAs and woreda experts. Accordingly, six FGDs were established (Table 1). Data related to production, marketing and utilization, gender roles and other socio-economic and institutional factors were collected.

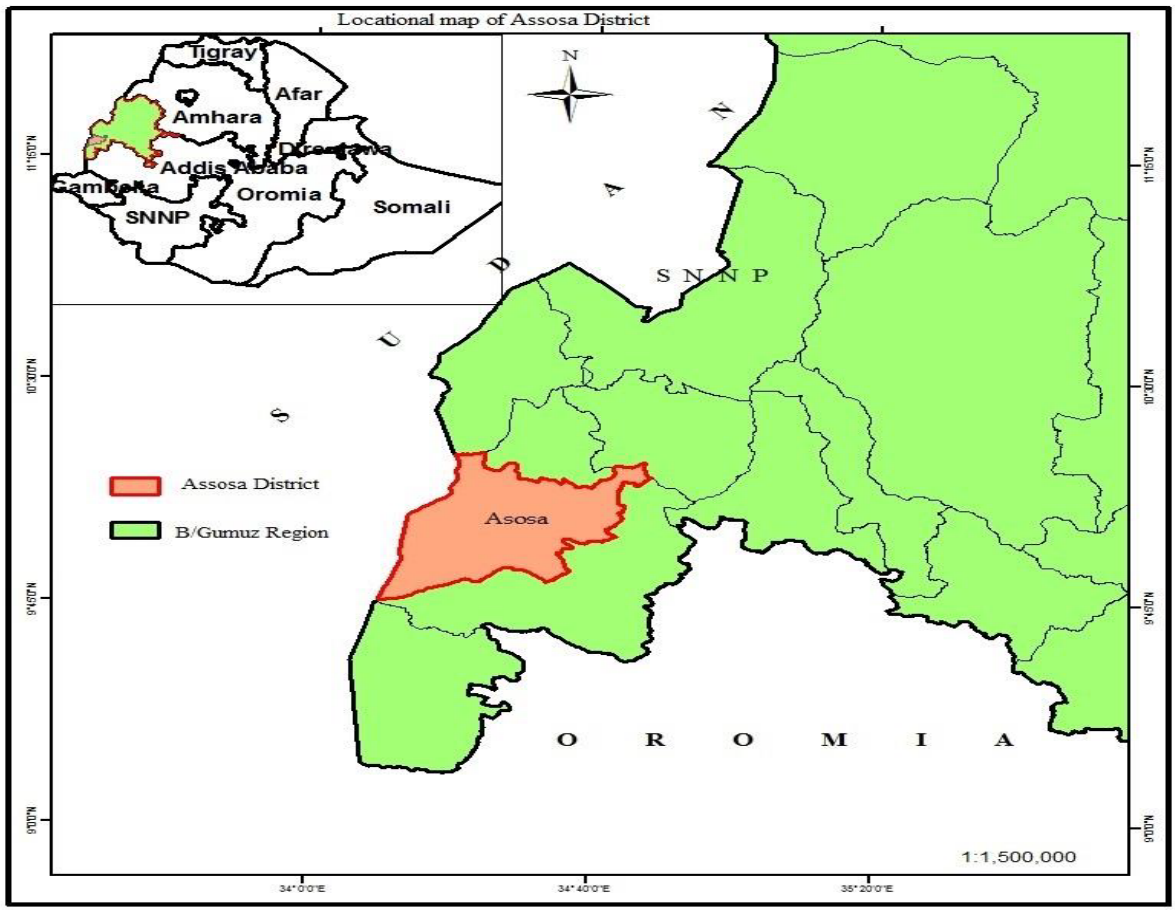


Figure 1. Map of the study area

2.2. Data Sources, Tools and Analysis

The research reviewed and analyzed results using existing secondary data with an emphasis on trends in sorghum production, marketing, value chain and other secondary data relevant for analysis and gap identification. The secondary data were collected from relevant sources such as published and unpublished regional and woreda level documents, journal articles, and others.

Moreover, primary data were collected and generated using FGDs and a semi-structured checklist. To achieve the stated objective, descriptive data analysis was employed to analyze the role of gender in sorghum farming systems using proportional piling, T-Tables, ranking, seasonal calendars and trend analysis. The collected data were compiled and analyzed using appropriate statistical methods. The quantitative and qualitative data were analyzed based on descriptive and narrative analysis technique, respectively.

3. Results

3.1. Regional Profile

Benishangul Gumuz has an estimated area of 51,000 km^2 and is located in the northwestern part of Ethiopia. It shares common borders with the state of Amhara in the east, Sudan in the northeast, and the state of Oromia in the south. It is divided into three administrative zones, 19 woredas (two of them special woredas), and 33 kebeles (the smallest administrative units). Metekel is the largest zone with an area of 26,272 km^2 followed by Assosa (14,166 km^2), and Kamashi (8,850 km^2).

Benishangul Gumuz has a diverse topography and climate. The latter includes the familiar traditional zones: *kola*, *dega* and *woyna dega*. About 75% of the region is classified as *kola* (lowlands), with an elevation ranging from 550 to 2,500 meters. Average annual temperatures are between 20-25 C, but during the hottest months (January - May) the region can reach temperatures from 28-34 C. In Assosa, the annual minimum and maximum mean temperature for the last 26 years is 12.4 C and 27.8 C, respectively. The rainy season lasts from May to October with rainfall amounts ranging from 500 to 1800 mm. Elevations in Assosa range from 600 m in the areas bordering Sudan to over 2500 m.

According to a July 2011 population projection, the population was estimated at 938,996 of which 51% were males and 49% were females (CSA, 2013). Rural population was estimated at 788,893 while the urban population was about 150,103 which indicates that agriculture is the mainstay of this regional state. The main annual crops grown in Benishangul-Gumuz include maize, sorghum, haricot bean, sesame, noug, millet and peanut. The *meher* growing season (April to September/October) accounts for 100% of the region's annual crop production. Other sources of income in the region include small-scale gold mining (which is limited to certain woredas), wild foods collection (which is threatened by heavy deforestation largely by wild fires and settlement activities) and wage labor.

Sorghum remains the first crop in area of cultivation in Benishangul Gumuz. In the 2013 cropping season, it accounted for about 65,933.36 cultivated hectares while maize was the second cereal crop, accounting for 49,476.37 cultivated hectares. The average regional productivity level of sorghum was below the national average productivity level (Figure 2) (CSA, 2013).

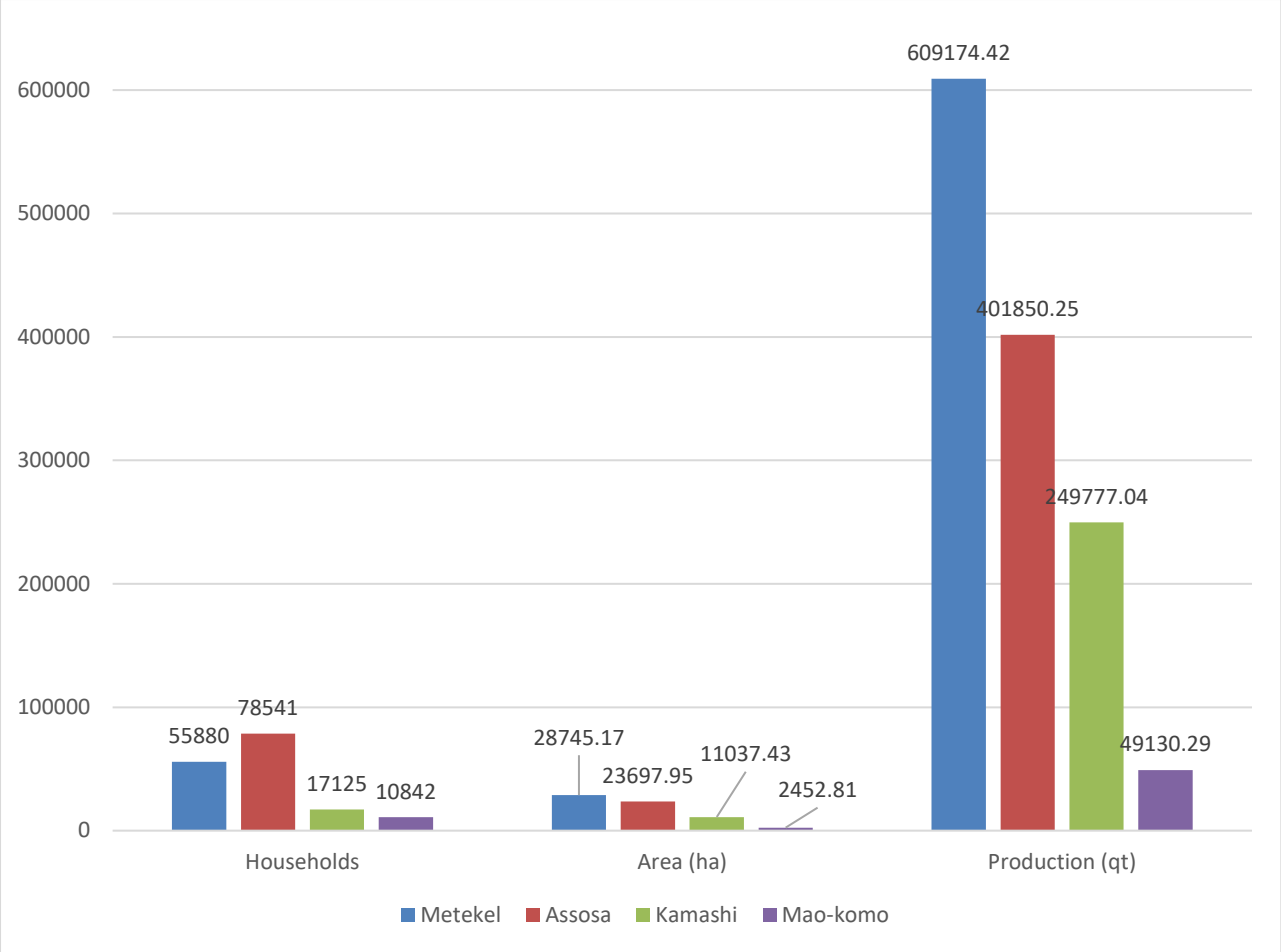
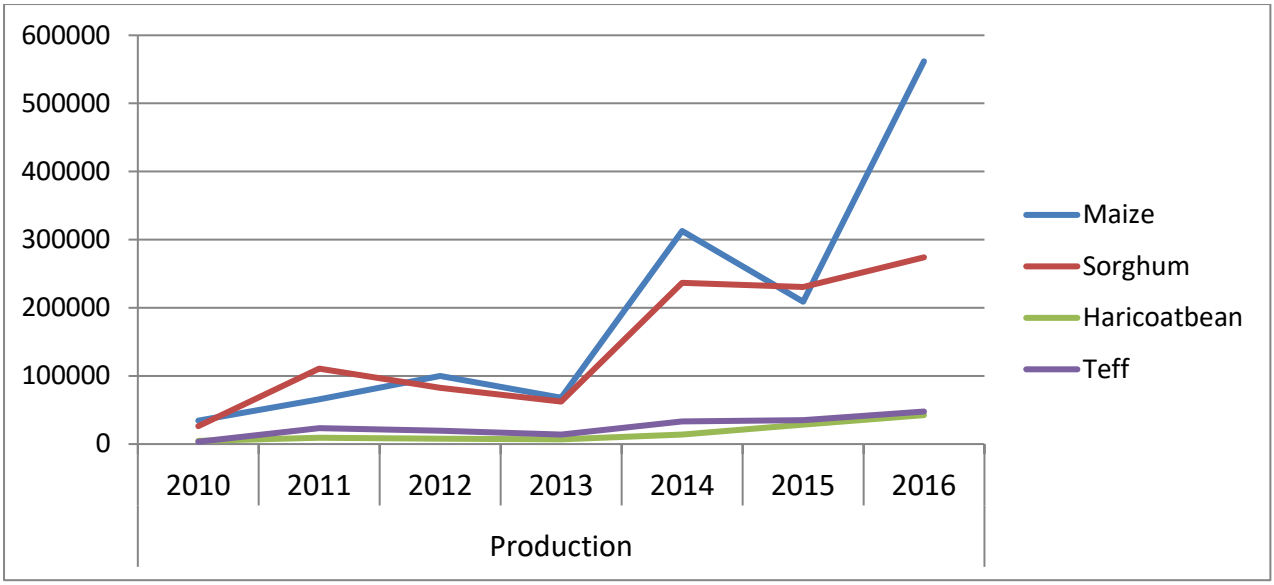


Figure 2. Sorghum-producing households, area, and production in Benishangul Gumuz region

Improved sorghum varieties, information and technology transfer in Assosa is dominated by the regional agriculture bureau structure. Training on crop production and post-harvest is provided by regional-, zone-, district- and kebele-level experts. Agricultural research centers, governmental and non-governmental input and service providers are sources of improved technologies, training on crop production and extension services. The technology transfer modalities in Assosa are demonstration plots done on farms, research stations and FTC, exhibitions, farmers' exchanges and field visits, media and training. However, farmers in Assosa have limited access to information on input and output markets.

3.2. Sorghum Production Trends

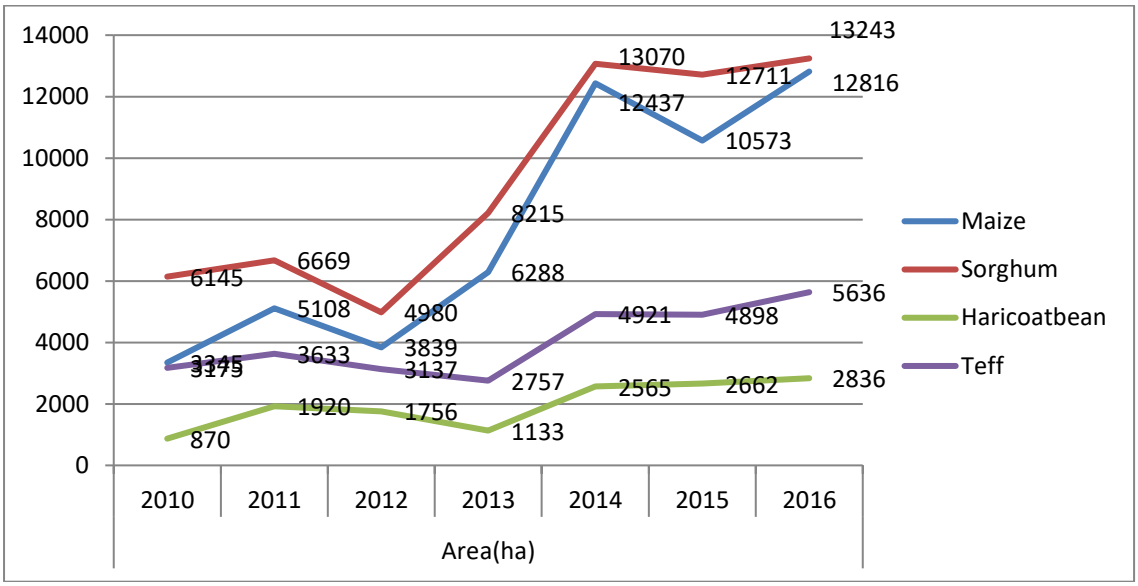
To elucidate sorghum production trends at district level, the project team used seven consecutive years of data complemented by FGD results. Consequently, results showed that sorghum production in Assosa increased from the year 2010 to 2011. However, it showed a decreasing trend for the years 2012 and 2013 while increasing from 2014 to 2016 (Figure 3).



Source: Assosa Woreda Agricultural and Rural Development office, 2017.

Figure 3. Major crop production (qt) in Assosa district

However, sorghum remained first in terms of area production at the district level, followed by maize (Figure 4). Farmers increased their sorghum cultivation from 2010 to 2011, decreased sorghum cultivation for 2012 and then showed a steady increase for two consecutive years (from 2013 to 2014). There was a stable trend for sorghum cultivation for 2015-16.



Source: Woreda Agricultural and Rural Development Office, 2017.

Figure 4. Area covered by major crops (ha) in Assosa district

FGD results revealed that the acreage planted for sorghum increased during the last 10 years for indigenous FHHs, while production decreased due to biotic and abiotic factors as indicated in Table 2. However, married women (both indigenous and settlers), and MHHs (indigenous and settlers)

described a 10-year decreasing trend of cultivated sorghum area and sorghum production. Results obtained from the district-level regarding sorghum acreage and production agreed with FGD results, for the most part. Differences between the two may be due to the fact that annual production trend data were not collected in FGDs; production trends may have increased at the district level and decreased at the kebele level as socio-economics and farming systems changed from year to year.

The biotic and abiotic factors hindering sorghum production included the parasitic weed striga, bird damage, shoot fly, low soil fertility, termites, low grain prices and shortages of farm land (Table 2). These factors resulted in farmers substituting cash crops like soybean, noug, groundnut, and other cereal crops like teff and maize.

Table 2. Farmer Responses on Trends in Sorghum Production

Group type	**Trend in the last 10 years**		**Reasons for change**
	Area	Production	
FHH (IND)	Increasing	Decreasing	Striga, bird damage, cut worm, shoot fly
Married Women (IND)	Decreasing	Decreasing	Bird damage and cut worm
MHH (IND)	Decreasing	Decreasing	Striga, dodder (Malalmush) weed substituted by soybean and noug
FHH (settlers)	Decreased	Decreased	Poor soil fertility (the land has been cultivated for long period of time) striga, termites
Married Women (settlers)	Decreased	Decreased	Low grain price and farm land shortages substituted by cash crops like groundnut and teff
MHH (settlers)	NA	NA	Striga, soil acidity, livestock death

3.3. Cropping Calendar

As shown in Table 3, land clearing and first cultivation for farmers in indigenous communities was in March, and second cultivation followed at the end of March or in April. Based on the availability of resources (e.g., oxen for plowing), time and rainfall for sowing, the third cultivation and planting began between mid-April and the end of May. First weeding started in June and second weeding in July and August. If necessary, third weeding was conducted in September.

Table 3. Cropping Calendar (Indigenous communities)

Crop type	Jan	Feb.	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Sorghum	9	10	1,10,11	2,5,12	3,4,5	6	7	7	8	12	12	
Maize			1,10,11	1	1,2,3,5	5,6	6,10,11	7,8	8	9		
Millet	12		1,2	3		5	6	6,7		9	9,10	10,11
Teff		12	1	2	2,3		4	5	6,7	8	9,10,11	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

Farmers harvested sorghum in January and threshed and winnowed in February and March. Sorghum products were taken to market after threshing in February and March. Based on price signals, product availability, and financial needs, sorghum marketing mainly sold in April, October and November (Table 3).

For the settler communities, land clearing also was during March and April. First, second and third cultivation was made in April and May. However, settler communities planted sorghum in May and at the start of June. Weeding started in June and ended in September. Settler communities harvested sorghum from December and into January (Table 4).

Table 4. Cropping Calendar (Settlers)

Crop type	Jan.	Feb.	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Sorghum	9,10,11	10,12	1,10, 11	1,2, 5	2,3,4, 5	5,6	6	7	7 ,8	12	12	9
Maize			1,10,11	1	1,2,3,5	5,6	6	7,8	8	9	10,11	
Teff	10,11	10,11				1	2	3,5	5.6	7		9
Millet				1,2	3,5	5	6,7				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

3.4. Importance of Sorghum in the Study Area

For both settler and indigenous communities, sorghum was economically important and a key food source in Benishangul Gumuz region in general and Assosa district in particular. Based on proportional piling results, Figure 5 depicts that maize and sorghum were almost equally

important crops for both FHHs and MHHs in indigenous communities, followed by soybean. Although these were the top three ranking crops, different household types disagreed about their importance. FHH (indigenous) said that maize had the most acreage, followed closely by sorghum. These households indicated that soybean accounted for less than half the acreage of either sorghum or maize. MHH (indigenous), however, indicated that sorghum had the most acreage, closely followed by both maize and soybean.

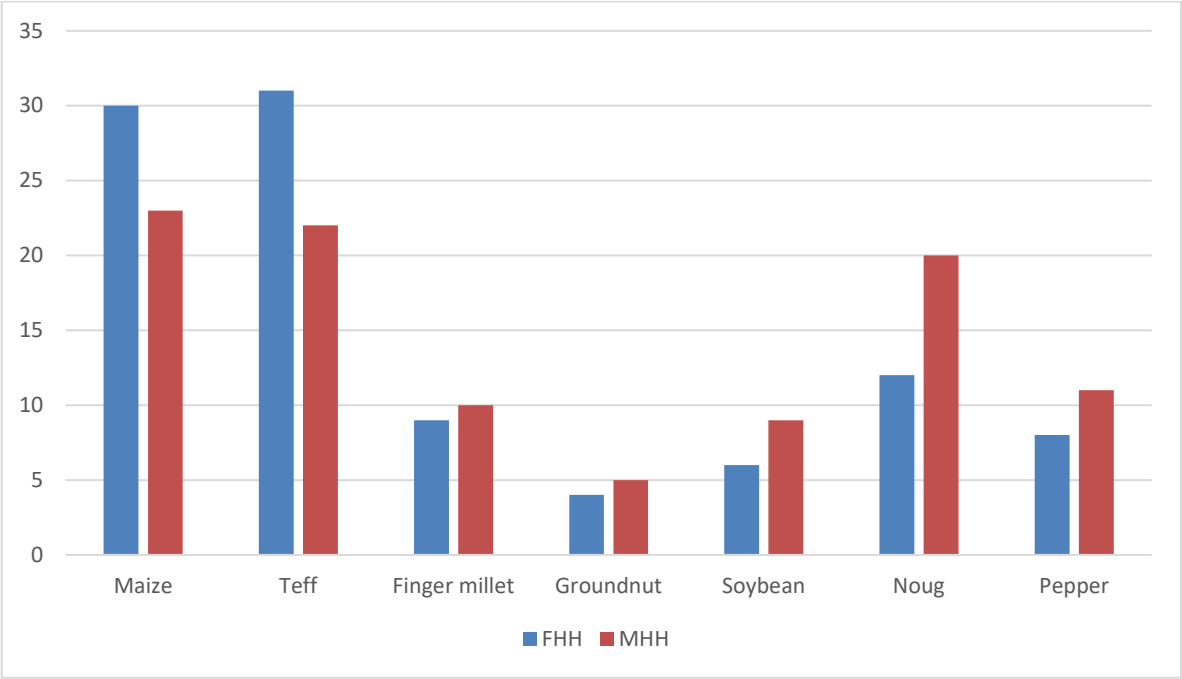


Figure 5. Major crops in terms of area coverage for indigenous communities

For settler communities in Assosa, sorghum followed maize as the second most-important crop (Figure 6). However, these communities planted a substantial acreage of other crops as well. Maize, teff and groundnut were crops commonly substituted for sorghum. The main reasons for substituting maize for sorghum was the high productivity of maize relative to sorghum; teff and groundnut grain prices were high compared to sorghum.

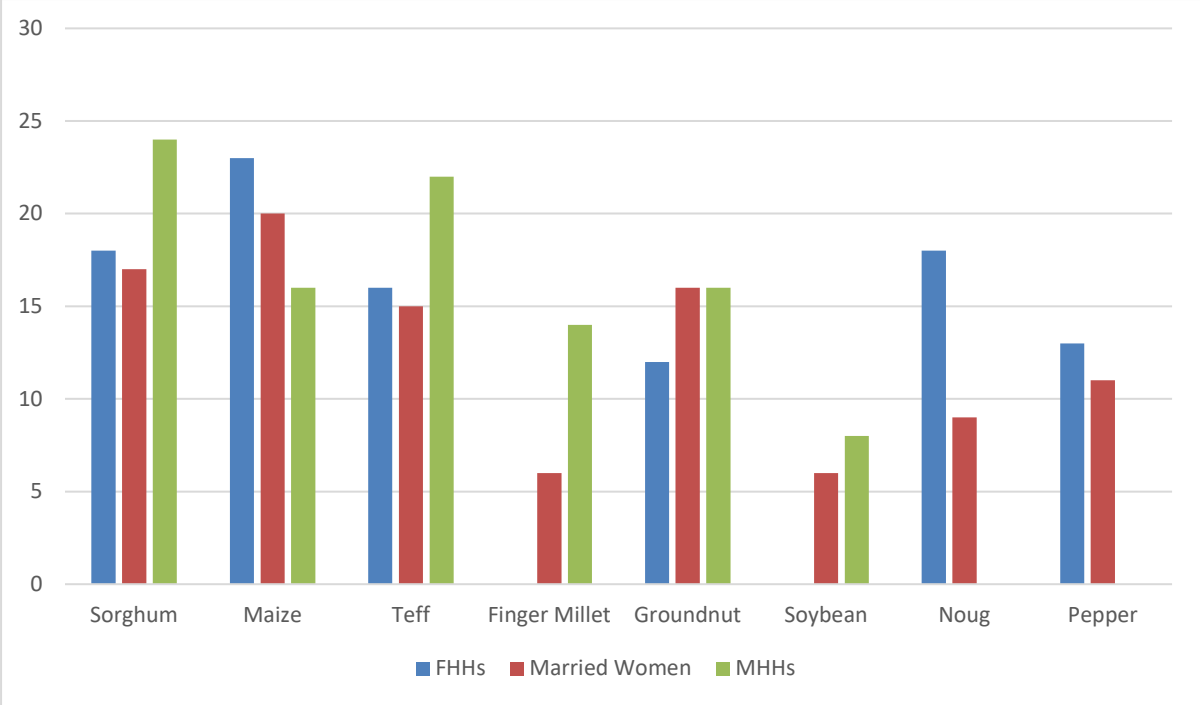


Figure 6. Major crops in terms of area coverage for settler communities

Results from the pair-wise matrix indicated that, out of seven crops, sorghum was the second most-important crop for indigenous communities (Nebar Komeshga) and the third most-important crop for settlers (Selga-24). Maize was the first most-important crop for indigenous communities and teff was most important for settlers (Table 5). The main reason for these responses was due to the low productivity of sorghum; both communities substituted other crops, such as maize, to make up for this lack. Settler communities reported that they substituted teff for sorghum due to sorghum's low grain market price.

Table 5. Rank of Importance of Sorghum Compared to Other Crops (pair-wise matrix)

Crop type	Indigenous community			Settlers		
	FHH	Married Women	MHH	FHH	Married Women	MHH
Sorghum	2	2	2	3	2	3
Maize	1	1	1	2	1	2
Teff	4	4	7	1	3	1
Millet	5	5	6	4	4	5
Groundnut	7	6	4	5	6	4
Soybean	3	7	3	6	8	6
Noug	6	3	5	7	7	

3.5. Sorghum Availability Year-Round

Having sorghum available as a food source year-round was important for both indigenous and settler communities in Assosa. FHHs (indigenous) explained that sorghum was available for

food in the household from February to September; beginning in October and November, little sorghum grain was available, and during the last two months prior to harvest, household members suffered from chronic sorghum shortages. The reason for these shortages included lack of high-yield improved varieties, use of only traditional agronomic practices, and use of only traditional farm tools, among others. Unlike women in FHHs, married women in MHHs (indigenous) responded that there was little or no shortage of sorghum for food in the household during the year. This may be due to the fact that married women have access to productive resources to produce enough sorghum for food throughout the year. According to men in MHHs, end-of-the-year shortages were due to pests damaging the sorghum that had been stored for food.

Table 6. Household Coping Strategies for Sorghum Shortages

Group type	**Coping strategy**
FHH (indigenous)	sell livestock like goat, sheep and participate in non-farm activities like gold mining
Married Women (indigenous)	sell livestock products
MHH (indigenous)	consume maize after sorghum has finished; sell agricultural products like nug, teff, ground, and soybean
FHH (settlers)	sell livestock to buy sorghum from the market
Married Women (settlers)	mix/blend sorghum with other crops like teff, millet and maize; sell groundnut and buy sorghum.
MHH (settlers)	sell livestock, poultry, sheep, goat

Respondents from FHHs (settlers) indicated that lack of access to adequate inputs (improved seed and fertilizer) temporally and spatially led to sorghum for food shortages throughout the year. FGD participants said that the sorghum produced did not last even for six months. Unlike their peers in the indigenous communities, married women in settler communities said that sorghum for food was not available throughout the year. These women faced chronic shortages, especially for the last four months before harvest; the reason given for the shortage was low sorghum yield and striga infestation associated with low soil fertility. However, the men in these same households indicated sorghum for food was not a problem.

3.6. Gender and Family Roles in Sorghum Production

3.6.1. Sorghum production activity profile for indigenous communities.

Different household members were assigned specific productive activities. Most of the time, women in both MHHs and FHHs cleared planting areas. Male respondents said that this task was shared by both genders (Table 7). Indigenous communities in Assosa used

both hand hoes and oxen to plow. This task was given mainly to males: in FHHs, boys plowed using oxen. In MHHs, the men did the plowing. Manual hoeing was reported as a task for females, but respondents disagreed on how this task was split. While FHHs and married women said that hand hoeing was overwhelmingly a job for females, men from MHHs said that men and boys participated 47% of the time (Table 7).

Table 7. Sorghum Production Activity Profile (Indigenous Communities)

Activity title		FHH			Married Women				MHH			
		W	**G**	**B**	**W**	**G**	**M**	**B**	**W**	**G**	**M**	**B**
Clearing		75	15	10	75	25	0	0	27	25	35	13
Plowing using oxen		0	0	100	0	0	90	10	0	0	65	35
Digging using hand hoe		60	30	10	0	0	100	0	43	20	30	7
Sowing	Broadcasting	50	15	35	0	0	0	0	35	9	35	21
	Row planting	N/A	N/A	N/A	25	25	25	25	25	25	25	25
Weeding		67	16	17	77	19	0	4	56	22	0	22
Applying pesticides		N/A	N/A	N/A	0	0	100	0	28	23	31	18
Applying fertilizers		N/A	N/A	N/A	30	25	30	15	25	25	25	25
Bird-scaring		100	0	0	0	50	0	50	0	0	61	39
Harvesting		100	0	0	0	50	0	50	22	6	49	23
Transporting harvest from field		70	15	15	35	24	40	1	33	28	23	16
Threshing		90	5	5	75	0	25	0	48	25	14	13
Winnowing		90	5	5	75	0	25	0	48	25	14	13
Marketing		89	6	5	100	0	0	0	34	0	66	0

Farmers in these communities planted sorghum using both broadcasting and row planting. FHHs said sorghum planting was done mostly by the women in their households (50%) followed by boys (35%) and girls (15%). FHHs reported that they never used row planting, despite its importance for crop management as well as for increased production and productivity. Male and female respondents from MHHs had conflicting responses about sowing practices and responsibilities. All respondents (male and female) from MHHs said that the responsibility for row planting was evenly split between the genders. However, when it came to broadcasting, married women said that it was never practiced, while men from the same households said that the responsibility for broadcasting was split evenly between men and women, boys and girls (Table 7).

Survey results (Table 7) indicated that all household types considered weeding a task for females. This was particularly true for women in FHHs, where 81% of the weeding was done by women and girls, and married women said that the numbers were even higher (96% of weeding done by women and girls). Male respondents from MHHs gave lower

numbers, saying that women and girls were responsible for 78% of the weeding, while boys were responsible for the remaining 22% (Table 7).

The soil type in Assosa is red and characterized by low soil fertility. As a result, application of fertilizer is mandatory for increased production and productivity. However, FHHs reported that they never applied or used any type of fertilizer. This could have been due to lack of access, availability and affordability of fertilizers for FHHs. Respondents from MHHs said that the responsibility for fertilizer applications was split evenly between the genders, although men said that it was split evenly between men and women, girls and boys, whereas married women from the same households said that children were responsible for a smaller percentage of fertilizer applications. Likewise, women from FHHs also reported that they never applied pesticides to their sorghum crops. MHHs did use pesticides, but the genders disagreed on the activity profile: married women said that this responsibility was 100% male, while men from the same households said that women and girls applied pesticides 51% of the time, while men and boys applied pesticides to crops 49% of the time.

As shown in Table 7, sorghum harvesting was a responsibility only for women in FHHs, while married women said that harvesting was a responsibility split evenly by the household's children (boys and girls). Men from the same households had a different perspective; they said that sorghum harvesting was done mostly by men (49%), but that boys and women also played a role in the task. Transporting sorghum from the field was done mostly by women in FHHs (75%), with the remaining done by household children. For respondents from MHHs, opinions again varied. Married women said that the task was more or less evenly split between men and women, with some assistance from boys. Men from MHHs said that women and girls were responsible for 61% of the transportation, with men and boys responsible only for 23% and 16%, respectively.

Threshing and winnowing were completed simultaneously. For FHHs, women contributed 90% of the labor for this task. Married women said that they contributed 75%, with the men contributing the remaining 25%. However, men from the same MHHs said that children played a much larger role in this task and indicated that women were responsible for threshing and winnowing only 48% of the time, with girls responsible for 25%, men responsible for 24%, and boys for the remainder (Table 7). There were further differences

between household members when discussing marketing. Married women said that they were responsible for 100% of the marketing, while men from the same households said that men were responsible for marketing 66% of the time.

3.6.2. Sorghum production activity profile for settler communities.

As shown in Table 8, FHHs revealed that 90% of clearing activities were done by women in their households. Married women said that clearing was mostly a responsibility for men (50%), but the men from the same households said that land clearing was not practiced in Selga 24. Boys did most plowing activities in FHHs, while respondents from MHHs (male and female) said that plowing was a responsibility mainly for men, with some assistance from boys. Unlike the indigenous communities, settler communities did not use hand hoes for plowing purposes.

Table 8. Sorghum Production Activity Profile (Settler communities)

Activity title	FHH			Married Women				MHH			
	W	G	B	W	G	M	B	W	G	M	B
Clearing	90	5	5	23	18	50	9	n/a	n/a	n/a	n/a
Plowing using oxen	10	n/a	90	n/a	n/a	70	30	n/a	n/a	75	25
Digging using hand hoe	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Broadcasting	n/a	n/a	n/a	n/a	n/a	67	33	n/a	n/a	n/a	n/a
Row planting	50	25	25	22	10	51	17	36	12	36	16
Weeding	55	20	25	45	17	21	17	30	10	50	10
Applying pesticides	70	15	15	16	17	50	17	30	n/a	70	n/a
Applying fertilizers	70	10	20	48	28	n/a	24	40	10	40	10
Bird-scaring	0	0	0	0	0	0	0	0	0	0	0
Harvesting	70	15	15	23	18	41	18	n/a	n/a	85	15
Transporting harvest from field	80	10	10	49	20	19	12	75	5	20	n/a
Threshing	90	5	5	n/a	n/a	66	34	18	6	70	6
Winnowing	90	10	n/a	0	0	66	34	0	0	100	0
Marketing	98	n/a	2	none marketable				70	n/a	n/a	30

Respondents from FHHs said that sowing using broadcasting was never used (Table 8). Male respondents from MHHs agreed, but married women from the same households said that broadcasting was done by men (67%) and boys (33%). Row planting was employed more regularly, according to FGD participants. In FHHs, women (50%) split the responsibility for row planting with girls (25%) and boys (25%). Men from MHHs also said that row planting was a shared responsibility between the genders, with both men and women in the households responsible for this activity 36% of the time, respectively.

Household children also participated. However, married women from the same households said that men had a greater share of the responsibility for row planting (51%), while women were responsible for a much smaller percentage (22%).

Women mostly were responsible for weeding activities in FHHs. Men said that they were responsible for weeding half the time, whereas married women in the same households said that men were responsible for this activity only 21% of the time (Table 8). Children (boys and girls) participated in weeding much less when compared to their adult counterparts. Threshing and winnowing was done by female heads of household, but in MHHs, these were considered male responsibilities. Men considered marketing a female responsibility, but women from the same households said that sorghum was not taken to market. Respondents from FHHs said that marketing was left mostly to the women (Table 8).

3.7. Reproductive Role of Gender and Family Members in Sorghum-Based Farming System

Generally, males and females play both productive and reproductive roles in society. While gender roles differed by culture, societal group, geographic location or customs, FGDs in Assosa showed that both men and boys played productive and reproductive roles, while women and girls contributed largely to reproductive roles both in the household and in the community (Table 9).

According to FGD results from indigenous communities, women and girls were responsible for activities like food preparation, washing utensils, washing clothes, childbearing and children rearing, cleaning houses, fetching water, collecting fuel wood, clearing water sources, and care for old/sick persons. As shown in Table 9, men and boys contributed little to these activities. However, there were some discrepancies in responses. For example, while male respondents said they played no part in child rearing, married women said that men and boys were responsible for this 35% of the time.

Table 9. Community Activities by Gender (Indigenous Communities)

Activity	FHH			Married Women				MHH			
	W	G	B	W	G	M	B	W	G	M	B
Food preparation	60	40	n/a	70	30	n/a	n/a	39	61	n/a	n/a
Washing utensils	60	40	n/a	54	46	n/a	n/a	40	60	n/a	n/a
Washing clothes	50	50	n/a	70	15	n/a	15	35	50	n/a	15
Childbearing and child rearing	70	30	n/a	50	15	20	15	68	32	n/a	n/a
Cleaning house, etc.	51	49	n/a	70	15	n/a	15	56	44	n/a	n/a
Building and maintenance of houses/fences	n/a	n/a	100	50	n/a	50	n/a	0	0	62	38
Fetching water	74	26	n/a	75	25	n/a	n/a	68	32	n/a	n/a
Collecting fuel wood	70	30	n/a	70	20	n/a	10	51	49	n/a	n/a
Collecting animal dung	66	34	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Water committee meetings	100	n/a	n/a	25	n/a	70	n/a	50	n/a	50	n/a
Cleaning water source	100	n/a	n/a	90	10	n/a	n/a	100	n/a	n/a	n/a
Care for old/sick persons	60	40	n/a	50	25	10	15	70	n/a	30	n/a
Weddings	72	38	n/a	25	25	25	25	29	28	29	15
Funerals	72	38	n/a	20	10	60	10	32	16	39	13
Involvement in village meetings	100	n/a	n/a	40	n/a	60	n/a	50	n/a	50	n/a
Involvement in public works	100	n/a	n/a	50	n/a	50	n/a	51	n/a	49	n/a
Involvement in NGO projects	n/a	n/a	n/a	n/a	n/a	n/a	n/a	50	n/a	50	n/a
Involvement in political activities	100	n/a	n/a	40	n/a	60	n/a	30	n/a	70	n/a
Membership in community organizations	50	n/a	50	50	n/a	50	n/a	40	n/a	60	n/a
Involvement in leadership of community organizations[1]	10	n/a	n/a	20	n/a	80	n/a	29	71	n/a	n/a

The major reproductive roles of men and boys in the indigenous communities were limited to building and maintaining houses/fences, participation at water committee meetings, involvement in political activities, membership in community organizations and involvement in community organization leadership. There were some differences in responses here, as well. For example, while married women indicated that building and maintaining fences was shared equally between men and women, male respondents from the same households said that women and girls were never involved in this activity. Men said that participation in water committee meetings was split evenly between the genders, but married women said that this was overwhelmingly a male responsibility (70%). Finally, while both male and female members of MHHs agreed that leadership in community organizations was a male responsibility, women from FHHs participated even more seldom (10%) than their female counterparts in MHHs.

[1] In the study area, 90% of leadership in community organizations is male. Therefore, only 10% of the respondents from FHHs indicated that they were involved in any leadership activities.

Table 10. Community Activities by Gender (Settler Community)

Activity	FHH			Married Women				MHH			
	W	G	B	W	G	M	B	W	G	M	B
Food preparation	90	10	0	68	32	0	0	78	22	0	0
Washing utensils	90	10	0	61	39	n/a	n/a	30	70	0	0
Washing clothes	80	20	0	38	62	n/a	n/a	30	48		22
Childbearing and child rearing	70	30	0	55	24	21	n/a	60	32	8	n/a
Cleaning house, etc.	70	30	0	53	28	0	19	20	80	0	0
Building and maintenance of houses/fences	70	0	30	0	0	61	39	0	0	80	20
Fetching water	100	0	0	51	29	0	20	55	35		10
Collecting fuel wood	100	0	0	49	25	26	n/a	58	31		11
Collecting animal dung	0	0	0	51	24	25	0	57	33	10	0
Water Committee meetings	100	n/a	n/a	50	n/a	50	n/a	45	n/a	55	n/a
Cleaning water source	100	n/a	n/a	35	25	14	26	50	n/a	50	n/a
Care for old/sick persons	100	n/a	n/a	n/a	n/a	n/a	n/a	90	10	n/a	n/a
Weddings	100	n/a	n/a	25	25	25	25	30	n/a	45	25
Funerals	100	n/a	n/a	25	25	25	25	30	n/a	45	25
Involvement in village meetings	100	n/a	n/a	31	n/a	53	16	25	n/a	75	n/a
Involvement in public works	100	n/a	n/a	29	n/a	71	n/a	39	n/a	61	n/a
Involvement in NGO projects	100	n/a	n/a	27	n/a	73	n/a	n/a	n/a	n/a	n/a
Involvement in political activities	100	n/a	n/a	31	n/a	79	n/a	50	n/a	50	n/a
Membership in community organizations	100	n/a	n/a	27	n/a	50	23	50	n/a	50	n/a
Involvement in leadership of community organizations	100	n/a	n/a	14	n/a	86	n/a	25	n/a	75	n/a

The reproductive role of women in the settler communities was more significant than men. Most of the reproductive activities were primarily the responsibility of women, including: food preparation, washing utensils, washing clothes, child care, housecleaning, fetching water and collecting fuel (Table 10). This was especially true in FHHs, where the women indicated that they were solely responsible for most of the activities, with no assistance even from children in the household. In some instances, however, men perceived that an activity was the responsibility of the women in the household, while the women did not indicate the same. An example of this was caring for the elderly or sick; women said this was not an activity that was practiced, although men in the same households said that it was only the responsibility of women (90%) and girls (10%). When asked about involvement in NGO projects, women said that men had almost three-quarters of the responsibility, but men from the same household said that there was no household involvement in NGO projects at all (Table 10). Women also said that they had less involvement in political activities (31%) and membership in community organizations (27%); men, however, said that participation in both these activities was split evenly between the men and women in the household.

3.8. Participation of Household Members in Decision-making

Based on the PRA survey results, both communities reported the decision-making processes to cultivate sorghum involved joint discussions including all family members: men and women acted together as core decision-makers, but girls and boys were allowed to suggest which field or site to cultivate sorghum, as well as how many acres to allocate for sorghum and other crops.

3.9. Access to and Control Over Productive Resources by Gender

The PRA survey results showed that, although two improved sorghum varieties have been released for the area, the indigenous communities have no access to or control over improved sorghum varieties. The reported reason was that these varieties were not introduced or promoted at their locality, resulting in no access to the improved sorghum varieties.

For FHHs in the surveyed indigenous communities, women reported access to and control over both land and income received from sorghum farming (Table 11). At the time of this survey, no households had access to improved sorghum varieties. However, for other resources, women sometimes perceived that they had more control over resources than their male counterparts. For example, MHHs reported that they had half of the access to income from sorghum sales and 75% of the control over that income. Married women from the same households agreed that the access to sorghum income was split evenly between the genders, but also asserted that there was an equal split for control over the income. When discussing land resources, both men and women in MHHs agreed that, while access to the land was equal, control over land was given completely to men.

Table 11. Access to and Control Over Productive Resources (Indigenous Communities)

Type of resources	FHH				MHH				Married Women			
	Access to		Control over		Access to		Control over		Access to		Control over	
	F	M	F	M	F	M	F	M	F	M	F	M
Improved sorghum varieties	0	-	0	-	0	0	0	0	0	0	0	0
Income from sorghum	100	-	100	-	50	50	25	75	50	50	50	50
Land for sorghum cultivation	100	-	100	-	50	50	0	100	50	50	-	100

The settlers' communities (Selga 24) also reported no access to improved sorghum varieties. Married women in MHHs had greater access to income from sorghum sales than their male counterparts but reported that genders had equal control over the income. Male respondents

from MHHs said that sorghum was not sold in their communities. Unlike the indigenous communities, settler communities reported equal access to and control over land for all groups, as indicated in Table 12.

Table 12. Access to and Control Over Productive Resources (Settler Communities)

Type of resources	FHH				MHH				Married Women			
	Access to		Control over		Access to		Control over		Access to		Control over	
	W	M	W	M	W	M	W	M	W	M	W	M
Improved sorghum varieties	0	-	0	-	0	0	0	0	0	0	0	0
Income from sorghum	100	-	100	-	Not sold				73	27	50	50
Land for sorghum cultivation	100	-	100	-	50	50	50	50	50	50	50	50

3.10. Main Sources of Information on Sorghum Production and Extension Services

FGD results shown in Table 13 revealed that FHHs from indigenous communities had neither access to nor control over extension education. Both men and women in MHHs also reported that men had more access and control over extension education than their female counterparts. Moreover, FHHs did not have access to credit or fertilizer while married women in MHHs indicated that men had access to fertilizer, but both men and women had equal control over fertilizer use. Both genders in MHHs reported an equal access to credit; women in MHHs said they had no control over the credit, while their male counterparts said that control over credit was evenly split between genders.

Table 13. Access to and Control Over Extension Services (Indigenous Community)

Type of resources	FHH				Married Women				MHH			
	Access to		Control over		Access to		Control over		Access to		Control over	
	W	M	W	M	W	M	W	M	W	M	W	M
Extension education	N/A	N/A	N/A	N/A	20	80	20	80	24	76	24	76
Use of fertilizer	0	-	0	-	0	100	50	50	50	50	50	50
Credit (all types)	N/A	N/A	N/A	N/A	50	50	0	0	50	50	50	50

Unlike the FHHs in indigenous communities, the FHHs in settler communities had access to and control over extension education, use of fertilizer and credit (Table 14). For MHHs, it was mostly the men, and not their wives, who received extension education. Both genders in MHHs indicated near-equal access to and control over both fertilizer use and all types of credit (Table 14).

Table 14. Access to and Control Over Extension Services (Settler Community)

Type of resources	FHH				Married Women				MHH			
	Access to		Control over		Access to		Control over		Access to		Control over	
	W	M	W	M	W	M	W	M	W	M	W	M
Extension education	100	0	100	0	0	100	0	100	27	73	27	73
Use of fertilizer	100	0	100	0	50	50	50	50	40	60	50	50
Credit (all types)	100	0	100	0	50	50	50	50	50	50	50	50

The only cropping method of sorghum by the indigenous FHHs is broadcasting, while that of male headed men and women showed that row planting is practiced by almost all (Table 15). The FHH households in settler communities dominantly practiced broadcasting, while the groups from MHHs (both men and married women) favored row planting. As shown in Table 15, the indigenous FHHs did not apply any fertilizer, while the married women and men in MHHs applied both organic and inorganic fertilizers. The settler communities also applied fertilizers to grow sorghum in the study areas.

Table 15. Cropping Methods and Use of Inputs for Sorghum Production

Group type	Type of fertilizer					Cropping Method	
	Compost	UREA	NPS	DAP	Non-users	Row planting	Broadcasting
FHH (indigenous)	0	0	0	0	100	0	100
Married Women (indigenous)	56	20	24	-		86	14
MHH (indigenous)	31	10	18	35	6	90	10
FHH (settlers)	52	21	27	N/A	N/A	24	76
Married Women (settlers)	49	11	0	30	10	77	23
MHH (settlers)	27	18	0	55	N/A	80	20

3.11. Priority Problems in Sorghum Production (Pair-wise ranking)

The major constraints along the sorghum value chain showed marked differences between indigenous and settler communities. Women in indigenous FHHs and MHHs ranked striga as the top constraint and insect pests as the second constraint (Table 16). Men in indigenous MHHs ranked low soil fertility as the top constraint, but striga as the second constraint.

FGD responses from settler communities matched those from men in indigenous MHHs: low soil fertility, striga and lack of improved varieties were the top three constraints (Table 16). Married women in MHHs disagreed, reporting that the top constraint for sorghum production was high-priced fertilizer, followed by lack of improved varieties and the timely availability of fertilizer, respectively. Men in MHHs indicated the lack of land as a top concern, with low soil fertility and timely availability of fertilizer as the other main constraints.

Table 16. Constraints of Sorghum Production, Marketing and Utilization

Type of constraints	Indigenous			Settlers		
	FHH	Married Women	MHH	FHH	Married Women	MHH
	Rank	**Rank**	**Rank**	**Rank**	**Rank**	**Rank**
Low soil fertility	3	7	1	1	5	2
Striga	1	1	2	2	6	11
Birds	8	3	19	6	15	19
Insects/pests	2	2	14	5	12	18
Diseases	4	12	16	9	13	17
Drought	15	19	20	19	18	20
Maturity time	11	5	17	8	14	16
Lodging	13	12	7	10	8	15
Lack of improved varieties	7	4	3	3	2	10
Prices of improved seed	NP	13	4	14	NP	13
Quality of improved seed	NP	17	8	15	NP	14
High price fertilizer	NP	11	6	4	1	7
Timely availability of fertilizer	NP	15	10	16	3	3
Credit	NP	8	15	11	17	4
Access to markets and information	12	14	12	17	16	5
Reasonable grain prices	10	18	13	18	11	9
Lack of land	14	16	9	12	9	1
Lack of improved seeds provider	5	9	5	13	4	6
Low yield	6	10	11	13	7	8
Storage problems	9	6	18	7	10	12

3.12. Preferred Phenotypic Characteristics of Sorghum Varieties

According to FGD results, farmers from both indigenous and settler communities had no access to improved sorghum varieties in the study area (Tables 11 and 12). However, farmers reported that they tried to select local preferred cultivars based on their knowledge and familiarity to the cultivars (Table 17).

FHHs in indigenous communities preferred a local variety, *Feide*. This variety was selected due to high grain yield, grain size, water-holding capacity, milling quality and ease of threshing. Married women preferred a variety called *Katama,* due to its early maturity and tolerance to bird damages. MHHs preferred white sorghum due to its high grain yield, grain quality, color, size, milling quality, bread/*kita*/*injera*-making qualities and taste.

Table 17. Farmer Preferred Traits for Sorghum

Group type	Variety name	Preferred traits
FHH (Indigenous)	*Feide*	Grain yield, grain size, water holding capacity, milling quality, grain thresh ability
Married Women (Indigenous)	*Katama*	Early maturity, bird attack tolerance
MHH (Indigenous)	White	Grain yield, grain quality, grain color and size, milling quality, bread/*kita*-making quality, taste, *injera*-making quality.
FHH (settlers)	White	Grain yield, grain color and size, water-holding capacity, cooking time, *injera*-making and -keeping quality
Married Women (settlers)	White	Grain yield, *injera*-making and -keeping,
	Dabara	Biomass production, bread/*kita* making
MHH (settlers)	White	Grain yield, grain quality
	Dalecha	*Injera*-making quality

The settler communities preferred different cultivars, as indicated in Table 17. FHHs preferred white sorghum over other types for its grain yield, biomass, grain color and size, water-holding capacity, cooking time, and *injera*-making quality. Married women in settler communities chose two varieties: the white variety due to its high grain yield and good injera-making qualities and *Dabara* for its biomass production and bread-making quality. MHHs said that white sorghum was preferred for its yield advantages and grain quality (as preferred at the market), while *Dalecha* was preferred for its *injera*-making quality.

3.13. Major Storage Pests and Post-harvest Losses

According to FGD results, most post-harvest losses for sorghum were due to humidity and storage pests, such as weevils and/or mice. All household types in the surveyed indigenous communities responded that more than 20% of sorghum grain was lost post-harvest. However, the post-harvest loss was much higher for settler communities, who said their losses ranged from 30% to 64%.

The main measures taken to minimize sorghum post-harvest losses included application of chemical tablets, mouse traps, hot pepper and *Neem*. Sometimes, sorghum was stored mixed with finger millet. Other biological control methods included using cats to control vermin and roasting the grain in an oven.

4. Discussion

Sorghum has both economic and food importance for both settler and indigenous communities in Ethiopia's Assosa woreda, as shown in Figure 7. The majority of sorghum grain was utilized in the form of *injera*, porridge and *kita* (Figure 8). FHHs in indigenous communities used sorghum for making *injera*, fermented dough, *genfo*, and *kolo;* a very small amount of sorghum was used as feed for poultry and livestock. MHHs also used sorghum to prepare soft drinks for brewing purposes. Likewise, farmers in settler communities used sorghum grain primarily for human consumption.

A small portion of sorghum grain was used for brewing of soft (non-alcoholic) and alcoholic drinks such as *aleseliya and tella.* Figure 9 indicates that most of the sorghum grain utilized in brewing was used for alcoholic (*Tela* and *areke*), especially in settler communities This could have been due to the fact that FHHs participated in off-farm activities, such as selling *tela* or local drinks, with the remaining sorghum used for brewing soft drinks.

Communities in Assosa woreda also used sorghum stalks. Although the prime use for sorghum stover was cooking/fuel, farmers also utilized the stalks for mulching, fodder and construction purposes (Figure 10).

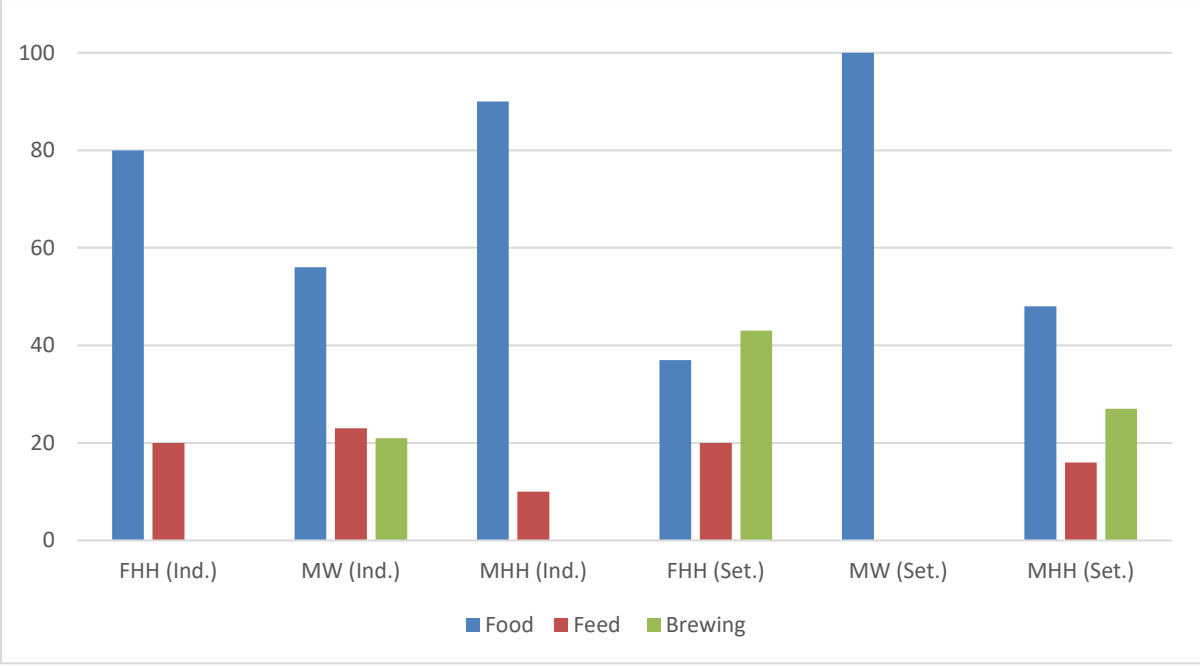


Figure 7. Uses for sorghum grain, by household type and gender

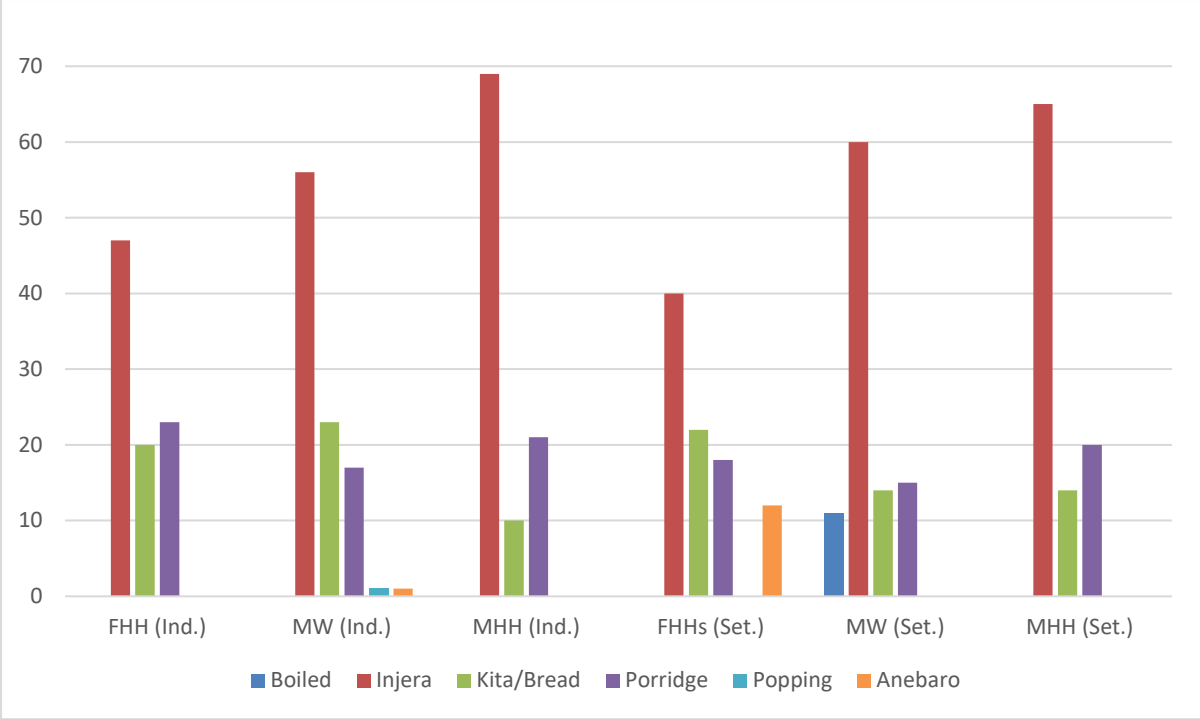


Figure 8. Methods of preparing sorghum grain, by household type and gender

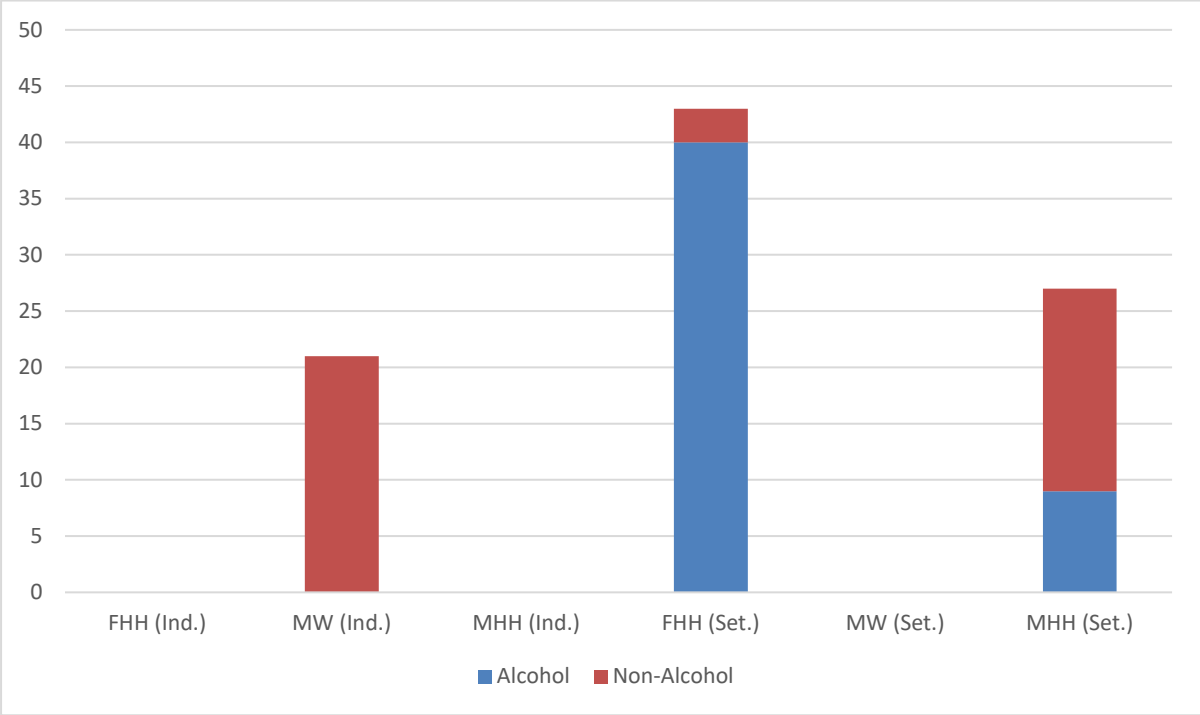


Figure 9. Sorghum grain use in brewing beverages, by household type and gender

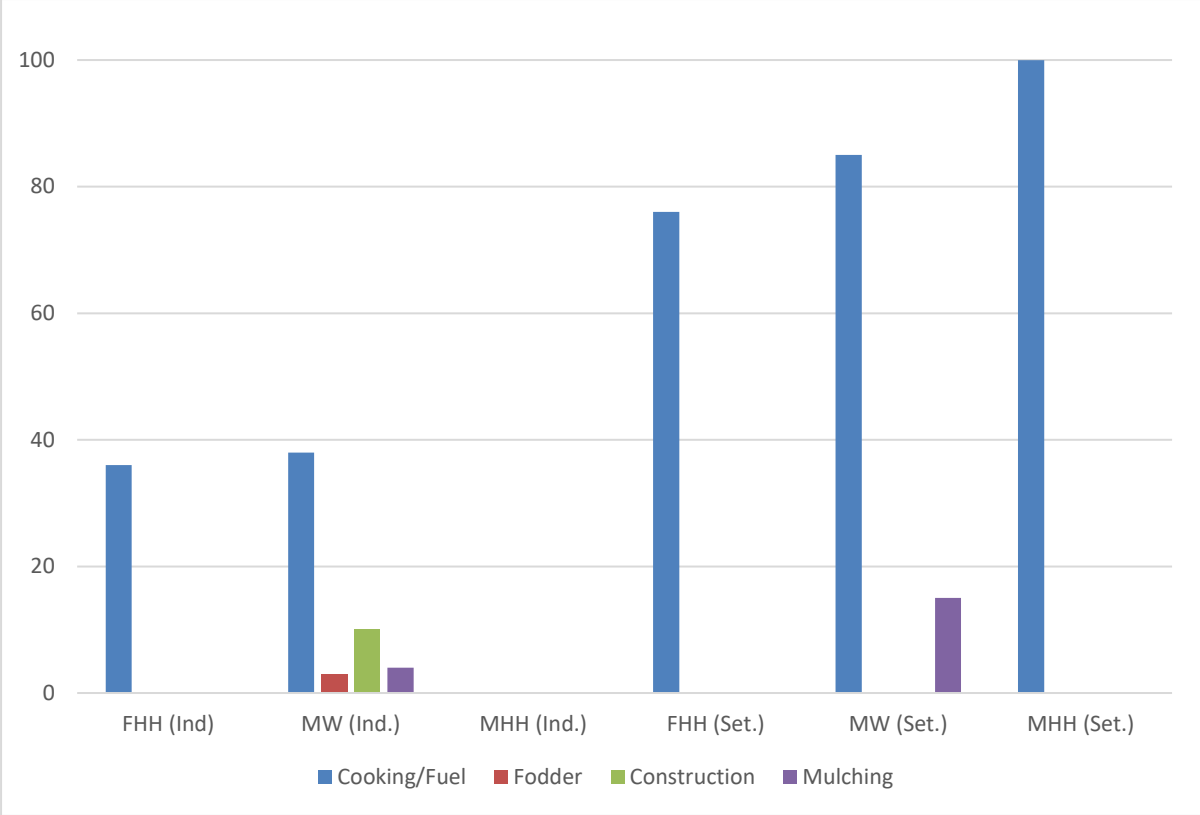


Figure 10. Uses for sorghum stover by gender and community type

The important implication drawn from the information about sorghum use in these communities is that, when varieties are released in the area, *injera*-making and keeping qualities, followed by porridge and *kita*-making quality should to be considered. The community's multiple uses for sorghum (both grain and stover) also indicate that sorghum breeding programs should focus on both yield and bio-mass production. Thus, it would benefit farmers to consider stalk size and height during the variety development process. This could, for example, help minimize the workload for females, who gather firewood and other fuels.

Though sorghum is the major crop in the study area, farmers face a number of problems when accessing sorghum information and technology transfer. As a result, the woreda farmers have suffered from lack of access to information regarding improved sorghum varieties, extension services, and market information on inputs and outputs. Other challenges for sorghum production include; *striga* weed and termites. Research and development must create access to improved seeds, training on fertilizer rates and application times and other agronomic practices to improve production and productivity of sorghum in Assosa District.

This Ethiopian region is characterised by a wide range of agro-climatic conditions, which account for the enormous resources of agro-biodiversity complemented by the immense genetic diversity of various crop plants. Although the Assosa area is rich in local sorghum genetic diversity due to its humid and intermediate agro-ecological conditions, sorghum genotypes collected and/or released from other areas were not adapted to growing conditions in this woreda. As a result, releasing varieties adaptable to Assosa area was challenging; two high-yielding sorghum varieties were released in May 2015, but seed multiplication and delivering enough seed for farmers remained problematic.

Because sorghum is important in terms of food, feed and fuel in Assosa woreda, the role of gender in sorghum production process has been ignored historically. However, this research investigated the role of gender along sorghum value chain in communities within Assosa district. In addition to productive roles, the reproductive roles of gender were identified: women in the study area were responsible for a large percentage of sorghum production and had high labor contribution along the sorghum value chain. In addition to productive roles, women and girls were responsible for many reproductive activities such as food preparation, washing utensils, clothes, childbearing and children rearing, cleaning houses, fetching water, collecting fuel wood, clearing water sources, caring for elderly or sick persons, etc. For both communities (indigenous and settlers) the reproductive role of women was higher than men and boys, followed by girls.

At the time of this research, sorghum had the greatest area of cultivation in Assosa woreda, followed by maize. However, in terms of production, it remained the second cereal crop. Production trends showed an increase in both area coverage and production at the woreda level, while area coverage and production trends at the household level indicated little difference. This could be explained by the fact that annual production trend data were not collected for the FGDs; production trends could increase at the woreda level and decrease at the kebele level as socio-economic and farming systems change from year to year.

Sorghum production is also influenced by biotic and abiotic factors. The biotic and abiotic factors hindering sorghum production in the study area included striga, bird damage, shoot fly, low soil fertility, termites, low grain prices and shortages of farm land, among others. As a result of these factors, farmers substituted cash crops such as soybean, noug, groundnut, and other cereal crops like teff and maize. Therefore, research and development should develop

and promote new sorghum varieties resistant to biotic and abiotic factors, creating market linkages along the sorghum value chain.

Generally, sorghum production in the study area was characterized by low input use, low soil fertility, limited access to extension services, lack of improved varieties, low grain price to attract mass production for market, weed infestations and low yield for both types of communities. Farmers in the area requested sorghum varieties that have high yields and resistance to disease, pests and striga. *injera*-, porridge-, and bread-making qualities were also major considerations for farmers' varietal preference.

5. Conclusions and Recommendations

5.1. Conclusions

This study showed that sorghum had significant importance to smallholder farmers as a food source and economic livelihood, especially as it was the area's major crop for production and productivity. FGD results illustrated that households used sorghum grain for multiple purposes, including: food, feed, and brewing. Moreover, sorghum stalk was a major source of fuel for cooking. Although sorghum had multiple benefits, its area of production and productivity decreased as a result of biotic and abiotic factors, resulting in farmer substitution of maize, teff, soybean, groundnut and noug. Moreover, farmers in the study area had very limited access to input and output information and technology transfer. Thus, district farmers lacked access to information regarding improved sorghum varieties, extension services, market information on inputs and outputs.

With these factors in mind, this research also analyzed the reproductive and productive roles of household members by gender. We found that women and girls contributed significantly to the agriculture sector at a micro level by engaging in productive, reproductive and community services. However, their contribution was not recognized. Consequently, though the labor contribution of women remained at its highest level, research, extension and development interventions were skewed towards men. For this reason, women's participation in extension services, such as access to credit, improved seeds and fertilizers, and control over productive factors such as land was limited.

5.2. Recommendations

Though sorghum is an economically important crop in Ethiopia and in Benishangul Gumuz region in particular, the production, utilization, and marketing of this crop have not been researched adequately, nor have agronomic practices, post-harvest losses, gender roles, extension services or farmer preferences been identified. Furthermore, because sorghum is a staple food crop in Ethiopia, production, marketing and utilization concerns need to be identified so appropriate policy measures can be taken to enhance its production and productivity.

To solve the major production and marketing constraints along the sorghum value chain, the following recommendations are suggested for enhanced sorghum production and productivity in Assosa woreda:

- We suggest that further empirical evidence is needed on the role of gender in agriculture at the regional level, in order to craft appropriate policy and strategies to mainstream gender. Access to extension services and productive resources such as inputs, improved farm implements, extension education and credit should be created especially for FHHs. Training on sorghum productive activities should be targeted, based on the labor contribution of different genders and households to improve production and productivity.
- To ensure the availability of sorghum year-round, we suggest improved access to extension services, improved awareness of agronomic practices, and improved farm implements to increase production and productivity of sorghum crops.
- Although women and girls are responsible for much of the reproductive activities in a community, their leadership and political position is limited. This skews the decision-making processes at the community level. Consequently, we suggest that involving women and girls with decision-making processes and designing community policies and strategies would hasten economic growth and development.
- To improve production and productivity of sorghum, research and development should focus on striga-resistant sorghum varieties and create access to improved seeds.
- Farmers need improved training on fertilizer rates and application times and agronomic practices. Awareness must be created within FHHs on the use and importance of fertilizers. We suggest that training on recommended rates and times of fertilizer application be given to all family members. There should be a special focus on organic fertilizers that improve soil fertility; striga management practices to improve production and productivity of sorghum should also be integrated.
- The existing improved sorghum varieties should be promoted to smallholder farmers, and the breeding program should focus on generating striga-resistant varieties adaptable to the region's agro-ecologies.
- Farmers currently substitute teff, noug, soybean, and groundnut for sorghum. The threshold at which farmers (male and female) switch their production system from traditional to cash crops needs to be identified. Moreover, we suggest that intensification may help to maintain sorghum production for food.
- Gender perceptions on biomass, yield, *injera*-making, porridge-making and storage qualities must be considered when releasing new varieties. To minimize post-harvest losses, technologies like PICS bags should be promoted. Moreover, farmers'

indigenous knowledge on post-harvest pest management tools and techniques must be verified and investigated to minimize high post-harvest losses.

- For indigenous communities, research on appropriate intercropping patterns for sorghum and haricot bean should be identified. In addition, row planting should be developed and promoted to smallholder farmers, regardless of gender.
- Technologies that can assist with clearing activities in sorghum fields could minimize the work load of women along the sorghum value chain.
- Farm implements and management practices that could reduce weed infestation should be investigated and promoted to sorghum farmers to minimize the work load of women and girls in particular. Capacity-building activities on weed management should target women and girls in the indigenous communities.

6. References

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	Indigenous communities						**Settler communities**					
	FHHs		**Married Women**		**MHHs**		**FHHs**		**Married Women**		**MHHs**	
Preferred traits	Ketama	Feide	ADU	White	Bobe	Adu	White	Red	Debara	White	dalacha/ Brown	White
Grain yield	Feide	Feide	White	White	Bobe	Bobe	White	White	white	White	White	White
Biomass production	Feide		ADU	ADU	Adu	Adu	White	White	Debara	Dabara	similar	
Grain and biomass production	Feide		ADU	ADU	Adu	Adu	White	White	Debara	Dabara	similar	
Rotation or soil fertility	Same	Same	Same	Same			Same		Debara	Dabara	White	White
Maturity	Ketama	ketama	Same	Same	Adu	Adu	Same		Same	Same	Similar	
Stalk palatability	Ketama		White	White	Adu	Adu	Same		Not used for feed		Not used	
Grain quality	Both	Both	White	White	Adu	Adu	Same		white	White	White	White
Grain thresh ability	Feide	Feide	White	White	Bobe	Bobe	Same		white		Similar	
Striga resistance	Feide		Same	Same	Bobe	Bobe	Same		white		Similar	
Resistance to diseases	Feide		Same	Same	Bobe	Bobe	Same		white		Similar	
Resistance to insects	Feide		Same	same	Same		Same		Same		Dalacha	
Bird tolerance	Ketama	ketama	White	White	Bobe	Bobe	Same		White	White	White	
Cooking time	Same	Same	Same	Same	Bobe	Bobe	White	White	White		White	
Taste			White	White	Adu	Adu		White	White		White	
Injera-making quality	Both	Both	White	White	Adu	Adu		White	White		dalacha	
Injera-keeping quality	Both	Both	Same	Same	Adu	Adu		White	White		similar	
Bread/*kita*-making quality	Both	Both	White	White	Adu	Adu		White	Debara	Dabara	similar	
Milling quality	Feide	Feide	White	White	Bobe	Bobe		White	white	White	similar	
Water holding capacity	Feide	Feide	Same	same	Adu	Adu		White	Debara	Dabara	dnk	
Grain color	Red	Red	White	White	Adu	Adu		White	White	White	White	
Grain size	Feide	Feide	White	White	Adu	Adu		White	White		similar	
Price (*Birr*/quintal)	Feide	Feide	ADU	ADU	Adu	Adu	Same	Same	White		similar	