



REAP

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ANALYTICAL
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**Patterns of Agricultural Production among Male and Female Holders:
Evidence from Agricultural Sample Surveys in Ethiopia**

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Leulseged Kasa

Gashaw Tadesse Abate

James Warner

Caitlin Kieran

**International Food Policy Research Institute (IFPRI)
Addis Ababa, Ethiopia**

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Leulseged Kasa (l.kasa@cgiar.org) is a research officer in the Markets, Trade, and Institutions Division of the International Food Policy Research Institute (IFPRI), Addis Ababa.

Gashaw Tadesse Abate (g.abate@cgiar.org) is a research collaborator in the Markets, Trade, and Institutions Division of IFPRI, Addis Ababa.

James Warner (j.warner@cgiar.org) is a research coordinator in the Markets, Trade, and Institutions Division of IFPRI, Addis Ababa.

Caitlin Kieran (c.kieran@cgiar.org) is a senior research assistant in the CGIAR research program on Policies, Institutions, and Markets (PIM) led by IFPRI, Washington DC.

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ABSTRACT

Gender inequities present a major barrier to increased agricultural production and food security in Ethiopia. However, a lack of nationally representative sex-disaggregated data and analysis hinder the development and implementation of evidence-based policies. This report aims to contribute to filling this gap by presenting a gender analysis of the Ethiopian Central Statistics Agency's Agricultural Sample Survey (AgSS) data, collected between 2010 and 2013. The analysis reveals clear gender gaps between male and female holders in terms of human capital, natural capital, financial capital, agricultural input use, and participation in crop production and livestock husbandry. Specifically, female holders are less educated, have less family labor, own and manage less land, and are less likely to cultivate rented land compared to male holders. Concurrently, female holders have limited access to extension and advisory services and, therefore, to knowledge and information concerning best agronomic practices. Compared to male holders, female holders are less likely to cultivate commercial and economically valuable crops. This difference substantially contributes to the gender resource gap since these crops generate a higher market value than traditional staple crops. Moreover, a significantly lower proportion of female holders reported ownership of livestock, especially oxen and equines, which are the primary sources of draught power for plowing and transportation in rural Ethiopia. Overall, this report identifies significant differences in the patterns of agricultural production of male and female holders in Ethiopia and calls for closing these gender gaps, because it would yield enormous benefits at the individual, household, and national levels. The report also puts forward policy priorities for prospective interventions.

Keywords: gender, agriculture, Ethiopia.

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While we received considerable guidance and technical inputs from all of these partners and colleagues, this report has not gone through IFPRI's standard peer-review procedure. The views and opinions expressed in this report belong to the authors' and do not necessarily reflect those of the individuals and institutions acknowledged here.

ABBREVIATIONS AND ACRONYMS

AgSS	Agricultural Sample Surveys
ATA	Agricultural Transformation Agency of Ethiopia
CSA	Central Statistics Agency of Ethiopia
DAP	Di-Ammonium Phosphate
EEA	Ethiopian Economics Association
FAO	Food and Agriculture Organization of the UN
FTCs	Farmer Training Centers
GDP	Gross Domestic Product
HH	Household
ICPALD IGAD	Center for Pastoral Areas and Livestock Development
IFPRI	International Food Policy Research Institute
LSS	Livestock Surveys
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
MSPHS	<i>Meher</i> Season Post-Harvest Survey
REAP	Research for Ethiopia's Agricultural Policy project of IFPRI
SNNP	Southern Nation Nationalities and People's Region

1 INTRODUCTION

Twenty years after the adoption of the *Beijing Declaration and Platform for Action* and 15 years after the adoption of the *Millennium Declaration* by the international community, a lack of gender equality and women's empowerment, in all aspects of development, persist as global challenges (UN women 2014). In the developing world in particular, where agriculture remains the dominant source of livelihoods, ensuring equitable access to and/or control over productive resources (e.g. land), inputs (e.g. improved seed and chemical fertilizers), and decent jobs for female- and male-farm operators is essential for achieving inclusive growth (Doss et al. 2015; Quisumbing et al. 2014; Kieran et al. 2015). Although women provide an average of 40 percent of the agricultural labor hours in crop production across six countries in Africa south of the Sahara (SSA) (Palacios-Lopez et al., 2015), and are largely responsible for food processing and preparation, they are less likely than men to own land and non-land assets, use credit and other financial services, or receive education and extension advice (Doss et al., 2015; Fletschner and Kenney, 2014; Peterman et al., 2014; WEF 2013). Emerging evidence suggests that women farmers may also have lower returns to inputs than men farmers, further contributing to the gap in agricultural productivity (Aguilar et al., 2015; Backiny-Yetna and McGee, 2015; Kilic et al., 2015; Oseni et al., 2015; Slavchevska, 2015). Gender equality and women's empowerment have implications on the stock of human capital, labor and product market competitiveness, investment in physical capital, and agricultural productivity (Ward et al. 2010). As a result, beyond socio-political gains, gender equality and women's empowerment have key economic development roles as well (Klasen and Lamanna 2009; FAO 2011; Kumar and Quisumbing 2015). According to FAO (2011), ensuring equal access to productive resources for women farmers could increase yields on their farms by 20-30 percent, which could have a 2.5-4 percent increase on total agricultural output. Although multiple factors contribute to the poor economic performance and slow pace of poverty reduction in SSA, gender inequality and women's low rate of empowerment is believed to contribute significantly (Seguino and Were 2013).

Ethiopia is characterized by a high rate of poverty incidence (WB 2015) and low human development index (UNDP 2014). Although agriculture employs about 85 percent of the labor force (MoARD 2010), accounts for about 44 percent of the national gross domestic product (GDP) (MoFED 2013), and accounts for about 71 percent of total exports of the country (EEA 2013), the poor performance of this sector is among the key development constraints in the country. It is not only gender inequalities in access to ownership of, control over, and use of livelihood assets and inputs that matter in Ethiopian agriculture, but also disproportionate employment opportunities for women and men (FAO 1997; 2011; Barrett et al. 2009). There is clear evidence that gender differentials in varied forms could be potential sources of poverty and food insecurity (Quisumbing et al. 1995). Few studies have been undertaken to clarify the role of gender in Ethiopian agriculture. Studies by Fafchamps and Quisumbing (2002), CSA and WB (2013), Aguilar et al. (2015), CSA (2014), Doss et al. (2015), Gella and Tadele (2014), Tura (2014), Kumar and Quisumbing (2015), and Palacios-Lopez et al. (2015) are among the important contributions in this regard. However, the lack of sex-disaggregated data at both the national and intra-household levels limit the availability of empirical evidence and analysis. As a result, important research questions remain unanswered regarding the extent of gender differences in access to, ownership of, control over, and use of livelihood assets and the patterns of men's and women's participation in crop and livestock production. This paper aims to shed light on these topics and generate sex-disaggregated baseline indicators on access to, ownership of, control over, and use of livelihood assets as well as crop and livestock production participation. This will help facilitate the development of evidence-based policies to effectively reduce gender inequalities in Ethiopia's agricultural sector.

The Ethiopian Central Statistics Agency (CSA) collects crop and livestock production information and basic socioeconomic profiles of producers. The data are collected annually at the holder level through agricultural sample surveys (AgSS), covering more than 45,000 crop growers and 67,000 livestock producers. In this paper, we analyze data collected in 2010/11, 2011/12, and 2012/13. Importantly, these data can be disaggregated by the sex of the holder. Section 2 provides detailed descriptions of the methodology; section 3 presents major findings on the differences between male and female holders in crop agriculture; section 4 reports the results on gender differences in livestock agriculture, and the final section concludes by summarizing the main findings and highlighting the policy implications.

2 METHODOLOGY

This section describes the sample distribution of holders from whom CSA collects data on crop and livestock production, the data used to analyze the role of gender in crop and livestock agriculture, and the method of analysis.

Sample Distribution

The data used in this analysis were obtained from the Ethiopian Central Statistics Agency (CSA). CSA collects annual sex-disaggregated data on both crop and livestock production through their Agricultural Sample Surveys (AgSS). The *Meher*^a Season Post-Harvest Survey (MSPHS) and the Livestock Survey (LSS) are the major components of the AgSS and geographically cover most of the country. CSA follows a two-stage sampling strategy to draw sample households in these areas. The geographic areas are usually stratified by agroecology (low, mid, and high altitude) and clustered into different enumeration areas (EA), which are the primary sampling units. EAs have, on average, approximately 150 to 200 agricultural households, although their size can vary. Sample EAs are determined and then systematically selected proportionate to their relative population. The target population within the selected EA for the MSPHS are agricultural households who cultivate at least one crop. For the LSS, the target population is households who own livestock including poultry and honeybee colonies during the survey period. Each year, an updated list of the target population is developed within the sampled EA, and 20 households for the MSPHS and 30 households for the LSS are systematically selected. Finally, the data are collected at the holder level within sampled households. At the country level, MSPHS covers, on average, close to 47,000 holders, and in 2011/12 and 2012/13 more than 19 percent were female holders (Table 2.1). Most of the holders in MSPHS were identified as household heads. Of the total households in 2012/13, 97 percent had only one holder (the household head), 2 percent had two holders, and the remaining 1 percent had more than two holders per household.

^a There are two annual crop production seasons in Ethiopia including the *Meher* and *Belg*. The Meher season is relatively long and widespread, producing a larger crop harvest, while the Belg season is relatively short and more restricted in extent, producing a relatively small harvest.

Table 2.1 Distribution of holders involved in crop production by gender and region

Year	Holder's Gender	National*	Regions			
			Amhara	Oromia	SNNP	Tigray
2012/13	Female	9200** (19.63)***	1611 (18.21)	2632 (17.4)	2555 (21.78)	749 (23.11)
	Male	37671 (80.37)	7236 (81.79)	12496 (82.6)	9177 (78.22)	2492 (76.89)
	Total	46871 (100.00)	8847 (100.00)	15128 (100.00)	11732 (100.00)	3241 (100.00)
2011/12	Female	9411 (19.67)	1710 (19.39)	2574 (17.15)	2566 (20.27)	822 (25.32)
	Male	38437 (80.33)	7111 (80.61)	12431 (82.85)	10095 (79.73)	2424 (74.68)
	Total	47848 (100.00)	8821 (100.00)	15005 (100.00)	12661 (100.00)	3246 (100.00)
2010/11	Female	8124 (17.93)	1452 (16.80)	2252 (15.66)	2361 (19.10)	695 (21.88)
	Male	37193 (82.07)	7192 (83.20)	12124 (84.34)	10001 (80.90)	2482 (78.12)
	Total	45317 (100.00)	8644 (100.00)	14376 (100.00)	12362 (100.00)	3177 (100.00)

Source: Authors' computation based on meher season post-harvest survey data (2010/11 – 2012/13).

Note: * the national level figures include data from all regions; ** = number of observations; *** = percentages

However, in terms of holders who are not the household head, men are 2.5 times less likely to identify themselves as a holder in a female-headed household than women in a male-headed household. More specifically, 3.5 percent of total female holders are in male-headed households while about 1.4 percent of male holders identify themselves to be within female-headed households. The lower percentage share of male holders within female-headed households is hypothesized to be the result of men wanting to establish an independent family rather than live in a female-headed household. From a regional perspective, the highest proportion of female holders is observed in Tigray while the lowest record was observed in Oromia. The highest proportion of female holders in Tigray could be the result of the lengthy civil war that resulted in the death of a disproportionate number of male fighters (Holden et al. 2011).

As indicated in Table 2.2, the sample distribution of livestock holders shows similar patterns to those displayed in the distribution of crop growers. Overall, the percentage share of sample female holders grew slightly from about 18 percent in 2010/11 to 19 percent in 2012/13. The highest percentage share of sample female holders comes from Tigray, which ranges from about 22 to 24 percent, while the lowest percentage share are from Oromia, which ranges from about 16 to 18 percent. Because there are 30 households per EA for the LSS, the overall sample size of the livestock data is larger than the sample size for the crop data. Similar to the crop data, the livestock data are also collected at holder level. In 2012/13, the number of livestock holders per household ranged from 1 to 6 holders. However, about 91 percent of the households have single holders, 7.3 percent have two holders, 1.7 percent have three holders, and the remaining have more than three holders. The same pattern is observed for 2011/12 and 2010/11 data.

It is worth noting that, because the majority of sample households in both the MSPHS and LSS had only one holder, and the holder was generally the household head, these data do not allow us to analyze the role that other adults in the household play in agriculture. In particular, it does not provide information on the large group of women who live in male-headed households or on men who live in female-headed households.

Table 2.2 Distribution of sample livestock holders by gender and region

Year	Holder's Gender	Regions				
		National*	Amhara	Oromia	SNNP	Tigray
2012/13	Female	12970** (19.22)***	2317 (17.34)	3881 (17.31)	3746 (21.48)	1140 (23.66)
	Male	54525 (80.78)	11045 (82.66)	18546 (82.69)	13694 (78.52)	3678 (76.34)
	Total	67495 (100.00)	13362 (100.00)	22427 (100.00)	17440 (100.00)	4818 (100.00)
2011/12	Female	13394 (19.25)	2454 (18.42)	3984 (17.61)	3813 (20.17)	1141 (23.74)
	Male	56199 (80.75)	10869 (81.58)	18637 (82.39)	15092 (79.83)	3666 (76.26)
	Total	69593 (100.00)	13323 (100.00)	22621 (100.00)	18905 (100.00)	4807 (100.00)
2010/11	Female	12226 (17.83)	2199 (16.61)	3524 (15.97)	3653 (19.17)	1066 (22.28)
	Male	56345 (82.17)	11040 (83.39)	18540 (84.03)	15406 (80.83)	3718 (77.72)
	Total	68571 (100.00)	13239 (100.00)	22064 (100.00)	19059 (100.00)	4784 (100.00)

Source: Authors' computation based on CSA's livestock survey data (2010/11 to 2012/13).

Note: * the national level figures include data from all regions; ** = number of observations; *** = percentages

Data Description

In this analysis, we considered both the MSPHS and LSS datasets collected in 2010/11, 2011/12, and 2012/13. These years cover the first three years of the Ethiopian Growth and Transformation Plan (GTP) implementation period, which is part of the country's five-year economic development program (2010-2015). The MSPHS data include a basic socioeconomic profile of cropland holders, land use, cultivated area by crop (all cereals, pulses and oilseeds, and the most commonly grown vegetables, root crops and perennial crops), input use and agronomic practices, and grain production. However, it should be noted that productivity is estimated using crop-cuts from a maximum of five plots per EA. The yield for the EA is determined by the average of the crop cuts, which is then multiplied by the individual plot area to estimate the amount of crop produced per plot for EA. This yield estimation technique does not allow us to determine individual yield estimates for comparisons between plots.

The LSS data also includes a basic socioeconomic profile of livestock holders and livestock and poultry ownership by breed (indigenous, crossbred/hybrid, and exotic) at the holder level. In addition, it contains honeybee colony ownership by hive type (traditional, transitional, and modern) at the holder level. The socioeconomic variables considered in both the crop and livestock data are limited to the holder and include only basic demographics (the holder's gender, age, education level, and family size).

Finally, we would like to acknowledge that the AgSS does not collect a detailed profile of the household (for example, age, gender, education level, and role and responsibilities in agricultural production of household members). This limits our analysis and inferences cannot be made about household members who are not holders. Put another way, our analysis is limited to information collected from and about the holders; we have no information concerning household characteristics (other than household size), intra-household production decisions, or marketing influences.

Method of Data Analysis

Sex-disaggregated data are a prerequisite for undertaking gender analysis (Doss 2013; Doss and Kieran 2014). However, the depth of the analysis depends on the research question and data availability. We believe that, though not initially designed for gender analysis, the data collected in MSPHS and LSS are sufficient to undertake some basic gender analyses. Although there are a relatively small number of households with multiple holders, making holders the unit of analysis is justifiable because holders are the primary decision makers about the resource they manage. Furthermore, the basic socioeconomic variables are collected at the holder level. As the data have been collected from different holders over time, we cannot perform panel data analysis. However, we employed some basic descriptive and inferential statistical analysis for the cross-sectional data, which is sufficient to address the study objectives. We used mean, proportions, and percentages to summarize the quantitative data. Using male and female holders as a grouping variable, we also undertake the two-sample t-test of means (assuming unequal variance) and the two-sample test of proportions (StataCorp 2013). However, as holders were not considered in the initial sampling design by CSA, we preferred not to use the survey design sampling weights by household in our analysis. We would also like to note that most of the figures presented in this document are three years' arithmetic mean values. Readers who are interested to see the detailed computed values in each year and hypothesis tests can contact the authors.

3 GENDER DIFFERENTIALS IN CROP AGRICULTURE IN ETHIOPIA

Due to the availability of diverse agro-ecologies that are suitable for crop cultivation, different crop types and varieties are widely grown in Ethiopia. The major crops commonly grown are usually classified as grain crops (which include cereals, pulses, and oilseeds), vegetables, root crops, fruit crops, and others (coffee, sugar cane, chat, hops, and enset). Grain crop production takes the highest share in terms of the number of holders who participate in production, the size of the cultivated area, and quantity of production. For instance, in the 2012/13 *meher* production season, more than 14 million holders were involved in grain crop production; 91 percent of the total cropped area was grain crops; and about 80 percent of the total crop production was derived from grain crops. In terms of the number of holders engaged in production, grain crop production is followed by vegetable production, root crops production, and fruit crops production respectively. Before presenting the gender analysis in crop agriculture in detail, we briefly assess the basic socioeconomic characteristics of sample holders used in our analysis.

Demographic profile of sample holders involved in crop agriculture

Age is among the factors that are frequently used in smallholder agriculture studies. It has implications for labor availability in farm activities, farming experience, agricultural technology adoption decisions, and productive efficiency. In Ethiopia, female holders are, on average, older than male holders by about five years (Table 3.1). This could be attributed to the fact that the majority of female holders are female heads of household, who are often widows. In Ethiopia, significant age differences are common between husbands and wives, and the wife is usually younger than her husband. As a result, there is a high likelihood that the older husband dies before his wife does. In this context, it is not surprising that female holders are generally older than male holders (Holden et al. 2011). Ethiopian female holders also tend to have smaller household sizes than do male holders. Nationally, on average, female holders have 1.6 fewer household members than their male counterparts. The maximum gap was observed in Tigray, where female holders have 2.2 fewer household members than their male counterparts. This has important implications for household labor availability and access to labor through social arrangements, which is an important source of agricultural labor in rural Ethiopia. Female holders are also less educated, on average, than male holders. The proportion of female holders who cannot read and write is about 31 percentage points higher than the proportion of male holders who cannot read and write. A significantly higher gap in the proportion of holders who cannot read and write is observed in Oromia region (about 37 percentage points) while the lowest gap is observed in Amhara (about 25 percentage points). Regardless of regional discrepancies, male holders are about four times more likely to have either primary or secondary education.

Table 3.1 Basic socioeconomic profile of crop growers by gender and region

Indicators	National		Regions							
			Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Age of holder	47.08	42.12	49.47	44.09	47.85	40.95	46.22	41.49	49.30	46.62
Household size of holder	3.99	5.61	3.31	5.17	4.31	5.85	4.06	5.59	3.37	5.54
Literacy status & education level of holder										
Cannot read & write, %	89.42	58.21	92.70	67.97	88.70	51.31	88.70	54.86	91.01	57.31
Attended informal schooling, %	1.92	7.86	2.37	16.25	2.63	6.57	1.09	2.50	1.58	15.71
Primary school (1-4), %	4.63	16.67	2.30	8.63	4.86	21.20	5.68	20.14	3.95	16.59
Primary school (5-8), %	3.18	13.14	2.24	5.91	3.05	15.76	3.77	17.51	2.07	8.37
Secondary school (9-10), %	0.60	2.86	0.28	0.91	0.48	3.62	0.47	3.36	1.17	1.57
Secondary school & above (>11), %	0.26	1.26	0.10	0.31	0.27	1.55	0.28	1.63	0.21	0.45
Average Observation (n)	8912	37767	1591	7180	2486	12350	2494	9758	755	2466

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Gender differentials in access to, ownership of, control over, and use of livelihood assets

Livelihood assets refer to both tangible and intangible productive resources, and they can be categorized as human capital (e.g. education and skills), natural capital (e.g. land and water), financial capital (e.g. savings and credit), physical capital (e.g. agricultural equipment), social capital (e.g. membership in organizations), and political capital (e.g. effective participation in governance) (Meinzen-Dick et al. 2011). These assets enable people to engage in different livelihood activities to achieve their livelihood goals. The livelihood strategies and welfare status of individuals have direct and indirect links with access to, ownership of, control over, and use of these livelihood assets (DFID 2001). The following sub-sections present the gender dimensions of access to, ownership of, control over, and use of basic livelihood assets in crop agriculture.

Management and ownership of land

Across the three survey years, an average landholder managed about 1.10 hectares of land for annual and perennial crop cultivation, grazing and fallow land, woodland, and other land use purposes. Over 97 percent of both male and female holders own land, suggesting that there are no major gender gaps in landownership among holders. However, a holder is about four times more likely to be a male than female, and female landholders manage, on average, about 0.66 hectares of land as compared to 1.19 hectares for male landholders (Table 3.2). This implies that the size of land managed by female landholders is, on average, 43 percent smaller than the size of land managed by their male counterparts. This difference is statistically significant at a minimum of 10 percent throughout the study period. The smaller size of land managed by female landholders could be attributed to the way in which many women become holders as well as household heads. In Ethiopia, if the female holder is a household head due to her husband's death, she can have relatively small land holdings because, when the husband dies, the widow is supposed to transfer half of the jointly owned land to any of his eligible family members to inherit (Holden et al. 2011). Hence, the widow's farm size will be half the size of her former husband's holdings. In addition, female holders are relatively less likely to rent land than are male holders, which is likely due to barriers to their access and use of other related inputs required to manage land (Holden et al. 2011). For example, our findings show disproportionate oxen ownership between female and male holders. Only about 12 percent of female holders have a pair of oxen, required for plowing, as compared to more than 30 percent of male holders. This lack of oxen ownership may hinder female holders from accessing land through renting. In addition, landowners may be more

likely to rent out their land to those farmers who own relatively more oxen, have better access to labor, and are equipped with better agronomic management skills.

Table 3.2 Land size managed by holders by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Total size of land managed by the holder, ha	0.68	1.19	0.62	1.32	1.09	1.65	0.55	0.81	0.49	1.09
Proportion of holders who own land, %	97.23	97.17	96.77	97.87	97.14	96.53	98.72	98.81	95.65	96.71
Total size of owned and managed land, ha	0.63	1.00	0.57	1.03	0.98	1.38	0.53	0.75	0.45	0.85
Per capita size of owned and managed land, ha	0.18	0.19	0.17	0.21	0.25	0.25	0.14	0.14	0.16	0.17
Proportion of holders who rented-in land, %	8.27	20.32	11.99	33.88	8.95	20.35	6.81	14.07	13.72	37.26
The total size of rented-in land, ha	0.03	0.13	0.04	0.22	0.04	0.15	0.02	0.05	0.04	0.23
The per capita size of rented-in land, ha	0.01	0.03	0.01	0.05	0.01	0.03	0.00	0.01	0.01	0.05
Observation (n)	8912	37767	1591	7180	2486	12350	2494	9758	755	2466

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13).

There is significant variation in ownership patterns of managed land between female and male landholders. While female holders own 92 percent of the land area they manage, male holders own only 84 percent of the area they manage. The remaining 8 percent of the land area managed by female holders and 16 percent of the land area managed by male holders is accessed through land transactions. This indicates that male holders have relatively better access to land than their female counterparts. This is further supported by the fact that 11 percent of the total land area managed by male holders is rented land while just 4 percent of the land area managed by female holders is rented land. In other words, male landholders are more than twice as likely as female landholders to rent land (20 percent versus 8 percent) and rent four times the land size, compared to female holders (0.13 ha versus 0.03 ha). The remaining percentage shares of the size of land managed by both female and male holders were accessed through some other means including getting land free of cost and squatting.

There is regional variation in terms of the size of land managed and the proportion of holders who are involved in land renting markets between female and male holders. Both male and female holders in Oromia have, in general, the largest size of land managed over the study period whereas female holders in Tigray and male holders in SNNP managed the smallest plots. The same goes for the distribution of the size of land owned and managed by landholders. The per capita size of owned and managed land in Oromia and SNNP is similar for female and male holders. However, the gap between female and male holders was relatively high in Amhara. Tigray and Amhara have higher proportions of landholders who rented land than do Oromia and SNNP. This could be attributed to the presence of a relatively higher proportion of landholders who feel more secure in terms of their land tenure in Tigray and Amhara than in the other regions. These findings are consistent with research suggesting that stronger land rights exist in Tigray and Amhara, which were early adopters of the land registration and certification programs, than the other regions, which began their land registrations later. The impact of land tenure security on land rental market participation in Ethiopia is well documented in Holden et al. (2007) and Deininger et al. (2009).

Oxen ownership

In Ethiopian smallholder agriculture, draught animals, especially oxen, are the principal source of power for pulling plowing tools during land preparation for planting and threshing of crops during harvest. As a result, oxen ownership has significant implications for the livelihoods of farm households in rural Ethiopia. However, just over one-quarter of female holders owns one ox or more, on average. In contrast, more than half of male holders own one ox or more (Table 3.3). Although a pair of ox is used for plowing in traditional Ethiopian agriculture, only about 12 percent of female holders can satisfy this requirement whereas more than 30 percent of male holders can meet this minimum standard. There are also significant regional variations in this regard. The gender gap in ownership of two or more oxen is smallest in Oromia, where male holders are less than twice as likely as female holders to own two or more oxen, and largest in Tigray, where male holders are approximately six times more likely to own two or more oxen as compared to female holders. Female and male holders in Amhara and Tigray regions have different coping strategies; female holders in these regions use pairing to match their ox with another farmer's ox while most male holders borrow oxen. The latter strategy is used by most of both female and male holders in Oromia region. Most female and male holders in SNNP use hand digging as a coping and/or adaptation strategy if they have less than two oxen.

Table 3.3 Access to draught-power and coping strategies by gender and region

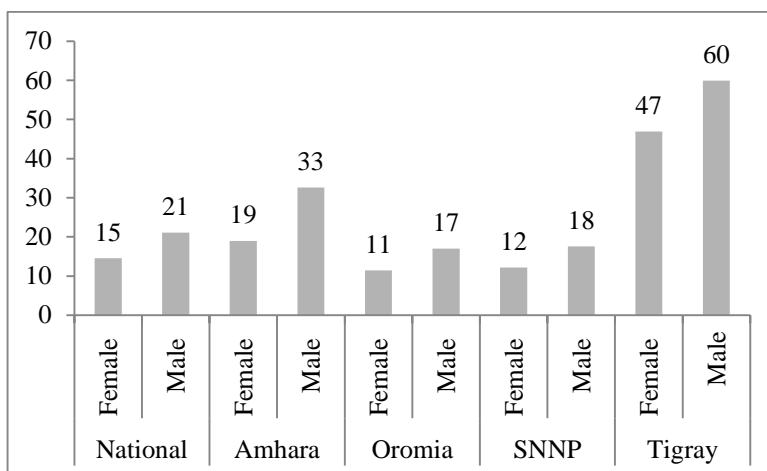
Indicators	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Percentage of holders who have one ox or more	27.20	52.19	29.32	70.27	37.02	56.99	26.47	45.48	30.11	74.46
Percentage of holders who have one ox only	14.94	21.46	18.01	31.24	16.11	19.12	16.47	22.76	21.08	29.37
Percentage of holders who have two oxen or more	12.26	30.73	11.31	39.03	20.91	37.87	10.00	22.72	9.03	45.09
Holders' coping strategies in case of one or no ox										
Renting ox (%)	7.44	7.22	7.61	6.61	6.79	8.72	6.17	6.11	18.47	13.64
Pairing with other's ox (%)	15.22	26.60	17.52	42.36	17.51	25.84	17.62	27.71	20.61	45.74
Pairing with cow/horse (%)	0.69	1.17	1.17	4.96	0.88	0.91	0.32	0.56	1.43	3.68
Use cows or horses (%)	0.74	1.63	1.69	5.74	0.50	0.72	0.34	0.26	0.83	1.16
Hand digging (%)	26.69	25.96	8.45	3.56	16.94	19.39	36.65	36.26	5.65	2.13
Borrowing oxen (%)	28.89	19.95	41.37	20.32	35.79	29.33	27.53	18.92	30.37	15.43
Other coping strategies (%)	20.32	17.05	22.18	16.44	21.59	15.09	11.36	10.18	22.65	18.22
Average Observations (n)	9150	38538	1648	7258	2570	12571	2569	10310	784	2480

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Use of credit

Providing access to financial services and credit, in particular, is crucial for enabling smallholder farmers to invest in productivity-enhancing modern inputs. Smallholder farmers in the developing world attribute the limited use of modern inputs to a shortage of financial assets. Differential adoption and application of inputs, like fertilizer and improved seeds, are often ascribed to differences in access to credit (ECA 2007). In Ethiopia, despite the increase in the number of rural financial service provider institutions (microfinance and financial cooperatives) in recent years, the use of credit generally remains low in the country (Figure 3.1). At the national level, 15 percent of female landholders and 21 percent of male landholders reported taking out loans. Regionally, there is significant variation, but the gender gap in credit use is substantially high across regions—i.e. credit use is higher among male landholders than among female landholders in all regions. Among both male and female holders, the use of credit service is lowest in Oromia and highest in Tigray. The largest gender gap in credit use exists in Amhara, and the smallest gender gap is observed in Tigray.

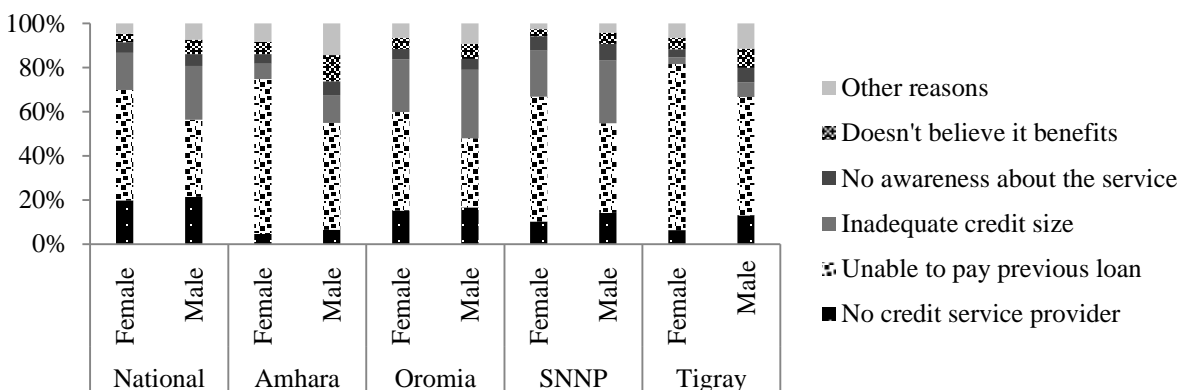
Figure 3-1 Percent of female and male holders using credit by region



Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

In Ethiopia, for both female and male holders, an inability to pay previous overdue loans has been reported as the main obstacle for current credit uses (Figure 3.2). However, at the country level, female holders reported this reason 15 percent more often than male holders. In regions like Oromia and SNNP, lack of credit service providers and inadequate credit size are also important factors that deter farmers from using credit.

Figure 3-2 Percentage share of reasons for not using credit by gender and region



Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Gender differentials in input use

Use of improved seeds

In Ethiopia, the promotion of improved seed that are well-adapted and high quality has been part of agricultural extension packages for some time. This is believed to increase agricultural output through enhancing crop productivity which, in turn, is thought to improve food security, reduce rural poverty, and transform agriculture into a more productive and profitable sector (Benson et al. 2014). However, the rate of adoption for improved seed, in general, remains low due, in part, to systemic bottlenecks (Spielman et al. 2011). The analysis results show that there is also significant variation in improved seed

use between female and male holders (Table 3.4). Over the study period, on average, only about 11 percent of female holders used improved varieties, which is lower by about five percentage points compared to male holders. However, among the holders who use improved seed, female holders tend to use improved seeds on a greater proportion of their cultivated land than do male holders. This could be attributed to their smaller plot sizes and/or female holders may be less skeptical of new technologies if they have access to the knowledge base and technology. However, to arrive at a justifiable conclusion, further analysis is necessary. One of the potential approaches could be comparing the seed use of similar groups of male and female holders based on their individual characteristics and livelihood asset endowments and testing if there are significant differences between the mean values of the estimates.

Table 3.4 Use of improved seeds by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Used improved seed (1=yes, %)	10.63	16.01	11.93	20.23	13.14	18.94	11.87	15.91	7.97	10.41
Area share cultivated with improved seeds, %	33.82	26.94	39.75	25.03	33.03	27.20	32.70	29.61	31.21	24.78
Observation (n)	8026	35765	1468	7052	2302	12024	2463	9686	680	2398

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Use of chemical fertilizers and application rates

Over the study period, on average, close to half of sample female holders and about 58 percent of male holders reported that they used chemical fertilizers. Under the period studied, farmers could only use DAP and Urea either together or separately. At the national level, the proportion of female holders who applied chemical fertilizers was about 8 percent less than their male counterparts. Nonetheless, the proportion of fertilized area to the total crop cultivated area of female holders is 5 percent higher than the fertilized area by male holders. Furthermore, the rate of application of chemical fertilizers among female holders who used chemical fertilizers exceeds that of male holders. Regionally, both male and female holders in Tigray have the highest rate of fertilizer use as well as the rate of application.

Table 3.5 Use of chemical fertilizers and application rates by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Applied chemical fertilizer (1=yes, %)	49.61	58.18	39.67	52.77	57.52	65.97	46.85	53.09	61.36	68.03
Area with chemical fertilizer, %	59.16	54.76	55.25	50.66	63.86	58.28	51.15	49.23	69.32	61.34
Observation (n)	8025	35759	1468	7051	2302	12021	2462	9685	680	2398

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Both female and male holders were asked to mention the primary reason she or he did not apply chemical fertilizer in any one of their crop-cultivated land. Unsurprisingly, the lack of money for purchasing chemical fertilizers is the main reason mentioned by both female and male holders (Table 3.6). However, the percentage share of female holders who mentioned financial constraint as their primary reason, on average, is about 8 percent higher than their male counterparts. Interestingly, female holders are about 58 percent less skeptical concerning the positive outcomes of the application of chemical fertilizers than their male counterparts. Dropping both female and male holders who lack awareness about chemical fertilizers in our analysis substantiates the findings from the full sample, and the differences between male and female holders within both analyses are statistically significant.

Table 3.6 Proportion (%) of reasons for not using chemical fertilizers by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Lack of awareness	5.64	5.10	7.73	6.30	3.97	3.95	6.12	5.18	4.11	4.62
High price	8.69	9.57	7.49	7.23	10.30	12.23	9.67	11.23	10.66	8.84
Lack of money to buy	39.76	31.75	42.23	28.56	46.88	38.75	43.30	34.52	38.92	29.60
Supply shortage	7.00	10.09	5.20	9.35	4.14	6.45	2.60	4.68	0.82	3.11
Lack of credit	0.94	1.43	0.28	0.67	1.13	1.69	0.91	1.04	0.35	0.59
Skeptical of outcome	4.16	7.14	8.04	13.23	3.04	4.71	4.24	8.40	5.13	10.71
Other reasons	31.46	31.97	26.36	31.84	27.37	28.32	31.44	31.95	34.19	37.11

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13).

Use of irrigation

Crop production in Ethiopia is generally characterized as rainfed agriculture. Rainfall variability (onset timing, distribution, offset timing) often induces crop failure in the country. In such cases, it is advisable to supplement crop fields with water, based on soil moisture status and the crop water requirement. Irrigation is an important source of water for such supplemental irrigation purposes. Furthermore, irrigation increases land productivity by allowing multiple cropping per piece of land per year. However, use of irrigation by smallholder farmers in Ethiopia during *meher* crop production season is generally below 10 percent (Table 3.7). The proportion of female holders who use irrigation is about three percentage points below their male counterparts. While the average size of irrigated land for female holders is lower by 0.06 hectares, this can be explained by female holders' relatively smaller farm size. However, female holders who have access to and use irrigation tend to allocate a higher proportion of their cultivated land for irrigation. This may also strengthen our hypothesis that if female farm managers receive access to agricultural technologies, they tend to be less skeptical about applying them. It should also be noted that use of irrigation varies widely by region. The proportion of both male and female holders who use irrigation is highest in Tigray followed by Amhara, Oromia, and SNNP, respectively. Although the proportion of holders who use irrigation in SNNP is relatively small, those who are using irrigation allocate the highest proportion of their cropland to irrigation.

Table 3.7 Use of irrigation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Holders who use irrigation, %	5.32	7.95	7.49	11.79	4.11	5.78	2.32	3.59	10.79	14.27
Share of irrigated land for users, %	45.04	35.05	24.85	13.77	42.06	29.19	62.90	59.82	23.01	14.03
Size of irrigated land for users, ha	0.14	0.20	0.06	0.09	0.16	0.20	0.21	0.36	0.09	0.13
Observation (n)	8912	37767	1591	7180	2486	12350	2494	9758	755	2466

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13).

Gender differentials in crop production participation

In this section, we present the summary of (2010/11-2012/13) female and male growers' production participation in cereal, pulse, oil crop, fruit crops, root crops, vegetables, and other commonly grown crops in Ethiopia.

Gender differentials in cereal crops production participation

Cereals are by far the dominant crops in Ethiopia in terms of their share of area cultivated, production, and consumption. Cereals account for about 71 percent of the total area cultivated and 66 percent of the total crop production during the 2012/13 *meher* season (CSA, 2013). Regarding consumption, cereals are the main source of staple foods in the country and account for more than 60 percent of the national average per capita daily calorie intake or consumption (Dorosh and Rashid, 2012; Taffesse et al., 2012; Berhane et al. 2012). Given its importance in production and consumption, understanding the role of gender in cereal production is imperative. At the country level, maize, sorghum, teff, wheat, and barley are the commodities in which both male and female holders participate most in production. However, the percentage share of female holders who participated in cereal production is, on average, lower than the percentage of male holders who engage in this activity. In particular, the proportion of female holders who participate in teff production is about 14 percentage points lower than for male holders. This may be attributed to higher labor requirements for teff, including land preparation, weed management, and other agronomic practices. Unlike the other cereals for which farmers use weedicides, teff weed management is usually undertaken using manual labor. This may put female holders, who have relatively lower labor access, at risk during peak seasons. There is also significant regional variation in terms of teff production participation between female and male holders, where the highest gender gap is observed in Amhara while the lowest is in SNNP. Regardless of differences in relative magnitudes, an almost identical pattern is observed for the other commodities. The other potential reason could be the relatively higher rate of land preparation practiced by farmers for cereal crops than for other field crops. This demands more oxen labor, which is in short supply among female holders compared to male holders. Furthermore, unlike other crops grown on homesteads, cereals are mostly field crops. As a result, female holders, who are often busy with domestic work, may not find cultivating cereal crops convenient.

Table 3.8 Cereal crops production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Teff producers, %	27.21	40.88	35.58	59.67	34.35	44.09	23.48	35.22	36.23	53.52
Maize producers, %	57.55	61.70	61.14	62.46	66.49	69.89	41.28	45.67	57.11	67.73
Sorghum producers, %	29.28	39.77	30.24	41.35	27.56	38.50	22.71	27.91	34.14	54.09
Wheat producers, %	22.70	28.00	25.58	38.17	29.06	33.79	19.68	21.67	38.89	40.21
Barley producers, %	21.70	25.95	25.70	36.85	25.35	27.64	18.39	22.14	44.61	44.62
Observation (n)	7820	35620	1441	7008	2225	11893	2411	9935	673	2376

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13 average).

Note: ^a Share from the total land covered by annual crops in the production season; ^b Qt stands for quintal = 100 kilograms.

Gender differentials in pulse crops production participation

In Ethiopia, pulse crops are the second and third most important crop categories in terms of area coverage and output, respectively. During the 2012/13 *meher* season, crop production, pulse crops accounted for 14 percent of the total crop cultivated area and 9 percent of the total crop output harvested (CSA, 2013). Pulse crops also account for about 10 percent of the agricultural value addition. They are the principal non-meat protein source in the country and account for approximately 15 percent of total protein intake (Rashid et al., 2010). Also, pulses significantly contribute to smallholders' income, as a high-value crop. In terms of exports, they are the fourth largest export crop after coffee, oilseeds, and flowers, accounting for about a 7-percent share in total export earnings (EEA, 2012). Moreover, pulses improve soil fertility through nitrogen fixation. Among the dominantly grown pulse crops in the

country, faba bean, haricot bean, and field pea are the most widely grown by both female and male holders (Table 3.9). The same pattern is observed across regions. However, the proportion of female holders who participated in pulse crop production, in general, is relatively low. Nationally, the percentage of female holders who participated in each type of pulse production is, on average, lower than the percentage of male holders who engaged in the same activity. The largest gender gap is observed in Amhara while there are only small differences in pulse crop production participation between male and female holders in Tigray.

Table 3.9 Pulse crops production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Chickpea producers, %	2.68	5.46	6.66	13.38	3.27	5.46	0.78	1.44	2.70	6.40
Haricot bean producers, %	17.13	20.71	9.47	12.22	17.60	22.24	28.47	32.07	1.75	3.15
Faba bean producers, %	19.89	23.76	25.56	34.33	21.49	25.51	22.37	24.31	23.32	23.36
Field pea producers, %	8.37	10.97	10.20	16.94	8.03	10.00	11.70	14.05	6.05	5.18
Lentil producers, %	2.74	4.63	7.10	11.67	2.93	4.50	0.58	1.30	4.80	6.29
Vetch producers, %	2.33	4.06	6.36	10.90	2.98	4.23	0.15	0.18	2.99	6.27
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13 average).

Gender differentials in oil crops production

Oil crops like linseed, *neug*, sesame, rapeseed, and groundnuts are important crop categories that generate income for farm households in Ethiopia. Oil crops are the second highest in export earnings next to coffee, accounting for approximately 16 percent of total export earnings (EEA, 2012). Based on the 2012/13 *meher* season post-harvest assessment, oil crops account for only about 6 percent of the total crop cultivated area (i.e. about 0.8 million hectares) and 2.5 percent of the total crop output (i.e. about 0.73 million metric tons) (CSA 2013). Similar to patterns observed for cereals and pulses, male holders tend to participate more in the production of each type of oil crops compared to female holders. The highest concentration of both female and male oil crop growers exist in Amhara followed by Oromia, Tigray, and SNNP. However, there are variations in production participation based on the holder's gender and region. At the national level, female holders have the highest rate of production participation in rapeseed, which is usually cultivated around homesteads in most cases. There is also the smallest gender gap in rapeseed production participation. In all regions except SNNP, female holders participate in rapeseed production at higher rates than male holders. Both male and female holders have the lowest participation rate in groundnut production, which is relatively labor intensive. A similar pattern is observed across the regions, although *neug* production is less common than groundnut in SNNP. If we specify by commodities, female holders in Amhara are the lead rapeseed producers whereas male holders in Tigray region are the lead sesame producers.

Table 3.10 Oil crops production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Linseed producers, %	3.41	6.00	6.47	12.26	3.80	6.17	1.41	2.12	5.38	8.40
Neug producers, %	3.67	6.85	5.48	10.29	7.21	10.90	0.06	0.18	2.85	4.71
Sesame producers, %	3.15	6.44	5.02	9.84	2.36	4.54	0.20	0.65	4.79	14.59
Rapeseed producers, %	4.65	4.86	11.05	10.79	7.16	6.50	1.39	1.51	0.30	0.28
Groundnuts producers, %	1.77	3.08	0.84	1.14	1.45	3.55	0.13	0.43	0.10	0.15
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13 average).

Gender differentials in root crop production

Root crops like potatoes, sweet potatoes, taro/*godere*, garlic, and onions are important food and income sources for smallholder farmers in rural Ethiopia. Based on the 2012/13 *meher* season post-harvest assessment, root crops account for only about 1.5 percent of the total crop cultivated area, which is about 0.2 million hectares and is ranked fourth following the areas occupied by cereals, pulses, and oil crops. However, in terms of production, it accounts for more than 12 percent of the total crop output, which is about 3.6 million metric tons and ranked second next to cereal output (CSA 2013). Nationally, the percentage share of female holders who participated in each type of root crop production is lower than the percentage share of male holders, with the exception of taro/*godere* production (Table 3.11).

Table 3.11 Root crops production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Potato producers (%)	6.22	7.60	9.13	12.88	6.71	6.63	7.39	9.02	2.67	2.89
Sweet potato producers (%)	9.80	12.04	0.81	1.10	8.73	12.75	17.01	21.19	0.00	0.01
Taro/ <i>godere</i> producers (%)	14.05	13.04	0.00	0.01	6.94	7.53	36.35	36.06	0.00	0.00
Garlic producers (%)	9.99	10.78	23.90	24.55	12.91	12.12	3.77	4.15	6.49	6.65
Onion producers (%)	3.90	5.49	4.51	7.24	5.06	6.42	3.31	4.37	3.34	3.42
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13).

Both male and female holders have the highest rate of participation in taro production in SNNP, and female holders participate at slightly higher rates. Garlic production is also common in Amhara, Oromia, and Tigray, with female holders participating at higher rates than male holders in Oromia. The participation rate of male and female holders is lowest across almost all types of root crops in Tigray. Onion production, which is relatively labor intensive and needs irrigation, is not common among male or female holders. The largest gender gap is observed in onion production participation in Amhara, where male holders are 1.6 times more likely than female holders to produce onions.

Gender differentials in vegetable production

Green and red peppers, Ethiopian cabbage, and tomatoes are the dominant vegetables grown in Ethiopia. Farmers residing near urban centers produce most of the vegetables. Vegetable farming is uncommon among most rural farm households. For this reason, vegetables occupied only 1.4 percent of

the total cultivated area and accounted for about 3 percent of the total crop output in the country. Nationally, the percentage share of male holders who participate in the production of each vegetable type is relatively higher than the share of female holders. However, the differences in production participation are much narrower than in most other crops, except for red peppers. Female holders in Amhara and Tigray are about seven percentage points less likely to grow red pepper than are male holders in these regions.

Table 3.12 Vegetable production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Green pepper producers (%)	6.53	7.75	4.65	5.47	11.25	11.43	5.66	6.74	4.11	7.45
Ethiopian cabbage producers (%)	2.42	3.03	1.78	2.40	4.29	4.75	2.32	2.78	0.68	0.94
Red peppers producers (%)	9.57	14.44	18.47	25.13	10.09	14.82	5.53	7.28	10.13	16.77
Tomato producers (%)	1.40	1.78	1.11	1.44	0.97	1.50	1.21	1.30	1.67	2.36
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Gender differentials in fruit crop production

Fruit crop production in Ethiopia has a relatively small share in terms of overall cultivation area and quantity of production. Based on the 2012/13 *meher* season post-harvest assessment, fruit crops accounted for only 0.5 percent or only 62 thousand hectares of total farmland. Likewise, its share of the total crop production was limited to 1.6 percent (i.e., 479 thousand tons). Bananas, mangos, papayas, oranges, and avocados are the dominant fruit crops in the country. Across the four regions (Table 3.13), the proportion of female holders who produce each type of fruit crop is lower, on average, than the share of male holders producing each fruit crop, with the exception of avocado. However, these national averages hide the wide variation in fruit crop production by region.

Table 3.13 Fruit crop production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Banana producers (%)	14.00	16.31	1.81	3.06	12.13	14.92	27.57	33.19	0.41	1.03
Mango producers (%)	7.62	8.06	1.34	1.66	5.72	6.83	10.11	11.45	0.15	0.40
Papaya producers (%)	4.72	5.49	1.94	2.16	2.44	3.53	6.91	9.23	1.44	1.68
Orange producers (%)	2.87	3.35	1.97	3.11	2.13	2.56	4.46	4.24	0.58	1.34
Avocado producers (%)	8.24	7.89	0.37	0.51	3.86	4.56	21.62	20.97	0.20	0.25
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

SNNP and Oromia have the highest participation rate in fruit crop production, although the participation rates in SNNP are at least twice that of Oromia for most fruit crops. Fruit production is least common in Tigray. While male holders are generally more likely than female holders to produce each type of fruit crop, female holders in SNNP are more likely to produce both oranges and avocados than male holders in the region. We observe the largest gender gap favoring male holders in the rates of participation in banana production across the four regions.

Gender differentials in stimulant and other crops production

Stimulants (chat and coffee) and other crops (sugar cane, hops, and enset) are combined into a single category. These crops represent considerable area coverage and production in the country. Farm households involved in the production of the two major stimulant crops (i.e., coffee and chat) alone are by far larger in number than those growing fruits (CSA, 2013). Compared to fruit and root crops, coffee and chat farms also occupied a substantial share of the total crop area. Coffee and chat took up 3.9 and 1.3 percent of the total crop cultivated area in 2012/13 *meher* season, respectively. These two crops are also known for generating income at both the household and national levels. Coffee is the number one crop in generating export earnings and accounts for more than 35 percent of total export earnings in the country (EEA, 2012). Sugarcane and hops, on the other hand, are grown only in some parts of the country and represent a small fraction of the total crop area. Each crop occupied approximately 0.2 percent of the total crop area during the 2012/13 *meher* season. Enset is a common crop grown mostly in the southwestern part of the country and covers considerable acreage in SNNP and Oromia. Table 3.14 summarizes the production participation rate of female and male holders by region. There are relatively higher proportions of smallholders growing enset, sugar cane, and coffee in SNNP followed by Oromia. Chat is grown most commonly in Oromia followed by SNNP, and hops are produced by the most holders in Amhara followed by Tigray. In addition to regional variations, there are gender variations in production participation in some of these crops. For example, female holders in SNNP tend to participate in enset production at higher rates than their male counterparts. This could be attributed to production location. Unlike other field crops, enset, for instance, is a homestead crop that makes it convenient for female holders to cultivate. In addition, enset is relatively less labor intensive compared to other annual cereal crops like teff, which makes it a preferred crop commodity by female holders. In addition, while female holders in SNNP and Tigray also have higher participation rates in hops production than male holders in each region, male holders in Amhara are almost 1.3 times as likely to participate in hops production as their female counterparts. Across the four regions, the largest gender gaps are in the production of chat.

Table 3.14 Stimulant crop production participation by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Sugar cane producers (%)	6.36	8.40	1.07	2.30	4.26	6.13	14.36	18.48	0.10	0.22
Chat producers (%)	10.98	16.48	3.53	5.65	15.78	23.54	13.54	16.72	0.43	0.86
Coffee producers (%)	25.82	29.78	6.76	8.71	24.61	31.72	52.31	56.72	1.13	1.42
Enset producers (%)	31.74	30.04	0.07	0.06	25.22	24.79	77.31	76.80	0.00	0.01
Hops producers (%)	9.47	10.82	19.56	25.13	8.11	8.44	6.68	6.16	14.72	13.72
Observation (n)	7936	35523	1450	7028	2288	11975	2450	9653	671	2393

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

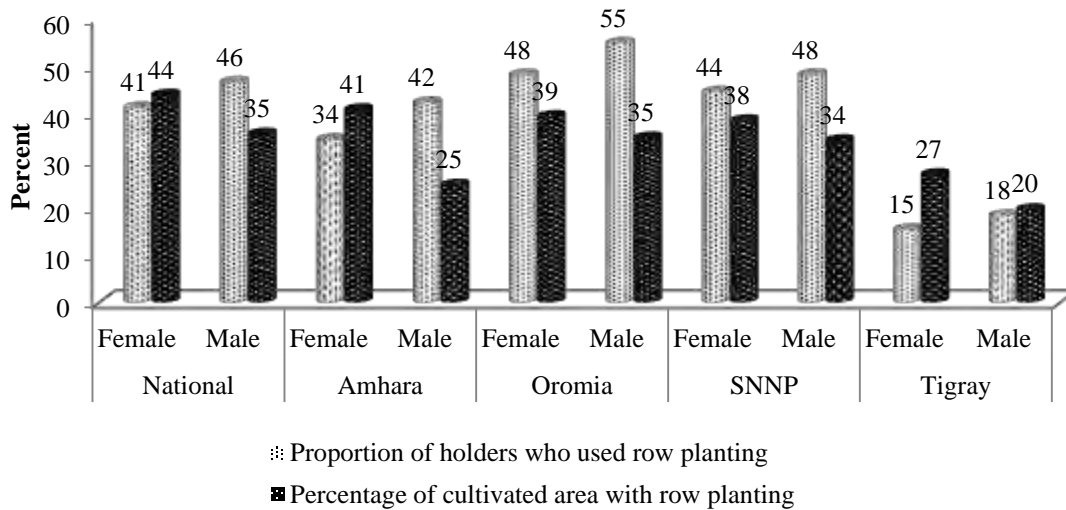
Gender differentials in some agronomic practices

Planting method

The dominant seeding method for grain crops in Ethiopia is manual broadcasting. This method is criticized, at least for some grain crops, due to its effect on plant spacing and seed cost. The spacing between plants and rows has an important implication on plant density per unit-cultivated area. This in turn affects the availability of soil nutrients and water for healthy plant growth. Furthermore, excessive use of seed per plot beyond the recommended rate is an unnecessary cost for farmers. To maintain

appropriate plant density and avoid the unnecessary seed cost, the Ethiopian Agricultural Transformation Agency (ATA) in collaboration with the Ministry of Agriculture (MoA) has been intensively promoting row planting. In 2012/13, farm households were asked about the planting method they follow while sowing seeds. About 41 percent of female holders and 46 percent of male holders use row planting. The difference is statistically significant. The low rate of application of row planting by female holders could be attributed to the relatively higher labor demand of row planting (Vandecasteele et al. 2014). However, those female holders who used row planting have relatively higher proportions of their cultivated land under row planting than their male counterparts (Figure 3.3). This could be attributed to the smaller plot sizes that they cultivated.

Figure 3-3 Distribution of holders who applied row planting by gender and region



Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2012/13).

Cropping frequency and crop rotation practices

Increasing cropping frequency by cultivating a plot of land more than once per year is one of the agronomic practices promoted to increase land productivity and agricultural production in Ethiopia. Multiple cropping, the practice of growing two or more crops in the same space during a single growing season, in the form of double cropping and / or relay cropping has been practiced in the country where there is bimodal rainfall, terminal moisture, and irrigation. Beyond yield increments, such practices have environmental benefits (Waha et al. 2013). A study conducted in Ethiopia showed the advantage of double cropping in terms of yield gain, minimizing soil erosion, checking physical expansion of cropped area, managing weeds, and increasing labor efficiency (Tanner et al. 1994). Such benefits will be maximized more if the proper crop rotation, in which two or more crops are grown one after the other on the same land, is maintained based on the history of precursor crop on the crop field (Mohler and Johnson 2009). The cereal-legume/oil crop rotation is the dominant practice in Ethiopia. Numerous studies show the economic as well as the environmental feasibility of such agronomic practices (Tanner et al. 1994; Abera et al. 2005; Teklewold et al. 2013). As a result, different research and development stakeholders in Ethiopia are promoting such agronomic practices to boost agricultural production sustainably. For instance, the ATA is scaling-up double cropping practices with teff-chick pea rotation. However, multiple cropping practices remain low in the country.

Table 3.15 Multiple cropping & crop rotation practice by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Holders practicing multiple cropping, %	2.00	3.21	3.14	5.63	2.92	4.25	0.98	1.19	1.60	2.35
Share of area with multiple cropping, %	32.60	25.08	29.77	21.90	30.41	22.95	35.94	36.09	26.04	14.57
Holders practicing crop rotation, %	71.48	77.77	86.21	94.37	78.91	84.49	71.90	74.20	89.59	95.93
Crop field type										
Pure stand (%)	53.76	61.68	60.42	73.87	58.86	65.76	48.84	53.05	70.53	83.72
Mixed (%)	15.15	14.98	13.81	11.15	11.69	13.05	22.05	22.02	5.41	5.33
Other (%)	31.09	23.34	25.77	14.98	29.44	21.19	29.11	24.94	24.05	10.95
Observation (n)	7782	34974	1449	7013	2242	11825	2354	9349	672	2393

Source: Authors' computation based on CSA's *meher* season post-harvest survey data (2010/11 – 2012/13).

During our analysis period, on average, only 2 percent of female holders and 3 percent of male holders reported multiple cropping practices per *meher* production season per year (Table 3.15). This is a direct reflection of the low level of irrigation use in the country. Those who are practicing multiple cropping, primarily double cropping, use terminal moisture to cultivate the second crop after the main crop is harvested. Cultivation of chickpea with terminal moisture is a good example of this practice in Ethiopia. Regionally, Amhara and Oromia have a relatively higher proportion of holders who practice multiple cropping. Interestingly, among female holders, the share of the area with multiple cropping is larger than the share among male holders. In regards to crop rotation, more than 71 percent of female and 78 percent of male holders practice it. Female farmer's relatively small plots or lack of access to inputs like seeds could prevent them from engaging in such basic agronomic practices. Nationally, single crop cultivation per plot (pure stand crop) is the dominant cropping practice for both female and male holders, although male holders are more likely than female farmers to practice single crop cultivation. However, female holders participate at similar rates to male holders in mixed crop farming. The same pattern is observed in Amhara and Tigray. This could be due to female holders' interest in producing relatively diverse crop types to meet consumption needs and produce higher yields (if complementary crops are used) in their smaller plots.

Access to crop production advisory services

To increase crop productivity, use of improved crop technologies (improved seed, fertilizer, and agronomic practices) are necessary, but not sufficient, conditions. Achieving optimal productivity often entails the use of the right mix of these inputs by farmers. Farmers' knowledge, skill, and experience in this regard are also of paramount importance. The government of Ethiopia has heavily invested in establishing Farmer Training Centers (FTCs) and hiring development agents who provide extension and advisory services at the local level. For our analysis, we classified crop agriculture related extension services into two categories. The first category is the provision of crop extension advisory services, including visiting farm households, teaching farmers in FTCs or other convenient places, showing them demonstration or model farmers' plots, undertaking exchange visits, as well as other services. The goal is to increase the knowledge and change the attitudes of farmers to promote adoption of improved crop technologies. At the national level, on average, more than half of sample crop growers reported that they received crop production related advisory services over the study period (Table 3.16). However, the percentage share of female holders who received such advisory services was about 13 percentage

points lower than the percentage of male holders who received these services. The same pattern of lower rates of access to advisory service among female holders is observed in all regions. This finding is consistent with the research of Mogues et al. (2010) and Ragasa et al. (2012). Both male and female holders in Tigray have reported a higher rate of access to advisory services than in other parts of the country. Among the primary reasons for the lack of access to advisory service is inadequate advisory service coverage. This factor is especially significant in SNNP and Oromia.

Table 3.16 Access to crop extension advice by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Holders who received advice, %	51.04	63.70	65.13	82.54	49.99	63.98	52.45	64.23	73.37	84.66
Reason if holders did not get advice, %										
Absence of advisory service	20.03	23.77	8.23	13.22	10.64	13.29	5.91	7.45	4.60	9.58
Inadequate advisory service	32.78	39.60	20.29	29.80	36.44	44.21	41.48	48.70	9.74	21.43
Lack of awareness	24.37	16.82	34.82	21.62	25.80	19.20	32.05	23.77	33.07	26.15
Such service doesn't benefit	2.81	3.64	3.70	7.02	3.40	4.68	3.51	4.19	2.95	6.70
Other reasons	15.75	9.73	27.77	17.15	19.91	13.28	12.77	9.24	38.94	19.62
Observation (n)	8025	35759	1468	7051	2302	12021	2462	9685	680	2398

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

The second category of extension services in Ethiopia is the promotion of crop technologies as a package. The major crop extension packages are improved seed and fertilizer, as well as commodity-specific agronomic practices, based on recommendations from extension agents. However, only a little more than a quarter of male holders and only about 20 percent of female holders used various crop extension packages (Table 3.17). Similar to extension advisory service participation rates, both male and female farmers in Tigray have higher rates of use of crop extension packages than in other regions, while use is relatively low for both male and female holders in SNNP.

Table 3.17 Use of crop extension packages by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Used extension packages, %	19.44	27.62	26.52	39.82	20.60	26.87	13.86	20.94	47.37	60.64
Area under extension packages, %	56.77	50.18	60.42	54.83	52.27	44.93	42.51	39.70	73.40	66.61
Observation (n)	8025	35759	1468	7051	2302	12021	2462	9685	680	2398

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

The main reasons for not participating in extension packages differ somewhat by the gender of the holder. Similar to the fertilizer case, female holders report a lack of money for input purchase as the primary reason for not applying crop technology packages recommended by extension agents but are less skeptical than their male counterparts about the potential benefits of employing crop technologies as a package (Table 3.18).

Table 3.18 Percentage share of reason for not using crop extension packages by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Lack of awareness	12.36	11.31	16.34	16.43	10.73	9.86	12.08	10.50	14.27	17.18
Lack of money	36.80	31.72	33.00	24.97	41.46	36.98	41.57	36.12	33.49	25.18
Skepticism of the outcome	5.75	9.16	8.28	13.44	5.69	7.91	5.42	10.15	7.43	14.46
Non-availability	14.17	15.88	13.29	20.06	10.52	11.64	4.04	4.66	3.43	6.68
Lack of adequate land	15.09	13.98	12.48	9.45	14.39	13.93	22.58	21.78	18.95	14.88
Other reasons	15.82	17.96	16.61	15.65	17.21	19.69	14.31	16.80	22.43	21.63
Observation (n)	8025	35759	1468	7051	2302	12021	2462	9685	680	2398

Source: Authors' computation based on CSA's meher season post-harvest survey data (2010/11 – 2012/13).

Conclusion

In this sub-section, we examined gender differentials in crop production using CSA's meher season post-harvest survey data collected in 2010/11 to 2012/13. The analysis indicates that female holders who are involved in crop production have a substantially lower livelihood asset base required for crop agriculture than do male holders. In terms of human capital, female holders are five years older, have 1.6 fewer family members, and are less educated. The proportion of female holders that cannot read and write is 31 percentage points higher than this proportion of male holders. In addition, female holders are less endowed with natural and agricultural capital. In terms of accessing land through leasing, only about 8 percent of female holders rented land while the corresponding figure for male holders is about 20 percent. Although both female and male holders are about equally likely to own their land, the total size of owned and managed land for female holders is about 0.63 hectares while it is about 1.00 hectare for male holders. Similarly, regardless of ownership, the size of land managed by female landholders is, on average, 43 percent below the size of land managed by their male counterparts. Furthermore, about 12 percent of female holders have two or more oxen whereas more than 30 percent of male holders own two or more oxen. Likewise, only about 11 percent of female holders used improved seed varieties, which is lower by about five percentage points as compared to male holders.

Similarly, we observed a disproportionate use of chemical fertilizers between female and male holders. Close to half of female holders used chemical fertilizers while about 58 percent of male holders did. While national access to irrigation is limited, the proportion of female holders who use irrigation is about 38 percentage points less than their male counterparts. When we compared female and male holders who used improved seed, chemical fertilizer, and irrigation, female holders tend to have a higher intensity of use of these agricultural inputs. This could imply that if female holders have access to inputs, they tend to be less skeptical than their male counterparts about using them on a relatively higher proportion of the land they are managing. However, this needs further analysis to arrive at conclusive statements, as this might also be related to female holders' smaller size of households and plots. The other livelihood asset differential between female and male holders we observed is on financial capital (credit use). The proportion of female holders who used credit is 31 percentage points lower than their male counterparts.

In relation to participation in crop production, we also observed variations between female and male holders. In general, female holders participate in crop production at lower rates than their male counterparts. However, there are significant variations across crops and regions. For example, female holders tend to have higher rates of participation in rapeseed, taro, and enset production, as compared to other crop types, which is not surprising given that these crops are usually cultivated around homesteads and require relatively less labor. In some regions, female holders participate in the

production of these crops at higher rates than their male counterparts. On the other hand, female holders have lower rates of participation in groundnut, onion, and fruit crops, possibly due to high labor requirements and distance factors. Even within crop types, we observe large variations. For example, within cereals, the proportion of female holders who participated in teff production is about 14 percentage points less than the proportion of male holders producing teff, while this difference is much smaller, on average, for maize (4.15 percentage points) and barley (4.25 percentage points). This could be due to a shortage of labor since teff production is relatively labor intensive compared to other cereal crops. Furthermore, as teff is one of the crops that is mostly cultivated on main fields that are relatively far away from residential areas, female holders, whose time is consumed by domestic work, may not find teff cultivation convenient.

Notable disparities between female and male holders in crop production relates to some basic agronomic practices. Like that of livelihood assets ownership and participation in crop production, the proportion of female holders who practiced row planting is lower by about five percentage points compared to male holders and the difference is statistically significant. The low rate of application of row planting by female holders could also be attributed to the relatively higher labor demand of row planting. However, those female holders who used row planting put relatively higher proportions of their cultivated land under row planting than their male counterparts. This could be because of the smaller plot size they cultivated and/or they are less skeptical about adopting new technologies. Further investigation is necessary to understand why this is the case. The same pattern is observed regarding the use of crop extension advisory service and application of crop extension packages. The percentage share of female holders, as compared to male holders, who received crop production related advisory services and who applied crop extension packages is lower by about 13 and 9 percentage points, respectively.

4 GENDER DIFFERENTIALS IN LIVESTOCK PRODUCTION IN ETHIOPIA

Ethiopia accounts for the largest share of livestock population in Africa. More specifically, in 2012/13, the country owned about 54 million cattle, 25.5 million sheep, 24.1 million goats, 1.9 million horses, 6.8 million donkeys, 0.4 million mules, and 0.9 million camels (CSA 2013). This sub-sector plays a vital role in the agricultural sector as well as in the overall economy (Gebremariam et al. 2010). The livestock sub-sector accounts for more than 10 percent of the national GDP and 22 percent of the agricultural value added (EEA 2013). The average annual income from livestock and livestock products exports is estimated to be between 10-13 percent of total income (Negassa et al. 2012). The non-monetized contributions of the livestock sub-sector include the benefits of livestock in providing traction power, transportation, a substitute for credit, and self-insurance (ICPALD 2013; Metaferia et al. 2011). Livestock also provides the needed animal proteins (nutritious foods) and fuel for cooking for rural farm households. The subsequent sections present the results and analysis from the sex-disaggregated data.

Demographic Profile of Sample Livestock Holders

Table 4.1 outlines summary statistics of basic demographic attributes of the sample households involved in animal husbandry from 2010/11 – 2012/13. Consistent with the sample households used in crop agriculture, at the national level, female holders are found to be older by about four years as compared to male holders and are characterized by a relatively small average family size. The latter implies that female holders have less family labor at their disposal for farm activities. Female holders also lag behind their male counterparts in levels of education. Close to 90 percent of the female holders in the sample do not have any formal education, and the gap is considerable when compared to male holders – a difference of about 23 percentage points. Male holders are relatively more literate with about 30 percent attending primary school and 4 percent having a secondary education. Female holders are approximately three times less likely to attend primary or secondary school as compared to male holders.

Table 4.1 Socioeconomic profiles of livestock holders by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Holder's age	46.23	42.07	48.31	44.04	46.27	40.84	45.36	41.32	48.73	46.80
Holders household size	4.10	5.62	3.49	5.17	4.43	5.88	4.19	5.62	3.54	5.55
Holders education status										
<i>No formal education (%)</i>	88.92	65.47	92.30	83.39	87.23	57.69	87.75	56.13	90.17	72.94
<i>Primary education (%)</i>	9.86	30.35	6.87	15.18	11.26	37.04	11.08	38.53	8.40	25.08
<i>Secondary and above (%)</i>	1.22	4.18	0.83	1.43	1.51	5.27	1.17	5.34	1.43	2.76
Average Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Livestock Ownership and Participation in Livestock Extension Packages

In this sub-section, livestock includes cattle, goats and sheep, equines, poultry, and honeybees. In general, more than 90 percent of the sample farm households are involved in some form of livestock production. Overall, the proportion of female holders participating in some form of livestock production is about 4-5 percentage points lower than the share of male holders participating in these activities.

Consistent with much of the gender differentials depicted in crop production, the number of total livestock (measured in Tropical Livestock Units (TLU)), owned by female holders, was found to be about 25 percentage points less than the number owned by male holders. In other words, while female holders do participate in livestock holdings at roughly the same high rates as male holders, they own less livestock. These inequalities are most pronounced in Tigray, where female holders have about 50 percent fewer TLUs than their male counterparts (Table 4.2).

To improve livestock production and productivity, the government of Ethiopia is promoting milk, meat, poultry, and honey technologies as different technology packages. However, the level of involvement of farm households in one or more of these packages is far below expectations. Only about 1 percent of sample households have reported that they are involved in different livestock extension packages. Although the overall participation rates are quite small, women holders are about 20 percent less likely to participate than are male holders. It should be noted that male and female livestock holders in Tigray have participated at rates about five times higher than the national averages.

Table 4.2 Livestock ownership and participation extension packages by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Involved in livestock raising, %	90.22	95.26	87.44	96.36	92.29	94.90	91.77	94.84	87.79	97.21
Size of livestock owned in TLU	3.12	4.28	2.47	3.86	3.62	4.69	2.94	3.68	2.50	4.77
Livestock extension package users, %	1.02	1.32	0.82	1.27	0.53	0.91	0.68	1.03	5.34	6.15
Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Cattle ownership

As indicated above, the cattle population in the country is estimated to be about 54 million, of which 64 percent are aged between 3-10 years. Cattle were mainly used for draught-power (24.73 percent), breeding (21.93 percent), and milk production (12.5 percent) in 2012/13 (CSA, 2013). More than 70 percent of the farm households owned cattle during this period. However, there is a clear gender disparity in cattle ownership, with male holders having a 15 percentage point higher ownership rate over female holders (Table 4.3). The differences do vary by region, with women holders about 30 percent less likely to own cattle in Tigray and Amhara with only about a six percentage point differential in SNNP. On average, male holders own about one more cow than female holders, with the exception being Tigray where males own approximately two more cattle. Most of the cattle owned are indigenous or local breeds.

Table 4.3 Cattle ownership by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Own cattle (1=yes, %)	65.42	81.30	58.45	87.22	73.49	82.28	76.18	83.87	55.61	88.33
Number of cattle owned	4.01	5.03	2.95	4.02	4.30	5.29	3.55	4.29	3.14	5.31
Cattle breed composition, %										
<i>Local breed</i>	99.42	98.32	99.31	99.25	99.51	99.22	99.24	99.24	98.39	98.82
<i>Exotic</i>	0.13	0.11	0.06	0.07	0.08	0.11	0.13	0.10	0.30	0.27
<i>Crossbreed</i>	0.68	0.76	0.61	0.67	0.61	0.83	0.78	0.89	1.43	1.05
Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Goat and sheep ownership

The number of sheep and goats in Ethiopia is comparable to the number of cattle in the country. According to a 2013 CSA report, there are about 50 million sheep and goats in the country. Goats and sheep are the main sources of cash earnings or income for a considerable number of rural farm households. Table 4.4 presents sex-disaggregated data on the number of goats and sheep owned by livestock holders. The summary statistics indicate that, on average, 31 percent of the female holders and 36 percent of male holders own sheep, implying a 5 percent gap between the two groups. The gap is highest in Amhara (11 percent deficit for women holders) and lowest in Tigray where the gap is essentially zero. Similar to sheep holdings, a relatively lower proportion of female holders owned goats. The proportion of female holders that raised goats is about 7 percent lower than male holders. The difference is highest in Tigray (22 percent lower for women holders) and lowest in Oromia (5 percent lower for women holders). Even though we observed statistically significant differences between female and male holders on the number of goats and sheep owned, the magnitude is relatively small compared to their differences of the number of cattle owned. Similar to cattle, almost all of the goats and sheep owned by both female and male holders are found to be indigenous or local breeds.

Table 4.4 Goat and sheep ownership by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Owned goat (1=yes, %)	25.40	32.95	18.85	28.57	23.23	28.32	20.25	27.43	20.65	40.54
Number of goat owned	6.88	7.49	4.52	5.67	4.66	5.00	5.40	5.41	5.93	9.20
Goat breed type, %										
<i>Local breed</i>	99.87	99.85	100.00	99.96	99.81	99.89	99.74	99.73	100.00	99.95
<i>Exotic</i>	0.03	0.01	0.00	0.00	0.00	0.02	0.13	0.01	0.00	0.00
<i>Crossbreed</i>	0.01	0.03	0.00	0.00	0.00	0.01	0.04	0.12	0.00	0.02
Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687
Owned sheep (1=yes, %)	31.18	36.14	25.39	36.38	33.35	36.44	37.42	40.02	19.32	20.21
Number of sheep owned	4.70	5.52	4.74	5.83	3.91	4.49	3.24	3.55	5.26	6.61
Sheep breed type, %										
<i>Local breed</i>	99.88	99.86	99.87	99.69	99.86	99.91	99.89	99.90	100.00	99.69
<i>Exotic</i>	0.00	0.02	0.00	0.03	0.01	0.01	0.00	0.03	0.00	0.08
<i>Crossbreed</i>	0.01	0.06	0.07	0.26	0.01	0.01	0.00	0.01	0.00	0.08
Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Ownership of equines

There are close to 10 million equines (for example, donkeys, mules, horses, and camels) in Ethiopia (CSA, 2013). Most of the equines are used for transportation, with relatively few used for draught power or other purposes. A considerable number of farm households' own donkeys compared to other equines (Table 4.5). Nationally, almost one-third of all male holders have donkeys while the corresponding figure for female holders is only 17 percent. Similar to the gender gap in donkey ownership, there is an equivalent gap between female and male holders in horse ownership. The proportion of male holders who own horses is twice the proportion of female holders. This has important social and economic implications because, while donkeys are the main means of transporting goods to the farms and marketplaces, horses are the common mode of human transportation in rural areas. As shown in Table 4.5, there are regional variations in horse ownership, and some are worth noting. Female holders in Oromia and male holders in Tigray have the highest proportion of donkey ownership. On the other hand, there is little difference between male and female holders in the number and type of the other equines owned.

Table 4.5 Ownership of equines by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Owned donkey (1=yes, %)	17.48	31.34	18.58	43.04	23.65	34.87	9.17	13.93	19.18	50.50
Number of donkey owned	1.42	1.46	1.37	1.43	1.46	1.50	1.30	1.28	1.33	1.44
Owned mule (1=yes, %)	0.75	2.43	0.52	3.20	1.22	3.10	1.00	2.49	0.03	0.58
Number of mule owned	1.07	1.10	1.05	1.06	1.09	1.12	1.06	1.09	1.00	1.06
Owned horse (1=yes, %)	4.02	8.07	2.01	7.20	6.63	12.67	5.79	8.87	0.06	0.25
Number of horse owned	1.48	1.54	1.42	1.44	1.67	1.70	1.29	1.31	1.00	1.63
Owned camel (1=yes, %)	1.72	3.02	0.52	1.54	1.20	1.42	0.01	0.01	0.41	3.01
Number of camel owned	6.50	6.02	3.00	1.58	4.99	3.30	0.50	0.84	1.96	1.70
Observation (n)	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock surveys data (2010/11 – 2012/13).

Poultry ownership

The total poultry population at the national level is estimated to be about 50 million and includes cocks, cockerels, pullets, laying hens, non-laying hens, and chicks. Despite the general belief that poultry production is relegated to females, the results in Table 4.6 indicate that a relatively higher proportion of male holders are involved in poultry ownership. In addition, male holders own approximately one more chicken, on average, than do female holders. However, as we did not have detailed information on the intra-household division of labor for poultry production, we do not know who is primarily responsible for poultry management within the household. Additional research is needed to measure the amount of labor time that women contribute to raising chickens. Regarding the poultry mix, close to 98 percent are indigenous poultry breeds, and there is no statistically significant difference in the breed mix by gender of holders.

Table 4.6 Poultry ownership by gender and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Owned poultry (1=yes, %)	50.64	58.34	59.88	68.17	47.51	56.51	47.20	55.42	67.05	75.23
Number of poultry owned	5.61	6.27	4.39	5.27	5.35	6.19	5.08	5.89	6.03	7.20
Poultry breed type, %										
<i>Local breed</i>	97.41	97.13	97.19	96.53	98.03	97.72	98.48	98.30	93.11	91.93
<i>Exotic</i>	0.59	0.61	0.57	0.57	0.30	0.43	0.39	0.46	1.43	1.73
<i>Crossbreed</i>	1.88	2.18	2.08	2.81	1.60	1.80	1.01	1.21	5.19	6.20
<i>Observation (n)</i>	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Beehive ownership

The 2012/13 livestock survey report of CSA estimated the total honeybee colonies to be 5.21 million in the rural sedentary area of the country (CSA, 2013). Honey, which is the main product of honeybees, is the primary sources of income for beekeepers. The proportions of male holders who own honeybee colonies are about three times the number of female holders. In addition, male beekeepers have more colonies (the national average for male holders is about five honeybee colonies and three for female holders) (Table 4.7). Nationally, on average, traditional beehives comprise almost 94 percent and 95 percent of beehive holdings of female and male holders, respectively. However, the figures are only 81 percent for female holders and 79 percent of male holders in Tigray, showing the higher proportion of modern beehives in the region. Except in SNNP and Tigray, female holders have a relatively higher proportion of modern beehives. This could be attributed to projects that target women as honeybee producers and provide modern beehives. In addition, the nature of the enterprise (homestead business and less labor requirement) may also contribute to women taking up beekeeping.

Table 4.7 Honeybee colony ownership by beehive types, gender, and region

Indicator	Regions									
	National		Amhara		Oromia		SNNP		Tigray	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Owned honeybees (1=yes, %)	3.47	10.57	3.79	10.48	3.84	12.09	3.32	9.44	4.84	13.67
Number of honeybee colonies	3.10	4.98	1.84	2.57	3.27	5.31	3.29	4.43	1.79	1.94
Beehive type, %										
<i>Traditional</i>	93.83	94.71	87.97	91.79	97.65	97.15	97.65	97.80	80.89	78.65
<i>Intermediate</i>	1.48	1.34	3.33	2.22	0.37	1.31	1.41	0.87	0.93	1.10
<i>Modern</i>	4.69	3.96	8.70	6.01	1.99	1.54	0.95	1.33	10.80	14.16
<i>Observation (n)</i>	12863	55690	2323	10985	3796	18574	3737	14731	1116	3687

Source: Authors' computation based on CSA's livestock survey data (2010/11 – 2012/13).

Conclusion

In this sub-section, we examined gender differentials in livestock production using CSA's livestock survey data collected between 2010/11 to 2012/13. The summary statistics of demographic characteristics of the sample households show female holders are, on average, four years older than male holders, and have 1.5 fewer family members. Female holders also lag behind their male counterparts by 23 percentage points in basic reading and writing abilities, 20 percentage points in primary education

attendance and 3 percentage points in secondary school attendance. Likewise, the proportion of female holders who are involved in livestock production is about five percentage points lower than male holders. In addition, the total number of livestock (measured by TLU) owned by female holders is, on average, lower by about 25 percentage points as compared to male holders. Similarly, female holder's participation in livestock extension packages is lower by about 20 percentage points. More specifically, the proportion of female holders who own one or more cattle is 15 percentage points lower than that of male holders. Likewise, the proportion of female holders who are involved in goats and sheep production is lower by about seven and four percentage points, respectively. Regarding ownership of equines, female holders are far less likely than male holders to own mules, horses, donkeys, and camels. This is important to consider from a gendered perspective because it can imply limited access to transportation, as donkeys are the main means of transporting goods to and from the farms and marketplaces and horses are the common mode of human transportation in rural areas. The proportion of female holders who own poultry and honeybee colonies is seven percentage points less than that of male holders for both assets. Female holders also own one less chicken and two fewer honeybee colonies than do male holders. Regardless of gender differences, the cattle are almost all indigenous breeds, and most hives are traditional.

5 SUMMARY AND POLICY IMPLICATIONS

This report presents the findings of gender analysis using nationally representative sex-disaggregated data on Ethiopian agriculture collected by the Ethiopian Central Statistics Agency (CSA) from 2010/11 to 2012/13. The analysis specifically uses the meher season post-harvest survey (MSPHS) data to analyze differences between male and female holders participating in crop agriculture. The MSPHS data includes basic household demographics and socioeconomic profiles (e.g. holder sex, age, education level, and family size), cultivated area for major cereals, pulses, oilseeds, vegetables, root and fruits, and other crops, input use and agronomic practices, and grain production. The Livestock Surveys (LSS) also include a basic socioeconomic profile, livestock and poultry ownership by breed (indigenous, crossbred, and exotic), and honeybee colony ownership by hive type (i.e. traditional, transitional, and modern). Both the MSPHS and LSS datasets are collected at the holder level. The holder is defined to be the primary person responsible and decision maker in the crop and livestock production process related to a specific piece of land or designated animal. The MSPHS and LSS cover, on average, close to 47 and 68 thousand holders, respectively and more than 19 percent were female holders in both data sets. It is worth mentioning that most of the holders are found to be household heads. Based on the 2012/13 MSPHS, about 97 percent of households had only one holder, 2 percent had two holders, and the remaining 1 percent had more than two holders per household. As a result, these data do not facilitate analysis of the role that other adults in the household play in agriculture. More detailed data are needed to understand how the many women who live in male-headed households contribute to and benefit from agricultural production.

The crop analysis results indicate the presence of significant gender disparities in access to, ownership of, and use of livelihood assets required for crop production. More specifically, female holders have substantially lower livelihood assets than their male counterparts. In terms of human capital, female holders have relatively smaller family sizes and are less educated. In addition, female holders are less endowed with natural and agricultural capital. They own relatively smaller total land area, are involved less in land rental markets, and cultivate relatively smaller size plots than male holders. Furthermore, female holders own fewer oxen than male holders. In addition, a smaller proportion of female holders used improved crop varieties, chemical fertilizers, and irrigation compared to male holders. However, when we observe the ratio of area of these inputs to the total land managed by the holder, female holders tend to have higher intensity of use of improved seed, chemical fertilizer, and irrigation. Female holders are also less skeptical of these technologies than are male holders. This could imply that increasing female holders' access to inputs is one mechanism to increase the area of land under improved technologies. However, further analysis is needed to understand why female holders have higher input use intensity.

There are also gender differentials in crop production participation, and the variations are largely related to the labor requirements and management complexity of a given crop, and its proximity to the residential area. Female holders tend to participate relatively less in crops that are labor-intensive and require complex management (for example, teff, groundnut, and onion). They are more involved in the production of homestead crops like rapeseed, taro, and enset. Furthermore, there are clear discrepancies by gender on the application of agronomic practices and access to crop extension services. The proportion of female holders who used row planting, had access to advisory services, and applied crop extension packages are lower by about 5, 13, and 9 percentage points, respectively, compared to male holders.

The livestock analysis also shows significant discrepancies in terms of the human capital and livestock ownership between female and male holders. As found in the MSPHS data analysis, female holders have relatively smaller family sizes and are less educated than male holders. The proportion of

female holders who are involved in livestock and poultry production and beekeeping is about five percentage points lower than that of male holders. In addition, the total number of livestock owned by female holders is, on average, about 25 percentage points lower than the number owned by male holders. In general, female holder's participation in and ownership of cattle, goat, sheep, equine, poultry, and honeybee colonies is relatively lower than their male counterparts. Similarly, female holder's participation in livestock extension packages is lower than that of male holders by about 20 percentage points.

Overall, this report indicates significant gender differentials in Ethiopian agriculture and calls for closing these gender gaps, as it would yield enormous benefits at both the household level (for female holders and their families) as well as the national level. These benefits include, but are not limited to, increasing food security and improving livelihoods as indicated by FAO (2011). The following policy priorities are recommended as methods to reduce the gender gap in agriculture:

- **Improving the literacy level of female holders:** Female holders are significantly more illiterate than their male counterparts. Furthermore, female holders are four times more likely not to have either primary or secondary education. Research confirms that differences in education or schooling can translate into differences in agricultural innovation and technology diffusion (Weir 1999; Weir and Knight. 2000), and productivity and technical efficiency (Asadullah, and Rahman. 2009). Hence, promoting adult education for female farmers can reduce the literacy gap and the agricultural technology adoption and productivity gap.
- **Promote technologies and tools that can substitute for labor:** Female holders in the sample tend to have smaller household sizes than do male holders, which imply a more limited pool of household labor. Because labor is one of the critical inputs for production, improving laborsaving technologies may potentially have more important implications for female holders' production capacity than for that of male holders. In other words, differences in the availability of household labor can be a major barrier to achieving equality in the production and productivity of female and male holders. Promoting technologies and tools that can substitute labor can considerably reduce the observed gaps in access to household labor between female and male holders. Of course, complementary finance or some other way to facilitate improved technology access would also need to be considered.
- **Support female holders' equal access to and control over land:** The results concerning access to and ownership of agricultural land clearly indicate that female holders have lower access to various types of land and, on average, operate smaller land sizes. Female holders are also less likely to have access to irrigated lands. Supporting female holders' access to and control over various types of land has the potential to increase agricultural production and the food security of female holders and their families and may also empower female holders.
- **Ensure equal access to and use of productivity-enhancing inputs by female holders:** Although female farmers tend to plant improved seeds on a greater percentages of their plots and have a higher intensity of fertilizer per hectare, the proportion of female holders who have access to improved seeds and fertilizer is far lower than that of male holders. The most common reason cited by female holders for not using chemical fertilizers is the lack of money to purchase these inputs. Enhancing female farmers' access to and use of modern inputs through improving their access to financial services can considerably boost production and productivity since they are more likely to follow the recommended application practices.
- **Targeted extension and advisory services for female holders:** Gender disparities were also observed regarding access to extension and advisory services. The proportion of female holders that reported access to extension and advisory services are about 10-15 percentage points lower when compared to male holders. Female holders are also less likely to practices some

basic agronomic practices like crop frequency and rotations. Providing extension services that are tailored to the needs of female holders can facilitate the adoption of best agronomic practices among female farmers and result in increased productivity.

- **Improving female holders' access to and use of credit:** This report indicates a statistically significant difference between female and male holders concerning credit use. Female holders reported a 7-8 percentage points lower credit use compared to their male counterparts. Nationally, they more frequently cite the inability to pay previous loans than do male holders as the reason they do not use credit. They also indicated "credit constraints" as the main reason holding them back from use and proper application of modern inputs. Improving female holders' access to and use of credit is indispensable in terms of reducing gender gaps on input uses and enhanced production outcomes.
- **Expand and support female holders' participation in commercial and economically valuable crops:** The analysis of gender differentials in crop production participation clearly indicates a significantly lower involvement of female holders in the production of most major crop groups in the country. The magnitudes of their differences with male holders were especially notable on crops or crop categories that are commercial or economically valuable (i.e., *teff*, pulses, oilseeds, coffee, and chat). Supporting female holders' participation in commercial and economically valuable crops can increase their cash earnings and investment on productivity-enhancing technologies and tools. However, any interventions to promote increased participation of female holders in cash crops should be designed to prevent the potentially negative effects on nutrition outcomes.
- **Expand and support female farmers' oxen and equine asset base:** The results from this report also clearly indicated that female holders are far less likely to own oxen and other draught animals (equines). As noted previously, these are the major sources of traction power and transportation. For instance, it was evident that female holders heavily rely on hand digging and borrowed oxen for plowing, which can be extremely time-consuming. Supporting female holders to build the necessary household assets is vital in terms narrowing gender gaps in production and market participation.
- **Collect and analyze sex-disaggregated data on the asset ownership and role in agriculture of all household members:** Female holders make up just 19 percent of the sample. However, recent analysis of individual-disaggregated, plot-level labor input data from a nationally representative survey in Ethiopia finds that the average female labor share in crop production is 29 percent, which does not include labor input in livestock activities or food processing (Palacios-Lopez, Christiaensen, and Kilic 2015). In addition, the Demographic and Health Surveys from 2011 find that 50 percent of women of reproductive age own land, as compared to 54 percent of men of reproductive age, and 12 percent of women own land solely only (CSA and ICF 2012). This suggests that women living in male-headed households contribute significantly to agriculture and, through joint titling, may have certain rights to land even if they do not manage it. More data are needed to understand how women contribute to agricultural decision-making.

In conclusion, we strongly recommend that all national agricultural plans and policies should be based on detailed gender analysis that acknowledge the existing gender differentials and layout strategies and detailed, actionable items to narrow such gaps. Furthermore, this has to be supported by establishing a system that allows sex-disaggregated data collection, analysis, reporting, and information dissemination. This will help facilitate the development of evidence-based policies that successfully promote gender equality and women's empowerment in the country.

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